Insights Imaging (2015) 6 (Suppl 1):S159–S445
DOI 10.1007/s13244-015-0387-z

B

Scientific Sessions and Late-Breaking Clinical Trials (B)

Scientific session numbers are prefixed by SS.
Presentation numbers are prefixed by the letter B.
Sessions and abstracts are listed by days.

The Late-Breaking Clinical Trials session is listed at the end of section B. (page 443)

Wednesday, March 4

10:30 - 12:00 **Room B**

Abdominal Viscera

SS 201a

Liver MRI

Moderators:
S. Phoa; Amsterdam/NL
F. Regini; Florence/IT

B-0002 10:30

Hepatic lipid assessment: Multi echo Dixon technique versus MR spectroscopy at 3 T scanner

M. Abd Ellah[1], B. Henninger[1], C. Kremser[1], S. Kannengießer[2], X. Zhong[3], W.R. Jaschke[1]; [1]*Innsbruck/AT*, [2]*Erlangen/DE*, [3]*Malvern, PA/US (dr_m_hamdy2006@hotmail.com)*

Purpose: To evaluate a single breath hold magnetic resonance 3D multi echo Dixon sequence with advanced reconstruction for hepatic lipid assessment compared to a single breath-hold multi echo MR spectroscopy sequence with T2 correction.
Methods and Materials: 116 (47 females and 69 males), 15-86 years (mean ± std 55.9 ±16.4) were included in the study, referred to MRI for different reasons. MRI was done using a 3 T MR scanner (Magnetom Skyra, Siemens, Germany). A standard in and opposed Phase gradient echo (IOP-GRE) sequence was performed in all patients and fat fractions calculated off-line. A multi gradient echo Dixon sequence with 6 different echo times, with advanced reconstruction and in-line calculation of hepatic fat fraction maps (Siemens work in progress package 796B) in 113 patients. Single-breath hold multi-echo spectroscopy with T2 correction (Siemens work in progress package 787B) in 107 patients. Four different ROIs were drawn for IOP-GRE and multi echo Dixon images. The obtained fat fractions from IOP-GRE sequence, multi echo Dixon sequence and spectroscopy were recorded and statistical analysis was performed. A resulting fat fraction ε 5% was considered abnormal.
Results: The results of multi echo Dixon sequence showed good correlation against both IOP-GRE and spectroscopy (r=0.856 and r=0.902, respectively).
Conclusion: 3D multi echo Dixon sequence allows full coverage of the liver during one single breath hold. It gave consistent results for hepatic fat content with high correlation to MR spectroscopy. It may have the potential to become a fast routinely used non invasive technique for fatty liver quantification.

B-0001 10:38

Diagnostic accuracy of a three-step magnetic resonance imaging approach for the assessment of hepatic steatosis in a healthy general population

H. Hetterich[1], C. Bayerl[1], A. Peters[2], C. Meisinger[2], H. Kramer[1], B. Ertl-Wagner[1], M.F. Reiser[1], F. Bamberg[1]; [1]*Munich/DE*, [2]*Neuherberg/DE (holger.hetterich@med.uni-muenchen.de)*

Purpose: To determine the feasibility of a multistep magnetic resonance imaging (MRI) approach for comprehensive assessment of hepatic steatosis defined as liver fat content of > 5% in a healthy reference population.
Methods and Materials: Asymptomatic volunteers from the general population without a known history of liver disease underwent a three-step MRI based assessment of liver fat content. First, a dual-echo Dixon (TE1: 1.23 ms, TE2: 2.46 ms) sequence was performed to identify subjects with hepatic steatosis followed by a multi-echo Dixon sequence (TE1-TE6: 1.23 ms-7.38 ms) with correction for T1 bias, T2* decay, eddy current and spectral modelling. Finally, a T2 corrected multi-echo spectroscopy (TE1-TE5: 12.00 ms-72.00 ms) of the left and right liver lobe was acquired, and employed as the standard of reference.
Results: A total of 215 volunteers successfully completed the MRI protocol (54% male, average age: 55 years). Mean liver fat percentage was 9.2±8.5% by multi-echo Dixon and 9.3±8.6% by multi-echo spectroscopy (p=0.51), respectively. Dual-echo Dixon overestimated liver fat by 1.4±2.0% (p < 0.0001). All measurements showed an excellent correlation (rε0.9, p < 0.001). The prevalence of hepatic steatosis was high (55%). Dual-echo Dixon was highly sensitive for the detection of hepatic steatosis (sensitivity: 0.97, NPV: 0.96) with good specificity and PPV (0.75 and 0.81; respectively).
Conclusion: A multistep MRI approach may enable rapid and accurate identification of subjects with hepatic steatosis in the general population.

B-0003 10:46

Does hepatic steatosis influence the detection rate of metastases in hepatobiliary phase of Gd-EOB-DTPA enhanced MRI with conventional 3D-T1-weighted fat-saturated sequences?

J.H. Rothe, T. Denecke, T. Weissmann, C. Grieser, B. Hamm, W. Brenner, I.G. Steffen; *Berlin/DE (jan-holger.rothe@charite.de)*

Purpose: To evaluate the influence of hepatic steatosis on the detection of metastases in Gd-EOB-enhanced standard 3D-T1-weighted hepatobiliary phase sequence.
Methods and Materials: A total of 52 patients with hepatic metastases and steatosis underwent a Gd-EOB-DTPA enhanced MRI (T1w in-/opposed-phase, T2w fat sat, 3D-T1w fat sat unenhanced and 3-phase dynamic and 3D-T1w fat sat hepatobiliary phase, delay 20 min). The degree of hepatic steatosis was determined as relative signal reduction from in- to opposed-phase. Two observers (O1, O2) assessed independently the number of metastases on all unenhanced and dynamic images (UD-MRI), separately on the hepatobiliary phase images (HBP-MRI). The influence of the degree of steatosis and lesion diameter were analyzed in a linear model.
Results: A maximum number of 479 (mean diameter, 11 mm; range, 2-105 mm) metastases were detected. O1/O2 detected 69%/67% of lesions concordantly in UD-MRI and HBP-MRI. Of the discordantly detected lesions, 9%/10% were seen only on UD-MRI, while 20%/15% were only depicted on HBP-MRI. For all lesions detected only on UD-MRI, the mean in/opp signal loss was 84%, significantly higher (p < 0.010) then for those seen only on HBP-MRI (39%). An increasing degree of steatosis significantly reduced the detection rate on HBP-MRI (p < 0.001), a decreasing lesion diameter (p=0.010) significantly influenced the detection for metastases observed only in ND, the observer had no significant influence (p=0.740).
Conclusion: The detection rate of hepatic metastases in patients with a strong hepatic steatosis (in/opp signal loss, > 60%) can be reduced on HBP-MRI with a standard fatsaturated 3D-T1w sequence.

B-0004 10:54

Gd-EOB-DTPA-enhanced liver MRI for prediction of liver growth after portal vein occlusion

B.K. Barth, M.A. Fischer, C.S. Reiner; *Zurich/CH*

Purpose: To evaluate the use of Gd-EOB-DTPA-enhanced magnetic resonance imaging (MRI)-derived fat- and liver function-measurements for prediction of liver growth after portal vein occlusion (PVO) in patients scheduled for major liver resection.
Methods and Materials: Forty-five patients (Age 59±13.9y) who underwent Gd-EOB-DTPA-enhanced liver MRI within 24.5±18 days Prior to PVO were included in this study. Fat-Signal-Fraction (FSF) and relative liver enhancement (RLE) of the future liver remnant (FLR) were calculated from in- and out-of-phase (n=42) as-well-as from unenhanced T1-weighted, and hepatocyte-phase images (n=35), respectively. Outcome parameters were the degree of hypertrophy (DH) and kinetic growth rate (KGR, volume increase/day) of the FLR post-PVO. Receiver operating characteristics analysis was computed to identify cutoff values for predicting liver growth.
Results: FSF showed significant inverse correlation with DH and KGR of the FLR (r =-0.462 and -0.375, p < 0.05), whereas no significant correlation was found for RLE with DH and KGR. Patients with steatosis (FSF> 10%; n=12) showed significantly lower DH than those without steatosis (FSFδ10%; n=30, 2.7% vs.12.6%, p < 0.05). FSF was significantly lower in patients with DH> 5% (n=28) than with DHδ5% (n=14, 0.021 vs. 0.166, p=< 0.05). With a cutoff-FSF of 0.4 patients with DH> 5% were identified with 100% (28/28, 95%CI, 98-100%) sensitivity and 100% negative predictive value (3/3, 95%CI, 83-100%).
Conclusion: Liver fat-content, but not liver function derived from Gd-EOB-DTPA-enhanced MRI is a predictor of liver growth after PVO. Thus, liver MRI could help in identifying patients at risk for insufficient liver growth, which could lead to re-evaluation of the therapeutic strategy.

B-0005 11:02

T1 segmental hyperintensity in liver cholestasis on MRI: in vitro explanation

I.L. Gubskiy, O.N. Sergeeva, V. Panov, I.E. Tyurin, B. Dolgushin; *Moscow/RU (shtangakun@gmail.com)*

Purpose: T1 segmental hyperintensity (T1SH) of cholestatic liver has been previously described in several issues (Gabata T et al. 1997, Hashimoto M. et al., 2005). Pathologists revealed nothing but bile pigment within hepatocytes and dilated ductules in the affected areas. There was no evidence of hemorrhages or fat and iron deposition. The reasons of the phenomenon were not clear.

Methods and Materials: Eleven obstructive jaundice patients (9 hilar cholangiocarcinomas, 2 sclerosing cholangitis) demonstrating T1SH on pre-procedural MRI underwent percutaneous transhepatic bile drainage (PTBD). The collected bile was studied in vitro with MRI and MR relaxometry. The processes similar to those in the cholestatic liver - bile oxidation (heating at the presence of oxygen) and acidification (addition of citric acid) - were simulated. Sodium thiosulfate was used for the treated bile reduction.
Results: T1SH disappeared in 5 out of 11 patients and decreased in others after PTBD in the cholestatic areas on post-procedural MRI. Bile oxidation resulted in color change from brown to dark-green (oxidation of bilirubin to biliverdin) and dispersoid appearance. While biliverdin solution had high T1 relaxation time (T1RT) the dispersoid had short T1RT. Bile acidification resulted in sludge precipitation showing short T1RT. Sludge liquefaction was attained by treatment of the precipitated bile with sodium thiosulfate; subsequent T1RT increase was noticed. So, sludge formation/disappearance and T1RT changes is governed by bile mucin sulfhydryl group oxidation/reduction processes.
Conclusion: T1SH in cholestatic liver is determined by turn of mucin sol into gel, which has higher viscosity and thereafter shorter T1RT.

B-0006 11:10

Quantitative analysis of diffusion-weighted MRI at 3 T: which parameter is more useful in differential diagnosis of focal solid liver lesions?
K.K. Lomovtseva[1], N.A. Karelskaya[2], G.G. Karmazanovsky[2]; [1]*Vidnoe/RU*, [2]*Moscow/RU (powerflower@mail.ru)*

Purpose: To determine more useful quantitative parameter of diffusion-weighted imaging (DWI) at 3 T in differential diagnosis between benign and malignant focal solid liver lesions.
Methods and Materials: 57 patients with focal solid liver lesions underwent respiratory-triggered DWI MRI (3 T), using b values 0, 300, 600 s/mm2. Apparent diffusion coefficients (ADC) of lesion, liver, spleen, left kidney, body of pancreas, vertebral body, back muscle were measured on ADC map. The ADC ratio (lesion/anatomical structure) and ADC delta (lesion-anatomical structure) were calculated. The ROC analysis was performed and cut-off values of more useful parameters for differentiation of benign and malignant lesions were determined.
Results: There were 132 malignant (97 metastases, 25 hepatocellular carcinomas, 9 cholangiocarcinomas, 1 extrarenal rhabdoid tumour) and 12 benign (8 focal nodular hyperplasias, 2 hepatocellular adenomas, 2 angiomyolipomas) lesions. Mean ADC values of benign solid lesions (1.709±0.824 x 10-3 mm2/s) were higher than malignant solid lesions (1.079±0.371 x 10-3 mm2/s) with statistically significant ($p < 0.001$). The largest area under the ROC curve was reached by ADC delta (lesion-liver) (0.879), ADC ratio (lesion/liver) (0.876). The mean ADC delta (lesion-liver) for benign and malignant solid tumors was 0.337±0.753 x 10-3 mm2/s, -0.256±0.338 x 10-3 mm2/s, respectively. The mean ADC ratio (lesion/liver) for benign solid tumors was 1.232±0.480 and for malignant, 0.800±0.252. The cut-off values of ADC delta (lesion-liver) and ADC ratio (lesion/liver) were -0.147x10-3 mm2/s, 0.894, respectively (sensitivity 91.7%, specificity 72.7%).
Conclusion: Both ADC delta (lesion-liver) and ADC ratio (lesion/liver) are more useful quantitative parameters in differential diagnosis of focal solid liver lesions.

B-0007 11:18

Image quality of the hepatic arterial phase in gadoxetic acid-enhanced liver MRI: analysis of respiratory pattern and image quality
Y. Park, C. Lee, J. Lee, J. Choi, K. Kim, C. Park; *Seoul/KR (pys797979@naver.com)*

Purpose: To objectively evaluate respiratory patterns during breath hold and determine the relationship between breath-holding pattern and image quality of the hepatic arterial phase in gadoxetic acid-enhanced liver MRI.
Methods and Materials: One hundred fifty-four patients (M:F=108:46) underwent gadoxetic acid-enhanced liver MRI. Hepatic arterial phase was obtained using CAIPIRINHA during a 13-second breath hold. During acquisition of hepatic arterial phase the respiratory motion signal was acquired and analyzed on a 5-point scale based on standard deviation of the respiratory waveform. Hepatic arterial phase images were evaluated with respect to overall image quality and motion artifact using a 5-point scale. The correlation between breath holding degree and image quality parameters was evaluated. In patients with respiratory difficulty during breath hold, the relationship between respiratory regularity and image quality was assessed.
Results: Respiratory difficulty during breath hold was 9.7% (15/154). Degraded hepatic arterial phase was 5.2% (8/154). Breath-holding degree was correlated with overall image quality and motion artifact (r=0.667 and 0.664). In patients with respiratory difficulty during breath hold, overall image quality score (3.70 vs. 3.10) and motion artifact score (3.65 vs. 3.10) were higher in patients with a regular respiratory waveform than in those with an irregular respiratory waveform (P=0.023 and 0.037).
Conclusion: Image quality of the hepatic arterial phase correlates with breath-holding degree. Compared to the incidence of respiratory difficulty in breathing during hepatic arterial phase, the incidence of degraded hepatic arterial image is 5.2% in gadoxetic acid enhanced liver MRI using 13-second breath-holding CAIPIRINHA technique.

B-0008 11:26

Performance of magnetic resonance elastography for the staging of liver fibrosis: in terms of comparison between patients with chronic hepatitis B and those with other etiologies
W. Chang, J. Lee, J. Han, B. Choi; *Seoul/KR (sword1981@hanmail.net)*

Purpose: The objectives of this study were to evaluate performance of magnetic resonance elastography (MRE) for the staging of liver fibrosis (LF) and to determine if liver stiffness (LS) measurements is different in chronic hepatitis B (CHB) and other etiologies.
Methods and Materials: A total of 360 patients (286 hepatitis B, 27 hepatitis C and 14 alcoholic hepatitis patients, 33 patients without definite etiologies) with hepatocellular carcinomas and 63 living liver donors underwent MRE. Liver stiffness values (LSV) were measured on quantitative shear-stiffness maps. The diagnostic performance of MRE for staging LF was evaluated using the receiver operating characteristic curve analysis and Obuchowski measure on the basis of the histopathologic analysis of LF.
Results: The areas under the receiver operating characteristic curve values of the LSVs for the diagnosis of significant fibrosis (F2), severe fibrosis (F3), and cirrhosis (F4) in CHB patients and donors were 0.970 (95% confidence interval [CI], 0.946-0.986), 0.937 (95% CI, 0.907-0.960), and 0.906 (95% CI, 0.870-0.934), respectively. The estimated cutoff values were 2.61, 2.78 and 3.56 kPa for F2, F3 and F4, respectively. Obuchowski measures were similarly high in CHB and other etiologies (0.784 vs. 0.786). LSVs and cut off values for liver cirrhosis in CHB patients were lower than those in other etiologies (4.82 vs 5.91 kPa,p=0.002; 3.56 vs 4.65 kPa, respectively).
Conclusion: Performance of MRE for the staging of Liver fibrosis are similarly high in CHB and non-CHB groups. And LSVs for differentiating liver cirrhosis are different between CHB and non-CHB groups.

Author Disclosures:
J. Lee: Advisory Board; Bayer AG.

B-0009 11:34

Characterisation and evaluation of longitudinal extent of perihilar biliary strictures: does diffusion-weighted MRI provide additional value?
K. Choi, J. Lee, I. Joo, J. Han, B. Choi; *Seoul/KR (jmsh@snu.ac.kr)*

Purpose: To evaluate whether diffusion-weighted imaging provides additional value to conventional MRI with MR cholangiopancreatography in the differential diagnosis of perihilar strictures and resectability assessment of perihilar cholangiocarcinomas.
Methods and Materials: This retrospective study was approved by our institutional review board, and informed consent was waived. One hundred and fourteen patients with perihilar strictures (81 malignant; 33 benign) underwent gadobutrol-enhanced MRI with MRCP and DWI. Two readers independently reviewed a set of MRI-MRCP and a combined set of MRI-MRCP and DWI, and scored the likelihood of malignancy of perihilar strictures and resectability by assessment of bilateral secondary confluence involvement in cases of malignant strictures using a 5-point scale. Diagnostic performance of the two imaging sets was compared using ROC analysis.
Results: In the characterization of perihilar strictures, adding DWI to conventional MRI set did not provide improved diagnostic performance for diagnosing malignancy: Az values of reader 1 and 2 were 0.947 and 0.930 for the MRI-MRCP set; and 0.923 and 0.905 for the combined set, respectively (P>.05). For determining resectability of malignant strictures by assessment of bilateral secondary confluence involvement, both the conventional MRI set and the combined set showed similar diagnostic performance: Az values of reader 1 and 2 were 0.820 and 0.826 for the MRI-MRCP set; and 0.868 and 0.829 for the combining set, respectively (P>.05).
Conclusion: Addition of DWI to conventional MRI-MRCP did not improve diagnostic performance in the differential diagnosis of perihilar biliary strictures, and in the determining resectability of perihilar CCs.

B-0010 11:42

MR evaluation of biliary-enteric anastomoses with Gd-EOB-DTPA-enhanced MR cholangiography: comparison with conventional T2-weighted MR cholangiography
P. Boraschi, F. Donati, F. Pacciardi, G. Gherarducci, R. Gigoni, F. Falaschi, C. Bartolozzi; *Pisa/IT (p.boraschi@gmail.com)*

Purpose: To assess the added efficacy of Gd-EOB-DTPA-enhanced MR-cholangiography (MRC) compared with T2-weighted MRC in patients with biliary-enteric anastomoses.

Methods and Materials: Fifty patients with pre-existing biliary-enteric anastomoses and clinical-echographical suspect of complications underwent MR imaging at 1.5 T-device. After acquisition of T1w/T2w images, conventional MRC was performed through thin-slab 3D FRFSE and thick-slab SSFSE T2w sequences (image set 1). In each patient a 3D fat-suppressed LAVA sequence was performed before and 15.20,25.30,40 minutes after intravenous administration of 10 ml Gd-EOB-DTPA (Primovist®, Bayer HealthCare), followed by injection of isotonic saline (20 ml); T1w sequences were also obtained after 90-120 minutes in 8/50 cases (image set 2). Two observers reviewed the image set 1 alone and image set 1 and 2 together. All segments of the biliary tree were analyzed for the presence of ductal dilatation, stricture, bile leakage, intraductal filling defects and other abnormalities. MRI findings were compared to surgical findings, when scheduled, conventional cholangiography and/or a six-months-lasting clinical-radiological follow-up.
Results: Diagnostic confidence of image set 1 alone and image sets 1 and 2 together were judged "very confident" in 3 and 37 cases, "confident" in 30 and 11, "not confident" in 14 and 1," not confident at all" in 3 and 1, respectively. Concordance between image set 1 alone and image sets 1 and 2 together and the reference standard results was present in 22/50 cases (44%) and 48/50 (96%), respectively ($p < 0.0001$).
Conclusion: Gd-EOB-DTPA-enhanced MRC yields information that improves the diagnostic performance of conventional T2w MRC in the assessment of patients with biliary-enteric anastomoses.

B-0011 11:50

An increased flip angle in late phase Gd-EOB-DTPA MRI shows improved performance in bile duct visualisation compared to T2w-MRCP
L. Stelter, P. Freyhardt, C. Grieser, T. Walter, D. Seehofer, T. Denecke;
Berlin/DE (lars.stelter@charite.de)

Purpose: To estimate the additional value of an increased flip angle of 35° in late phase Gd-EOB-DTPA-enhanced magnetic resonance cholangiography, as compared to T2w-MRCP.
Methods and Materials: 40 adult patients underwent Gd-EOB-DTPA-enhanced MRI of the liver including a T2-weighted 3D TSE MRCP (T2w-MRCP) as well as a late phase T1-weighted THRIVE sequences applying a flip angle of 35° (fa35). Two experienced observers evaluated the images regarding the delineation of the different biliary regions using a three-point grading system. A five-point scale was applied to determine the readers' confidence in identifying anatomical variations of the biliary tree. ROI analysis was performed to compare the signal-to-noise (SNR) and contrast-to-noise (CNR) ratios.
Results: The quality for visualizing the biliary tree differed between T2w-MRCP and fa35 ($p=< 0.001$). Late phase EOB-MRC was rated as good for delineating the entire biliary system, whereas T2w-MRCP received an overall poor rating. Especially, the depiction of the intrahepatic bile ducts was estimated as problematic in T2w-MRCP. T2w-MRCP and fa35 revealed a discordant assessment of anatomical variations in 12.5% of the cases, comprising a generally higher confidence level for fa35 (4.0 ± 1.1 vs. 2.2 ± 1.2, $p=< 0.001$). SNR prooved to be significantly higher in fa35 ($p=< 0.001$), whereas T2w-MRCP revealed a significantly higher CNR (< 0.001).
Conclusion: Gd-EOB-DTPA-enhanced magnetic resonance cholangiography acquired with a flip angle of 35° revealed a better diagnostic performance compared to T2w-MRCP and might be a valuable adjunct in assessing functional bile duct abnormalities.

10:30 - 12:00 **Room C**

Breast

SS 202a

Imaging for neoadjuvant chemotherapy

Moderators:
P. Martínez-Miravete; Zaragoza/ES
F. Thibault; Paris/FR

B-0012 10:30

Predictability of complete response through apparent diffusion coefficient measured before neoadjuvant chemotherapy in breast cancer depends on tumour phenotype
E. Bufi, P. Belli, M. Costantini, A. Cipriani, A. Bonatesta, G. Franceschini, D. Terribile, L. Bonomo; *Rome/IT (reagandus@alice.it)*

Purpose: To clarify the role of apparent diffusion coefficient (ADC) measured before neoadjuvant chemotherapy in the prediction of pathological complete response (pCR) in locally advanced breast cancer.
Methods and Materials: We revised the breast MRI examinations performed before neoadjuvant chemotherapy in 225 patients with locally advanced breast cancer. Diffusion-weighted imaging with determination of the ADC was performed. Response to chemotherapy was defined as pCR at final histopathology.
Results: Tumour phenotypes were: Luminal 143 (60.9%), Triple-negative (TN) (16.4%), HER2-enriched (7.6%) and Hybrid (HR+/HER2+, 12.4%). pCR was observed in 17.3% of cases. Average pre-treatment ADC was 1.132 ± 0.191*10-3 mm2/s in pCR patients vs. 1.092 ± 0.189*10-3 mm2/s in non-pCR patients (not significant, p=0.23). Conversely, significant or near-significant difference was observed in the TN and HER2+ subgroups. Among these, the optimal ADC cutoff values for the prediction of pCR were 0.995*10-3 mm2/s and 0.971*10-3 mm2/s, respectively (Youden index methodology); these yielded adequate diagnostic performance (area under the ROC curve: 0.766 and 0.813, respectively). Neither significant difference in pre-treatment ADC among pCR vs. no-pCR patients, nor ADC cutoff yielding sufficient diagnostic performance were found in the Luminal and Hybrid subgroups.
Conclusion: The pre-treatment ADC value may be helpful in the prediction of pCR to neoadjuvant chemotherapy in breast cancer. Nonetheless, such reliability depends on tumour phenotype, probably due to different histological and biochemical architecture. The clinician may plan the neoadjuvant chemotherapy protocol on the basis of the projected likelihood of response through determination of ADC and of phenotype at biopsy.

B-0013 10:38

Shrinkage patterns of tumour regression after neoadjuvant chemotherapy on magnetic resonance imaging: correlation with tumour biological subtypes and pathological response after therapy
S. Gigli, L. Ballesio, F. Di Pastena, C. Petriglia, C. Catalano; *Rome/IT (adrenalina_1@hotmail.it)*

Purpose: To analyse MRI shrinkage pattern (SP) of tumour regression after neoadjuvant chemotherapy (NACHT) and to evaluate the relationship with biological tumour subtypes and final pathological response.
Methods and Materials: We retrospectively viewed the MRI studies of 42 patients performed at time 0,IV-V and at last cycles of therapy and classified the SP into 3 groups based on the tumour regression morphology: A) concentric, B) nodular, C)mixed.We gave a numeric score (1:low;2:medium; 3:high) to the enhancement intensity decrease (ED) after NACHT. According to Miller and Payne criteria we classified patients as a Complete Responder (CR: grade 5), Partial Responder (PR :grades 4-3), Non-Responder (NR:grades 1-2). We identified 4 biological tumour subtypes (Luminal A, Luminal B, HER2, triple negative).Pearson correlation and t-test were used to relate SP with biological subtypes and the response after NACHT.
Results: 17/42 lesions showed nodular pattern, 15/42 concentric and 11/42 mixed. We found a statistically association between concentric pattern and Luminal B cancer (5/ 6 cases, p: 0.002);Triple negative cancer and nodular pattern (8/11 cases, p: 0.05) and HER 2 (3/4) with mixed pattern. After NACHT 10 patients were CR, 20 RP and 12 NR. We observed a statistically correlation between PR and concentric pattern. Score 3 of DE was associated with CR after treatment (p: 0.004).
Conclusion: Concentric patterns was more frequently observed in pathological responder group and in Luminal A subtypes, while nodular pattern occurred in NR group and in Triple negative cancers. Score 3 of DE was frequently observed in CR.

B-0014 10:46

What happens to the DCIS in HER 2 positive cancers treated with NACT and trastuzumab?

R. Millican-Slater, K. Horgan, M. McMahon, D. Dodwell, B. Dall, N. Sharma; *Leeds/UK (nishas@doctors.org.uk)*

Purpose: Patients with HER-2 positive cancers treated with trastuzumab in addition to neoadjuvant chemotherapy (NACT) are more likely to achieve a pathological complete response (pCR) than tumours that are HER-2 positive and treated with NACT alone. pCR is defined as the absence of invasive tumour in the final excision specimen allowing for the presence of ductal carcinoma in-situ (DCIS). There is little data regarding the effect of NACT and trastuzumab on any DCIS associated with the HER 2 positive invasive carcinoma.
Methods and Materials: All cases that were HER-2 positive from our local NACT database were identified from 2010-2012. The imaging features, core biopsy and final histology were documented.
Results: 41 of 150 patients that received NACT (anthracycline and taxane based), were HER-2 positive and treated with trastuzumab. 40/41 cases had surgery following neo-adjuvant treatment. 24/41 (59%) cases had calcifications on mammography. 21/41 obtained a pCR. Of the 24 cases with calcification, 14 had a pCR with 9/14 having residual DCIS. 7/24 cases had a WLE in which the calcifications on mammography were unchanged in extent or appearance. 17/41 without calcification, 7 had a pCR with 2/7 having residual DCIS which was non calcified.
Conclusion: pCR is higher in the HER-2 positive group compared to the HER 2 negative group (51% vs 20%). 48% achieved a pCR with no residual DCIS but 52% still had residual DCIS, suggesting that trastuzumab maybe less effective in treating HER 2 positive DCIS. The calcifications remained unchanged whether DCIS resolved or not.

B-0015 10:54

Breast MRI in the evaluation of patients undergoing neoadjuvant chemotherapy: assessment of tumour features and predictive markers of response according to histopathology

E. Schiani, C. Losio, F. Ballati, M. Panzeri, G. Cristel, M. Rodighiero, F. De Cobelli, A. Del Maschio; *Milan/IT (schiani.elena@hsr.it)*

Purpose: To investigate the role of tumour features (signal, morphology, vascularization) assessed with MRI as markers of tumour response to neoadjuvant chemotherapy (NAC) in locally advanced breast cancer.
Methods and Materials: 50 patients with locally advanced breast cancer underwent NAC. Most tumours were Luminal B (LUM B), HER2-enriched and Triple Negative (TN). Baseline MRI (1.5 T) protocol included a T2 TSE sequence, diffusion-weighted imaging (DWI) and dynamic Gadobutrol-enhanced study. Morphological parameters included tumour size, morphology, presence of pseudocapsule, edema and rim enhancement, necrosis, T2 signal intensity and water diffusivity (mean Apparent Diffusion Coefficient, ADC). Dynamic parameters included kinetic curve patterns and contrast-enhancement data obtained from the curve analysis. Final response to NAC was evaluated with pre-surgical MRI (for non-complete responders) and histopathological surgical analysis for pathologic complete responders (pCR).
Results: 19 patients showed a pCR. Percent tumour shrinkage was higher for HER2 (p=0.054). Lesion margins were mostly spiculated in LUM B, irregular in HER2 and smooth in TN (p=0.025). Pseudocapsule was more frequent among TN (p=0.003). Most aggressive tumours (HER2, TN) showed a higher T2 signal; ADC was higher in TN (p=0.052). Perilesional edema was significantly associated (p=0.026) to non-response. Wash-in rates were significantly lower (p=0.004) in responders (7.7±3.1/s) than non-responders (7.9±1.7/s). A significantly higher wash-out rate was found (p=0.029) in responders (1.33±1.4/s) than non-responders (1.18±0.6/s).
Conclusion: Some MRI tumour features can be related to specific histological subtypes, reflecting growth patterns and aggressiveness. Hypervascularization influences tumour response to NAC in different ways. Peritumoural edema seems the strongest predictor of non-responsiveness.

B-0016 11:02

Before the tumour shrinks: apparent diffusion coefficient in early assessment of breast cancer response to neoadjuvant chemotherapy

M. Nadrljanski, R. Maksimovic, V. Plesinac-Karapandzic, M. Nikitovic, Z. Milosevic; *Belgrade/RS (dr.m.nadrljanski@gmail.com)*

Purpose: To assess tumour response after the 2nd cycle of neaodjuvant chemotherapy (NACT).
Methods and Materials: Fifty patients were analyzed on MRI (1.5 T) for RECIST and apparent diffusion coefficient (ADC) initially and after the 2nd cycle of NACT (anthracycline-based regimen). Responders (R) and non-responders (NR) were defined based on histologic criteria. ADC was calculated according to two b-values (b0, 800) on diffusion-weighted imaging.
Results: The average tumour size initially in R and NR, was not significantly different (2.99±0.57 cm vs. 3.33±0.49 cm; p> 0.05), while the difference in ADC was considered highly statistically significant (1.004±0.009 mm^2/s x 10^{-3} vs. 0.840±0.134 mm^2/s x 10-3; p=0.0001). After the 2nd cycle of NACT, ADC value increased significantly in R (1.004±0.009 vs. 1.284±0.005; p0.05) and the change according to RECIST was 4.5% (SD). In R, only moderate correlation between ADC and RECIST was noted after the 2nd cycle of NACT (r=0.49).
Conclusion: ADC changed significantly in R after the 2nd cycle of NACT, while the size (RECIST), remained categorized as SD. In NR, neither parameter changed significantly. Should larger trials confirm the results, ADC may have predictive value in early tumour response assessment to NACT, earlier than the recommended standardized measuring tools based on morphologic changes.

B-0017 11:10

Apparent diffusion coefficient and fractional anisotropy values as biomarkers for treatment response in breast cancer

E.A. Joyce, A.J. Fagan, J.P. McMorrow, D. Byrne, M.J. Kennedy, J.F. Meaney, S.A. O'Keeffe; *Dublin/IE (joyceea@tcd.ie)*

Purpose: To evaluate if changes in apparent diffusion coefficient (ADC) and fractional anisotropy (FA) values predict early response in patients receiving neoadjuvant chemotherapy (NACT) for breast cancer.
Methods and Materials: 20 patients with invasive breast carcinoma underwent MRI at 3 timepoints: baseline (TP0) and following the first (TP1) and second (TP2) cycle of NACT. 3 T MRI (Achieva, Philips) was performed using a standard protocol including diffusion weighted and diffusion tensor imaging. Baseline and sequential data in responder and non-responder groups were compared. Response to NACT was determined by the Miller Payne grade of the surgical specimen.
Results: At baseline, mean tumour ADC (0.92 × 10-3 mm2/s) was statistically lower than disease free fibroglandular breast tissue (1.75 x10-3 mm2/s)($P < 0.0001$). Mean FA values of tumour (FA= 0.139) and disease free tissue (FA= 0.135) were similar. Compared with baseline values, tumour ADC of responders significantly increased at TP1 ($P < 0.0001$) and TP2 ($P < 0.0001$) while a significant increase in tumour FA of responders was seen at TP2 ($p < 0.008$). No statistical change occurred in tumour ADC or FA values of the non responder group. The mean percentage change in tumour ADC values in the responder group between TP0 and TP2 was 30% and for FA values was 23%.
Conclusion: Changes in ADC and FA values early in the course of treatment may predict response in patients receiving NACT for breast cancer. Of these, ADC appears to be the more valuable biomarker as significant changes in tumour ADC values in the responder group were greater and occured earlier in the course of treatment.

B-0018 11:18

A new parameter to assess response to neoadjuvant chemotherapy by quantitative vascular mapping in patients with locally advanced breast cancer

C. Rebellato, G. Gennaro, L. Evangelista, E. Bezzon, I. Polico, L. Pescarini; *Padova/IT (chiara.rebellato@gmail.com)*

Purpose: To determine the response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer (LABC) evaluating the vascular map with a semiquantitative method based on dynamic contrast-enhanced magnetic breast imaging (DCE-MRI).
Methods and Materials: Thirty-one women (mean age 50 years) with unilateral LABC DCE MRI before and after NAC. The volume of breast vessels was obtained from the second maximum intensity projection by selecting an appropriate threshold on the histogram and subtracting possible areas above the threshold but not belonging to the vessels. The ratio between the vessel volumes before and after NAC was used to compare responder and non-responder patients. The response to NAC was histopathologically determined.
Results: The median vascular volume ratio was 2.8 (range: 1.1 - 10.0) for the 14 responders, and 1.0 (range: 0.5 - 2.1) for the 17 nonresponders, resulting in a significant difference ($P = 0.0001$). Responder patients showed a reduction of the vascular map after NAC in 13 out of 14 cases (93%), while the vascular volume ratio was unchanged in the remaining case. For nonresponders, the vessel volume was increased in 29% of cases, unchanged in 42%, and reduced in 29%. A vascular volume ratio above 1.5 was found to distinguish tumours with complete to incomplete pathological response.
Conclusion: The vascular volume ratio seems an effective and sensitive tool for assessing response to NAC in LABC patients. It could be used after the first cycle of NAC to predict the final outcome, and eventually drive a therapy change.

B-0019 11:26

MRI parameters as imaging biomarker for prediction of response in patients with breast cancer receiving neoadjuvant therapy

S. Viganò[1], A.J. Patterson[2], M.A. McLean[2], H. Earl[2], R. Bedair[2], W.G. Matthew[2], M.J. Graves[2], E. Provenzano[2], F.J. Gilbert[2]; [1]*Milan/IT*, [2]*Cambridge/UK (sar.vigano@gmail.com)*

Purpose: Neoadjuvant chemotherapy (NAC) is used in breast cancer (BC) to downstage tumours and improve patient outcome with pathological complete response (pCR) correlating with improved survival. Prediction and early assessment of response is important to ensure optimal therapy. Our study assesses tumour volume and diameter measured by dynamic contrast enhanced magnetic resonance (MRI), and apparent diffusion coefficient (ADC) as imaging biomarkers for prediction of pCR before and mid-treatment in BC patients receiving NAC.
Methods and Materials: Patients receiving NAC had MRI pre- (MRt0) and at mid-treatment (MRt1). Volume, maximum diameter and ADC were measured. We compared parameters between responders (pCR or minimal residual disease at histology) and non-responders (no or partial response at histology) at MRt0 using the Mann-Whitney U test. Prediction of response was calculated using ROC analysis. Inter-observer agreement was evaluated using intra-class correlation coefficient (ICC).
Results: Forty one patients (mean age 47±10 years) completing both MRt0 and MRt1 were analyzed. Before treatment only ADC is predictive of response (p=0.005) with lower values for responders vs non-responders (968±149 mm2/s vs 1136±164 mm2/s). At MRt1 all parameters are predictive of pCR but ADC had the largest AUC (AUC=0.83). The ADC measurements had high inter-rater agreement (ICC=0.99) compared to volume (ICC=0.82) and diameter (ICC=0.77).
Conclusion: ADC can predict pCR before treatment and so could be used for improved patient selection. Volume, diameter and ADC might be useful to assess response, but ADC is the most robust and reproducible measure. ADC is a reproducible biomarker of pCR pre and mid treatment.

B-0020 11:34

Factors influencing the accuracy of magnetic resonance imaging in the assessment of disease response following neoadjuvant chemotherapy in early and locally advanced breast cancer

J. Murphy, K. James, P. Nicholson, L. Duddy, N. Marshall, M.F. Ryan, J. Barry; *Cork/IE (murphyjennifern@gmail.com)*

Purpose: The purpose of this study is to investigate the accuracy of magnetic resonance imaging (MRI) in the assessment of disease response in patients with early and locally advanced breast cancer following neoadjuvant chemotherapy (NAC) and to identify factors that can influence this assessment in a national breast cancer centre.
Methods and Materials: Retrospective review of patients with newly diagnosed, early and locally advanced breast cancer suitable for NAC was performed. MRI was performed prior to commencing NAC and preoperatively following completion of NAC. Covariates including patient demographics, tumour histology, biomarkers, NAC regimens, MRI features and time to surgery were recorded.
Results: Sixty-six patients were included in this study. Of these patients, 24.2% demonstrated complete response on MRI and 15.2% achieved pathological complete response (pCR). The mean (±standard deviation) of the absolute difference between MRI and pathological residual tumour size was 1.5±1.4 cm (range, 0-3.5 cm). The overall sensitivity and specificity of MRI in the detection of residual invasive disease are 83.93% [95% confidence interval (CI) 71.67 % - 92.36 %) and 70.0% (95% CI 34.84 % - 92.97 %) respectively. Univariate regression analysis demonstrated that tumour type, hormone receptor status and tumour grade were significantly associated larger size discrepancies between MRI and pathological specimen ($p < 0.05$).
Conclusion: This study demonstrates the sensitivity and specificity of MRI in the detection of residual disease following NAC. It also illustrates the impact of factors such as tumour histology and tumour grade on the assessment of residual disease which can impact on clinical outcomes.

B-0021 11:42

The value of multi-parameter strategy of ultrasound in the assessment of neoadjuvant chemotherapy for breast cancer

Y. Jin, L.Y. Peng, Y.B. Ma; *Chengdu/CN (jyjiayou@foxmail.com)*

Purpose: On the basis of two-dimensional Ultrasound, CDFI and contrast-enhanced ultrasound (CEUS) estimation before and after neoadjuvant chemotherapy (NAC), to investigate the value of multi-parameter strategy in the assessment of NAC for breast cancer.
Methods and Materials: A group of 31 patients receiving NAC was taken as research object. Pre-operative biopsy and post-operative surgical pathology as the reference standard, the effect of NAC was estimated by two-dimensional US, CDFI and CEUS separately and was scored. According to the aggregate score, the therapeutic effect of NAC was divided into ultrasonic relief (uR,0~5) and ultrasonic null relief (unR,6~9). The sensitivity, specificity and the uniformity to the pathological results of the multi-parameter strategy of ultrasound were calculated.
Results: (1) After NAC, the tumour pathological response was complete response, 8 cases (13.89%); partial response, 15 cases (61.11%); steady disease, 4 cases (18.06%); and progressive disease, 4 cases (6.94%). (2) After NAC, according to the score of two-dimensional US and CDFI, the assessment of NAC efficacy in terms of sensitivity, specificity and rough coincidence rate was 86.96%, 50% and 77.42%. Combined with CEUS, the multi-parameter strategy of ultrasound in effect of NAC was 22 cases of uR and 9 cases of unR. The sensitivity, specificity and rough coincidence rate of the multi-parameter strategy of ultrasound were 91.3%, 87.5% and 90.32%.
Conclusion: The evaluating accuracy could be raised assessing the effect of NAC using the multi-parameter strategy of ultrasound. The method is of great value being applied into clinical.

B-0022 11:50

Evaluation with digital breast tomosynthesis of the pathological response to neoadjuvant chemotherapy in locally advanced breast cancer

G. Mariscotti, M. Durando, E. Sardo, E. Regini, P. Campanino, G. Donato, C. Bogetti, P. Fonio, G. Gandini; *Turin/IT (giovanna.mariscotti@libero.it)*

Purpose: To evaluate the accuracy of digital breast tomosynthesis (DBT) combined with digital mammography (DM) in the assessment of the pathological response to neoadjuvant chemotherapy (NCT) in locally advanced breast cancer.
Methods and Materials: Between January 2011 and December 2013, 24 patients (mean age 49.7 ± 10.6 years; range 31-71) with locally advanced breast cancer underwent DBT combined with DM before, during and at the end of NCT. All patients signed an informed consent before undergoing DBT+DM. Two dedicate breast radiologists, with five years' experience in DBT, retrospectively evaluated the residual tumour size, assuming as gold standard the pathological examinations. Measurements were considered concordant if they were ± 5 mm; 95% confidence intervals (CI) were estimated for all percentages. Pearson's correlation coefficient was also calculated.
Results: The size agreement with pathology was 58.3% (95%CI: 38.8-75.5%) for DBT combined with DM. DBT+DM overestimated tumour size in 12/24 cases (50%; 95%CI: 31.4-68.6%), whereas an underestimation was observed in 7/24 cases (29.2%; 95% CI: 14.9-49.2%). DBT+DM measurements had a high correlation with pathological tumour size (r=0.79). DBT+DM correctly identified the complete pathologic response to NCT in 5/5 cases.
Conclusion: DBT combined with DM showed to provide a good correlation with pathology in patients undergoing neoadjuvant chemotherapy.

10:30 - 12:00 **Room Z**

Molecular Imaging

SS 206

Clinical molecular imaging

Moderators:
M. Eisenblaetter; Münster/DE
F.A. Gallagher; Cambridge/UK

B-0023 10:30

SECURE study: observational post-marketing study on the safety profile of gadoterate meglumine: final results in 35,499 patients

R. Souillard-Scemama, C. Mellerio, C. Oppenheim, J.-F. Meder, P. Soyer; *Paris/FR*

Purpose: To prospectively assess the safety profile of gadoterate meglumine and the overall incidence of nephrogenic systemic fibrosis (NSF).
Methods and Materials: A worldwide post-marketing study collected safety data in adults and children with or without renal insufficiency, who were scheduled to undergo routine contrast-enhanced magnetic resonance (MR) imaging using gadoterate meglumine (Dotarem®). Risk factors at inclusion, indications for MR imaging, and occurrence of adverse events (AE) were recorded. Each patient with renal impairment at the time of inclusion (*i.e.*, estimated creatinine clearance < 60 mL/min or estimated glomerular filtration rate < 60 mL/min/1.73m²), was followed-up during a period of at least 3 months to detect any suspicion of NSF.
Results: A total of 35,499 patients were analyzed (female, 53.1%; mean age: 49.5 years; range: 0-98 years). Most indications were for central nervous system imaging (56.8%). The main risk factors were renal insufficiency (14.7%) and hypertension (11.9%). A total of 70 AEs were observed in 44 patients (0.12%). The most frequent AEs were urticaria (0.03% of patients), nausea (0.02% of patients) and vomiting (0.01% of patients). Thirty-two patients had at

least one AE related to contrast material administration (0.09%). Nine adult patients (0.03%) experienced serious AE. Moderate to severe impairment of renal function was reported in 515 patients (1.5%), 477 of them (92.6%) were followed-up with no suspicion of NSF observed.
Conclusion: This final analysis in more than 35,000 patients of all ages confirms the excellent safety profile of gadoterate meglumine.

B-0024 10:38

68Ga-labelled PSMA- versus 11C-Choline PET/CT in the detection of recurrent prostate cancer

H. Rempp, J. Schwenck, G. Reischl, K. Nikolaou, C. La Fougère, C. Pfannenberg; *Tübingen/DE (h.rempp@yahoo.de)*

Purpose: The aim of the study was to compare 68Ga-labelled-PSMA (prostate specific membrane antigen) ligand with the standard 11C-Choline based PET/CT.
Methods and Materials: 42 patients underwent a PET/CT 5 min p.i. 11C-Choline and 60 min p.i. of 68Ga-HBED-CC-PSMA. The examinations were performed on the same day. 39 patients had a biochemical relapse after prostatectomy/radiotherapy (mean PSA 8.3 ng/ml), 3 patients had a primary staging. Suspicious lesions were evaluated semiquantitatively (mean SUV, standard uptake value and T/B, tumour to blood ratio).
Results: In 36/42 patients, at least one lesion suspicious for cancer could be detected using 68Ga-PSMA (detection rate 85.7%), while at least one lesion could be found by 11C-Choline in 34/42 patients (detection rate 81.0%). In five patients no lesion was found in both methods. Twelve patients had local recurrences, whereof 11/12 relapses were detected by both methods. One local relapse was not detected by 68Ga-PSMA. In 28 patients suspicious lymph nodes (LN) were detected. Among all 98 suspicious LN, 86 were PSMA-positive and 80 were Choline-positive. 18 LN were PSMA-positive only, 12 were Choline-positive only. Bone metastases were found in 14 patients, the number of detected lesions and tracer uptake was clearly higher using 68Ga-PSMA (SUV mean 11.4±8.4 vs 6±3.2). In one patient bone metastases were only dertected with 68Ga-PSMA-PET.
Conclusion: 68Ga-PSMA-PET/CT is able to detect recurrent PC with a higher detection rate compared to the standard 11C-Choline PET/CT and has an improved T/B ratio and is therefore promising particularly for detection of recurrence in patients with low PSA.

Author Disclosures:
K. Nikolaou: Speaker; Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG.

B-0025 10:46

Navigation in an intraoperatively acquired freehand SPECT scan has the potential to improve lesion identification

N.S. van den Berg[1], T. Engelen[1], G.H. KleinJan[1], R.A. Valdés Olmos[2], W.M.C. Klop[2], F.W.B. van Leeuwen[1]; [1]*Leiden/NL*, [2]*Amsterdam/NL (N.S.van_den_Berg@lumc.nl)*

Purpose: To improve intraoperative sentinel node (SN) identification in patients with head and neck melanoma we evaluated the feasibility of navigation in an intraoperative acquired freehandSPECT scan.
Methods and Materials: Six patients with head and neck melanoma were included after obtaining informed consent. Following a subcutaneous indocyanine green (ICG)-99mTc-nanocolloid (av. 86.8 MBq) injection surrounding the lesion lymphoscintigraphy and SPECT-CT imaging were performed to determine the number and location of the SN (s). Prior to incision, the area harboring the SN (s) was scanned with a handheld gamma camera (Crystal Cam, Crystal Photonics). Acquired data was loaded into the navigation system (declipseSPECT; SurgicEye) and after image reconstruction the freehandSPECT scan was obtained. The gamma probe was then navigated in augmented-reality to the SN (s) as seen on the reconstructed 3D freehandSPECT scan. The acoustic feedback provided by the gamma probe allowed confirmation of navigation accuracy. The skin-SN depth distance according to the navigation system was noted and compared to the true depth at which the SN was intraoperatively located with the gamma probe.
Results: Preoperative imaging revealed 11SNs. FreehandSPECT acquisition took 72-126sec (image reconstruction time 31-211sec). All but one SN could be visualized an navigated to on the acquired 3D freehandSPECT scans. A depth error of 3-6 mm was found.
Conclusion: Intraoperative 3D freehandSPECT scan acquisition and navigation in this scan to the SN is feasible. The depth estimation provided by the navigation approach has the potential to be of additional value for SN localization. Improvements in navigational accuracy are required to further optimize the approach.

B-0026 10:54

Diagnosing relapse in brain tumours utilising integrated [11C]-methionin PET/MRI

L. Umutlu[1], T. Pöppel[1], K. Wrede[1], O. Müller[1], C. Pöttgen[1], P. Heusch[2], T.C. Lauenstein[1], M. Forsting[1], M. Schlamann[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE (Lale.Umutlu@uk-essen.de)*

Purpose: To evaluate and compare the diagnostic potential of simultaneous [11C]-Methionin PET/MRI to MRI alone for assessment of potential tumour relapse in patients suspect for brain tumour recurrence.
Methods and Materials: 30 patients with suspected recurrence of glioblastoma multiforme (n=12), low grade astrocytoma (n=15) and three anaplastic astrocytoma underwent a simultaneous [11C]-Methionin PET/MRI examination (Biograph mMR, Siemens). The scan protocol comprised: 1) FLAIR, 2) DWI, 3) T1 TSE, 4) MPRAGE post contrast [after the application of 0.05 mmol kg/bw Gadoteric acid (Dotarem, Guerbet)], 5) SWI. The corresponding datasets (PET/MRI and MRI alone) were read separately by two radiologists for assessment and differentiation between potential tumour relapse or exclusive posttherapeutic changes (2 point ordinal scale) as well as diagnostic confidence (3 point ordinal scale).
Results: Tumour recurrence was present in 21 of 30 patients, with 9 patients showing posttherapeutic changes without a corresponding tracer uptake. The 21 diagnosed tumour recurrences comprised 9 glioblastoma multiforme (mean tracer uptake 3.9) and 12 low-grade astrocytoma (mean tracer uptake 2.6). PET/MRI allowed for correct identification of all tumour recurrences (100%), while MRI alone allowed for correct identification of 26 out of the 30 recurrences (86.7 %). Furthermore, PET/MRI offered significantly higher diagnostic confidence for detection of tumour relapse (PET/MRI:2.8±0.4; MRI alone 2.5±0.5; $p < 0.05$) as well as posttherapeutic changes (PET/MRI:2.4±0.7; MRI alone:1.7±0.5; $p < 0.05$).
Conclusion: Based on the improved discrimination of tumour recurrences while maintaining equal acquisitions times to MRI alone, integrated PET/MRI may serve as a valuable tool for assessment of potential tumour recurrences.

Author Disclosures:
L. Umutlu: Speaker; Bayer Healthcare.

B-0027 11:02

Role of ^{11}C-methionine PET as a prognostic factor in patients with primary brain gliomas eligible for surgery

E. Lopci, L. Bello, L. Olivari, M. Riva, M. Simonelli, F. Raneri, A. Chiti; *Rozzano/IT (egesta.lopci@gmail.com)*

Purpose: To identify prognostic biomarkers of tumour grading and outcome in patients affected by brain gliomas and candidate to surgery.
Methods and Materials: We analysed data from 58 patients (M:F=40:18; mean age 46years) with pathology proven gliomas and referred to our Institution for tumour resection. All patients underwent ^{11}C-methionine PET-CT and semi-quantitative analyses were obtained by taking into consideration SUV_{max} of the lesion and SUV_{ratio} to normal brain. These data were subsequently correlated to disease outcome and compared to other clinical, instrumental and biological information obtained by histology, for a median follow-up period of 14.5 months; we considered Gd-enhancement on MRI, WHO grade and gene profiling, i.e. IDH1 mutation, 1p/19q co-deletion and MGMT promoter methylation.
Results: According to WHO classification, we analysed 23 low-grade gliomas (LGG: grade II), and 35 high-grade gliomas (HGG: 18 grade III and 17 grade IV). We determined a statistically significant correlation between SUV_{max} and SUV_{ratio} vs. tumour grading ($p < 0.001$) and IDH1 mutation ($p=0.007$ and < 0.001, respectively). When considering disease outcome, we identified a statistically significant correlation between Gd-enhancement ($p=0.019$), grade ($p=0.017$) and SUV_{ratio} ($p=0.032$), with an optimal cut-off point at ROC analysis $SUV_{ratio} > 2.2$ ($p < 0.001$). On multivariate analysis, we did not identify an independent prognostic factor, although SUV_{ratio} cut-off showed a borderline p-value (0.053). All the other factors considered did not show any significant correlation with outcome.
Conclusion: In this cohort of patients candidate to surgery semi-quantitative analyses correlate to tumour grading and IDH1 mutation. Moreover, grading, Gd-enhancement and SUV_{ratio} appear as prognostic factors to outcome.

B-0028 11:10

Impact of attenuation correction on quantification of tracer uptake in a fully integrated PET/MR system: comparison between MR- and CT-based attenuation correction

F. Seith, S. Gatidis, H. Schmidt, I. Bezrukov, C. La Fougère, K. Nikolaou, C. Pfannenberg, N. Schwenzer; *Tübingen/DE*
(Ferdinand.Seith@med.uni-tuebingen.de)

Purpose: Attenuation correction (AC) in fully integrated PET/MR systems plays a key role for the quantification of tracer uptake. The aim of this prospective study was to assess accuracy of standardized uptake value (SUV) quantification using MR-based AC in direct comparison to CT-based AC of the same PET dataset on a large patient population.
Methods and Materials: 68 patients (22 female, 61±11 years) were examined by means of combined PET/CT and PET/MR (11C-Choline, 18 F-FDG or 68Ga-Dotatate) subsequently. PET images from PET/MR examinations were corrected with MR-derived AC based on tissue segmentation (PETMR). The same PET data were corrected using CT-based attenuation maps (AM) derived from PET/CT after non-rigid registration of the CT to the MR-based AM (PETMR_µCT). CT-based AMs for PET data from PET/MR were created using MATLAB. PET SUVs were quantified placing ROIs or VOIs.
Results: Reduced SUVs were measured in PETMR compared to PETMR_µCT in all tissue types. Mean relative differences were 14.8±22.7% (blood-pool), 8.99±19.2% (spleen), 6.43±18.7%/8.18±24.9% (liver), 8.85±23.9% (muscle), 10.20±25.5% (fat), 54.04±15.7%/56.28±15.2% (femora), 18.97±25.99% (spine), 8.31±32.4% (lung), 2.87±17.4% (liver lesions), 6.46±8.0% (bone lesions) and 4.14±34.45% (soft-tissue lesions).
Conclusion: Results obtained using different tracers show that MR-based AC is accurate in most tissue types resulting in SUV underestimations below 10%. In bone, however, underestimations can be highly pronounced leading to inaccurate SUV quantifications. Thus, prediction of osseous tissue should be integrated into MR-based AC.

B-0029 11:18

Simultaneous PET/MRI for primary staging of patients with cervical cancer: preliminary results

J. Grueneisen[1], B.M. Schaarschmidt[2], M. Heubner[1], V. Ruhlmann[1], T.C. Lauenstein[1], M. Forsting[1], L. Umutlu[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE*
(johannes.grueneisen@uk-essen.de)

Purpose: To assess the diagnostic value of integrated PET/MRI for staging of patients with primary cervical cancer, as well as to investigate a potential association between PET/MRI derived functional parameters and prognostic factors of cervical cancer.
Methods and Materials: 25 consecutive patients with histopathologically confirmed cervical cancer underwent a whole-body PET/MRI examination prior to therapy. Two radiologists separately evaluated the PET/MRI datasets, regarding local tumour spread of primary cervical cancer lesions as well as detection of nodal and distant metastases. Furthermore, SUV and ADC values of primary tumour lesions were analyzed and correlated with dedicated prognostic factors of cervical cancer. Results from histopathology and cross-sectional imaging follow-up were used as the reference standard.
Results: PET/MRI enabled the detection of all 25 primary tumour lesions of the uterine cervix and allowed for the correct determination of the T-stage in 21 (84%) out of the 25 patients. Furthermore, patient-based sensitivity and specificity for the depiction of lymph node metastases amounted to 100% and 93%, respectively. Quantitative assessments of PET/MRI derived functional parameters revealed significantly higher SUV and lower ADC values for poorly-differentiated tumours in comparison to well- and moderately differentiated cervical cancer lesions ($p < 0.05$). Additionally, calculated SUVs revealed a significant and positive correlation with tumour size, while mean ADC values inversely correlated with the size of cervical cancer lesions ($p < 0.05$).
Conclusion: The present study demonstrates the high diagnostic potential of integrated PET/MRI for staging patients with primary cervical cancer, providing additional PET and MRI derived functional prognostic parameters in a pretreatment setting.

B-0030 11:26

Translational imaging in diagnostic workup of neurodegenerative parkinsonian syndrome

C. Paschetta, F. Buttari, D. Gned, M. Iudicello, A. Skanjeti, A. Veltri, V. Podio; *Orbassano/IT (cristina.olena@mail.ru)*

Purpose: Movement disorders are common, and neuroimaging plays a pivotal role in diagnosis. Aim of this study was to perform an automated integration by voxel based morphometry (VBM) of MRI and FP-CIT SPECT to optimize the diagnostic accuracy in neurodegenerative parkinsonian syndrome (NPS).
Methods and Materials: Sixty-two patients with suspicion of Parkinson's disease (age 66±11, 33 M) underwent FP-CIT SPECT and brain MRI within 2 years. Later, NPS was confirmed by neurological assessment in 31 patients. Images were normalized (with our FP-CIT template and built-in T1 template, respectively) and analyzed by SPM; VOIs data for each modality were extracted with MarsBaR software. Multivariate logistic regression was used to evaluate the correlation of both SPECT and MRI semi-quantitative data with diagnosis.
Results: At SPECT, basal ganglia uptake was significantly lower in NPS compared to NPS-free (p=10-5). In T1 images, SPM detected difference between the two groups in thalami and in anterior cingulate (p=0.005 and p=0.04, respectively): in both occurrences MR accuracy was lower than SPECT accuracy. Multivariate analysis showed that MRI data of thalami were independently and significantly correlated with diagnosis and improve accuracy from 77% of SPECT alone to 87% (SPECT + MRI). Cingulate data showed to be non significant (probably variable dependent from thalami).
Conclusion: SPECT is mandatory when NPS is suspected; an integrated voxel-based analysis of MR and SPECT by SPM showed to increase accuracy. Translational imaging should be encouraged in order to fully develop the strength of both structural and functional imaging in patients with suspected NPS.

B-0031 11:34

Implementation of a fast-protocol for simultaneous PET/MR imaging for whole-body staging of female patients with recurrent pelvic malignancies: a comparison to the PET/CT

J. Grueneisen[1], B.M. Schaarschmidt[2], M. Heubner[1], S. Kinner[1], V. Ruhlmann[1], T.C. Lauenstein[1], M. Forsting[1], L. Umutlu[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE*
(johannes.grueneisen@uk-essen.de)

Purpose: To evaluate the diagnostic performance of a fast-protocol for integrated PET/MRI to perform whole-body staging of female patients suspect for a recurrence of a pelvic malignancy in comparison to PET/CT.
Methods and Materials: 24 female patients with a suspected recurrence of a pelvic malignancy were enrolled for a clinically indicated PET/CT and a subsequent PET/MRI examination. Two readers separately evaluated both examinations and were instructed to identify all tumour lesions. For PET/MRI readings, a whole-body fast-protocol was implemented, comprising (1) a transversal DWI (EPI) sequence, (2) a transversal T2w HASTE sequence and (3) a transversal post-contrast T1w VIBE sequence. Furthermore, qualitative assessment of PET and DWI data was performed. Image interpretation comprised visual lesion-to-background contrast (4-point ordinal scale) for all suspect lesions.
Results: A total of 104 suspect lesions were detected, including 81 (78%) malignant and 23 (22%) benign lesions. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for the detection of malignant lesions were 82%, 91%, 97%, 58% and 84% for PET/CT and 85%, 87%, 96%, 63% and 86% for PET/MRI. Differences between the two imaging modalities were not statistically significant ($P > 0.05$). No significant difference for lesion-to-background contrast was found between PET/CT and PET/MRI based on qualitative analysis ($p < 0.05$).
Conclusion: The fast-protocol for PET/MRI offers an equivalently high diagnostic performance for restaging female pelvic malignancies with only slightly prolonged scan duration. With regard to the significant reduction of radiation dose, PET/MRI may serve as a powerful alternative to PET/CT in the future.

B-0032 11:42

Blood oxygen level-dependent magnetic resonance imaging (BOLD-MRI) evaluating human visceral adipose tissue (AT) oxygenation induced by salt loading/depletion: feasibility study

L. Zheng[1], Z. Zhang[2]; [1]*Shanghai/CN*, [2]*Chicago, IL/US*
(zhenglinfeng04@aliyun.com)

Purpose: To investigate the feasibility of blood oxygen level-dependent magnetic resonance imaging (BOLD-MRI) in evaluating human visceral adipose tissue (AT) oxygenation induced by salt loading/depletion.
Methods and Materials: This study was approved by the ethics committee and written informed consent was obtained from all volunteers. Twenty-three healthy volunteers were given a dietary intervention protocol as following: three-day usual diet followed a seven-day high-salt diet (ε15 g NaCl/day) and a seven-day low-salt diet (δ5 g NaCl/day). The oxygenation in peri-renal AT was evaluated by measuring R2* signal value in BOLD-MRI. CD14++CD16+ monocytes were counted by flow cytometry. The correlation between AT R2* values and CD14++CD16+ monocytes were analyzed.
Results: Salt loading led to a consistent increase in the R2* signal in peri-renal AT ($25.2±0.90$ second^{-1} vs. $21.5±0.71$ second^{-1}, $P < 0.001$; a ~17% increase in R2* signal). The R2* value was positively correlated with the CD14++CD16+ monocytes ($r=0.419$, $P < 0.001$).
Conclusion: The results provide that it is feasible using BOLD-MRI for evaluating peri-renal AT oxygenation in humans induced by dietary salt loading/depletion, and BOLD-MRI can serve as a novel non-invasive tool for assessing visceral AT hypoxia.

B-0033 11:50

The hybrid tracer ICG-99mTc-nanocolloid for combined radio- and fluorescence-guidance to the sentinel node in the groin

N.S. van den Berg[1], G.H. KleinJan[1], O.R. Brouwer[2], S. Horenblas[2], R.A. Valdés Olmos[2], H.G. van der Poel[2], F.W.B. van Leeuwen[1]; [1]*Leiden/NL*, [2]*Amsterdam/NL (N.S.van_den_Berg@lumc.nl)*

Purpose: For penile cancer, sentinel node (SN) biopsy is a well-validated procedure to stage clinically node-negative patients. Generally, for this a combination of radiocolloid and blue dye is used. The hybrid tracer indocyanine green (ICG)-99mTc-nanocolloid was developed to combine the beneficial properties of radioguidance and fluorescence imaging. This study evaluated the value of the hybrid tracer for SN biopsy in patients with penile cancer.
Methods and Materials: 165 Patients with penile cancer scheduled for SN biopsy of the cN0 groin were included. Following a peritumoural injection of the hybrid tracer lymphoscintigraphy (dynamic and static) and SPECT-CT imaging were performed to determine the number and location of SNs. Prior to the start of the operation blue dye was injected peritumourally. Initially, SNs were pursued using the gamma probe followed by optical confirmation blue dye detection and fluorescence imaging.
Results: Preoperative imaging revealed 454 SNs (301 groins). Intraoperatively, blue dye stained 54.5% of the SNs. In contrast, via fluorescence imaging 82.9% of SNs were visualized in vivo (98.9% ex vivo) ($p < 0.0001$). All excised SNs were radioactive. Tissue penetration of the fluorescent signal and the rapid flow of blue dye limited the in vivo detection sensitivity. A tumour-positive SN was found in 32 patients (19.4%).
Conclusion: ICG-99mTc-nanocolloid allows for preoperative SN mapping and combined radio- and fluorescence guided SN biopsy in patients with penile cancer. Fluorescence imaging strongly improved optical SN detection compared to blue dye ($p < 0.0001$).

10:30 - 12:00 **Room M**

GI Tract

SS 201b

Improving abdominopelvic imaging: technical aspects

Moderators:
D.J. Breen; Southampton/UK
R. Malago; Verona/IT

B-0034 10:30

Does abdominal ultrasound show equivalence to computed tomography and magnetic resonance enterography in predicting disease severity and complications?

A. Wadhwani, S. Batool, K. Novak, S. Wilson; *Calgary, AB/CA (aman.wadhwani@me.com)*

Purpose: To assess the effectiveness of transabdominal ultrasound in predicting disease activity and intestinal complications in patients with Crohn Disease (CD) in comparison to temporally related computed tomography (CT), computed tomography enterography (CTE) or magnetic resonance enterography (MRE).
Methods and Materials: 308 consecutive patients with CD who had temporally related US and CT/CTE/MRE scans with no intervening therapy were retrospectively analyzed. Images were independently reviewed by two blinded specialty-physicians and overall disease activity, bowel wall thickening, presence of inflammatory fat and mural blood flow were similarly graded on all cross-sectional imaging. Major complications were identified and reported. Concordance of US and CT/CTE/MRE imaging on disease activity measures and the detection of complications were determined with 95 % confidence intervals.
Results: Disease activity grades on US and reference imaging were concordant in 98.05% (95% CI: 94-100) of patients on the basis of wall thickness, 96.69% (95% CI: 97-100) on the basis of blood flow and 87.13% (95% CI: 83-92) with respect to inflammatory fat. Complications were identified on US as compared to alternate imaging as follows: strictures in 84/86, 97.67% (95% CI: 93-100), fistulae in 53/54, 98.14% (95% CI: 97-100), and abscess in 18/20, 90% (95% CI: 88-95). Overall inter-rater agreement was high (kappa value =0.96).
Conclusion: US showed equivalent ability to predict disease activity and clinical complications, equal to and at times superior to that of either CT or CTE/MRE. US can be used as a first line investigation tool in emergency and routine surveillance of CD.

B-0035 10:38

Reduction of contrast and radiation dose in multidetector computed tomography (MDCT) using individualised tailored protocols

A. Vanzulli[1], L. Romano[2], N. Flor[1], A. Carriero[3], T. Albrecht[4], M. Prokop[5]; [1]*Milan/IT*, [2]*Naples/IT*, [3]*Novara/IT*, [4]*Berlin/DE*, [5]*Nijmegen/NL*

Purpose: To determine whether MDCT protocols tailored to the individual patient using dedicated software permits reductions of radiation and contrast dose relative to standard protocols in routine clinical use.
Methods and Materials: 981 patients, consecutively and prospectively enrolled at 4 sites, were randomized to receive either standard or tailored MDCT imaging (chest, abdomen, liver, or thoracoabdominal CTA) using different scanner types. Contrast agent (Iomeprol 400; Bracco) was administered at the volume and flow rate specified by the standard or tailored protocol based on the lean bodyweight of the patient. The radiation dose applied was either standard or was adapted in the tailored protocol based on bodyweight. Image quality, applied radiation and contrast dose as well as enhancement and signal-to-noise ratio (SNR) were compared between the two protocol groups.
Results: Almost all patients had examinations of diagnostic image quality regardless of the protocol (99.2% for the standard protocol vs. 98.5% for the tailored protocol, p=0.38). The total dose of contrast agent was significantly lower in patients undergoing the tailored protocol across all body areas (overall: 83.2 ml vs. 99.6 ml, $p < 0.0001$). Likewise the applied radiation dose was also significantly lower in patients undergoing the tailored protocol (overall CTDI: 10.5 vs. 11.4, p=0.012). Whereas contrast enhancement demonstrated an inverse correlation with bodyweight when using standard protocols, both enhancement and SNR were more consistent and independent of lean bodyweight when using tailored protocols.
Conclusion: Tailoring MDCT protocols using dedicated software permits significant reductions of radiation and contrast dose without impairing diagnostic quality.

B-0036 10:46

Low-dose fluoroscopic examinations of the upper gastrointestinal tract: assessment of image quality and radiation levels

J. Weiß[1], A. Pomschar[2], K. Neumaier[2], W. Flatz[2], B. Ertl-Wagner[2], M. Li[2], M. Notohamiprodjo[2]; [1]*Tübingen/DE*, [2]*Munich/DE*

Purpose: To evaluate dose exposure and image quality of dynamic low-dose fluoroscopy pulsed images (FP) compared to normal digital radiographs (DR) of the upper gastrointestinal tract.
Methods and Materials: Thirty-six patients underwent contrast-enhanced (Imeron 300) FP at 30 pictures/second (Artis Zee MP, flat-panel detector, Siemens) with low-dose protocols and copper filtering followed by single image conventional DR. Consensus reading was performed by two radiologists regarding overall image quality, noise and depiction of the contrast agent and the trachea using a five-point Likert scale (5=excellent, 1=non diagnostic). For dose measurements, we used an Alderson-Rando Phantom with 60 thermoluminescent dosimeters placed in relevant organs of interest. Images (DR and FP) were taken at 30 p/s to a dose of 500 mGy, to reduce measurement errors. Direct/scattered dose and dose-area product were calculated for an acquisition time of 10 seconds.
Results: Overall image quality of FP images vs. the DR standard was rated 4.1±0.6, noise with 3.6±0.5, contrast of the trachea with 4.4±0.7 and contrast of the contrast agent with 5.0±0.6. Dose-area product (µGym2) was 26.9 (FP) and 931.5 (DR). Phantom dose measurements showed a general dose reduction of factor 25 for FP vs. DR. Direct and scattered dose (mGy) were lower for FP (direct: oesophagus (0.48), stomach (0.39); scattered thyroid (0.03), gonads (male 2.6x10-4, female 4.2x10-3)) compared to DR (direct: oesophagus (13.11), stomach (10.85); scattered: thyroid (0.76), gonads (male 4.2x10-3, female 0.01)).
Conclusion: FP provides comparable image quality while achieving a significant dose reduction up to 25-fold vs. DR.

B-0037 10:54

Clinical impact of double reading of abdominal CT scans of surgical patients

P.M. Lauritzen[1], J. Andersen[2], M. Stokke[3], A. Tennstrand[4], T. Heggelund[1], R. Aamodt[1], P. Hurlen[1], G. Sandbæk[2], P. Gulbrandsen[5]; [1]*Lørenskog/NO*, [2]*Oslo/NO*, [3]*Drammen/NO*, [4]*Bærum/NO*, [5]*Nordbyhagen/NO (plau@ahus.no)*

Purpose: Consultant radiologists in Norwegian hospitals submit 39% of interpreted CT scans for quality assurance by double reading. The purpose of this study was to evaluate the clinical impact of changes to radiology reports made following double reading of abdominal CT scans of surgical patients.
Methods and Materials: Preliminary and final reports from 1072 consecutive double read abdominal CT scans were collected from five hospitals with a combined catchment population of 1.1 million. Preliminary and final reports were compared. Two experienced abdominal surgeons rated the clinical

impact of all changes in content on a 5-point scale devised for this purpose. Clinically insignificant changes, not affecting investigation, controls or treatment, were rated "minimal" or "small". Changes affecting further investigations or controls were rated "intermediate". Changes implying a change of treatment or diagnosis were rated "large". Changes demanding immediate action were rated "critical".
Results: There were clinically significant changes in content to 229 (21%) of the 1072 reports. Changes in content to 161 (15%) of the reports were rated "intermediate", 61 (6%) were rated "large" and 7 (< 1%) were rated "critical". The "critical" changes regarded vascular issues (2), intestinal or bowel obstruction (2), anastomotic leakage (2) and cancer (1). From the clinically significant changes 69 % represented an increase in severity while 14% represented a decrease in severity. In 17% there was no change in severity.
Conclusion: Clinically significant changes were made to 21% of reports as a result of double reading. Seven out of ten represented an increase in severity.

Author Disclosures:
P. Lauritzen: Research/Grant Support; Research funding from the Norwegian Medical Association, Research funding from the Norwegian Association of Radiologists.

B-0038 11:02

Diagnostic efficacy of a low-radiation high-contrast dose protocol in single-pass abdominal multi-detector CT (MDCT): a prospective comparison with a standard protocol

L. Camera, I. Liccardo, F. Romano, S. De Fronzo, A. Rispo, R. Liuzzi, M. Imbriaco, F. Castiglione, M. Salvatore; *Naples/IT (camera@unina.it)*

Purpose: To prospectively evaluate the diagnostic efficacy of a low radiation - high contrast (LR-HC) dose protocol compared with a standard (SD) protocol.
Methods and Materials: 40 (21M;19 F; aged 20-65 yrs) patients with acute bowel disease underwent a single-pass contrast-enhanced MDCT of abdomen and pelvis (coll. 1x32 mm; tube speed 36 mm/s; rotation time 0.75 s; helical pitch=27; rec. thickness = 5 mm; 120 kVp; AEC) with scan delays of 70-100 seconds. Patients were divided in two age-groups: A (20-44 yrs, n=20; 61 ± 8 kg) and B (45-65 yrs, n=20; 68 ± 9 kg). For each group, a different Noise Index and contrast medium dose were selected as follows: A (NI=15; 2.5 cc/kg) and B (NI =12.5; 2 cc/kg). Radiation exposure was reported as Dose Length Product (mGy/cm). Prospective CT findings were compared with final diagnoses based on endoscopy with (n=7) or without biopsy (n=7), surgery (n=7), histology (n=1), clinical (n=11) or instrumental follow-up (n=7). Statistical analysis was performed with Student's T-test for continuous variables and Chi-Square for percentages.
Results: Sensitivity, specificity and diagnostic accuracy were 92 vs 86% ($p > 0.05$), 86 vs 83% ($p > 0.05$) and 90 vs 85% ($p > 0.05$) for the LR-HC and the SD protocols, respectively. DLP and contrast media were 499+218 vs 965+331 mGy/cm ($p < 0.001$) and 152 + 22 vs 136 + 18 cc ($p < 0.05$) for the LR-HC and the SD protocol, respectively.
Conclusion: A LR-HC dose is a dose-effective protocol in the evaluation of acute bowel disease by single-pass abdominal MDCT.

B-0039 11:10

Comparison of water and mannitol as negative contrast agents in abdominal staging CT

T. Kaireit, C. Lutat, M.J. Peperhove, F. Wacker, K.I. Ringe; *Hannover/DE (kaireit.till@mh-hannover.de)*

Purpose: To compare the performance of water and mannitol as negative oral contrast agents administered for abdominal CT in clinical routine.
Methods and Materials: 100 patients (30f, 70m; mean 61y) prospectively underwent abdominal staging CT with either oral application of 1 l mannitol (n=50) or water (n=50) administered 45 min prior to the scan. Intestinal distension was assessed quantitatively by two radiologists in consensus in the following segments: pars descendens and pars horizontalis duodeni, proximal and distal jejunum, proximal and distal ileum. For qualitative analysis two blinded radiologists independently scored the diagnostic quality in each segment (two-point-scale) and the degree of distention (three-point-scale). Quantitative and qualitative results were compared (t-test, Mann-Whitney test). Interobserver variability was calculated (Cohen k).
Results: There was a significantly better distention of all intestinal segments using water compared to mannitol ($p < 0.05$), except for the proximal ileum (p=0.20). After water administration 37% and 40% of intestinal segments were rated as diagnostic (reader 1 and 2); and 46% and 46% after mannitol administration, respectively. Qualitatively, intestinal distention was rated equally by both readers, except for the proximal ileum (reader 1; p=0.048) and the distal jejunum (reader 2; p=0.02). Interobserver variability regarding the number of diagnostic segments was moderate for water and mannitol examinations (k=0.43 and 0.53).
Conclusion: As a negative oral contrast agent water does not perform inferior to mannitol in terms of quantitative and qualitative intestinal distension at abdominal CT, and may thus be preferable in clinical routine due to better patient tolerance and lower costs.

B-0041 11:18

Comparison between two different techniques for dynamic magnetic resonance imaging of the pelvic floor, one with gel rectal filling and the other with air balloon rectal distention in the evaluation of pelvic floor disorders

N. Al Ansari, F. Maccioni, V. Buonocore, F. Mazzamurro, C. Catalano; *Rome/IT (najwaalansari@yahoo.it)*

Purpose: To prospectively compare 2 different techniques for Dynamic Pelvic Floor MRI (DPF-MRI) based on different rectal filling in patients affected by pelvic floor disorders.
Methods and Materials: 22 females patients (25-75 yo) with pelvic floor dysfunctions underwent two different rectal filling techniques during the same procedure. First a balloon filled with 15-20 cc of saline was placed in the rectum (Foley catheter) followed by additional 300 cc of room air. Static and dynamic scans where then acquired at rest, contraction and maximal straining. In the second phase, 180 cc of ultrasound gel were administered to distend the rectum, then static and dynamic scans were acquired, with final evacuation.The two examinations were compared with regard to the evidence of rectocele, rectal invagination, cystocele, anorectal junction descent, enterocele and other pathologic findings. Gold standard was conventional defecography when available, surgical intervention and clinical evaluation in non-surgical patients.
Results: DPF-MRI performed using gel-filling-technique showed 22 rectoceles, 18 invaginations, 6 enteroceles, 16 cystoceles, 2 dyskinesias and 0 urethral hypermobility. DPF-MRI performed using air-filling-technique showed 19 rectoceles, 16 invaginations, 10 enteroceles, 20 cystoceles, 1 dyskinesias and 4 urethral hypermobilities. The air -balloon technique missed 3 small rectoceles;a higher number of enteroceles, cystoceles and urethral hypermobility was depicted with the air-balloon -technique.
Conclusion: Both techniques allowed a satisfactory evaluation of posterior floor disorders. The gel-filling-technique allowed a better evaluation of diskinesia and rectoceles. The air balloon technique showed higher sensitivity for urogenital disorders and enteroceles than the gel technique.

B-0042 11:26

Radiation dose of 3rd generation CT colonography

D. Skripkin; *Omsk/RU (skripkinomsk1@mail.ru)*

Purpose: To assess the radiation dose of colonography, performed on 128-detector row single-source dual-energy MDCT with automatic modulation current of the tube.
Methods and Materials: In this retrospective study was analyzed CT colonography 210 symptomatic patients (112 women, 98 male, mean age 51 years, body weight women 78.4 ± 10.5 kg, body weight men 84.3±12.9 kg). Helical scan parameters: collimation 128*0.6 mm, pitch 0.9, the rotation time 0.5 seconds. Tube voltage in all cases was 120 kV, automatic dynamic modulation current were 24 mAs to 53 mAs, an average of 35 ± 5 mAs. Scan time was 4-10 seconds. The image quality parameter was determined by HU measurements in the colonic lumen at four anatomic levels. Standard deviation (SD) was used to estimate the noise which characterizes the dispersion of the density values in HU with respect to its mathematical expectation in a particular ROI.
Results: Radiation dose helical prone scanning was 2.0 ± 0.55 mSv, and helical supine scanning was 1.6 ± 0.34 mSv. Summary radiation dose was 3.65 ± 0.72 mSv. The image noise level was on average 16.1 ± 4.2 HU, which corresponds to a good quality image.
Conclusion: These parameters of radiation dose CT colonography on the latest generation of MDCT with modern methods of dose reduction to 100% lower dose CT colonography in 1999. Reasonable radiation dose of CT colonography, along with highly informative and minimally invasive allows more extensive use of this technique in clinical practice.

B-0043 11:34

Pelvic static MR vs MR-defecography in the study of woman's pelvic floor disorders

A. Ambrosi, G. De Franco, F. Lorusso, M. Cascarano, A. Scardapane, G. Angelelli; *Bari/IT (annalisaambrosi85@gmail.com)*

Purpose: To assess static MR and MR-defecography impact in the evaluation of pelvic floor disorders.
Methods and Materials: 21 women underwent pelvic-MR and MR-defecography: 8 patients presented constipation, 4 rectal prolapse, 3 bladder prolapse, 3 bladder and uterine prolapse and 2 enterocele. MR examinations were performed in prone position and SSTH T2 sequences in the 3 space

plans were obtained both in indifferent position and under straining. As later stage the patient's rectum was filled with ultrasound gel and dynamic defecographic images were acquired with B-FFE sequences on a medium sagittal plane (1 sec/image, 110 overall images). In the static scans we considered images obtained at the level of the pubic symphysis to evaluate thickness and symmetry of the levator ani muscles, the levator hiatus, the vaginal morphology and the pubovescical ligaments. MR-Defecogrphy was assessed according HMO system for pelvic floor laxity. The presence of rectocele, rectal intussusception, enterocele and bladder's incontinence was also evaluated.
Results: In the axial static scans we recognized a levator hiatus flare in 5 patients and an asymmetry of the levator ani muscles in 4 patients. Sagittal scans allowed the recognition of 3 rectal prolapses, 2 bladder prolapses and 1 enterocele. In the dynamic defecographic sequences all the cases of bladder and rectal prolapse were identified; 2 rectal intussusceptions, 9 cases of anterior rectocele and 3 cases of bladder's incontinence were also recognised.
Conclusion: Static and dynamic MR are complementary techniques and provide essential information to fully understand the complex disorders of women's pelvic floor.

B-0044 11:42

Semi-automatic computed tomography volumetry of esophageal cancer: a reproducible method for assessment of primary tumour size insensitive to radiologist experience

Y.-H. Zhang, M. Fisher, A. Tomson, H. Lehmann, G. Herlin, I. Rouvelas, L. Lundell, T.B. Brismar; *Stockholm/SE (yi-hua.zhang@ki.se)*

Purpose: Computed Tomography (CT) volumetry of esophageal cancer tumour size has been practiced but the clinical and research value remain controversial. In order to assess the value of CT volumetry, the reproducibility of the method has to be validated. In this study, the reproducibility of CT volumetry using manual segmentation by consultant radiologists was compared to semiautomatic segmentation by consultant radiologists and radiologists under training.
Methods and Materials: Five consultant radiologists measured the tumour volume of 18 patients under evaluation for curative resections for esophageal cancer in 2004-2005 with esophageal cancer by manual segmentation (group A). Two second year radiology residents and two consultant radiologists measured the tumour volume of 23 esophageal cancer patients not subject to any prior treatment by semiautomatic segmentation (group B) in order to assess the effect of clinician experience on the reproducibility of CT volumetry. The patients evaluated underwent a CT exam 2007-2012. Inter-reader agreement of volume measurements was assessed by calculating the intra-class correlation coefficient.
Results: The inter-reader agreement was excellent among experienced radiologists using segmentation (ICC 0.96) and among experienced radiologists and radiologists under training using semi-automatic segmentation (ICC 0.98). The average absolute difference from mean volume was 14 % using semiautomatic segmentation and 24 % using manual segmentation. The lower difference of 10 percentage points using semiautomatic segmentation was highly significant ($p < 0.001$).
Conclusion: Semiautomatic CT volumetry seems to be a highly reproducible method to measure esophageal tumour volume which is insensitive to the radiologist experience and superior to manual segmentation.

10:30 - 12:00 **Room N**

Cardiac

SS 203a

Tissue characterisation

Moderators:
N. Kawel-Böhm; Chur/CH
B.K. Velthuis; Utrecht/NL

B-0045 10:30

Integrated FDG PET/MRI in the assessment of cardiac tumours

F. Nensa, T.D. Poeppel, C.J. Jensen, P. Heusch, T. Schlosser, K. Nassenstein; *Essen/DE (felix.nensa@gmail.com)*

Purpose: To evaluate whether integrated FDG-PET/MRI can improve the diagnostic workup in patients with cardiac tumours.
Methods and Materials: Twenty patients were prospectively assessed using FDG-PET/MRI (mMR Biograph, Siemens Healthcare). The MR protocol consisted of cine, T2-weighted and T1-weighted images before and after contrast enhancement. For PET, patients were prepared with a high-fat, low-carbohydrate diet and 50 IU/kg of heparin were administered 15 minutes prior the FDG injection.
Results: Cardiac masses were diagnosed as: 3 x metastases, 1 x direct tumour infiltration via pulmonary vein, 2 x local relapse of primary sarcoma after surgery, 1 Burkitt's lymphoma, 2 x scar/patch tissue after surgery of primary sarcoma, 4 x myxoma, 1 x fibroelastoma, 3 x caseous calcification of mitral annulus, 3 x thrombus. SUVmax in malignant lesions was significantly higher than in non-malignant cases (13.2 ± 6.2 vs. 2.3 ± 1.2, $p < 0.001$). Using a threshold of $\varepsilon 5.2$, SUVmax was found to yield 100% sensitivity and 92% specificity for the differentiation between malignant and non-malignant cases. T2-weighted hyperintensity and contrast-enhancement both yielded 100% sensitivity, but weak specificity of 54% and 46%, respectively. Morphologic tumour features as assessed by cine MRI yielded 86% sensitivity and 92% specificity. Consent reading using all available MR features yielded 100% sensitivity and 92% specificity. A combination of SUVmax $\varepsilon 5.2$ with consent MRI reading improved sensitivity and specificity to 100%.
Conclusion: In selected patients, FDG-PET/MRI can assist in the noninvasive assessment of cardiac masses and may be especially useful in the local staging and follow-up of cardiac malignancies before and after surgery.

B-0046 10:38

Extramedullary hematopoiesis (EMH) is associated with lower cardiac iron loading in regularly politransfused thalassaemia patients

F. Terrazzino[1], A. Meloni[2], P. Ricchi[3], N. Giunta[1], D. Messana[1], A. Pepe[2]; [1]*Palermo/IT*, [2]*Pisa/IT*, [3]*Naples/IT (fabrizia.terrazzino@libero.it)*

Purpose: Extramedullary hematopoiesis (EMH) is an incidental finding in regularly polytransfused thalassaemia patients but no study has evaluated if it is a marker of a peculiar pattern of iron loading. We studied the relationship between EMH and Magnetic Resonance Imaging (MRI) findings.
Methods and Materials: 1266 thalassemia patients (pts) transfused (655 F; 31.25 ± 8.86years) were considered. MRI was used to assess the presence of EMH by SPGR sequences, to quantify cardiac and hepatic iron overload by a multiecho T2* approach, and to assess cardiac function, volumes and pulmonary diameter by SSFP sequences. Myocardial fibrosis was evaluated by LGE technique.
Results: EMH was detected in 167 pts (13.2%). At the comparisons between EMH- and EMH+ pts: no significant differences were found in the chelation regimens between the two groups. EMH+pts had significant less cardiac iron overload than EMH-. Biventricular volumes, cardiac index, ejection fractions, atrial areas and presence of myocardial fibrosis were comparable between the two groups. EMH+ patients had a significantly higher LV mass index and pulmonary artery diameter. The MRI LIC was significantly lower in the EMH+ patients than EMH- pts.Considering the 482 (38.1%) patients with MRI LIC ε 7 mg/g dw, the EMH+ group had a significant lower frequency of global heart T2*< 20 ms (18.4% vs 40.8%).
Conclusion: In this cohort of regularly transfused thalassemia patients, EMH was not rarely observed and was associated to a heart thalassemia intermedia like pattern (reducedcardiac and liver iron loading and stigmata of high cardiac output state) despite the transfusional regimen.

B-0047 10:46

Quantitative T2 mapping in the distinction of salvaged and infarcted myocardium within the ischemic area-at-risk: validation and comparison with T2-weighted images

L.-M. Wu, A.-L. Andong, J.-R. Xu; *Shanghai/CN (wlmssmu@126.com)*

Purpose: To determine the diagnostic performance of quantitative T2-mapping in the distinction of salvaged and infarcted myocardium within the ischemic area-at-risk compared with T2-weighted images.
Methods and Materials: Thirty-two patients with established myocardial infarction and ten healthy volunteers were performed CMR at 3.0 T, Late gadolinium enhancement images were used to define the infarcted, salvaged, and remote myocardium. T2-weighted image signal intensities (T2WI-SI) from and T2 values from T2 mapping were measured in the corresponding areas.
Results: There were no significant differences in mean T2WI-SI or T2 values in the normal myocardium of healthy volunteers compared to the remote myocardium of acute MI patients ($p> 0.05$). The T2WI-SI of the salvaged myocardium was higher than that of remote (86.32 ± 18.5 vs. 65.43 ± 13.3, $P < 0.001$). There were no significant differences in mean T2WI-SI or T2 values in infarcted myocardium compared with salvaged myocardium. The T2 value of the salvaged myocardium was longer than of remote (66.0 ± 6.9 vs. 51.4 ± 3.5 ms, $P < 0.001$). The T2 value was also longer in the infarcted myocardium compared with remote (71.4 ± 7.6 ms, $P < 0.01$ vs. salvage and 64.0 ± 6.9 ms). Adopting a threshold value of 58.27 ms. T2 star mapping resulted in89.2% sensitivity, 76.3% specificity in the identification of alvaged and infarcted myocardium within the ischaemic rea-at-risk.
Conclusion: Quantitative T2 mapping is a novel method for objectively detecting myocardial edema with a high diagnostic performance.It may provide additional information quantifying salvaged and infarcted myocardium within the ischaemic area-at-risk.

B-0048 10:54

T1 ratios are superior to actual T1 values for assessment of myocardial injury and left ventricular remodelling in coronary chronic total occlusion

Y. Chen, S. Yang, H. Yun, H. Jin, M. Zeng; *Shanghai/CN (xiaogu_417@126.com)*

Purpose: This study sought to investigate whether T1 mapping allows assessment of myocardial injury and left ventricular (LV) remodelling in coronary chronic total occlusion (CTO) and which parameters obtained from T1 mapping provide better performance.
Methods and Materials: Fifty consecutive patients with angiographically documented CTO were prospectively enrolled. Cardiac magnetic resonance protocol included cine, T1 mapping before and after contrast and late gadolinium enhancement (LGE) imaging. T1 values, T1 ratios and extracellular volume fractions (ECV) were derived at myocardial infarction, remote myocardium and global myocardium. On segment level, mean segmental T1 values, T1 ratios and ECV were also obtained to investigate their relationship with the severity of myocardial injury, which was semi-quantitatively assessed by transmurality of LGE and regional wall motion abnormalities (RWMA) score.
Results: ECV and post-contrast T1 ratio provided best diagnostic accuracy for identifying infarction from myocardium, with area under the ROC curve of 0.998 and 0.996, respectively. A significant relationship was found between T1 mapping, transmurality of LGE and RWMA score, where post-contrast T1 ratio was almost as good as ECV that it clearly distinguished each subgroup classified according to transmurality of LGE and RWMA score. Furthermore, mean global T1 ratios and ECV correlated with ejection fraction and the correlation coefficients of T1 ratios were superior to actual T1 values.
Conclusion: In CTO, T1 mapping allows for assessment of myocardial injury and LV remodelling. Compared to T1 value, T1 ratios provide better performance and T1 ratio on enhanced mapping is almost as good as ECV.

B-0049 11:02

Myocardial extracellular volume fraction quantified by cardiovascular magnetic resonance compared with histological and organic blood markers

J. Izaaryene, A. Jacquier; *Marseille/FR (jizaaryene@yahoo.fr)*

Purpose: Diffuse interstitial fibrosis is a common condition of a broad variety of cardiomyopathies leading to adverse cardiovascular events. Several therapeutic strategies aimed at regression of reversible interstitial fibrosis are available. The objective of our study was to validate a cardiac magnetic resonance-based approach for the assessment of extracellular matrix expansion in human compared with histological and blood test data.
Methods and Materials: We prospectively included 15 patients with sever aortic valve stenosis requiring surgical valve replacement in cardiac surgery department of our hospital. All patients underwent CMRI and blood tests for organic markers of myocardial fibrosis before surgery and biopsies in the interventricular septum during surgery. Concerning CMR, T1 relaxation times were measured before and after gadolinium, allowing us to determine extracellular volume fraction, a marker of fibrosis. For histological data, connective tissue volume fraction was quantified, using Masson stain and expressed as a percentage of fibrosis of normal myocardium. These analyses were performed by 2 operators to determine the intra- and interobserver.
Results: The mean percentage of fibrosis measured ith histology was from 0.036 to 0.29. The mean EVC measured with CMRI was from 0.19 to 0.389. The correlation between MRI data concerning ECV and the histological quantification was excellent (r : 0.87). The correlation between MRI and organic blood markers of fibrosis was very good.
Conclusion: Cardiac magnetic resonance allowed detection provides a robust non-invasive estimation of extracellular volume fraction and is correlated very strongly with organic blood markers of fibrosis and with histological measures of interstitial fibrosis.

B-0050 11:10

Automatic software for extracellular volume (ECV) fraction map generation of the myocardium

N. Galea, L. Altabella, C. Borrazzo, E. Di Castro, M. Francone, C. Catalano, I. Carbone; *Rome/IT (nicogale2000@yahoo.it)*

Purpose: Extracellular volume fraction (ECV) is emerging as accurate biomarkers in cardiac diseases associated with diffuse myocardial fibrosis. However generating ECV maps from pre- and post-Gd T1 maps is still laborious and time-consuming. We propose our automatic system for ECV map creation consisting of an executable file developed in Matlab (Mathworks).
Methods and Materials: 30 subjects were studied using MOLLI sequence before and after injection of gadobenate dimeglumine (Gd-BOPTA; Bracco). All MOLLI images were motion corrected within each series. These images were co-registrated using affine image registration between pre- and post-contrast image with longest inversion time to avoid possible patient position variations. Then, image transformation was applied to the whole post-contrast series. Motion-corrected and co-registered images were used to generate pre- and postcontrast maps. T1 time was calculated with a 3-parameter curve fitting using a Levenberg-Marquardt algorithm and T1* correction. Pixel-wise ECV map was computed following the relation: ECV=[1-hematocrit]*ΔR1myo/ΔR1blood. Blood relaxation rate was calculated automatically creating a mask on pre-contrast map applying a threshold on pixels with T1 greater than 1250 ms and then transferred on post-contrast map to calculate the mean T1 blood-post.
Results: Comparison between blood T1 values obtained automatically and manually showed a significant correlation for both pre ($r=0.84$ $p < 0.01$) and post-contrast ($r=0.99$ $p < 0.01$) datasets. Also for myocardium ECV values calculated by two approaches, a significant correlation ($r=0.95$ $p < 0.01$) was found.
Conclusion: Our software enables to obtain informative pixel-wise ECV maps in order to directly visualize extent and severity of ECV alterations respect to manual approach.

B-0051 11:18

Accuracy and reproducibility of native myocardial T1 mapping using 9, 10, and 11 heartbeat MOLLI acquisition schemes

S. Mangold[1], A. Varga-Szemes[1], C.N. De Cecco[1], G. Muscogiuri[1], P.M. Cannaò[1], J.L. Wichmann[1], P. Suranyi[1], W.G. Rehwald[2], U.J. Schoepf[1]; [1]*Charleston, SC/US*, [2]*Durham, NC/US*

Purpose: T1 mapping provides new diagnostic insights into cardiac disease. Even fast T1-mapping performed by modified look-locker inversion recovery (MOLLI) sequences may require long breath holds that are demanding for a majority of patients. We evaluated the reliability, variability, and reproducibility of T1 values acquired by different shortened MOLLI acquisition schemes.
Methods and Materials: In consecutive patients (n=27) referred for cardiac magnetic resonance (CMR) a pre-contrast fast T1-mapping protocol (TE/TR 1.1/2.2 ms, slice thickness 8 mm, flip angle 35°) was performed using a MOLLI sequence. Three pulse sequence schemes were developed with an acquisition length of 11 (S1), 10 (S2), or 9 (S3) heartbeats. Non-linear motion correction was performed before curve fitting, and a goodness of fit map was generated for quality assurance. Pixel-by-pixel T1 values were calculated and measured in the myocardium. The reliability of T1 measurements was compared to the literature. The relative variability was expressed by the coefficient of variation. Reproducibility was compared between repeated measurements.
Results: Average T1 values of normal myocardium obtained by S1, S2, and S3 acquisition schemes were 1024±48 ms, 1031±51 ms, and 1037±58 ms, respectively. The T1 values measured in our study showed good correlation among the three protocols, and with published reference values. The relative variability of T1 values between the three acquisition schemes ranged between 4.0-5.6% without significant differences.
Conclusion: Shortened MOLLI sequence schemes are feasible for native myocardial T1 mapping with high reliability and reproducibility. The short acquisition time combined with motion correction will enable T1 mapping even in challenging patients.

Author Disclosures:
W.G. Rehwald: Employee; Siemens Medical Systems. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0052 11:26

Left ventricular myocardial remodeling in pulmonary hypertension: a non-contrast magnetic resonance T1 mapping study

U. Reiter[1], G. Reiter[1], G. Kovacs[1], G. Adelsmayr[1], A. Greiser[2], H. Olschewski[1], M.H. Fuchsjäger[1]; [1]*Graz/AT*, [2]*Erlangen/DE (ursula.reiter@klinikum-graz.at)*

Purpose: To analyse alterations of non-contrast left ventricular myocardial T1 times in patients with pulmonary hypertension (PH) and their relation to severity of PH.
Methods and Materials: 30 patients with suspected PH (13/17 without/with PH) underwent right heart catheterisation (RHC) and 3-T magnetic resonance myocardial T1 mapping with a prototype-modified Look-Locker inversion recovery sequence in basal, mid-ventricular and apical short-axis orientations. RHC provided mean pulmonary arterial pressure (mPAP) and diagnosis of PH. Segmental T1 times were derived by manually outlining T1 maps according to the American Heart Association segmentation scheme. Septal, lateral and global myocardial T1 times were calculated as average of respective segmental values. Resulting T1 times and their relation to right-heart haemodynamics were analysed employing t test and correlation analysis.
Results: Mean segmental, septal, lateral and global myocardial T1 times were higher in patients with PH than in those without PH; in septal, lateral and global myocardium, the differences were significant (septal: 1260±61 ms vs. 1190±30 ms, p=0.0007; lateral: 1191±38 ms vs. 1155±34 ms, p=0.012; global: 1225±48 ms vs. 1174±25 ms, p=0.003). Irrespective of the presence of PH, septal, lateral and global T1 times correlated strongly with each other (global vs. septal: r=0.94, global vs. lateral: r=0.89, septal vs. lateral: r=0.74). Their correlation with mPAP was significant for all patients (septal: r=0.59, lateral: r=0.44, global: r=0.54), but became insignificant when restricted to PH.
Conclusion: PH alters non-contrast T1 times throughout the entire left ventricular myocardium and regional alterations are strongly interrelated. In patients with PH, T1 times are not significantly determined by right heart haemodynamics.

Author Disclosures:
G. Reiter: Employee; Siemens AG, Healthcare. **A. Greiser:** Employee; Siemens AG, Healthcare.

B-0053 11:34

Native T1-mapping for visualisation of septal left ventricular fibrosis in chronic thromboembolic pulmonary hypertension (CTEPH)

F.C. Roller, C. Schneider, G.A. Krombach; *Giessen/DE (fritz.c.roller@radiol.med.uni-giessen.de)*

Purpose: Septal and right ventricular insertion point (RVIP) LGE can be present in CTEPH. It may represent disease associated fibrosis, or physiological collagen fibre architecture. The aim of our study was to assess septal and RVIP fibrosis in CTEPH with T1-mapping compared to healthy controls and to published values.
Methods and Materials: Imaging was performed at 1.5 Tesla in 10 CTEPH (6 female; 59.6 years ± 6.3 standard deviation (SD)) and 10 control group patients (5 female; 56.1 years ± 9.3 SD) including native T1-mapping (MOLLI - modified look locker inversion recovery). T1 values were measured within the septal myocardium and the upper and lower RVIP at basal short axis and statistically analysed (cut-off value 990 ms).
Results: Mean septal T1 value in CTEPH was 1019 ms ± 51 SD and in control group 952 ms ± 16 SD ($p < 0.01$), upper RIVP 1069 ms vs. 970 ms ($p < 0.001$) and lower RVIP 1075 ms vs. 977 ms ($p < 0.01$). LGE was present in 6 CTEPH patients (control group none). Assuming a cut-off value of 990 ms 7 CTEPH and none of the control group patients showed pathologic septal T1 values (upper RVIP 10 vs. 2 patients; lower RVIP 9 vs. 2 patients).
Conclusion: Septal and RVIP T1-mapping values are significantly higher in CTEPH patients compared to our control group and to published cut-off values. We conclude that T1-mapping enables visualization of septal fibrosis in patients with CTEPH and might be an useful therapy-monitoring tool in the future.

B-0054 11:42

Early non-invasive detection of microvascular disfunction and myocardial damage in systemic sclerosis (SSc): a cardiovascular magnetic resonance

N. Galea, G. Barchetti, A. Fiorelli, M. Francone, E. Rosato, C. Catalano, I. Carbone; *Rome/IT (nicogale2000@yahoo.it)*

Purpose: Cardiac involvement in systemic sclerosis (SSc), even if clinically silent, may cause increase of morbidity and mortality, although pathophysiological mechanisms are not well clarified. Novel T1-mapping technique enables accurate non-invasive assessment of myocardial inflammation and fibrosis. Moreover microvascular damage associated to "raynaud's phenomenon" has been hypothesized in this disease. Our aim was to investigate diffuse myocardial damage and perfusion abnormalities in asymptomatic SSc-patients without known cardiac disease.
Methods and Materials: 20 SSc-patients (14 females, age:37y) and 10 healthy controls (6 females, age:34y) underwent CMR exams including: cineMR sequences, STIR T2w, MOLLI T1 mapping pre-contrast, LGE imaging and MOLLI post-contrast for ECV quantification. Myocardial perfusion was assessed in both groups at rest and after cold pressure stimulus (CPS) with a conventional first-pass sequence during administration of 0.05 mmol/Kg@3 mL/s of Gadobenate dimeglumine (Gd-BOPTA, Bracco).
Results: LGE and myocardial edema areas were found respectively in 6 and 2 patients, but none in controls. Native myocardial T1 values were significantly higher in SSc patients compared to controls (1030±34vs980±33;$p < 0.01$); significant expansion of ECV was found as well (28% vs. 23%, $p < 0.05$). Notably, T1 values and ECV did not correlate with the presence of LGE but they were associated to higher disease activity and severity. A significant reduction of perfusion upslope rate (p: 0.04) after CPS compared to rest curve was found on SSc patients.
Conclusion: SSc asymptomatic patients with preserved cardiac size and function have nonetheless cardiac involvement, mainly consisting in low-grade inflammation, diffuse fibrosis and cold-induced increase of perfusion resistance.

B-0055 11:50

Quantification and optimisation of computed tomography myocardial late enhancement imaging with correlation to magnetic resonance imaging

M.C. Williams, N. Weir, C. Gray, T. MacGillivray, E.J.R. van Beek, D.E. Newby, S. Mirsadraee; *Edinburgh/UK (michelle.williams@ed.ac.uk)*

Purpose: Computed tomography (CT) late enhancement imaging can assess myocardial viability. This study assesses parameters to optimise CT late enhancement and correlates quantitative assessment with magnetic resonance imaging (MRI).
Methods and Materials: 20 patients with MRI-proven myocardial fibrosis underwent late enhancement imaging using a 320 multidetector scanner after 100 ml iodinated contrast. Three patients underwent imaging at multiple time points to identify the optimal postcontrast delay. Subsequent patients were imaged using four tube voltages in rapid succession (80, 100, 120 and 135 kV). Tube current was based on scout image attenuation. CT attenuation (Hounsfield Units, HU) and image noise (standard deviation of HU) were measured in normal and abnormal myocardium, as identified by MRI.
Results: Mean heart rate was 62 beats per minute (95% CI 58.66), body mass index 27 kg/m2 (24.31) and 90% were male. Optimal postcontrast delay was between 3 and 6 minutes with an attenuation difference of 20 to 60 HU between normal and abnormal myocardium. Subsequent imaging was performed at 4 minutes. The mean difference in attenuation between normal and abnormal myocardium was significantly greater at 80 kV (45 (29.61) HU, $p < 0.001$) as compared to 100 kV (28 (18. 39) HU), 120 kV (16 (4.30) HU) or 135kv (14 (6.22) HU). However, decreased image noise at 100 kV aided visual assessment compared to 80 kV (24 (18.30) vs 43 (34.51) HU, $p < 0.001$).
Conclusion: Optimal imaging protocol is crucial to accurately identify myocardial fibrosis on contrast-enhanced CT. Accuracy of myocardial viability assessment by CT is improved by the optimised protocol identified in this study.

Author Disclosures:
E.J.R. van Beek: Speaker; Speaker fees at educational meeting. Toshiba.

10:30 - 12:00 **Room L 1**

Vascular

SS 215

Pre- and post-interventional work-up

Moderators:
E. Brountzos; Athens/GR
P. Vilela; Almada/PT

K-01 10:30

Keynote lecture
E. Brountzos; *Athens/GR*

B-0056 10:39

Median arcuate ligement syndrome: accurate diagnosis by 64 slice MDCT mesenteric angiography
S.S. Pathak; *Mumbai/IN (radsachin@gmail.com)*

Purpose: 64 slice MDCT mesenteric angiography accurately depicts Median arcuate ligament syndrome (MALS) as a cause of chronic epigastric pain. proper technique and classic imaging signs are helpful for confident noninvasive diagnosis of this condition.
Methods and Materials: 20 patients with chronic post- prandial epigastric pain who were negative for e/o acid peptic disease on gastrosopy and not having any obvious epigastric and lower chest pathologies on routine imaging (USG, CT abdomen and/or MRCP)and found to have narrowing of ostio-proximal coeliac artery on MDCT angiography with normal rest mesenteric arteries were closely evaluated and followed for 1 yr. classic imaging signs, intra-operative confirmation and post operative pain relief confirmed the diagnosis.
Results: Out of 20 patients 12 showed classic imaging sings of MALS (8 F,4M, all were young -age 17- 38 yrs), 5 showed ostial narrowing of coeliac artery by atheroscLerotic plaque and lack of classic imaging signs for MALS, 1 had mild narrowing of proximal coeliac artery and 2 showed pseudo-narrowing of coeliac artery as patient did valsalva during CT angiography due to contast induced nausea.Out of the 12 patients diagnosed as MALS, 8 were operated, 7 showed significant relief of symptoms on 3 and 6 months post operative follow-up and one had mild relief of symptoms
Conclusion: MALS is an important cause of chronic recurrent epigastric pain in young patients. High degree of clinical suspicion and classic MDCT imaging findings non-invasively and accurately depicts the condition obviating need for more invasive tests such as DSA.

B-0057 10:47

Value of ultrasound contrast agents in the endoleak diagnosis in patients AAA treated stentgraft implantations
A. Drelich-Zbroja, T. Jargiello, M. Sojka, M. Szczerbo-Trojanowska; *Lublin/PL (zbroanna@interia.pl)*

Purpose: To assess value of ultrasound contrast agents in the endoleak diagnosis in patients with AAA treated by stentgraft implantation.
Methods and Materials: 198 patients with AAA were treated with stentgraft implantation. In every patient control examination was done 6 months after treatment. Ultrasound before and after contrast administraions and Angio-CT were performed. In every ultrasound examination color, power, Bflow options were used before and after contrast injection and additionaly especially contrast option (CEUS) was performed after contrast administration.
Results: 6 months after stentgraft implantation in control ultrasound before contrast agent injection in all options (color, power, Bflow) 16 endoleaks were diagnosed: 6 type IA, 4 IB,2 type IIA and 4 type IIB. In control ultrasound after contrast injection using color, power and Bflow options 16 known endoleaks were confirmed and additionally 6 endoleaks were diagnosed:1 type IB, 2 type IIA, 3 type IIB. In ultrasound after contrast administration using contrast option (CEUS) 22 diagnosed endoleaks were confirmed and additionaly 4 endoleaks were diagnosed:2 type IIA, 2 type IIB. In Angio-CT 22 endoleaks were diagnosed: 6 type IA, 5 type IB, 4 type IIA, 7 type IIB. None of 4 additional endoleaks seen in CEUS were not recognized in Angio-CT.
Conclusion: Ultrasound contrast agents significantly increased sensitivity of ultrasound in the diagnosis of endoleaks, particularly type II. CEUS examinations show the greatest sensitivity in detecting the endoleaks, because they disclose endoleaks unrecognized by other techniques including angio-CT. Ultrasound after contrast injections can replace Angio-CT in monitoring patients after stentgraft implantations.

B-0058 10:55

Type III endoleak after endovascular aortic repair: incidence, etiology and management
L. Poorteman[1], B. Saint-Lèbes[2], S. Heye[1], S. Houthoofd[1], H. Rousseau[2], G. Maleux[1]; [1]*Leuven/BE*, [2]*Toulouse/FR (lien.poorteman@gmail.com)*

Purpose: To retrospectively assess the incidence, etiology and management of type III endoleaks in a large cohort of patients treated with endovascular aortic repair (EVAR) in two European university centers.
Methods and Materials: From 1995 till 2014, 965 EVAR procedures were performed with use of first & second generation (n=79) and third generation (n=886) endografts. Radiological follow-up was performed with computed tomography and abdominal plain film examinations, in accordance to the EUROSTAR scheme. Potential relationship between type of endograft and incidence of type III endoleak, time interval between Initial EVAR and type III endoleak diagnosis were calculated.
Results: 21 patients (2.1%) were identified with 26 type III endoleaks: n=10/79 (12.6%) for first and second generation endografts, n=11/886 (1.2%) for third generation endografts (P <.001). Disconnection was found in 18/26 endoleaks (69.23%), a fabric defect in 8/26 endoleaks (30.76%) without any difference between first and second versus third generation of endografts (P=0.378). Time interval between initial EVAR and type III endoleak was 3.87 and 5.92 years for respectively first-second generation and third generation endografts (P=0.14). 25 endoleak corrections were performed by endovascular technique (n=23; 92%) or by open surgical conversion (n=2; 8%).
Conclusion: Type III endoleak rarely (2%) occurs after EVAR with a higher incidence for first & second generation of endografts. In the majority of cases, the underlying mechanism is a disconnection of the stent-graft components. Type III endoleaks may occur early or late after initial EVAR and can, in the vast majority of cases, be managed endovascularly.

B-0059 11:03

Post-EVAR split-bolus CT-angiography using dual-energy CT: all you need in a single scan!
R. Iezzi, M. Nestola, G. Coppola, A. Contegiacomo, F. Snider, L. Bonomo; *Rome/IT (roberto.iezzi.md@gmail.com)*

Purpose: To evaluate the diagnostic potential of virtual-unenhanced images plus combined arterial-delayed-phase images obtained with a single acquisition by using a dual-energy split-bolus CT-angiography acquisition protocol in patients undergoing post-EVAR follow-up.
Methods and Materials: Thirty consecutive patients older than 75yo were enrolled and underwent a quadruple-phase dual-energy CT examination using a split bolus injection protocol, in order to obtain a dual-energy combined Arterial-Delayed-Enhanced-Phase as well as a triple-phase (Real-Unenhanced-Phase plus Arterial-Enhanced-Phase plus Delayed-Enhanced-Phase). After Real-Unenhanced-Phase acquisition, a test-bolus technique with 20 mL CM was performed to determine the aortic bolus-arrival-time. Two separate boli of CM (40 mL@4 mL/s) were injected. Arterial-Enhanced-Phase was acquired one bolus-arrival-time after injection of the first bolus, whereas Arterial-Delayed-Enhanced-Phase was acquired one bolus-arrival-time after injection of the second bolus, with a 80sec interval delay from the first bolus. Finally, Delayed-Enhanced-Phase was acquired 80sec after the second bolus. A Virtual-Unenhanced-Phase was generated from the dual-energy Arterial-Delayed-Enhanced-Phase acquisition. Three blinded radiologists assessed the presence of endoleak in different reading sessions, evaluating the diagnostic value of Virtual-Unenhanced-Phase plus Arterial-Delayed-Enhanced-Phase versus the triphasic gold-standard.
Results: All CT examinations were technically adequate. No significant differences were noted in terms of image quality, noise and diagnostic performance. The Arterial-Delayed-Enhanced-Phase images combined the information from the arterial and delayed phases. Virtual-Unehnanced-Phase images well replaced the Real-Unenhanced-Phase ones. Radiation dose saving was up to 78% compared with the reference triphasic study.
Conclusion: Our study depicts an accurate "all-in-one" approach to endoleak detection in post-EVAR follow-up, with critical radiation dose saving, without affecting diagnostic information and patient management.

B-0060 11:11

Dual-energy computed tomography (DECT): hard plaque imaging for endoleak detection

R. Müller-Wille, T. Borgmann, C. Stroszczynski, C. Dornia; *Regensburg/DE*

Purpose: To determine the diagnostic accuracy of hard plaque imaging dual-energy computed tomography (DECT) for detection of endoleaks after endovascular aneurysm repair (EVAR) for abdominal aortic aneurysm.
Methods and Materials: 95 patients (mean age, 71 years) underwent 98 triple-phase contrast-enhanced CT (non-contrast, arterial phase and dual-energy delayed phase) after EVAR for aortic aneurysm (standard of reference). For the generation of hard plaque images the delayed phase dual-energy data sets of tube A and B were transferred to an external workplace (color-codes: iodine = blue; calcium = red). Two radiologists (reader 1 and 2), who were blinded to the diagnosis of the triple-phase CT, reviewed all post-processed hard plaque images separately in random order. Endoleaks were defined as blue-coded areas between the aneurysm wall and the stent graft.
Results: Based on the triple-phase CT images (standard of reference) endoleaks were present in 27 of 98 scans (28%). Hard plaque images had a sensitivity/specificity of 93%/92% (reader 1) and 96%/92% (reader 2) for the detection of endoleaks after EVAR.
Conclusion: Using hard plaque algorithm, DECT enables an accurate diagnosis of endoleaks on delayed phase images after EVAR.

B-0061 11:19

Long-term results after EVAR: aorto-monoiliac configuration increases the risk of complications and aneurysm-related death

A.M. Morales Vargas, G. Garzón Moll, M. Martí de Gracia; *Madrid/ES (ammvar501@gmail.com)*

Purpose: To confirm whether long-term complications after EVAR are related with endograft configuration (Bifurcated or Aorto-monoiliac).
Methods and Materials: This study was approved by Research Ethics committee at our institution. 378 patients underwent to elective endovascular repair of abdominal aneurysm in a tertiary institution between January 2002 and December 2013 were prospectively collected in a database and evaluated retrospectively. High-Risk and Low-risk surgical patients were included. Patient selection criteria was the presence of an aneurysm 5.5 cm or more in diameter with anatomic suitability for EVAR documented in a tomography, based on vascular surgeon/vascular radiologist's decision. Statistical analysis included long-term survival and aneurysm-related death based on graft configuration. Outcomes are described according to reporting standards for endovascular aortic aneurysm repair EVAR.
Results: Patients mean age was 73 years (ranging from 40 to 89). Mean interval of follow-up was 49 months (ranging from 1 to 146 months); deployment of endografts was successful in 378 of 381 patients (99%). Primary technical success was achieved in 365 patients (96.5%). Thirty-day mortality was 2.3%. Type I endoleaks were present in 16 patients (4.23 %). According to Kaplan-Meier estimations, primary clinical success rate was 92.5% at 1 year, and 76% at 9 years. Cox Proportional-Hazards Model revealed that Aorto-monoiliac endografts, increases the risk of aneurysm-related complications and aneurysm-related death (p: 0.001; HR: 1.7; 95%CI 1.13-2.57).
Conclusion: Endovascular repair of abdominal aneurysm using Aorto-monoiliac endografts, increases significantly the risk of aneurysm-related complications and aneurysm-related death.

B-0062 11:27

Accuracy of MDCT angiography of the anterior abdominal wall in the planning of the mammary reconstruction with DIEP-flap in mastectomised patients

F. Carbonetti, A. Cremona, P. Aloisio, N. Maltzeff, G. Argento, C. Capotondi, V. David; *Rome/IT (francescocarbonetti799@hotmail.com)*

Purpose: To prove accuracy and feasibility of MDCT angiography of the anterior abdominal wall in the planning of breast reconstruction.
Methods and Materials: 34 nulliparous and 20 multiparous underwent MDCT angiography of the abdominal anterior wall to study the deep inferior epigastric arteries (DIEA) and its perforating branches. With MPR ,MIP and VR reconstructions were evaluated the caliber and integrity of DIEA ,the caliber of the perforating arteries at the emergence of the anterior fascia of the rectus abdominis muscle, respectively, and their distance from the transverse umbilical line and the linea alba. The collected data were verified by surgeons in the operating room.Standardized BMI was used for each patient.
Results: For the deep inferior epigastric artery (DIEA) Moon and Taylor classification was used. A correspondence of 100% of the number and location of the perforating arteries was found between the results obtained at the MDCT-angiography and surgery. It was recorded an average caliber size of 1.2 mm for the medial perforating vessels and 0.9 mm for the lateral. In 10/54 patients the caliber of the vessels was overstimated at the MDCT-angiography, the most frequent complications during surgery were related to venous necrosis of the vessels. Nullipaours did not show greater calibers of the arteries compared to multiparous, overweight and obese patients did not showed greater calibers than average weighted patients.
Conclusion: MDCT-angiography is a valid technique in the planning of the mammary reconstruction ,permits an accurate evaluation of the perforating vessels and it decrease the time of the surgery.

B-0063 11:35

Intra-arterial ultra low-iodine volume CT of renal transplant arteries

C.E. Althoff, R.W. Günther, B. Hamm, M. Rief; *Berlin/DE (christian.althoff@charite.de)*

Purpose: This study was designed to evaluate the technical feasibility and the image quality of intra-arterial 320-row CT angiography (ia-CTA) in the detection of transplant renal artery stenosis (TRAS) using a very low dose of contrast agent.
Methods and Materials: Evaluation of ia-CTA using a 4 F catheter in ten patients with impaired renal transplant function and suspected TRAS. Average amount of contrast agent applied was 10 ± 3.7 ml standard deviation (SD). Patient serum creatinine levels had been monitored for 72 h. TRAS was detected and graded (1: less than 20%; 2: 20-49%; 3: 50-74%; 4: 75-99%; 5: total occlusion) and presence of kinking was recorded. Attenuation and vessel delineation were parameters for image quality analysis of the renal arterial supply, divided into four segments. Subjective image quality.
Results: Ia-CTA of the renal transplant was technically successful in all patients, revealing relevant stenoses in 7 of 10 patients. Serum creatinine levels before and after ia-CTA were 2.71 ± 1.46 and 2.56 ± 1.39 mg/dl, respectively. None of the patients developed signs of contrast induced nephropathy within 72 h. Subjective image quality was excellent in all four segments, rated by two separate readers. Mean attenuation values in the arterial segments ranged between 754 and 987 Hounsfield units.
Conclusion: Wide detector ia-CTA for the diagnosis of TRAS is feasible using very low doses of contrast agent and results in high image quality.

Author Disclosures:
B. Hamm: Board Member; Deutsche Röntgengesellschaft European Congress of Radiology European Society of Euroradiology ESMRMB European School of Radiology Deutsche Forschungs-gemeinschaft. Consultant; Bayer Schering Pharma Toshiba. Grant Recipient; 1 Abbott 2 Actelion Pharmaceuticals 3 Bayer Schering Pharma 4 Bayer Vital 5 BRACCO Group 6 Bristol-Myers Squibb 7 Charité research organisation GmbH 8 Deutsche Krebshilfe 9 Dt. Stiftung für Herz- fo. Shareholder; All pharmaceutical and biochemical companies All medical technology companies All car companies. Speaker; ESMRMB ESOR.

B-0064 11:43

Effect of TIPS on splanchnic arterial and portal venous blood flow in 4D flow MRI measurement at 3 Tesla

Z. Stankovic[1], M. Roessle[2], W. Euringer[2], M. Schultheiss[2], R. Salem[1], A. Barker[1], M. Langer[2], M. Markl[1], J. Collins[1]; [1]*Chicago, IL/US*, [2]*Freiburg/DE (zoran.stankovic@uniklinik-freiburg.de)*

Purpose: To assess hepatic arterial, portal venous (PV) and collateral shunt hemodynamics in patients with cirrhosis before and after TIPS due to portal hypertension using 4D flow MRI.
Methods and Materials: 17 patients undergoing TIPS placement were enrolled in the study. K-t GRAPPA accelerated 4D flow MRI of the hepatic arterial, PV and TIPS hemodynamics was applied at 3 T MRI with acceleration factor R=5 (venc=100 cm/s; no contrast). Spatial resolution was 1.6x2.1x2.4 mm^3 with a temporal resolution of 62.4 ms. Qualitative flow analysis based on streamlines and particle traces. Quantitative evaluation assessed net flow and peak flow velocities within the hepatic arteries, PV, and the TIPS stent.
Results: Visualisation with 4D flow MRI showed good image quality with limitation in the PV system. 4D flow MRI was performed at 1 month after TIPS in 11 patients. Comprehensive quantitative assessment of the changes in liver blood flow after TIPS demonstrated increased peak velocities (38%; $p < 0.01$) and net flow (190%, $p < 0.05$) in the PV system as well as net flow in the hepatic artery (40%, $p < 0.01$). Before TIPS the arterial inflow in the splanchnic system was 821±356 ml/min while the PV flow was 327±269 ml/min (difference=494 ml/min). After TIPS the arterial inflow increased to 1064±609 ml/min while the PV flow increased significantly to 908±600 ml/min ($p < 0.05$) with a reduced difference of 156 ml/min after TIPS.
Conclusion: 4D flow MRI is feasible after TIPS for visualisation and quantification of hepatic arterial, PV, collateral and TIPS hemodynamics. It may be useful to predict TIPS malfunction and plan adjunctive procedures such as variceal embolisation.

B-0065 11:51

Evaluation of cranial DAVF: use of 4D CTA before and after embolisation

B. Tian, J. Lu, B. Xu, M. Wang, Q. Liu; *Shanghai/CN (bing.tian@hotmail.com)*

Purpose: This study aimed to evaluate the usefulness of four-dimensional CTA before and after embolisation treatment with ONYX-18 in seven patients with cranial dural arteriovenous fistulas, and to compare the results with those of the reference standard DSA.
Methods and Materials: Seven patients with cranial dural arteriovenous fistulas detected on DSA underwent transarterial embolisation with ONYX-18. Four-dimensional CTA was performed an average of 2 days before and 4 days after DSA. Four-dimensional CTA and DSA images were reviewed by 2 neuroradiologists for identification of feeding arteries and drainage veins and for determining treatment effects. Interobserver and intermodality agreement between four-dimensional CTA and DSA were assessed.
Results: Thirty-five feeding arteries were identified for ten fistulas in the seven patients. Of these, 29 (82%) were detected on four-dimensional CTA. After transarterial embolisation, the fistulas in all seven patients were completely occluded. The interobserver agreement for four-dimensional CTA and intermodality agreement between four-dimensional CTA and DSA were excellent ($\kappa = 1$) for shunt location, identification of drainage veins, and fistula occlusion after treatment.
Conclusion: Four-dimensional CTA images are as useful as DSA images both before and after transarterial embolisation treatment. Four-dimensional CTA can be used for diagnosis as well as follow-up of cranial dural arteriovenous fistulas in clinical settings.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 210
Intervention

Moderators:
I. Iacucci; Rome/IT
E. Llopis; Valencia/ES

B-0066 10:30

MR guided focused ultrasound surgery (MRgFUS) in the treatment of epiphyseal benign bone lesions: results after three year of experience

F. Arrigoni, S. Mariani, A. La Marra, L.M. Gregori, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (arrigoni.francesco@gmail.com)*

Purpose: To evaluate effectiveness and safety of MRgFUS in the treatment of epiphyseal benign bone lesions where surgery would be too demolitive. The complexity in managing this type of lesions is due not only to the aggressiveness of the lesions, but also to their location: in fact, a surgical treatment involving the articular or metaphyseal region, may also lead to slight, though disabling, complications.
Methods and Materials: From March 2011 to January 2014, we treated 13 epiphyseal benign bone lesions with MRgFUS (ExAblate 2000, InSightech, Israel). Prior to the treatment, all patients were studied by CT and MRI and a biopsy confirmed the benign nature of all lesions. The clinical symptoms were evaluated by VAS scale before and after the treatment (up to 36 months). Also a MRI and CT follow-up were performed to evaluate the residual biological activity of the lesion.
Results: After the treatment with MRgFUS, all patients showed a regression in painful symptomatology (VAS decreased from 7.8 to 0.8). After the treatment, the patients no longer needed any pain medication. The diagnostic follow-up in all cases demonstrated a disappearance of the radiological signs related to biological activity. In no case, major complications were observed.
Conclusion: In our experience the use of MRgFUS proved to be a safe and effective treatment of those benign bone lesions, where surgery would be too invasive in relation with the lesion aggressiveness.

B-0067 10:38

Ultrasound / MRI fusion imaging guided lumbar nerve root blocks; preliminary experience

D.J. Wilson, G.M. Allen; *Oxford/UK (david.wilson@ndorms.ox.ac.uk)*

Purpose: To review the outcome and safety of fusion imaging guided lumbar nerve root blocks.
Methods and Materials: 15 consecutive patients referred for either diagnostic or therapeutic lumbar nerve root blocks underwent 18 procedures in total using fusion imaging with ultrasound (General Electric E9) and MRI images (various manufacturers). Fusion was checked by locating several bone surface landmarks on each image. The target nerve root was identified using the MR image and marked on the fused images. A needle tracking system (eTrak) was employed to position the needle within 5 mm of the selected nerve root. A test dose of Lidocaine was introduced. If there were no adverse effects 40 mg of triamcinolone and 1 ml of bupivicaine were injected. The patients were followed with VAS pain scores at 24hrs, 48hrs and 2 weeks.
Results: The lidocaine test dose did not lead to immediate lower limb symptoms. However in three patients there was parasthesiae and some temporary weakness in the selected nerve root after the bupivicaine injection. There were no other complications of the procedure. To date 11 have returned pain diaries. 8/11 patients recorded substantial improvement or resolution of symptoms over the first 24 hours. 5/11 patients recorded improvement at 2 weeks.
Conclusion: Ultrasound fusion imaging using prior MR images and needle tracking permits lumbar nerve root blockade with similar results to fluoroscopic or CT guided methods. The technique appears safe and effective and takes around the same time to perform. There is no radiation dose to patient or practitioner.

Author Disclosures:
D.J. Wilson: Board Member; British Institute of Radiology. Owner; St Lukes Radiology Oxford. Shareholder; European Imaging London. **G.M. Allen:** Owner; St Lukes Radiology Oxford.

B-0068 10:46

Symptomatic Osteoartrhitis (OA) of the knee: treatment with platelet rich plasma in comparison with hialuronic acid group control

A. La Marra, F. Arrigoni, S. Mariani, L.M. Gregori, A. Mancini, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (alicelm@hotmail.it)*

Purpose: Evaluate the results after HA and PRP treatment in OA of the knee.
Methods and Materials: On the basis of clinical and radiological diagnosis of knees OA, we treated 223 patients with HA (105 pts Group A)and PRP (118 pts Group B). Exclusion criteria were rheumatic and hematology diseases. We performed MRI,clinical (VAS) and functional evaluation (WOMAC) before and 1 year after treatment; divided the pts into 2 subgroups on the basis of age: Group Aa (70 pts aged 62-81) and Ab (35 pts aged 36-61).Group Ba (38 pts aged 62-81) and Bb (80 pts aged 17-61). We created an imaging scale ranging from 0 to 11, on the basis of the distribution of joint effusion (subquadricipital bursa, anterior/posterior recess, gastrocnemius-semimembranosus and popliteal bursa), the chondral damage side (medial tibio-femoral, lateral ,patello-femoral), and the presence or not of subchondral edema.
Results: Group Aa: MRI showed an improvement of 60% (10 pre-treatment and 4 after),VAS of 40% and Womac of 65%;Group Ab: MRI showed an improvement of 29% (7 pre-treatment and 5 after) VAS improvement of 52% and Womac of 42%.Group Ba: MRI showed an improvement of 30% (10 pre-treatment and 7 after) VAS improvement 36 % and Womac 35%; Group Bb:MRI showed an improvement of 86% (7 pre-treatment and 1 after);VAS improvement of 82% and Womac 60%.
Conclusion: Our result show improvements in symptomatology, function, and imaging in all patients, with better results in pts treated with PRP (37-61 years) and in pts treated with HA (62-82).

B-0069 10:54

Targeted ultrasound-guided hydrodilatation via the rotator interval for adhesive capsulitis

D. McKean[1], P. Yoong[2], S.W. Duffy[3], N.P. Hujairi[4], R. Mansour[1], J. Teh[1]; [1]*Oxford/UK*, [2]*Reading/UK*, [3]*Norwich/UK*, [4]*London/UK (drdavidmckean@gmail.com)*

Purpose: To describe and evaluate ultrasound-guided hydrodilatation via the rotator interval for the treatment of adhesive capsulitis. The rotator interval and anterior joint capsule are strongly implicated in the symptomatology of adhesive capsulitis.
Methods and Materials: Patients referred to our department with adhesive capsulitis were consented for hydrodilatation. Inclusion criteria included failure to respond to conservative treatment and the absence of full thickness rotator cuff tear. 21 ml of a mixture of local anaesthetic and steroid was injected into the rotator interval using a 21-gauge needle. Patients were followed up at 2 weeks and 4 months, with the Oxford shoulder questionnaire and documented pain scores from 0 to 10 on a visual analogue scale.
Results: 22 patients were suitable for inclusion in the study. 19 were female (86%) and 3 male. The mean age was 55 years (range 32-71). The duration of symptoms ranged from 4 weeks to 20 months. At 4 months, 19/22 (86%) of patients described either complete (7/22) or good (12/22) improvement in symptoms. The mean pain score was 8.4 prior to the procedure, 3.1 at 48 hours and 1.9 at 4 months. 20/22 (91%) had a lower pain score at 4 months compared to before the procedure. There was a statistically significant ($P < 0.05$) improvement in the Oxford shoulder score, from a mean of 13.6 pre-procedure to 36.5 at 4 months.
Conclusion: The novel use of targeted ultrasound-guided hydrodilatation via the rotator interval gives good results in reducing shoulder pain and symptoms in adhesive capsulitis.

B-0070 11:02

Morphometric analysis of radiation dose and procedure time during percutaneous radiofrequency ablation of osteoid osteomas

P. Magyar, P.N. Kaposi, D. Kozics, B. Kovács, J. Kiss, I. Kalina, K. Karlinger, M. Szendrői, V. Bérczi; *Budapest/HU (drmagyarpeter@gmail.com)*

Purpose: Percutaneous radiofrequency ablation (RFA) has become the primary treatment for osteoid osteoma (OO) replacing surgical enucleation. Multivariate analysis on morphometric variables in our patient to identify risk factors of excess procedure time and radiation dose were performed.
Methods and Materials: Ninety-two OO patients (60 male, 32 female) aged between 7 and 60 years were treated from January 2009 till August 2014. The lesion was localized on a high-resolution CT scan (Philips Brilliance 16) with a bone kernel. Low-dose technique was used for guiding a Kirschner wire or coaxial drill into the nidus before inserting the Cool-tip ACT1507 (Covidien) electrode. Morphologic data were collected retrospectively and analyzed with the R 2.10.0 statistical package.
Results: Seventy cases involving the lower extremity were analyzed. Eight cases in the pelvis and 14 other localizations were excluded. Nidus diameter (mean±SD: 5.1±4, range 2-13 mm, R2=0.16, inversely proportional, $p < 0.015$) and number of repositions (1.7±1.54, range 1-9, R2=0.35, directly proportional, $p < 0.001$) were independent predictors of procedure time in multivariate analysis. Procedure time (42±18, range 15-115 min) showed non-significant correlation (R2=0.03, $p < 0.08$) with total dose length product (median 164 mGy*cm). In 59 cases the entry route was tilted from vertical direction more than 15 degrees to avoid sensitive structures. However, tilting was less likely ($p < 0.05$) with increasing soft tissue thickness.
Conclusion: Targeting of small, deep-situated lesions can be challenging and experience is required to avoid high patient dose. We advise the use of canulated drills in these cases while Kirschner wire provides quick access to more superficial lesions.

B-0072 11:10

Four years of clinical and MRI follow-up after intratendinous US-guided platelet rich plasma (PRP) injection in patients with degenerative tendinopathy of rotator cuff tendons of the shoulder

F. Arrigoni, A. La Marra, S. Mariani, L.M. Gregori, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (arrigoni.francesco@gmail.com)*

Purpose: To evaluate the evolution of degenerative tendinopathy of the rotator cuff from the morphological (MRI images) and clinical point of view 4 years after treatment with US-guided PRP injection of the supraspinatus tendon, compared with patients submitted to medical and physical therapy alone.
Methods and Materials: We retrospectively evaluated 240 patients (no trauma or surgery), 120 treated 4 years before with US-guided PRP injection of the supraspinatus tendon (group 1, G1) and 120 submitted, over a 4 year period, to medical and physical therapy alone (group 2, G2). 2 radiologists independently evaluated the MRI performed before and 4 years after the PRP injection (G1) or, in the G2, 2 MRIs performed at the distance of 4 years from each other; three categories were made: improvement, stationary findings or worsening. Clinical and functional evaluation was also performed (VAS and Constant scale).
Results: We recorded an improvement in the MRI appearance of the supraspinatus tendon in 31.7% of the G1 and only in 3.3% of G2; stationary findings: 48.3% (G1) and 34.2% (G2); worsening: 20% (G1) and 62% (G2). Mean VAS improvement: 74.5% (G1) and 16.2% (G2); mean Constant improvement 56% (G1) and 9% (G2).
Conclusion: Our study prove that the PRP injection can be effectively used in the rotator cuff tendinopathy: we recorded not only an improvement in MRI appearance of the supraspinatus tendon in a higher percentage of patients, but also a lower number of patients with a worsening in MRI findings. The clinical findings reflect the positive outcome.

B-0073 11:18

Comparison of ultrasound guided collagenase clostridium histolyticum injections and blinded injections in treatment of Dupuytren's contracture

V. Higueras, E. Llopis, L. Aguillella, R. Perez, E. Belloch; *Alzira-Valencia/ES (evallopis@gmail.com)*

Purpose: Collagenase injections have been proven an effective treatment for Dupuytren-disease. Our objective was to analyze the value of US guidance injections.
Methods and Materials: We included 42 patients with palpable joint contractures > 30º involving MCPJ or PIP excluding the thumb. The patients were randomly assigned to blind injection (group A) or US injection (B). Injection site was decided based on clinical exam by consensus. All US guided injections were performed in axial plane. Dose was 0.58 mg collagenase in sterile diluent. Passive extension was determined 24 h, 1 week, 1 month after the injection. We recorded type of cord and US features, grade of pre and post contracture, VAS and complications. MR was compared to US in 10 patients.
Results: All patients were male but one; average age 66/67 (group A/B); 5th finger was the most frequent, 50%/63.6% (group A/B); pretendinous cord was the most frequent 71%/52% (A/B) followed by lateral cord 13% /28.6% (A/B). US appearance is variable (hypoechoic 60%), mean diameter of the cord 3.9 mm. Complete extension was achieved in 36.97% and 57.14% (A/B), satisfactory VAS in 68% and 76% (A/B), failure in 32% and 23% (A/B) No nerve damage or tendon rupture occurred. Skin complications 32% and 23.8% (A/B). On MR and US a cellular and collagenous components can be identified.
Conclusion: US guidance offers better results and slightly decrease of skin complications than blind collagenasa injection and is an alternative to fasciectomy. MR and US can identify collagenous and cellular components, thus potentially improving effectiveness.

B-0074 11:26

Prognostic factors in needle aspiration of calcific deposits (NACD) for calcific tendinitis of the rotator cuff

B.W. Oudelaar[1], S.B.A. van der Valk[2], A.J.H. Vochteloo[1], R. Huis in t Veld[1], E.M. Ooms[1], R. Schepers-Bok[2]; [1]*Hengelo/NL*, [2]*Almelo/NL (steefvdvalk@hotmail.com)*

Purpose: Although NACD has proven to be an effective minimal invasive treatment for calcific tendinitis of the rotator cuff, hardly any studies have been conducted toward the factors associated with effective treatment or the need for multiple procedures.
Methods and Materials: Patients with symptomatic calcific tendinitis (N=431) who were treated by NACD were evaluated in a retrospective cohort study. Demographic details, medical history, sonographic and radiographic findings were collected from patient files. Failure of NACD was defined as the persistence of symptoms after a follow-up of at least six months. NACD performed within six months after a previous NACD were considered repeated procedures. Binary logistic regression analysis was used to determine factors associated with treatment failure and multiple procedures.
Results: Of the 431 patients, 277 (64.3%) were female. The mean age was 51.4 ± 9.9 years. Smoking (adjusted odds ratio (AOR): 1.7 (1.0-2.7); p=0.035) and age (AOR: 0.97 (0.95-0.99); p=0.015) were significantly associated with failure of NACD. Gärtner and Heyer type I calcific deposits were associated with multiple NACD procedures (AOR: 3.4 (1.6-7.5; p=0.002). Partial thickness rotator cuff tears were not associated with treatment failure (p=0.660).
Conclusion: These findings demonstrate that smoking almost doubles the chance of failure of NACD and that the presence of Gärtner and Heyer type I calcific deposits significantly increases the chance of multiple procedures. Furthermore, partial thickness rotator cuff tears do not affect the outcome of NACD. Based on the findings in this study, the importance of quitting smoking should be emphasized prior to NACD.

B-0075 11:34

Can PRP US-guided injection accelerate healing and be alternative to surgery for patients with Achilles and patellar tendinopathy?

A. La Marra, S. Mariani, F. Arrigoni, L.M. Gregori, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (alicelm@hotmail.it)*

Purpose: To evaluate and show the recovery time after injection with Platelet Rich Plasma (PRP) in athletes with tendinosis of Achilles and Patellar tendon.
Methods and Materials: In the last four years we evaluated 70 athletes with degenerative tendinosis of Achilles tendon and 50 athletes with degenerative tendinosis of patellar tendon. For the first time we evaluated the patient through diagnostic testing (MRI and US guided) and then through clinical observations (VAS for pain and VISA-A and VISA-P for functionality).The patients with tendinopathy did 3 PRP US-guided injections,one every 21 days. Another MRI was performed 30 days and one year after the last infiltration.
Results: In patients with tendinosis of Achilles tendon we found an overall improvement by 80% (VAS) and 46.7% (VISA-A). In patients with tendinosis of patellar tendon, the VAS value is increased of 76% and VISA-P value 49.8%. Patients with tendinosis of Achilles tendon presented a reduction of thickness tendon about 34.79% and patients with Patellar tendinosis about 35.69%
Conclusion: Our study showed that the US-guided PRP treatment in case of degenerative tendon diseases may increase Achilles and Patellar tendons functionality and reduce recovery times in athletes. Our experience proves that PRP infiltration may be a good therapeutic alternative for the treatment of Achilles and patellar tendinopathy in athletes

B-0071 11:42

Sonoelastography in carpal tunnel syndrome patients: findings after injection

M. Abd Ellah[1], H. Miyamoto[2], C. Martinoli[3], A. Tagliafico[3], G. Feuchtner[1], F. Plank[1], W.R. Jaschke[1], A. Klauser[1]; [1]*Innsbruck/AT*, [2]*Tokyo/JP*, [3]*Genoa/IT* *(dr_m_hamdy2006@hotmail.com)*

Purpose: To compare sonoelastographic color findings of the perineural area between carpal tunnel syndrome patients and healthy volunteers, and to analyze findings in that area before and immediately after intracarpal tunnel injection using sonoelastography.
Methods and Materials: We studied both hands of 15 healthy volunteers (seven men, eight women; mean age 60.1 years, range 41-88 years) and 72 hands from 70 patients with symptomatic carpal tunnel syndrome (24 men, 46 women; mean age 54.2 years, range 24-83 years). Sonoelastographic color distribution was assessed in the perineural area between the median nerve and adjacent flexor tendons. The color elastograms were graded using the following system; Grade 1 as red (softest), Grade 2 as yellow (soft), Grade 3 as green (hard), Grade 4 as blue (hardest). The patients were treated with corticosteroid injection, and re-assessed immediately after injection with sonoelastography.
Results: The color grading in the perineural area of carpal tunnel syndrome patients was Grade 3, 3.1 ± 0.3 (median, mean $\pm$ 95%CI), which was stiffer than that of healthy volunteers (Grade 1, 1.9 ± 0.4) ($P < .0001$). Immediately after injection, the diffusion of the injected fluid was observed as softer appearance (Grade 1, 1.4 ± 0.2) ($P < .0001$).
Conclusion: The perineural area surrounding the median nerve in carpal tunnel syndrome patients was stiffer than that in healthy volunteer. We could assess the diffusion of the injected fluid in the carpal tunnel with softer findings after injection in real time using sonoelastography.

B-0076 11:50

Meralgia paresthetica: ultrasound guided injection with 12-month follow-up data

M.M.H. Abd Ellah[1], C.M. Siedentopf[1], C. Martinoli[2], G. Feuchtner[1], F. Plank[1], W.R. Jaschke[1], A. Klauser[1]; [1]*Innsbruck/AT*, [2]*Genoa/IT* *(dr_m_hamdy2006@hotmail.com)*

Purpose: To evaluate the efficacy of ultrasound (US) guided injections around the lateral femoral cutaneous nerve (LFCN) in patients complaining of meralgia paresthetica at different injection levels and to document long-term results at 12 months.
Methods and Materials: Between 2008 and 2011, n=17 patients with symptoms of meralgia paresthetica, including 8 men (mean age, 61.4 years) and 9 women (mean age 61.6 years) were treated with US guided injection of steroids along the LFCN at 3 different levels in a mean of 2.2 sessions. A visual analog scale (VAS) was used to measure symptoms before treatment and at last treatment and at 12-month follow-up.
Results: Complete resolution of symptoms was documented in 12/17 patients (mean VAS change from 79.2 to 0), partial resolution in the remaining 5 (mean VAS decreased from 92 to 42), what could be further verified at 12-month follow-up. By using the different injection level Approach an overall significant better symptom relief could be obtained ($p < 0.05$).
Conclusion: Outcome of US guided injection along the LFCN can be further improved by injection at different levels ($p < 0.05$), what could be verified also in a 12-month long term relieve.

10:30 - 12:00 **Room E2**

Neuro

SS 211a

Inflammatory and degenerative disorders

Moderators:
A. Bozzao; Rome/IT
N. Guberina; Essen/DE

K-02 10:30

Keynote lecture

T.A. Yousry; *London/UK*

B-0077 10:39

Improved Alzheimer's disease diagnostic performance using structural MRI: validation of the MRI combination biomarker that won the CADDementia challenge

L. Sørensen[1], M. Lillholm[1], A. Pai[1], I. Balas[1], C. Anker[2], C. Igel[1], M. Nielsen[1]; [1]*Copenhagen/DK*, [2]*Kgs. Lyngby/DK (mli@biomediq.com)*

Purpose: Improved Alzheimer's disease (AD) diagnosis using a single structural MRI scan requires analysis of many aspects of the acquired scan. Our combination MRI biomarker recently won the CADDementia challenge (http://caddementia.grand-challenge.org/). In an effort to further validate this marker and its clinical applicability, we report its diagnostic performance on two recognized reference datasets.
Methods and Materials: The reference datasets were: a standardized dataset from the Alzheimer's Disease Neuroimaging Initiative (ADNI) [169 normal controls (CTRL), 234 subjects with mild cognitive impairment (MCI), 101 AD patients]; and the imaging arm of the Australian Imaging, Biomarker & Lifestyle Flagship Study of Aging (AIBL) [88 CTRL, 29 MCI, 28 AD]. The combination MRI biomarker was applied to each scan: several individual MRI biomarkers were computed (cortical thickness, hippocampal shape, hippocampal texture, and standard volumetry) and subsequently age-normalized and combined using a linear discriminant analysis classifier. The method was applied using 10-fold cross-validation stratified on diagnostic group and cohort, and performance on ADNI and AIBL was subsequently investigated separately.
Results: Three-class area under the receiver operating characteristic curve (AUC) with 95 % confidence intervals: ADNI 0.779 [0.748 0.809], AIBL 0.803 [0.752 0.857]. Per-class AUCs (ADNI / AIBL): CTRL 0.853 / 0.895, MCI 0.678 / 0.715, AD 0.819 / 0.803.
Conclusion: The reported diagnostic results were comparable to the challenge-winning results achieved for the CADDementia dataset. This demonstrates that the state-of-the-art performance of the combination MRI marker generalizes to recognized reference datasets, making it a potential marker for improved diagnostic support in clinical assessment of AD.

Author Disclosures:
L. Sørensen: Employee; Biomediq A/S. **M. Lillholm:** Shareholder; Biomediq A/S. **M. Nielsen:** Shareholder; Biomediq A/S.

B-0078 10:47

MRI-based automated hippocampal volumetry as a screening tool for Alzheimer's disease in subjects with memory complaints supplemented by FDG-PET/CT

I. Sacarea[1], P. Suppa[2], L. Spies[3], M. Pixberg[1], J. Müller-Hübenthal[1]; [1]*Cologne/DE*, [2]*Berlin/DE*, [3]*Hamburg/DE*

Purpose: Magnetic resonance imaging (MRI) based fully-automated hippocampal volumetry (FAHV) is capable of detecting subjects with memory complaints at risk of Alzheimer's disease (AD). Purpose of this study is to validate subjects at risk of AD with regard to non-invasive AD diagnosis using a combination of F18-FDG-PET/CT, DEMTECT and follow-up FAHV.
Methods and Materials: Subjects with memory complaints initially received a MRI with 3D T1-weighted gradient-echo sequence (3D-MPRAGE) and subsequent FAHV-analysis. Subjects with reduced hippocampal volume (HV) were identified as subjects at risk of AD. Follow-up examination (9-24 months after baseline examination) included an identical 3D-MPRAGE with FAHV and semi-quantitative F18-FDG-PET/CT. Clinical assessment included evaluation of activities of daily living. Screening for dementia was performed using DEMTECT.
Results: Thirty out of a total of 200 screened subjects were identified by FAHV as subjects at risk. Ten could be contacted and 5 agreed to follow-up examination. All subjects had a reduced HV at baseline. The AD hypothesis was confirmed in two patients by at least one of the following examinations: PET, follow-up MR or clinical assessment. F18-FDG-PET and DEMTECT results were not consistent with AD for the remaining three patients, one being compatible with frontotemporal dementia.

Conclusion: This pilot study suggests that FAHV may help identify subjects with memory complains at risk of AD. Patients then require a rigorous follow-up examination in a specialized clinic to consolidate the suspicion of AD. FDG-PET and longitudinal FAHV may increase specificity of FAHV. More data is being prepared to further substantiate these findings.

B-0079 10:55

Association of MR features, clinical presentation and levels of glutathione and glutatione peroxidase in erythrocytes of patients with clinically isolated syndrome and relapsing remiting multiple sclerosis

D. Stojanov, S. Ljubisavljevic, I. Stojanovic, S. Vojinovic; *Nis/RS (drstojanov@gmail.com)*

Purpose: To assess association of MRI features, clinical presentation, and levels of glutathione (GSH) and glutathione peroxidase (GPx) activity measured in erythrocytes of patients with clinically isolated syndrome of CNS (CIS) and relapsing remitting multiple sclerosis (RRMS).
Methods and Materials: Cross-sectional study included 50 CIS patients, 57 RRMS patients, and 20 control patients with nonspecific neurological symptoms. Clinically, all patients were assessed using Extended Disability Status Scale (EDSS). We calculated the number of T2W hyperintense lesions and load of T1W Gd-enhancing lesions as volume. Patients were divided into those with mild and severe MRI changes. Concentration of GSH and GPx were measured by spectrophotometry.
Results: The number of T2W lesions and T1W Gd-enhancing lesions volume were significantly higher in RRMS than in CIS patients ($p < 0.05$). Significant positive correlation between EDSS and T2W lesions was found in both study group ($p < 0.01$).Patients with higher EDSS had lower GSH content in erythrocytes in CIS (p=0.018) and RRMS (p=0.0012). The GSH values were significantly higher in both study groups with a lower number of T2W lesions (p=0.023 for CIS and p=0.0017 for RRMS). There were negative correlations between GSH values and EDSS (r=-0.513, p=0.004) and MR findings (r=-0.351, p=0.008) in CIS patients. The same correlation were observed in RRMS patients between GSH values and EDSS (r=-498, p=0.004) and radiological features (r=-0.454, p=0.005). No correlations were observed between GPx activities and all tested characteristics ($p > 0.01$).
Conclusion: GSH might serve as a marker which is closely correlated with MRI and neurological scoring of acute CNS inflammation.

B-0080 11:03

Disrupted small-world networks in never treated schizophrenia patients with long illness duration

L. Yao[1], W. Deng[1], W. Liao[2], F. Li[1], Y. Xiao[1], W. Zhang[1], J. Sweeney[3], Q. Gong[1], S. Lui[1]; [1]*Chengdu/CN*, [2]*Hangzhou/CN*, [3]*Dallas, TX/US (yaoli2033@163.com)*

Purpose: To examine the disruption of the topological properties of brain functional networks in a rare sample of chronic but never treated schizophrenia patients, and to explore whether the brain network changes are disease-duration related.
Methods and Materials: Twenty-two chronic schizophrenia patients with untreated illness duration over 5 years and 24 matched healthy control subjects underwent a resting-state functional magnetic resonance imaging scan. The whole brain functional networks were constructed by thresholding correlation matrices of 90 cortical and sub-cortical regions, and their topological properties were analyzed using graph theory-based approaches. Nonparametric permutation tests were used for group comparisons of topological metrics. Pearson's correlation analyses were conducted to evaluate the relationship between the topological properties and the illness duration.
Results: Both schizophrenia and control groups showed small-world architecture in brain functional networks. However, the schizophrenia patients showed altered quantitative values in the global properties, characterized by lower shortest path length, lower connection strength and lower global efficiency, implying a shift toward regularization in their brain networks. The schizophrenia patients exhibited decreased nodal centralities in olfactory cortex, amygdala, precuneus, putamen and middle temporal gyrus. The altered nodal centralities in bilateral putamen were correlated with disease duration.
Conclusion: Our findings revealed altered topological organization in drug-naive chronic schizophrenia patients. Specifically, the illness duration-related disruptions in putamen, suggest a neuroprogressive process over the course of schizophrenia that cannot be attributed to antipsychotic treatment. Decreased nodal centralities in other brain regions imply different pathological processes.

B-0081 11:11

The different pattern of functional and structural changes depending on the rate of cognitive decline in Parkinson's disease with mild cognitive impairment

I. Kim[1], J. Kwon[2], N.-Y. Shin[1]; [1]*Seoul/KR*, [2]*Gongju/KR (kinjoong@gmail.com)*

Purpose: To define the differentiation in white matter (WM) alteration and functional changes in patients with Parkinson disease associated mild cognitive impairment (PD-MCI) according to the duration of parkinsonism prior to MCI.
Methods and Materials: A total of 59 patients with PD-MCI who underwent both MRI including resting state functional MRI and diffusion tensor imaging and neuropsychological tests within 2 months interval were included. These patients were classified into two groups of shorter (< 1 year, PD-MCI-SD) and longer (ε 1year, PD-MCI-LD)duration of parkinsonism prior to MCI. The pattern of WM alteration was analyzed using tract-based spatial statistics and seed-based resting state functional connectivity analysis was also performed.
Results: The FA values were significantly decreased in the right frontal WM, whilethere was no region of increased FA values in PD-MCI-SD group compared with the PD-MCI-LD group. PD-MCI-SD group also showed significantly decreased functional connectivity in the hippocampus and dorsolateral prefrontal cortex when posterior cingulate and caudate were used as the seed, respectively. On the other hand, PD-MCI-LD group showed significantly decreased functional connectivity mainly in the medial prefrontal precortex and anterior cingulate when posterior cingulate was used as the seed.
Conclusion: The resting state fMRI and TBSS analysis might be useful tools to identify the changes in functional connectivity and WM integrity in PD-MCI patients according to the duration of parkinsonism prior to MCI, and functional and anatomical substrate may differ depending on the rate of cognitive decline in these patients.

B-0082 11:19

Comparison of 3 T and 7T susceptibility weighted angiography of the substantia Nigra in diagnosing Parkinson's disease

M. Cosottini, D. Frosini, I. Pesaresi, G. Donatelli, P. Cecchi, M. Costagli, L. Biagi, R. Ceravolo, M. Tosetti; *Pisa/IT (mircocosottini@libero.it)*

Purpose: Standard neuroimaging fails in defining the anatomy of the Substantia Nigra and has a marginal role in the diagnosis of Parkinson's Disease. Recently 7T-MR target imaging of the Substantia Nigra has been demonstrated to be useful in diagnosing Parkinson's Disease. We performed a comparative study to evaluate if Susceptibility Weighted ANgiography imaging allows the diagnosis of Parkinson's Disease with a 3 T scanner.
Methods and Materials: Fourteen Parkinson's Disease patients and 13 healthy subjects underwent MR examination at both 3 T and 7T using Susceptibility Weighted ANgiography Two expert blinded observers and one fellow neuroradiologist evaluated the 3 T and 7T images of the sample to identify Substantia Nigra abnormalities indicative of Parkinson's Disease. Diagnostic accuracy, intra and inter-observer agreement were calculated separately for 3 T and 7T acquisitions.
Results: Susceptibility Weighted ANgiography 7T-MRI allows a Parkinson's Disease diagnosis with a mean sensitivity of93%, specificity of100% and diagnostic accuracy of96%. 3 T-MRI diagnosed Parkinson's Disease with mean sensitivity of79%, specificity of94% and diagnostic accuracy of86%. Intra-observer agreement and inter-observer agreement were excellent at 7T. At 3 T intra-observer agreement was excellent for experts and inter-observer agreement ranged between good and excellent. The less expert reader obtained a diagnostic accuracy of89% at 3 T.
Conclusion: SWAN images obtained both at 3 T and 7T differentiate controls from PD patients, with a higher diagnostic accuracy at 7T. The capability of 3 T in diagnosing PD might encourage its use in the clinical practice. The use of the more accurate 7T should be supported by a dedicated cost-effectiveness study.

B-0083 11:27

Pattern of spontaneus neuronal activity within default mode network in patients with Parkinson's disease

E. Seliverstova, Y. Seliverstov, R. Konovalov, M. Krotenkova, S. Illarioshkin; *Moscow/RU (eselivers@yahoo.com)*

Purpose: To assess pattern of neuronal activity within default mode network (DMN) in patients with Parkinson's disease (PD) comparing to healthy controls.
Methods and Materials: We have exanimated and compared 3 independent right-handed groups. Sixteen patients with PD in early steps, 10 females; mean age 63.5; in pharmacological treatment; 9 newly diagnosed PD patients, 4 females, mean age 56.4; 15 healthy volunteers, 8 females; mean age 43.2; with no central nervous system diseases, underwent 1.5 T resting-state fMRI scanning, data were calculated using software GIFT 2.0, SPM5. Participants were instructed to lie still, relaxed with closed eyes, not to think about anything

in particular, and not to fall asleep. Gender and age have been taken as covariates in data analysis.
Results: We have observed significant greater areas of spontaneous neuronal activity in anterior medial frontal gyri region, including gyri rectus, in newly diagnosed PD patients versus patients on medication and healthy volunteers [pFWEcorr< 0.05; T=9.37]. Also we have observed area of activity in right superior frontal gyrus in SMA region (is not parts of DMN) and significant greater areas of the activity in both precuneus (are parts of DMN) in all PD patients compared with healthy volunteers.
Conclusion: We've found certain changes of the activation pattern within DMN in patients with PD, new regions of activation out of DMN in PD patients, which were absent in controls. Our findings may indicate the ongoing neurodegenerative process, reflect neuroplasticity phenomena and be demonstration of functional connectivity as compensatory mechanisms in neurodegeneration.

B-0084 11:35

Estimating the need for MRI conditionally safe deep brain stimulation systems in Parkinson's disease patients: a European perspective
C. Gunnarsson[1], G. Barnett[2], S. Autiero Walleser[3], J. Hinnenthal[4], Y. Safriel[5], M. Ryan[1]; [1]*Cincinnati, OH/US*, [2]*Dunganaghy/IE*, [3]*Tolochenaz/CH*, [4]*Minneapolis, MN/US*, [5]*Clearwater, FL/US*
(jennifer.hinnenthal@medtronic.com)

Purpose: To estimate the need for MRI conditionally safe DBS systems in patients with PD.
Methods and Materials: A three-phase approach was chosen: 1) a systematic literature review to identify comorbidities common in PD, 2) a review of EU clinical practice guidelines to identify those comorbidities for which MRI is appropriate, and 3) a retrospective administrative claims analysis (MarketScan®, U.S). to identify a PD population who may be eligible for DBS along with the percentage of patients potentially in need of an MRI, based on a diagnosis of conditions indicated for MRI (according to step 1 and 2). A series of 5 scenarios were considered, to test various assumptions for MRI-indicated conditions.
Results: Over a 2-year period, using the base case scenario, 6,770 (71.8%) PD patients potentially eligible for DBS had a diagnosis for at least one condition for which MRI is recommended. The range across all five scenarios was 66.1% to 79.8%. The most common condition contributing to the base case was cardiac disorders (36.3%) followed by cataracts (28.4%). The percentage of included PD patients with a MRI-indicated condition increased with age.
Conclusion: In PD patients potentially eligible for DBS, 71.8% have at least one condition for which MRI is recommended. This analysis demonstrates that there is a potential need for MRI in the PD population. However, access to MRI has been restricted by the limitations of current DBS systems.

Author Disclosures:
C. Gunnarsson: Consultant; Medtronic. **G. Barnett:** Consultant; Medtronic. **S. Autiero Walleser:** Employee; Medtronic. **J. Hinnenthal:** Employee; Medtronic. **Y. Safriel:** Consultant; Medtronic. **M. Ryan:** Consultant; Medtronic.

B-0085 11:43

Susceptibility weighted imaging improves the diagnostic accuracy of brain MRI in the work-up of parkinsonism
F.J.A. Meijer, B.A.C.M. Fasen, A. van Rumund, B.R. Bloem, B. Goraj; *Nijmegen/NL (anton.meijer@radboudumc.nl)*

Purpose: To evaluate whether SWI has added value to conventional 3 Tesla brain MRI for the diagnostic work-up of early stage parkinsonism.
Methods and Materials: Prospective observational cohort study of 65 patients presenting with parkinsonism but uncertain initial clinical diagnosis. At baseline, 3 Tesla brain MRI with conventional and SWI sequences was performed. Probable diagnoses could be made in 56 patients after clinical follow-up: 38 patients diagnosed Parkinson's disease (PD) and 18 patients diagnosed atypical parkinsonian syndromes (AP), including 12 patients diagnosed with the parkinsonian form of Multiple System Atrophy (MSA-P). Also, 13 healthy controls were evaluated with SWI. Conventional brain MRI abnormalities were grouped in disease specific scores. SWI was analyzed by a region-of-interest method of different brain structures. One-way ANOVA was performed to analyze group differences. ROC analyses were performed to evaluate the diagnostic accuracy of conventional brain MRI separate and combined with SWI.
Results: Disease specific scores of conventional brain MRI proved to have high specificity for AP, but sensitivity was limited. Mean SWI signal intensity of the putamen was significantly lower for MSA-P than for PD and controls ($p < 0.001$). Accuracy of brain MRI was improved by the presence of severe dorsal putaminal hypo-intensity: AUC was increased from 0.75 to 0.83 for identifying MSA-P and AUC was increased from 0.76 to 0.82 for identifying AP as a group.
Conclusion: SWI improves the diagnostic accuracy of 3 Tesla brain MRI in the work-up of parkinsonism by identifying severe putaminal hypo-intensity, which is indicative of MSA-P.

Author Disclosures:
B.R. Bloem: Board Member; associate editor for the Journal of Parkinson's disease. Consultant; consultant for Danone, Glaxo-Smith-Kline, and UCB. Research/Grant Support; Alkemade Keuls fund, Michael J Fox Foundation, Netherlands Organization of Scientific Research, Prinses Beatrix Foundation, and Stichting Internationaal Parkinson Fonds.

B-0086 11:51

Transcranial magnetic stimulation and MR with DTI in ALS patients: combination and correlations of their measurements
A. Stecco, M. Perchinunno, I. Divenuto, E. Migazzo, A. Carriero; *Novara/IT (marcoperchinunno@gmail.com)*

Purpose: To determine the diagnostic accuracy of MRI with DTI and TMS with MEPs in UMN assessment in ALS patients; secondary goal to assess if there is a correlations between DTI metric and MEPs.
Methods and Materials: 17 patients affected by ALS, underwent a TMS and MRI DTI evaluation within 30 days. By TMS, cortical motor threshold (MT) at rest, central motor conduction time (CMCT), cortical MEPs and spinal MEPs have been recorded. MR imaging DTI acquisitions have been performed with a 64 directions oriented tensor, on a 1.5 T magnet. Fractional anisotropy and ADC values have been recorded and compared to an institutional healthy volunteers database on the following several anatomical levels: semioval centers, internal capsule - posterior limb, cerebral pedicle, pons. Statistical analysis has been carried out by mean of Wilcoxon-Mann-Whitney test and Cochrane Q test.
Results: Only the internal capsule level FA measurements (mean FA = 0.64) differed statistically from the mean and range (0.74; 0.67-0.81) of values from the control data. Sensitivity assessment of MEPs (with or without a clinical sign) and DTI, showed a slight superiority of DTI if compared to MEPs alone, but when MEPs are combined with the clinical sign show a better sensitivity. The same behavior and results showed for TCMC.
Conclusion: MEPs TCMC and DTI with FA measurement at the internal capsule level, appear to study with the same sensitivity the quality of cortico-spinal tract in ALS patients in evaluating UMN. The clinical signs, if present, add sensitivity to TMS evaluation.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 216

Thoracic oncology

Moderators:
I.E Tyurin; Moscow/RU
A. Vilaplana; Seville/ES

B-0087 10:30

CT perfusion of lung tumour: do morphological and functional heterogeneity correlate?
D. Barone[1], A. Bevilacqua[2], S. Baiocco$_2$, G. Gavelli[1]; [1]*Meldola/IT*, [2]*Bologna/IT (domenico.barone@irst.emr.it)*

Purpose: In clinical routine the effectiveness of therapy in treatment of lung tumours mainly relies on visual-based morphological analysis. The aim of this work is to compare morphological and functional heterogeneity in CT perfusion (CTp) studies.
Methods and Materials: This study was approved by the institutional review board. 22 datasets referring to 14 patients (age 36-81 years) with NSCLC undergoing axial CTp were considered. For each lesion, two 25-year experienced readers chose in the CTp sequence, and manually delineated, the most representative section showing the highest contrast. The heterogeneity was visually assessed in this section using a 3-point scale and, after motion compensation, the blood flow was computed on the reference sequence. Two different local-based indices were used to measure the heterogeneity of the reference section and of the blood flow perfusion map. A local-based correlation between the obtained results was computed using linear Pearson coefficient and results made available in a colorimetric map.
Results: As expected, most of cases showed a relevant correlation between morphological and functional information. Nevertheless, it was worth mentioning at least one case were a severe mismatch arises from a lesion considered by radiologists as being structurally homogeneous, that was quite surprisingly characterized by a necrotic core and a distinct high perfusion region.

Conclusion: Although most of times information regarding lung tumour heterogeneity can be successfully derived from morphological analyses of a CT sequence, this study shows that morphological analysis only can even mislead clinical considerations, thus jeopardising the choice of most appropriate treatment.

B-0088 10:38

Virtual monoenergetic dual-energy CT: optimisation of keV-settings in lung cancer

M. Kaup, J.-E. Scholtz, A. Engler, R.W. Bauer, M. Kerl, T.J. Vogl, J.L. Wichmann; *Frankfurt a. Main/DE (Moritz.Kaup@kgu.de)*

Purpose: To evaluate the effects on objective and subjective image quality of virtual monoenergetic reconstructions at various energy levels of dual-energy computed tomography (DECT) in patients with lung cancer.
Methods and Materials: 48 patients (37-85 years) with biopsy-proven untreated primary or recurrent SCLC and NSCLC were included. Images were reconstructed with the standard linear blending setting (M_0.3; 30% of 80 kVp, 70% of 140 kVp spectrum) and as virtual monoenergetic images with 40, 60, 80 and 100 keV. Attenuation of lesion, various anatomic landmarks and image noise were objectively measured, lesion contrast-to-noise ratio (CNR) was calculated. Three radiologists subjectively rated each image series using a 5-point grading scale regarding overall image quality, lesion delineation, image sharpness, and image noise.
Results: Highest tumour attenuation was found at 40keV (133.0 HU) followed by 60keV (85.5 HU), 80keV (61.6 HU) and M_0.3 series (60.7 HU). The lesion CNR was highest in the 40keV reconstructions (2.8) followed by 60keV (1.6) and M_0.3 series (0.1) and superior to the other monoenergetic series (all $p < 0.001$). Subjective image analysis was highest for the 60keV series regarding overall image quality (4.58; ICC=0.833) and lesion delineation (4.93; ICC= 0.738) followed by the M_0.3 series (4.48, ICC=0.771; 4.06, ICC=0.836 all $P < 0.001$). Image noise was rated superior in the 80keV and M_0.3 series (4.72 vs. 4.72).
Conclusion: Compared to the standard linear blending setting, virtual monoenergetic reconstructions of DECT data at 60 keV significantly improve lesion enhancement, CNR, subjective overall image quality and tumour delineation of lung cancer.

B-0089 10:46

Potential influence of automated volumetry on treatment response classifications in lung cancer lesions

K. Akbari; *Linz/AT (kaveh.akbari@akh.linz.at)*

Purpose: To evaluate the potential influence of automated volumetry on treatment response classifications in lung cancer in comparison to manual unidimensional measurements.
Methods and Materials: 60 lung cancer patients were included in this retrospective study. For each patient, up to two target lesions were quantitatively evaluated in a baseline- and two follow-up CT scans (77 lesions, 154 response classifications) by two independent radiologists. For each lesion a unidimensional diameter measurement, as well as an automated CT-volumetry was performed. The response evaluation was assessed using unidimensional results following RECIST compared to volumetric results using converted volume-equivalent thresholds of RECIST (-65/+73%) and using adapted thresholds (-30/+37% i.e. MRE $\pm$ 5xSD), respectively.
Results: The manual measurements varied between the two observers by $6.34 \pm 17.12\%$, affecting the volume to the power of 3, whereas the volumetric measurements varied only by $3.33 \pm 6.66\%$. The volumetric assessment using converted thresholds (-65/+73%) led to a different response classification in 16.9% (26/154) of the lesions, with an effect on therapeutic decisions in 13% (20/154) of the cases. The volumetric assessment using adapted thresholds showed different response classifications in 28.6% (44/154) of the lesions, which would have an effect on the therapeutic procedure in 17.5% (27/154) of the cases.
Conclusion: The volumetric assessment of lung cancer lesions is more appropriately and has a significant effect on response classifications and therapeutic decisions. Adapting thresholds for stable disease when using a volumetric approach leads to a better and earlier detection of a partial remission or progressive disease.

B-0090 10:54

Prognostic value of additional findings in CT scans of patients with cancer-related pulmonary embolism: data from 208 consecutive cases from the EPIPHANY study

D. Calvo-Temprano[1], J. Plasencia[2], P. Jiménez-Fonseca[1], M. Solis[1], M. Benegas[3], M. Sanchez[3], S. Hernandez[4], D. Martinez de la Haza[3], A. Carmona-Bayonas[2]; [1]*Oviedo/ES*, [2]*Murcia/ES*, [3]*Barcelona/ES*, [4]*Madrid/ES (dhousev@gmail.com)*

Purpose: To assess the correlation among additional radiological findings (ARF) and clinical outcome.
Methods and Materials: 208 newly-diagnosed cancer-related PE were evaluated: 49.5% incidentally found on scheduled CT and 50.5% acute symptomatic patients through CT-angiography from the multicenter observational EPIPHANY study. PE in cancer patients has unfavorable prognosis not yet elucidated if it's due to severity of PE or to other cancer-related comorbidities. We compared differences in ECOG, clinical stability, cancer progression (CP), short term (< 15days) complications and 30-day mortality rates according to presence of ARF. Clinical stability was defined as: systolic pressure>100 mmHg, saturationε90%, respiratory rate<30/min, pulse<110/min, neither dyspnoea nor relevant hemorrhage.
Results: 51% patients showed ARF additional to PE in CT. Cancer-related ARF: 31% nodules, 37% pleural effusion, 7% pericardial effusion, 22% atelectasis, 4% lymphangitis and 2% radiation pneumonitis. Cancer-unrelated ARF: 17% emphysema, 11% pneumonia, 5% alveolar edema, 5% fibrosis and 11% other. Progression confirmed at PE diagnosis in 34%: 73.5% with ARF and 26.5% without ARF (OR 10.85, p0.0001). Patients with ARF had worse ECOG: ε2 84% vs. 65% (OR 2.8, p0.001). More patients with ARF were clinically unstable at admission without statistical significance (OR 1.4, p0.07). Most short-term complications developed when presence of ARF (32% vs. 11%; OR 3.73, p0.003)and had higher 30-day mortality rates (14% vs. 6%; OR 4.77, p0.001).
Conclusion: ARF are associated with worse PE prognosis due to tumour progression, worse PS and/or PE complications in cancer-related PE. Thus, the inclusion of ARF in specific PE prognostic scales might help to improve the management of these patients.

B-0091 11:02

High diagnostic performance for MRI-based regional lymph node staging in NSCLC: results from a meta-analysis

J. Peerlings, E.G.C. Troost, P.J. Nelemans, A.L. Hoffmann, R.G.H. Beets-Tan; *Maastricht/NL (jurgen.peerlings@maastro.nl)*

Purpose: Assessment of regional lymph node status in non-small cell lung cancer (NSCLC) is of crucial importance for treatment selection (surgery vs. chemo-radiotherapy) and for selective nodal irradiation. We analysed the diagnostic performance of MRI in detecting and differentiating (non-)metastatic regional lymph nodes on a per-patient and per-nodal basis.
Methods and Materials: Relevant studies were identified by a systematic literature search in PubMed, Web of Science, Embase, and MEDLINE databases. Two investigators independently evaluated the methodological quality of each study. Hierarchical summary ROC curves (hsROC) were generated to illustrate pooled sensitivity, specificity, and diagnostic odds ratio (DOR) and to estimate the overall diagnostic performance of MRI. Differences in diagnostic accuracy between subgroups (i.e., publication before 2008 or thereafter, and quantitative vs. qualitative evaluation) were tested for statistical significance and expressed as relative DOR (rDOR).
Results: Of 2551 initially identified studies, 12 eligible studies were included in this meta-analysis. On per-patient basis, the pooled estimates [95% confidence interval] for sensitivity, specificity and DOR-values were 0.87 [0.78-0.92], 0.88 [0.77-0.94] and 48.1 [23.4-98.9], respectively. On per-nodal basis, the respective measures were 0.88 [0.78-0.94], 0.95 [0.87-0.98] and 129.5 [49.3-340.0]. Subgroup analyses indicated an increased DOR for per-patient based studies published after 2008, while the DOR decreased for per-nodal based studies. The diagnostic performance of quantitative evaluation was significantly greater than qualitative evaluation on a per-nodal basis (rDOR=7.25 [1.75-30.09], P=0.01).
Conclusion: This meta-analysis demonstrates that there is Level II evidence for the high diagnostic value of MRI for regional lymph node staging in NSCLC.

B-0092 11:10

Diagnostic accuracy of different MRI pulse sequences in non-small cell lung cancer in a dedicated, thoracic 18 F-FDG PET/MRI protocol

B.M. Schaarschmidt[1], C. Buchbender[1], C. Rubbert[1], F. Hild[2], V. Ruhlmann[3], V. Ruhlmann[3], H.H. Quick[3], G. Antoch[1], P. Heusch[1]; [1]*Dusseldorf/DE*, [2]*Hamm/DE*, [3]*Essen/DE*

Purpose: To assess the diagnostic accuracy of different MR sequences as part of a dedicated, simultaneous positron emission tomography/magnetic resonance (PET/MR) imaging protocol to determine the local tumour extent in non-small cell lung cancer (NSCLC).
Methods and Materials: Local tumour staging was performed for each individual pulse sequence by three individual readers in fused mode with PET in 28 patients that underwent thoracic PET/MRI before NSCLC-resection. Histopathological results served as reference standard. McNemar's test was used to investigate differences between the MR sequences. Bonferroni correction was performed to prevent α-error accumulation. Furthermore, Bland-Altman analysis was performed to assess differences between tumour sizes determined by pathology as compared with tumour size on MRI.
Results: The number of correctly determined T-stages was significantly higher on transverse T2 Blade images (69%) as compared with transverse in-phase images of the Dixon-VIBE sequence acquired for attenuation correction (45%). Contrast-enhanced, transverse T1 allowed a correct T-staging in 59% of cases which was not significantly different from T2 and Dixon-VIBE. When assessing tumour size as compared with histopathology smaller limits of agreement were found for T2 Blade (-1.81 cm & 1.79 cm) than for contrast-enhanced T1 (-2.50 cm & 2.28 cm) and in-phase Dixon-VIBE (-2.20 cm & 2.82 cm).
Conclusion: Transverse, T2 Blade images are better suited for the evaluation of local tumour spread than in-phase images of the Dixon sequence acquired for attenuation correction. Dixon should be supplemented by at least T2 for diagnostic PET/MR.

B-0093 11:18

Multi-parametric PET-CT correlates with hypoxia, angiogenesis and ALK expression in non-small cell lung cancer

D. Neriman, B. Ganeshan, A. Groves; *London/UK (deena.neriman@nhs.net)*

Purpose: Tumour hypoxia, angiogenesis and ALK expression are recognized histological features of prognostic significance (relevant to targeted therapy) in non-small cell lung cancer (NSCLC) that are potentially associated with regional variations in tumour attenuation as quantified by CT texture analysis (CTTA) and glucose uptake on PET. This study correlates CTTA and PET glucose uptake with hypoxia, angiogenesis and ALK expression in NSCLC.
Methods and Materials: CTTA comprised histogram analysis of pixel values within tumour regions derived from the CT component of PET-CT images acquired prospectively in 28 patients with NSCLC. Texture parameters (kurtosis, skewness, mean of positive pixels - MPP) were obtained with and without Laplacian of Gaussian image filtration to highlight image features at fine, medium and coarse texture scale. PET glucose uptake was measured as the average and maximum standardized uptake value (SUV_{max}). CTTA and SUV were correlated with histological and immunohistochemical features related to tumour hypoxia (expression of HiF-1a, Glut-1 and CAIX), angiogenesis (CD105) and ALK expression obtained following subsequent tumour resection.
Results: For hypoxia-related markers, MPP correlated with HiF-1a expression (rs=0.542, p=0.003), skewness correlated with CAIX (rs=-0.424, p=0.028) and SUV correlated with Glut1 (SUV_{max}, rs=0.444, p=0.034). For angiogenesis, MPP and kurtosis correlated with CD105 (rs=0.496, p=0.007; rs=-0.427, p=0.023 respectively). MPP and kurtosis identified those patients with amplified ALK expression (p=0.018; p=0.023 respectively).
Conclusion: PET-CT texture and glucose-uptake parameters correlate with hypoxia-related features, angiogenesis and ALK expression in NSCLC, suggesting multi-parametric PET-CT has potential to be a prognostic biomarker in NSCLC with possible implication in targeted therapies.

Author Disclosures:
B. Ganeshan: Owner; Scientific Director of TexRAD Ltd.

B-0094 11:26

Correlation between CT features and KRAS mutation in patients with stage I lung adenocarcinoma and their prognostic value

H. Wang[1], Y. Liu[2], O. Grove[2], Y. Balagurunathan[2], J. Heine[2], S. Eschrich[2], Z. Ye[1], R. Gillies[2]; [1]*Tianjin/CN*, [2]*Tampa, FL/US (wanghua0718@163.com)*

Purpose: To explore correlation between CT features and KRAS mutation in patients with stage I lung adenocarcinoma and their prognostic value.
Methods and Materials: Seventy-nine patients with pathologic stage I lung adenocarcinoma, available KRAS mutation status, preoperative CT images, and survival data were included in the study. Seven CT features including spiculation, concavity, texture, bubblelike lucency, air bronchogram, pleural retraction, and pleural attachment were used to describe the tumours. The association between the clinical characteristics, including gender, age, race, smoking status, and stage, CT features and the mutation status was analyzed using Chi-square or Fisher's exact test, Student t test, and multiple logistic regression. The association between CT features, mutation status, and overall survival (OS) was analyzed using Kaplan-Meier survival curves with the log-rank test and multivariable Cox proportional hazard regression.
Results: KRAS mutation rate was 41.77% (33/79). Clinical characteristics were not associated with KRAS mutation, however, spiculation was associated with KRAS mutation (OR=2.99, 95% CI=1.16-7.68). KRAS mutation was not associated with OS, however, pleural attachment was associated with OS (HR=2.46, 95% CI=1.09-5.53).
Conclusion: This preliminary study indicates that CT features are associated with KRAS mutation and also have prognostic importance in patients with stage I lung adenocarcinoma.

B-0095 11:34

CT of the lung: distinct features of NSCLC harbouring the EML4-ALK translocation

U.G. Mueller-Lisse, A. Tufman, H.A. Zimmermann, C. Reiners, A. Borgmeier, F. Gamarra, S. Reu, M.F. Reiser, R.M. Huber; *Munich/DE (ullrich.mueller-lisse@med.uni-muenchen.de)*

Purpose: Advanced, chemotherapy-refractory EML4-ALK-gene-fusion-positive non-small-cell lung cancer (NSCLC) can now be treated with a dedicated ALK-tyrosine-kinase-inhibitor, crizotinib. Since EML4-ALK-gene-fusion is rare in NSCLC, and biopsy samples tend to be small, deciding who to screen remains a challenge. We tested computed-tomography (CT) lung-tumour-features previously used to describe broncho-alveolar-carcinoma-subtype-NSCLCs among patients with advanced NSCLC to distinguish fluorescence-in-situ-hybridization-EML4-ALK-gene-fusion-positive cases from ALK-negative controls.
Methods and Materials: For the retrospective analysis, institutional-ethics-committee approval was obtained. Two independent radiologists (R1, R2) who knew that patients had NSCLC, but did not know about the molecular marker status of the respective tumours, evaluated CT-scans for localization (either-central-or-peripheral-versus-combined), growth pattern (focal-versus-diffuse), array (single-versus-multiple lesions), delineation (infiltrative-versus-circumscribed), composition (solid-only-versus-non-solid parts), site-specific blood-vessel-appearance (normal-versus-altered), and air inclusions (present-versus-absent) of lung tumours. Patient age, gender, previous NSCLC-therapy, UICC-stage, and smoking-status were potential confounders. Two-tailed statistical tests (Fisher-Exact/Student-T) were significant for $p < 0.05$.
Results: All patients (age 57±10 years, 17 female, 22 male) were adult Caucasians, and 10 of 39 (26%) were ALK-positive. Diffuse tumour growth (R1/R2, ALK-positive 9/9, ALK-negative 7/5, $p < 0.0005/p < 0.0001$, agreement 95%), multiple-lung-lesion-arrays (R1/R2, ALK-positive 9/9, ALK-negative 6/6, $p < 0.0002$, agreement 82%), and combined central/peripheral tumour-localisation (R1/R2, ALK-positive 9/9, ALK-negative 12/7, $p < 0.01/p < 0.0005$, agreement 82%) each were associated with ALK-positive cases. Light-or-never-smoking differed between cases (80%) and controls (26%, $p < 0.008$).
Conclusion: Diffuse tumour growth, multiple-lung-lesion-arrays, and combined central/peripheral tumour localisation are CT features that appear to be useful in prioritizing NSCLC samples for ALK-testing.
Author Disclosures:
U.G. Mueller-Lisse: Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810. **A. Tufman:** Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810. **A. Borgmeier:** Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810. **F. Gamarra:** Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810. **S. Reu:** Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810. **R.M. Huber:** Other; EML4-ALK screening had been carried out in the context of one of two clinical trials initiated by Pfizer Oncology (Pfizer Pharma GmbH, Berlin, Germany) (EudraCT-No. 2009-012504-13; protocol-No. A80810.

B-0096 11:42

Epidermal growth factor receptor mutation in lung adenocarcinomas: comparing CT characteristics with and without activating EGFR mutation

J. Zhao, C. Heußel, J. Dinkel, H.-U. Kauczor, H.-P. Schlemmer, A. Warth, P. Schnabel, T. Muley, M. Steins; *Heidelberg/DE (zhaojing_sysu@126.com)*

Purpose: To retrospectively analyze and validate the morphologic computed tomography (CT) characteristics of pulmonary adenocarcinoma (ADC) with epidermal growth factor receptor (EGFR) mutations.
Methods and Materials: Available CT scans from a pseudonymized database of 1575 ADC patients with EGFR mutation analysis (exon 18-21) prior to surgery, chemo- or radiotherapy were included in our retrospective study (mutations: 138 patients, female 86, median age 66 years; and wildtype: 144 patients, female 67, median age 62 years). All clinical information of the patients was collected. Subsequently, EGFR mutation status was correlated with CT and clinical data.
Results: ADC with EGFR mutation showed specific CT characteristics. Tumour-bearing lobes of EGFR mutated patients: significantly more found as lower lobes (p=0.048) and more manifested with atelectasis (p=0.003); significantly more patients with satellite nodules, air bronchogram, pleural and liver metastases were found in the EGFR mutated group (p= 0.004, 0.033, 0.004 and 0.010, respectively). In addition, EGFR mutated patients had significantly higher numbers of pleural tags (p=0.013). EGFR mutated patients had shorter minor axis of ipsilateral pulmonary lymph nodes (p=0.023) and no bilateral adrenal gland metastases (p=0.002). Further, exon 19 deletions were significantly more frequent in female patients, and the air bronchogram was positively correlated with exon 19 deletions mutation (p=0.011).
Conclusion: There are morphological features associated with EGFR mutations of ADC. These findings may help to increase the pre-test probability EGFR mutation analysis in ADC patients.

B-0097 11:50

NSCLC with EGFR and KRAS positive genes mutations. Do CT findings help in differentiating these from other forms of NSCLC?

A. Sabri, M. Batool, Z. Xu, D. Bethune, D. Manos; *Halifax, NS/CA (sabri.ali@gmail.com)*

Purpose: To study the imaging characteristics of lung cancers with EGFR and KRAS mutations compared to other forms of NSCLC.
Methods and Materials: Molecular profiling for lung cancer has been performed at our institution since 2012. We performed a retrospective blinded review of Computed Tomography (CT) features for 105 profiled tumours in patients who consented to inclusion in a database.
Results: 15 patients had KRAS mutation (14%) and 7 were with EGFR mutation (7%). Mutation was more common in females than males. 43% of EGFR positive patients were smokers compared to 88% in the control group. KRAS positive cancers were larger at first CT. EGFR positive tumours were more likely to be ground glass or part solid (48% of tumours) compared to KRAS positive (27%) and control group (15%) tumours. Spiculated margin was seen in 29% of EGFR positive tumours, 60% of KRAS positive tumours and 66% of control tumours. Air bronchogram was present in 71% of EGFR positive tumours versus 27% in other groups. The mean doubling time for EGFR positive tumours was 488 days while the doubling time for control group was 255 days. There was no nodal enlargement in patients with EGFR mutation.
Conclusion: CT features including tumour size and density, doubling time, spiculated margin and presence of air bronchogram may help distinguish subtypes of adenocarcinoma with different prognosis and treatment options. Further studies should be performed to determine if CT features can be used to identify patients most likely to benefit from molecular profiling.

Author Disclosures:
Z. Xu: Advisory Board; Pfizer. **D. Bethune:** Advisory Board; Pfizer.

10:30 - 12:00 **Room F2**

Physics in Radiology

SS 213

Advances in CT imaging

Moderators:
J. Geleijns; Leiden/NL
A. Stratis; Leuven/BE

B-0098 10:30

Dose performance of a new CT system optimised for low kV imaging in whole liver dynamic studies

U. Haberland, E. Klotz, B. Schmidt; *Forchheim/DE (ulrike.haberland@siemens.com)*

Purpose: Radiation dose is a major concern with perfusion scans in the abdomen. We analyzed the performance of a new CT system designed for low kV scanning (Definition Force, Siemens Healthcare) with respect to possible radiation dose reduction at maintained contrast-to-noise ratio (CNR) for a whole liver perfusion imaging scenario.
Methods and Materials: We used dedicated cylindrical phantoms of water equivalent material (length 40 cm, diameters 32 or 40 cm) with three inserts (water, 1 mg/ml and 10 mg/ml iodine) to cover a representative range of abdominal attenuation and vascular and parenchymal enhancement values. Scan ranges compared were 15 cm (conventional state-of-the-art scanner, Definition Flash, Siemens Healthcare) and 17.6 cm (new CT system). Scans were performed using periodic spiral mode (25 repetitions) at 80/100 kV and 50/100/150 mAs. We measured iodine contrast, noise, and dose. CNR was used as an objective measure for comparison.
Results: 80 kV could not be used on the conventional scanner with the 40 cm diameter phantom; 100 kV and at least 100 mAs were necessary to avoid relevant electronic noise disturbance and visual artifacts. In comparison using 80 kV at identical mAs settings on the new system resulted in CNR values at least 15 % higher for both iodine concentrations in all scans. Despite the longer scan range, radiation dose was less than half compared to the state-of-the-art scanner: DLP at 100 mAs was 936 versus 2115 mGy*cm.
Conclusion: The new CT system allows routine use of 80 kV for abdominal perfusion imaging, also in large patients. At less than 50% dose it offers increased CNR with a larger scan range.

Author Disclosures:
U. Haberland: Employee; Siemens AG. **E. Klotz:** Employee; Siemens AG. **B. Schmidt:** Employee; Siemens AG.

B-0099 10:38

Formation of a well-defined arterial input function for contrast-enhanced CT using a pre-determined patient-specific circulatory function for individual contrast-agent bolus-shaping

J. Hansen, M.O. Wielpütz, G. Pahn, S. Skornitzke, L. Grenacher, H.-U. Kauczor, W. Stiller; *Heidelberg/DE (Jens.Hansen@med.uni-heidelberg.de)*

Purpose: For a given intra-venous contrast-agent bolus (CAB) arterial input function (AIF) shape is patient-specific due to the individual circulatory function (CF). Aim of this study is the formation of a well-defined AIF_{TARGET} by prior determination of CF for shaping of an individual CAB_{PAT}.
Methods and Materials: After injection of a small sharp test bolus CAB_{TEST} (10 ml CA, 50 ml NaCl, flow: 4 ml/s), CT images were dynamically acquired over a period of 30s (0.5s intervals) for determining AIF_{TEST}. Using software developed in-house, CF was extracted by deconvolution (GOLD algorithm) of CAB_{TEST} and AIF_{TEST}. Theoretical AIF_{TARGET} was defined to provide an enhancement plateau of 170 HU over 10s. Deconvolution of AIF_{TARGET} and CF resulted in CAB_{PAT}. For validation, CAB_{PAT} and CF were convolved (AIF_{PAT}) and compared to AIF_{TARGET}.
Results: After start of CAB_{TEST} injection, normalized CF fluctuates around zero for 10s before rising steeply to a maximum enhancement of 180 HU at 14s. Then, CF decreases to zero at 30s, showing distinct maxima at 24s, 26s and 29s (each ~50 HU). Using deconvolved CF, individualized CAB_{PAT} for formation of a pre-defined AIF_{TARGET} can be computed and obtained by variation of CA flow during injection (5 ml/s for 2s, 1 ml/s for 4s, and 2 ml/s for 5s): Overall good agreement between calculated AIF_{PAT} and pre-defined AIF_{TARGET} (mean deviation below 10 HU) can be achieved apart from the end of the plateau (max. 40 HU).
Conclusion: Measurement of CF can be used to compute CAB_{PAT} for formation of a well-defined AIF_{TARGET} providing a constant vascular compartment for any CT-perfusion model.

Author Disclosures:
H.-U. Kauczor: Research/Grant Support; Siemens. Speaker; Böhringer Ingelheim, Bayer, Novartis, Siemens, Almirall.

B-0100 10:46

Renal versus splenic maximum slope based perfusion CT modeling in patients with liver cirrhosis and portal-hypertension

M.A. Fischer, K. Brehmer, B. Leidner, A. Svensson, P. Aspelin, T.B. Brismar; *Stockholm/SE (katharina.brehmer@karolinska.se)*

Purpose: At maximum-slope based perfusion CT (P-CT) the time of peak splenic enhancement (PSE) is commonly used to define arterial (ALP) and portal liver-perfusion (PLP). However, PSE might be delayed in patients with portal-venous hypertension (PVH), while peak renal enhancement (PRE) should be insensitive to PVH. Thus, we aimed to evaluate time-to-peak of splenic (TTP_splenic) versus renal (TTP_renal) enhancement and P-CT parameters derived from PSE- versus PRE-based modeling in cirrhotic patients with different levels of PVH.
Methods and Materials: 30 cirrhotic patients (20 men; mean age 68±10), who underwent dynamic P-CT for evaluation of hepatocellular carcinoma (HCC) were retrospectively depicted to form three groups, (A) with-out PVH (n=10), (B) with PVH (n=10), and (C) with PVH and thrombosis (n=10). TTP_splenic and TTP_renal were determined from the time-resolved data-set. ALP, PLP and hepatic perfusion-index (HPI) of the liver and HCC were determined using both PSE- and PRE-based modeling.
Results: TTP_renal was similar in groups-A/B/C ($P > 0.05$), whereas TTP_splenic was significantly longer in the PVH groups-B/C ($P=0.02$). In group-A, perfusion parameters (liver and HCC) were similar for PSE- and PNE-based modeling (all, $P > 0.05$), whereas significant differences were seen for PLP and HPI in group-B and ALP in group-C respectively (all, $P < .05$).
Conclusion: TTP_splenic is significantly prolonged in patients with PVH, resulting in significantly different P-CT parameters of PSE- as compared to PNE-based modeling. Accordingly, TTP_splenic might serve as a non-invasive biomarker of PVH, whereas maximum-slope based P-CT might be improved in patients with liver cirrhosis by replacing PSE with PRE.

B-0101 10:54

X-ray phase-contrast CT: a novel method for differentiation of renal tumour subtypes ex-vivo

M. Braunagel[1], L. Birnbacher[2], M. Willner[2], M. Notohamiprodjo[3], S. Notohamiprodjo[1], T. Saam[1], M.F. Reiser[1], F. Pfeiffer[2], J. Herzen[2]; [1]*Munich/DE*, [2]*Garching/DE*, [3]*Tübingen/DE* *(margarita.braunagel@med.uni-muenchen.de)*

Purpose: We assessed the potential of x-ray phase-contrast computed tomography (PC-CT) imaging for visualization and characterization of renal carcinoma subtypes compared to CT and magnetic resonance imaging (MRI).
Methods and Materials: Grating-based x-ray PC-CT was performed with a conventional x-ray source at 40 kVp on 16 ex-vivo formalin-fixed kidney specimens: 8 clear cell carcinomas (ccRCC), 3 chromophobe (chrRCC) and 3 papillary RCCs (papRCCs). Two healthy kidneys were scanned for reference. Quantitative phase-contrast Hounsfield units (HUp) have been calculated from ten manually placed regions of interest for each specimen, resulted in mean values ± standard deviation. The same specimens were imaged with a conventional CT at 80 and 120 kVp as well as with a 3 T MRI scanner (T1w±fat saturation (FS), T2w±FS, SWI).
Results: PC-CT showed improved differentiation of soft-tissue components in comparison to conventional CT and MRI. PC-CT allowed for discrimination of cortex (57.7 ± 1.8 HUp) and medulla (45 ± 1.7 HUp) in healthy kidneys. Majority of clear cell carcinomas showed low phase contrast tissues with areas of higher contrast due to hemorrhage (49 ± 10 HUp). CcRCC revealed a significant difference ($p < 0.05$) of HUp-values in contrast to papRCCs and chrRCCs with tissues with low phase contrast (39.9 ± 2.7 HUp and 42.9 ± 5.4 HUp, respectively). No significant difference of HUp-values was shown between papillary and chromobobe RCCs.
Conclusion: PC-CT allows for improved discrimination of soft-tissue components of renal cell carcinoma subtypes compared to CT and MRI. The laboratory-based approach holds potential for translation as a clinical application.

Author Disclosures:
M.F. Reiser: Other; Editor-in-Chief European Radiology

B-0102 11:02

Visualisation of pulmonary emphysema and fibrosis in living mice using x-ray dark-field CT imaging

A. Yaroshenko[1], K. Hellbach[2], A. Velroyen[1], S. Auweter[2], M. Bech[3], F.G. Meinel[2], M.F. Reiser[2], F. Pfeiffer[1]; [1]*Garching/DE*, [2]*Munich/DE*, [3]*Lund/SE* *(andre.yaroshenko@mytum.de)*

Purpose: Recently, we have reported that x-ray dark-field increases significantly the visibility of lung tissue, compared to the conventional x-ray imaging. The goal of this study was to demonstrate the feasibility of acquiring x-ray dark-field CTs with living mice and to analyze the diagnostic value of the new imaging modality for visualizing pulmonary disorders such as emphysema and fibrosis.
Methods and Materials: Small-animal imaging was performed using a preclinical small-animal dark-field CT scanner. The scanner acquires conventional x-ray absorption simultaneously with dark-field images. This is achieved by introducing a Talbot-Lau interferometer onto the rotating CT gantry. To induce phenotypes of human-like emphysema and fibrosis in 10-week-old C57BL/6N female mice, a solution of pancreatic elastase and bleomycin was applied orotracheally (n=3, respectively). Mice were imaged 14 and 21 days after instillation and the results were correlated with histological findings.
Results: Using x-ray dark field it is possible to visualize the size and state of the alveoli without directly resolving them. Thus, the regions affected by emphysema and fibrosis could be clearly distinguished on the dark-field CTs. A better contrast between healthy (sHU 1008±121) and emphysematous (sHU 435±95) and fibrotic tissue (sHU 312±35) was observed in the dark field compared to the conventional CT (HU -899±12, -928±22, -810±23 for healthy, emphysema and fibrosis, respectively).
Conclusion: The obtained results demonstrate the feasibility to acquired in-vivo small-animal dark-field CT scans with a rotating gantry and furthermore illustrate the high potential of the new imaging modality for diagnosing pulmonary disorders like emphysema and fibrosis.

Author Disclosures:
M.F. Reiser: Other; Chief Editor of European Radiology.

B-0103 11:10

An MR-PET-CT phantom for quality assurance, research and development

P. Mann[1], T. Heußer[1], H. de las Heras Gala[2], M. Kachelrieß[1], P. Bachert[1]; [1]*Heidelberg/DE*, [2]*Zorneding/DE (p.mann@dkfz-heidelberg.de)*

Purpose: To implement and test a phantom that mimics the human pelvis for quality assurance, research and performance measurements in both MR-PET and PET-CT devices.
Methods and Materials: The phantom contains a refillable sphere to simulate the PET signal from the bladder, a prostate/ovary object including refillable cells to mimic tumours of several sizes, thigh bones which can be filled with bone-equivalent materials and an insert for an endorectal RF coil. The phantom was tested for routine quality control (alignment of co-registration) and research projects. For the alignment test, the centre of mass of the signals produced by MR or CT in one cell was calculated and compared to the corresponding signal obtained by PET. Research projects include MR spectroscopy sequences testing (e.g. for quantification of creatine, citrate and choline) and PET studies comparing reconstructions from PET-CT and MR-PET devices. The latter is very promising for testing new PET reconstruction algorithms. Since the phantom is available as 3D voxel phantom, all experiments can be cross-checked by simulations.
Results: The signal deviations in PET-CT and MR-PET cases were 0.85±0.20 pixels and 1.27±0.05 pixels. The spectroscopy analysis showed that all resonances can be resolved and offline PET simulations agree well with the outcome of phantom measurements (SUVmean differences < 5 %).
Conclusion: The phantom is a flexible tool to study both MR-PET and PET-CT. It can verify co-registration in a straightforward way. In addition, there is a variety for research applications, ranging from MR sequence testing to evaluating new PET reconstruction algorithms.

Author Disclosures:
H. de las Heras Gala: Consultant; QUART GmbH.

B-0104 11:18

Identifying iodine and calcium solutions and estimating their concentration using caterial decomposition images generated by spectral detector dual-layer CT

I. Leichter, T. Lipschuetz, T. Vichter, Z. Romman, J. Sosna; *Jerusalem/IL (Izhak@hadassah.org.il)*

Purpose: To use Spectral Detector CT (SDCT) for generating material decomposition images that automatically differentiate between calcium and iodine solutions and calculate their concentrations in a water-equivalent phantom.
Methods and Materials: Tubes of 11.1 mm diameter filled with iodine and calcium solutions at concentrations of 10 to 60 mg/ml and 100 to 1000 mg/ml, respectively, were inserted in a water-equivalent anthropomorphic CT phantom (QRM, Moehrendorf, Germany). The phantom, of two sizes (20×30 cm and 25×35 cm), was scanned with an SDCT prototype (Philips Healthcare, Cleveland, OH, USA) at 120 kVp and 200 mAs. Spectral maps describing the relationship between grey-level values in the low- and high-energy images were generated for the iodine and calcium solutions in the large phantom. Based on the spectral maps that uniquely characterise the material in the solution, decomposition images were generated displaying pixels of calcium iodine in different colours. For both phantom sizes, differentiation between materials and variation between the calculated concentrations were analysed.
Results: For both phantom sizes, more than 95% of the pixels of the tube of different concentration fitted into the spectral map equations and were displayed correctly without overlap between materials. In the large phantom, the calculated solution concentrations were 5.7% below the actual concentrations; while in the small phantom, they were 4.6% above actual values.
Conclusion: SDCT can differentiate between calcium and iodine solutions and calculate their concentrations with reliable accuracy in a phantom model. It may reliably differentiate contrast agents in blood and tumours from adjacent skeletal components.

Author Disclosures:
Z. Romman: Employee; Philips Healthcare. **J. Sosna:** Consultant; Philips Healthcare.

B-0105 11:26

Attenuation values in virtual non-contrast dual-energy CT: effect of acquisition protocol, phantom size and contrast agent concentration

K. Matsubara, K. Sakuda, H. Kawashima, T. Takata, K. Ichikawa, K. Koshida, T. Gabata; *Kanazawa/JP (matsuk@mhs.mp.kanazawa-u.ac.jp)*

Purpose: To assess the influence of acquisition protocol, phantom size, and contrast agent concentration on the reliability of attenuation values in virtual non-contrast (VNC) images.
Methods and Materials: We prepared high-density polyethylene (HDPE) bottles filled with a mixture of water and the contrast agent at different iodine concentrations (0, 3, 9, 15, and 30 mg I/ml) and volumes (15 and 30 ml). Each bottle was surrounded by same-sized six HDPE bottles filled with water, mounted on a custom-made elliptical polymethyl methacrylate phantom. For each iodine concentration and volume, a single-energy scan at 120 kV and three protocols of dual-energy scans at 100 kV/Sn 140 kV, 80 kV/Sn 140 kV, and 140 kV/80 kV were performed. The dual-energy datasets were post-processed to reconstruct VNC images. For image analysis, regions of interest were positioned within the center of the phantoms, and the mean attenuations in Hounsfield units (HU) were noted for single-energy and VNC images.
Results: The attenuation in the VNC images increased significantly at the iodine concentration of 30 mg I/ml with the small phantom ($P < 0.05$, Tukey's honestly significant difference test) and 15 and 30 mg I/ml with the large phantom ($P < 0.05$). In a dual-energy scan at 140 kV/80 kV, the attenuation in the VNC images increased significantly at all iodine concentrations ($P < 0.05$).
Conclusion: Attenuation in VNC images differs depending on the acquisition protocol, phantom size, and contrast agent concentration. Because of high or large-sized iodine attenuation, VNC attenuation increases over non-contrast attenuation.

B-0106 11:34

Model-based iterative reconstruction in CT thorax: first quantitative clinical results

C.C. Brussaard[1], B. Ilsen[1], J. Milles[2], W. Giepmans[2], J. de Mey[1]; [1]*Brussels/BE*, [2]*Eindhoven/NL (carola.brussaard@uzbrussel.be)*

Purpose: To determine the capability of Iterative Model Reconstruction (IMR-Philips) as dose reducing method in clinical practice.
Methods and Materials: CT-scan of the thorax (Philips iCT) was performed with standard care (iDose 4, thickness 0.9 mm) and low dose (50% of initial dose) in 10 patients over 65 years old. The low dose CT-scan was also reconstructed with a prototype model-based reconstructor (IMR, Philips) using filter Body Sharp Plus level 1 and 2 (thickness 1 mm). 8 items were evaluated and scored (0=not visible; 3=acceptable; 5=excellent) by two observers with no prior experience in evaluating images reconstructed with this technique.
Results: IMR-low dose is superior to standard CT-scan in detecting and delineating ground glass nodules (L2 4.8 ± 0.4). Only one patient showed emphysema, remarkably well seen on IMR and barely seen on conventional CT.
IMR-low dose showed at least acceptable image quality for detection of small pulmonary vessels (L1/L2 3.7 ± 0.5) and delineation of the pleural (L1 4.1 ± 0.5) and mediastinal wall (L1 3.8 ± 0.4). IMR-low provided an acceptable average image quality for the delineation of the fissures (L1 3.2 ± 0.9), but not for the detection of bronchial walls within 3 cm of the chest wall (L1 2.4 ± 0.5) and the delineation of major bronchi (L1 3.7 ± 0.9).
Conclusion: Iterative model-based reconstruction shows a potential as dose reducing reconstruction technique for tailored applications such as the screening of nodules and emphysema.

Author Disclosures:
J. Milles: Employee; Philips Healthcare. **W. Giepmans:** Employee; Philips Healthcare.

B-0107 11:42

Advanced modelled iterative reconstruction for abdominal CT: qualitative and quantitative evaluation

S. Gordic[1], L. Desbiolles[2], P. Stolzmann[1], L. Gantner[1], S. Leschka[2], D.B. Husarik[1], H. Alkadhi[1]; [1]*Zurich/CH*, [2]*St.Gallen/CH*

Purpose: To determine qualitative and quantitative image-quality parameters in abdominal imaging using advanced modelled iterative reconstruction (ADMIRE) with third-generation dual-source 192 section CT.
Methods and Materials: Forty patients undergoing abdominal portal-venous CT at different tube voltage levels (90,100,110, and 120 kVp, n=10 each) and 10 consecutive patients undergoing abdominal non-enhanced low-dose CT (100 kVp, 60 mAs) using a third-generation dual-source 192 section CT machine in the single-source mode were included. Images were reconstructed with FBP and ADMIRE (strength levels 1-5). Two blinded, independent readers subjectively determined image noise, artefacts, visibility of small structures, and image contrast, and measured attenuation in the liver, spleen, kidney, muscle, fat, urinary bladder, and objective image noise.
Results: Subjective noise was significantly lower and image contrast significantly higher for each increasing ADMIRE strength level and also for ADMIRE 1 compared to FBP (all,$p < .001$). No significant differences were found for artefact and visibility ratings among image sets (all,$p > .05$). Attenuation was similar across tube voltage-image datasets in all anatomical regions (all,$p > .05$). Objective noise was significantly lower for each increasing ADMIRE strength level, and for ADMIRE 1 compared to FBP (all,$p < .001$, maximal reduction 53%). Independent predictors of noise were tube voltage ($p < .05$) and current ($p < .001$), diameter ($p < .05$), and reconstruction algorithm ($p < .001$); the amount of noise reduction was related only to the reconstruction algorithm ($p < .001$).
Conclusion: Abdominal CT using ADMIRE results in an improved image quality with lower image noise as compared with FBP, while the attenuation of various anatomical regions remains constant among reconstruction algorithms.

B-0108 11:50

Adaptative statistical iterative reconstruction and model based iterative reconstuction in liver multiphase CT: quality image impact

E. Hérin[1], M. Chiaradia[1], F. Gardavaud[1], L. Baranes[1], P. Richard[2], F. Legou[1], J.-F. Deux[1], A. Rahmouni[1], A. Luciani[1]; [1]*Créteil/FR*, [2]*Buc/FR*
(edouard.herin@gmail.com)

Purpose: To compare the image quality of multiphase CT liver acquisitions reconstructed with filtered back projection (FBP), adaptive statistical iterative reconstruction (ASIR) and model-based iterative reconstruction (MBIR).
Methods and Materials: 65 patients who consecutively underwent a multiphase liver CT, with Iomeprol 350 injection (GE HD750, 120 kV, automated milliampere selection, noise index 25, collimation: 40 mm, helical pitch 1.375), were retrospectively included. Raw image data from each phase were reconstructed with FBP, ASIR 50% and 80% and MBIR. Mean noise and Contrast to Noise Ratio (CNR) of the liver parenchyma, of the hepatic artery (HA) and of the portal vein (PV), and also visibility of HA and PV branches were compared between each reconstruction (one-way Anova).
Results: The CNR of liver parenchyma (2.18 for FBP, 3.08 for ASIR 50%, 3.8 for ASIR 80%, and 3.8 for MBIR), HA (8.16 for FBP, 11.19 for ASIR 50%, 14.15 for ASIR 80%, and 15.97 for MBIR) and PV (1.78 for FBP, 2.55 for ASIR 50%, 3.21 for ASIR 80%, and 3.46 for MBIR) significantly differed between reconstruction techniques, with MBIR reconstructions providing higher CNR than FBP and ASIR 50% images ($p < 0.001$), with significantly reduced noise ($p < 0.001$). Visibility of HA and PV branches was higher with MBIR compared to ASIR 50% and FBP, respectively $p=0.05$ and $p < 0.001$. MBIR reconstructed images did not show a higher CNR or visibility than ASIR 80%.
Conclusion: Iterative reconstructions and especially MBIR, improves the liver parenchyma, HA and PV CNR and HA or PV visibility for multiphasic liver CT imaging.

Author Disclosures:
P. Richard: Author; Philippe Richard us ab employee from GE Healthcare France. All non industrial authors belong to the CHU Henri Mondor institution and were always in control of data processing.

10:30 - 12:00 **Room D1**

Breast

SS 202b

Axillary imaging and nodal staging

Moderators:
A. Athanasiou; Athens/GR
M. Dietzel; Erlangen/DE

B-0109 10:30

Risk stratification for axillary lymph node metastases in breast cancer patients

E. Song, S. Yun, Y.-M. Sohn, H. Lee; *Seoul/KR (kslisa85@naver.com)*

Purpose: To investigate clinicopathological features including immunohistochemical subtype and radiological factors for prediction of axillary lymph node metastasis (ALNM) and preoperative risk stratification of patients with invasive breast cancer.
Methods and Materials: From June 2004 to May 2014, a total of 369 breast cancer patients (mean age, 54.7 years; range, 29-82 years) who underwent ALN dissection were included. Two radiologists retrospectively reviewed clinicopathological features, initial mammography, and initial breast ultrasonography (US). Logistic regression analyses were used to evaluate associations between ALNM and variables. Odds ratio (OR) with 95 % confidence interval and risk of ALNM were calculated.
Results: Among 369 patients, 117 (31.7%) had ALNM and 252 (68.3%) had no ALNM revealed surgically. On multivariate analysis, four factors showed positive association with ALNM: presence of symptoms, triple-negative breast cancer (TNBC) subtype, mass size on US> 10 mm, and BI-RADS category on US≥4c. Risks of ALNM increased in patients with two, three, and four factors with ORs of 5.5, 14.3, and 60.0, respectively.
Conclusion: Presence of symptoms, TNBC subtype, larger size mass on US, and higher BI-RADS category on US were positively associated with ALNM. ALNM should be considered in patients with two or more associated factors.

B-0111 10:38

Axillary lymph node ultrasound features that can predict malignancy in patients with primary invasive breast cancer

P.A.C. Teixeira, N. de Barros, L.F. Chala, C. Shimizu, J.R. Filassi;
São Paulo/BR (pakissue@gmail.com)

Purpose: Nowadays, with the use of less morbid techniques for axillary staging and treatment, ultrasound and ultrasound-guided fine needle aspiration (FNA) are playing an important role in axillary evaluation. The purpose of this study is to correlate the sonographic features of lymph nodes in patients with primary invasive breast carcinoma with ultrasound-guided FNA results and with final pathology results from sentinel lymphadenectomy or axillary lymph node dissection (ALND) to identify nodal features that can predict metastatic involvement.
Methods and Materials: We evaluated patients recently diagnosed with primary invasive breast carcinoma. Through ultrasound and FNA, we assessed one ipsilateral axillary lymph node, normal or abnormal, for each patient (N=170). Lymph nodes were considered abnormal if they had any of the following features: diffuse cortical thickening greater than or equal to 3 mm, any asymmetric or focal cortical thickening, partial or complete obliteration of the fatty hilum; rounded, lobulated or irregular morphology, presence of calcifications, spiculated or ill-defined margins. Statistical analysis was performed using the chi-square and t tests.
Results: The lymph node features most associated with malignancy were length, width, cortex thickness and fatty hilum obliteration. All lymph nodes classified by ultrasound as normal had FNA results negative or inconclusive; $p << 0.001$. Ultrasound sensitivity=100%; specificity=35.8%; PPV=56.6% and NPV=100% according with FNA results, to differentiate normal and abnormal lymph nodes. Ultrasound-guided FNA sensitivity=66.6%; specificity=62.8%; PPV=71.1% and NPV=57.9% according with ALND.
Conclusion: The ultrasound features of axillary lymph nodes that are associated with malignancy can potentially improve treatment management of patients with invasive breast cancer.

B-0112 10:46

Feasibility of axillary sentinel lymph node detection using intradermal microbubble injections for staging breast cancer

T. Seaton, P. Thiruchelvam, K. Satchithananda, D. Cosgrove, D. Cunningham, A. Lim; *London/UK (transeaton@doctors.org.uk)*

Purpose: To assess the feasibility of microbubble axillary sentinel lymph node (SLN) identification in women with breast cancer.
Methods and Materials: Women with biopsy-proven breast cancer were prospectively recruited. 0.5-2 ml of SonoVue (Braco) was injected intradermally into the periareolar skin of the affected breast. Using a 14-5 MHz probe with a microbubble-specific mode the SLN was identified and subjected to core biopsies. Procedural time, nodal appearance and contrast uptake were documented. Biopsy findings were compared with subsequent surgically excised nodes.
Results: Forty-nine patients have been recruited. Optimization of scanner settings for tissue cancellation and improved microbubble signal detection was essential. The first four patients were unsuccessful owing to suboptimal settings. Five patients had interrupted lymphatics. The axillary SLN was identified in 40 patients. Median procedural time was approximately 30 minutes. In 3 cases, macrometastases were identified at both core biopsy and surgery. In 6 cases, the microbubble assisted biopsies were negative but malignancy was detected on surgical excision (2 isolated tumour cells, 3 micrometastases and 1 macrometastasis). 21 patients had negative core biopsies followed by negative surgical excision. One patient had a positive core biopsy which was negative at surgical excision (following neoadjuvant therapy). Nine patients currently await surgery.
Conclusion: This technique has not been reproducible since its initial description several years ago. This study demonstrates that contrast enhanced breast lymphography is feasible and reproducible. However, optimisation of scanner settings are essential. This technique enables core biopsy of the SLN with ease and can potentially save patients an additional surgical procedure.

B-0113 10:54

The role of magnetic resonance imaging in axillary lymph node staging of breast cancer patients: a systematic review

M. Lobbes, V. Kuijs, M. Moosdorff, R.J. Schipper, R.G.H. Beets-Tan, M. Smidt;
Maastricht/NL (marc.lobbes@mumc.nl)

Purpose: To assess whether magnetic resonance imaging (MRI) can exclude axillary lymph node metastasis, potentially replacing sentinel lymph node biopsy (SLNB), and consequently eliminating SLNB-associated morbidity.
Methods and Materials: PubMed, Cochrane, Medline and Embase databases were searched for relevant publications up to July 2014. After primary selection, studies were selected based on predefined inclusion and exclusion

criteria and independently assessed by two reviewers using a standardized extraction form.
Results: A total of 16 eligible studies were selected from 1,372 publications identified by the search. A dedicated axillary protocol (sensitivity 84.7%, NPV 95.0%) was superior to a standard protocol covering both breast and axilla simultaneously (sensitivity 82.0%, NPV 82.6%). Dynamic, contrast-enhanced MRI had a lower median sensitivity (60.0%) and NPV (80.0%) compared to non-enhanced T1w/T2w sequences (88.4%, 94.7%), diffusion-weighted imaging (84.2%, 90.6%) and ultrasmall superparamagnetic iron oxide (USPIO)-enhanced T2*w sequences (83.0%, 95.9%). The most promising results seem to be achievable when using non-enhanced T1w/T2w and USPIO-enhanced T2*w sequences in combination with a dedicated axillary protocol (sensitivity 84.7% and NPV 95.0%).
Conclusion: The diagnostic performance of MRI for excluding axillary lymph node metastases in breast cancer patients is promising, as the NPV approaches the NPV needed to replace SLNB.

B-0114 11:02

Preoperative axillary lymph node evaluation in breast cancer patients by breast magnetic resonance imaging (MRI): can breast MRI exclude advanced nodal disease?

S. Hyun, M. Kim, J. Yoon, H. Moon, E.-K. Kim; *Seoul/KR (butter-sword@hanmail.net)*

Purpose: To evaluate diagnostic accuracy of breast magnetic resonance image (MRI) in preoperative evaluation of axillary lymph node (ALN) status in breast cancer patients, and to assess whether breast MRI can exclude advanced N2 and N3 nodal disease.
Methods and Materials: From October 2012 to June 2013, 433 patients diagnosed with invasive breast cancer and had surgery at our institution were included. The breast magnetic resonance imaging (MRI) for all included patients was reviewed and correlated with the pathologic results of ALN by either axillary lymph node dissection (ALND) or sentinel lymph node biopsy (SLNB). Through this, diagnostic performance of breast MRI for evaluation of axillary lymph node metastasis (ALNM) was evaluated. Also, we evaluate whether negative MR findings (cN0) can exclude advanced nodal disease (pN2-pN3).
Results: A total of 112 of 433 patients were reported to have ALNM. Among them, 47 patients were diagnosed by breast MRI. The sensitivity, specificity, false-negative rate (FNR), positive predictive value (PPV), negative predictive value (NPV), accuracy of breast MRI in evaluation of ALN status were as follows; 42.0%, 91.3%, 58.0%, 63.5%, 81.9%, and 78.8%. After negative MR findings (cN0), pathology showed advanced nodal disease (pN2-pN3) in 2.2% of these cases, with an NPV of 97.8%.
Conclusion: Although the sensitivity of breast MRI in evaluation of ALNM was not high, a negative MR findings of axilla (cN0) can exclude the presence of advanced nodal disease (pN2-pN3).

B-0115 11:10

The diagnostic performance of dedicated axillary T2- and diffusion-weighted MRI for nodal staging in breast cancer

R. Schipper[1], M. Lobbes[1], R.G.H. Beets-Tan[1], P. Nelemans[1], B. de Vries[1], E. Heuts[1], K. van de Vijver[2], K. Keymeulen[1], M. Smidt[1]; [1]*Maastricht/NL*, [2]*Amsterdam/NL (marc.lobbes@mumc.nl)*

Purpose: Evaluation of the diagnostic performance of unenhanced axillary T2-weighted and diffusion-weighted MRI for axillary nodal staging in breast cancer patients.
Methods and Materials: Fifty women (mean age 60 years) underwent 3 T axillary MRI, consisting of T2W MRI without fat suppression and DW MRI, followed by either sentinel lymph node procedure or axillary lymph node dissection. Two radiologists independently scored each lymph node on a confidence level scale from 0 (benign) to 4 (malignant), first on T2W MRI, then on DW MRI. Two researchers independently measured the mean apparent diffusion coefficient (ADC) of each lymph node.
Results: T2W MRI had specificity 93-97% and 87-95%; sensitivity 32-55% and 50-67%; negative predictive value (NPV) 88-91% and 86-89%; positive predictive value (PPV) 60-70% and 62-75%; area under the ROC curve (AUC) 0.78 and 0.80-0.88, after node-by-node and patient-by-patient validation, respectively, with good interobserver agreement (kappa 0.70). Addition of DW MRI resulted in lower specificity (59-88% and 50-84%), higher sensitivity (45-64% and 75-83%), comparable NPV (89% and 90-91%), lower PPV (23-42 % and 34-60%) and lower AUC (0.68-0.73 and 0.70-0.86). ADC measurement resulted in a specificity of 63-64% and 61-63%, sensitivity of 41% and 67%, NPV of 85% and 85-86%, PPV of 18% and 35-36% and AUC of 0.54-0.58 and 0.69-0.74.
Conclusion: Dedicated high-resolution axillary T2W MRI showed good specificity, with good interobserver agreement. However, its NPV is still insufficient to substitute the sentinel lymph node procedure for exclusion of axillary lymph node metastasis. DW MRI and ADC measurement were of no added value.

B-0116 11:18

Potential role of Dixon sequences on predicting metastatic axillary lymph nodes in patients with breast cancer: preliminary results

M. Marcon, V. Bertani, P. Clauser, A. Linda, C. Zuiani, M. Bazzocchi; *Udine/IT (magda.marcon@gmail.com)*

Purpose: To evaluate the diagnostic value of fat-signal-fraction (FSF) assessment at MR imaging in predicting nodal metastasis in patients with breast cancer and suspicious axillary lymph nodes.
Methods and Materials: Twenty-six patients with breast cancer, undergoing pre-operative MRI and with suspicious axillary lymph nodes were included in this study. The largest ipsilateral axillary lymph nodes, with no visible fatty hilum, were evaluated. Benign and malignant lymph nodes were compared according to the pathologic reports. The volume and the FSF averaged over the full lymph node were evaluated using the separated water-only and fat-only images obtained from a dual-echo spoiled gradient-recalled echo MR sequence (Dixon) acquisition. Student-t test was used to test significant FSF and volume difference between benign and malignant lymph nodes. A p-value < 0.025 indicated statistical significance. Different cut-off point for FSF value were tested to categorize the lymph nodes as benign or malignant.
Results: Nodal metastases were documented in 14 (53.8%) axillary lymph nodes. The mean volume was significantly larger in malignant (mean±SD, 0.21±0.12 cm3; range, 0.03-0.4 cm3) compared to benign (mean±SD, 0.10±0.07 cm3; range, 0.02-0.18 cm3) lymph nodes (p=.022). The mean FSF was significantly lower in malignant lymph nodes (mean±SD, 13.41±6.27; range 5.34-25.55) compared to benign lymph nodes (mean±SD, 22.14±8.05; range 12.42-38.9) (p=.005). Considering a FSF value lower than 10.6 as positive for malignancy we estimated a positive predictive value of 100% with a 100% specificity and 50% sensitivity.
Conclusion: FSF evaluation of suspicious lymph nodes can be helpful in predicting nodal metastasis in patients with breast cancer.

B-0117 11:26

Role of DWI assessing nodal involvement and response to neoadjuvant chemotherapy in advanced breast cancer

C. Buccheri, E. Bufi, A. Bonatesta, R. Fubelli, M. Tumino, F. Padovano, F. Patrolecco, P. Belli, L. Bonomo; *Rome/IT*

Purpose: To assess variations in mean ADC values and number (N) of axillary nodes in DWI images during neoadjuvant chemotherapy and possible relation with nodal disease status.
Methods and Materials: 27 MRI of patients addressed to neoadjuvant chemotherapy followed by lymphadenectomy were retrospectively reviewed. Mean ADC values were obtained for each axilla at the time of diagnosis (0) and after chemotherapy (1). ADC and N in pathological axilla (PA) (even stratified between "responders" and "non responders") and in the healthy one (HA), at time 0 and time 1 were compared using t-test.
Results: ADC was 0.8408 ± 0.218 at time 0, 0.888 ± 0.203 at time 1 (p= 0.314) in PA; 0.84 ± 0.232 at time 0, 0.846 ± 0.24 at time 1 in HA (p= 0.9). N was 5.35 ± 2.95 at time 0, 4.65 ± 2.77 at time 1 (p=0.274) in PA, 3.42 ± 2.41 at time 0 and 3.58 ± 2.84 at time 1 (p= 0.76) in HA. ADC was 0.908 ± 0.21 for "responders" and 0.871 ± 0.22 for "non responders" at time 0 (p=0.26), 0.995 ± 0.19 and 0.826 ± 0.19 respectively at time 1 (p= 0.049).
Conclusion: Slight increase of ADC and decrease of N during chemotherapy was observed in PA, with p values > 0.05 probably due to small number of patients, while no significant variations were appreciated in HA. ADC was higher in responder vs non responder in PA at time 0 and this difference became significantly higher at time 1.

B-0118 11:34

The diagnostic performance of gadofosveset-enhanced axillary MRI for nodal (re-)staging in breast cancer patients: can the initial promising results be reproduced?

R. Schipper, M. Smidt, L. van Roozendaal, P. Nelemans, B. Brans, K. Keymeulen, J.E. Wildberger, R.G.H. Beets-Tan, M. Lobbes; *Maastricht/NL (marc.lobbes@mumc.nl)*

Purpose: To evaluate the diagnostic performance of gadofosveset-enhanced (GDF-MRI) for nodal (re-)staging in newly diagnosed breast cancer patients.
Methods and Materials: 73 patients underwent a dedicated axillary 3.0 T MRI, consisting of standard MRI and GDF-MRI. Two radiologists independently scored each lymph node on a confidence level scale, first on standard MRI, subsequently adjusting their score based on the GDF-MRI, if deemed necessary. Diagnostic performance parameters were calculated based on a node-by-node and patient-by-patient validation with histopathology as gold standard. To investigate the presence of a learning curve for reading GDF-MRI, the diagnostic performance on the first 50 exams was compared to the last 23.

Results: For all patients, the node-by-node validation for reader 1 showed similar diagnostic performance for standard MRI and GDF-MRI with an AUC of 0.78 and 0.80 (p=0.442). For reader 2 it was 0.79 and 0.71 (p=0.007). For patient-by-patient validation, the AUC of standard and GDF-MRI were 0.89 and 0.82 for reader 1 and 0.81 and 0.77 for reader 2. For reader 1 AUC of the first 50 cases was 0.75, increasing to 0.94 in the last 23 cases (p=0.09). AUC increased from 0.75 to 0.80 for reader 2 (p=0.783). For reader 1, corresponding diagnostic parameters finally were: sensitivity 83%, specificity 94%, PPV 83% and NPV 94%.
Conclusion: The current study confirmed previous observations that GDF-MRI has the potential as a non-invasive method for nodal (re-)staging in breast cancer. However, a learning curve exists, especially for breast radiologists not familiar with GDF-MRI.

B-0119 11:42

Correlation between enlarged axillary lymph nodes to breast silicone implants tears seen on MRI

E. Klang, O. Helshtok, A. Rundstein, A. Shalmon, Y. Servadio, M. Gotlieb, M. Sklair-Levy; *Ramat Gan/IL (eyalkla@hotmail.com)*

Purpose: To investigate a correlation between enlarged axillary lymph nodes (EALN) to silicone breast implants tears (IT) seen on breast MRI.
Methods and Materials: This retrospective study investigated two groups. In group A, a search for "lymph node" and "silicone breast implants", in breast MRI interpretations, yielded 97 females, with 173 implants. Chi-square test evaluated relationship between presence of EALN to IT, T-test evaluated relationship between EALN size to IT. In group B, a search for "silicone IT", in breast MRI interpretations, yielded 75 females, with 146 implants. Chi -quare test evaluated relationship between presence of IT to EALN.
Results: In group A, 55/173 implants were associated with EALN, from them 18/55 (=32.7%) had IT, compared with 118/173 implants without EALN, from them 6/118 (=5%) had IT. Chi-square $p < 0.0005$. Relationship between EALN size to IT was not statistically significant (18.55±6.37 mm with IT vs. 16.02±4.86 mm without IT. T-test p=0.15). In group B, 91/146 implants had IT, from them 19 (19/91=21.8%) had EALN, compared with 55/146 implants without IT, which none of them had EALN (0/55=0%). Chi-square $p < 0.0005$.
Conclusion: There is a significant statistical correlation between the presence of EALN to IT. The rate of EALN in the presence of IT is 21.8%. The rate of IT in the presence of silicone implants and EALN is 32.7%.

10:30 - 12:00 **Room D2**

Interventional Radiology

SS 209

Peripheral arterial and venous interventions

Moderators:
E. Dósa; Budapest/HU
K. Schürmann; Dortmund/DE

B-0120 10:30

Advanced age and renal dysfunction in cathlab: what should we do?

R. Accardi, F. Pellone; *Macerata/IT (r.accardi@alice.it)*

Purpose: The aim of the study was to evaluate the incidence of CIN in patients with age over 80 years, with estimated glomerular filtration rate (eGFR) of less than 60 ml/min/1.73m², undergoing coronary angiography or angioplasty with iobitridol, a water-soluble, non-ionic, monomeric, low-osmolar, iodine-based contrast medium.
Methods and Materials: 260 consecutive patients with eGFR less than 60 ml/min have been enrolled; 48% were males, mean age 81.8 years and incidence of diabete mellitus was 59%. All the pts were hydrated with 1 ml/kg/h of saline (0.45%) or 0.5 ml/kg/h for pts with left ventricular ejection fraction 25% after 48 hours. One way ANOVA test was used to determine differences between variables.
Results: Baseline eGFR was 38.9+9.57 mL/min/1.73 m2, after 24 hour was 39.85+9.4 mL/min/1.73 m2 (ns), after 48 hours was 37.17+9.25 mL/min/1.73 m2 (ns); the incidence of CIN was significantly higher in those patients (42, 16.15%) with eGFR < 40 ml/min/1.73 m2 ($p < 0.001$), but none of these pts was treated with hemodialisis.
Conclusion: In high risk patients with advanced age and renal dysfunction, the incidence of CIN after iobitridol administration was low, but always without need of hemodialitic treatment. Incidence of CIN in patients over eighty supports the use of hydration and the use of a low-osmolality contrast medium as a preventive measure in this high risk patients. Caution in administration of contrast medium is necessary in elderly pts with eGFR < 40 ml/min/1.73m2, particularly during interventional procedures.

B-0121 10:38

The role of cutting balloon angioplasty for the treatment of short infrapopliteal bifurcation steno-obstructive disease

A. Posa, R. Iezzi, E. Antonuccio, M. Santoro, F. Snider, L. Bonomo; *Rome/IT (alessandro.posa@gmail.com)*

Purpose: To evaluate the safety, feasibility and effectiveness of cutting balloon in the management of infrapopliteal short bifurcation steno-obstructive disease.
Methods and Materials: Between November 2009 and March 2013, 23 patients (16 men, 7 women; mean age: 69.6±9.01 years; range: 56-89 years) with a total of 25 bifurcation lesions (16 popliteal bifurcation lesions; 9 tibioperoneal bifurcation lesions), which comprised a total of 47 arterial stenosis, were treated by using a cutting balloon angioplasty. Baseline patient demographic data, pre- and post-procedural patient clinical data, and procedural results were recorded. Follow-up consisted of clinical examination and color duplex ultrasonography every 3 months.
Results: All treatments were technically successful; we registered no peri-procedural major or minor adverse events needing treatment, with no death, amputation, or surgical conversion. No flow-limiting dissection was observed so that no stent implantation was needed. The mean post-procedural MLD and acute gain were 0.28 cm (SD: ±0.04) and 0.20 cm (SD: ±0.06), respectively, with a registered residual stenosis of 0.04 cm (SD: ±0.02). Primary and secondary patency rates were 89.3% and 93.5% at 6 months, and 77.7% and 88.8% at 12 months, respectively; 1-year primary and secondary patency rates of the treated bifurcation were 74.2% and 87%, respectively. The survival rate estimated by Kaplan Meier was 82.5% at 1 year, with a 12-month limb salvage rate of 96%.
Conclusion: CBA seems to be a safe and effective tool in the routine treatment of steno-obstructive infrapopliteal bifurcation lesions, without any procedure-related complications, overcoming PTA limitations and improving its outcome.

B-0123 10:46

Patency rates of self-expandable bare metal stents after endovascular treatment of peripheral occlusive artery disease: a matter of stent design?

K.M. Treitl, B. Wörner, M.F. Reiser, M. Treitl; *Munich/DE (karlamaria.treitl@med.uni-muenchen.de)*

Purpose: The risk of restenosis after femoro-popliteal stenting varies and may be related to stent design. The aim of this study was to retrospectively analyse the patency rates of femoro-popliteal stenting with three different self-expandable stent designs.
Methods and Materials: 239 patients (154 m; age 72.3 ± 11.3 yrs; 39.7 - 95.0) with symptomatic PAOD of the femoro-popliteal vasculature underwent PTA and stenting with a self-expandable stent (Supera Veritas SV; n=86; Sinus Repo SR; n=68; Astron Pulsar AP; n=85). Follow-up examination included measurement of the ABI and duplex ultrasound the next day and 3, 6, and 12 months after intervention. One-year post-procedural target lesion revascularization (TLR_12M) rates were investigated using Chi2-test with regard to the comorbidity of diabetes, the degree of calcification, evaluated on a three-point score, the length and localization of the target lesion.
Results: The TLR_12M rate of SV differed from SR (SV: 14.3%; SR: 23.5%; P=0.3) and from AP (AP: 24.7%; P=0.2), but the difference was not significant. In diabetics (n=119), the TLR_12M rate of SV significantly differed from AP (SV: 15.8%; AP: 31.0%; P=0.1). In popliteal target lesions (n=80), the TLR_12M rate of SV significantly differed from SR (SV: 11.1%; SR: 50.0%; P=0.05). In strongly calcified lesions (n=72), the TLR_12M rate of SV significantly differed from SR (SV: 10.5%; SR: 27.8%; P=0.1).
Conclusion: In our observation, the interwoven stent design exhibited lower TLR_12M rates than standard open and closed cell stent designs. However, this was only significant for popliteal lesions, in diabetic patients, and with strongly calcified lesions.

B-0124 10:54

Acute thrombosis of Viabahn stents in the peripheral arteries: is the incidence much higher than initially anticipated?

A. Parthipun, S. Lamki, A. Diamantopoulos, Y. Gupta, K. Katsanos; *London/UK (aneeta@hotmail.co.uk)*

Purpose: Little is known about the incidence of acute thrombosis and limb ischaemia after covered stent placement in peripheral arteries. We report results of a single-center retrospective audit investigating the phenomenon in the aortoiliac and infrainguinal arteries.
Methods and Materials: Patients with supra- and infrainguinal peripheral arterial occlusive disease were eligible for Viabahn stent placement. Relevant patient archives were retrospectively audited and scrutinised for any events of acute limb ischaemia with angiographically confirmed covered stent thrombosis. Correlation of thrombotic events with baseline anatomical and clinical variables was performed.

Results: The study covered a period of over 5 years (July 2008 - December 2013). Patient notes of a total of 100 cases who had undergone covered stent (Viabahn, Gore Medical; 137 stents) placement during that period were analysed. In 29 cases, Viabahn stents were placed in the aortoiliac arteries and in 71 cases, in the infrainguinal vessels without any peri-procedure or short-term (30 days) major complications. After a median follow-up of 1 year (range 0.15.5), there were 12 events of acute covered stent thrombosis presenting with acute limb ischaemia symptoms. Thrombosis rate in the aortoiliac segment was zero (0%). All acute thromboses occurred in the femoropopliteal segment (rate 16.9% - incidence of 15 events per 100 person-years). 8 resulted in a bypass graft or amputation and 4 were successfully thrombolysed.
Conclusion: Acute thrombosis of Viabahn covered stents in the femoropopliteal arteries is a true phenomenon with an underestimated incidence. Patients present with acute limb ischaemia and may end up with major amputations.

B-0125 11:02

Interventional radiology service provision: can we treat safely peripheral vascular disease in a day unit setting?

A. Cannavale, S. Ilyas, N. Shaida, C. Cousins, M. Krokidis; *Cambridge/UK*
(alessandro.cannavale@hotmail.com)

Purpose: Interventional radiology offers minimal invasive treatment with shorter hospitalization stay than surgery. We review the results of the treatment of peripheral vascular disease (PVD) in the Radiology Day Unit (RDU) of our institution.
Methods and Materials: Data from patients who underwent treatment of PVD (angioplasty /stent) as day case over an 18-month period were reviewed. Immediate results, complication rate, hospitalization time and mean cost were analysed.
Results: Two hundred and seventy-three patients (204 males;mean age 68.9y,range 46-93y) were included in the study. In 19%(54/273) of the cases, the disease was on iliac segment; in 67%(182/273), in the femoro-popliteal; in 3%(8/273), below the knee; and in 11%(29/273), multilevel. In 84% of the cases (229/ 273), an angioplasty alone was performed from a 4 Fr sheath (55%, 125/229 pts, 90% antegrade, 10% retrograde) and a 5 Fr sheath (45% 104/229 pts, 45%antegrade, 55% retrograde). In 16%(44 pts) of the cases, angioplasty plus stent deployment was performed from a 6 Fr sheath (54%,24 pts, 45%antegrade, 50%retrograde) and from a 7 Fr sheath (46%,20 pts, 100% retrograde). In one case, a double puncture with a 6 Fr sheath (antegrade) and a 4 Fr sheath (retrograde) was performed. In 98.9% of the cases, manual compression was performed. In 3 cases, a closure device was used to seal a 6 Fr antegrade puncture. In 2.5% of the cases, a second scan was performed post procedure and in 1.4%, overnight stay was required.The service offered significant cost saving for the hospital.
Conclusion: PVD may be treated safely in a RDU with very low complication rate and significant reduction of the cost of the service.

Author Disclosures:
A. Cannavale: Research/Grant Support; CIRSE Fellowship Grant.

B-0126 11:10

Analysis of outcome after PTA in patients with infrainguinal TASC A and TASC B arterial lesions

D. Ilic, T. Kokovic, V. Vucaj-Cirilovic, V. Till, S. Stojanovic; *Novi Sad/RS*
(metzen.ns@gmail.com)

Purpose: To present result of analysis of outcome after PTA in patitents with infrainguinal TASC A and TASC B arterial lesions.
Methods and Materials: This retrospective six-year study (2007 to 2013). Included 107 patients with femoro-popliteo-crural occlusive disease, in which individually or jointly carried 141 baloon dilatation arteriae femoralis communis, arteriae femoralis superficialis, arteriae popliteae, ateriae tibilais anterior and tibialis posterior. All patients were pre performance PTA procedure had TASC A or B type femoro-popliteal lesions and were in IIb, III or stage IV peripheral arterial occlusive disease according to Leriche-Fontaine with indication for endovascular revascularization of the lower extremities. The analysis is based on the clinical findings and DUS which is used to determine the site of restenosis and the number of patients who have requested subsequent open surgical bypass intervention or amputation.
Results: The majority of patients 70/107 (%) had TASC type A lesions, TASC type B lesions had 37/107 (%) of patients. The analysis of results in 89/107 patients were identified patency of previously dilated blood vessels, on average 38 months after the intervention. In 13/107 patients after balloon dilation were performed bypass reconstruction, due to occlusion of the dilated segment (9/13 patients ipsilateral femoropopliteal bypass reconstruction with Dacron bypass, 1/13 patients femoro-tibioperoneal bypass the VSM, 1/13 patients aorto-bifemoral bypass, 1/13 ilio-popliteal, and one patient with arterial bypass popliteo-tibial posterior artery with VSM). In 5/107 patients were performed limb amputation.
Conclusion: Endovascular revascularisation femoro-popliteo-crural occlusive disease in selected patients have a good long-term effect of revascularisation.

B-0127 11:18

Recanalisation of femoro-popliteal chronic total occlusions: no fancy devices, just a crossing catheter

A. Cannavale, M. Krokidis; *Cambridge/UK*
(alessandro.cannavale@hotmail.com)

Purpose: A wide variety complex and expensive devices have been developed for the recanalization of femoro-popliteal chronic total occlusions (CTOs). Our aim is to report our experience with the sole use of a hydrophilic crossing catheter in the recanalization of peripheral CTOs, reporting success rate and complications.
Methods and Materials: Thirty-two patients with long femoro-popliteal CTOs underwent endovascular treatment. All cases were treated from an ipsilateral approach with the use of a hydrophilic crossing catheter Navicross (Terumo Europe) with or without the support of a guidewire. If recanalization was achieved, a wire was advanced and standard angioplasty ±stenting followed. The leading efficacy endpoint was successful crossing of the catheter into the distal true lumen. Primary safety endpoints included no major adverse events, no clinically significant perforation or embolization, and no flow limiting dissection.
Results: The mean CTO length was 85 mm (range, 50-350 mm). Twenty-one lesions (65.6%) were classified as heavily calcified. In all cases a subintimal approach was used. Successful CTO crossing was reported in 96.8% (31/32) of cases. In 64.5% (20/31) a sole catheter was used to cross the lesion without guidewire support. No major adverse events occurred. In 12.5% (4/32) minor contrast extravasation in the musculature occurred but without any clinical significance.
Conclusion: The Navicross catheter demonstrated a 96.8% crossing success rate with no associated complications. In the majority of the cases CTOs may be crossed with a crossing catheter alone; this novel technology reduces significantly the time of the procedure, the cost and the complication rate.

Author Disclosures:
A. Cannavale: Research/Grant Support; CIRSE Fellowship Grant.

B-0128 11:26

Peripherally inserted central venous catheter-related infections in a large cohort of hospitalised adult patients

C. Bouzad[1], S. Duron[2], A. Bousquet[3], L. Valbousquet[3], G. Weber-Donat[1], J. Baccialone[1], J. Potet[1]; [1]*Clamart/FR*, [2]*Marseille/FR*, [3]*Saint-Mandé/FR*
(caroline.bouzad@gmail.com)

Purpose: To determine the incidence and the risks factors of peripherally inserted central venous catheter (PICC)-related infectious complications.
Methods and Materials: Medical charts of every in-patient that underwent a PICC insertion in our hospital between January 2010 and October 2013 were reviewed. All PICC-related infections were recorded and consisted in catheter-related bloodstream infections (CR-BSI), exit-site infections and septic thrombophlebitis.
Results: 923 PICCs were placed in 644 unique patients, mostly male (68.3%) with a median age of 58 years. 31 (334%) PICC-related infections occurred during the study period corresponding to an infection rate of 1.64 per 1 000 catheter days. We observed 27 (87.1%) CR-BSI, corresponding to a rate of 1.43 per 1000 catheter days; 3 (9.7%) septic thrombophlebitis and 1 (3.2%) exit-site infection. Multivariate logistic regression analysis showed a higher PICC-related infection rate with chemotherapy (OR=7.2 - IC 95% [1.77 - 29.5]), auto/allograft (OR=5.9 - IC 95% [1.2 - 29.2]) and anticoagulant therapy (OR=2.2 - IC 95% [1.4 - 12]). Neutropenic patients also seem more at risk of PICC-related infections but we were not able to statistically prove this association, probably because of lack of power (OR = 2.45 - p=0.07).
Conclusion: PICC-related infections occur frequently among patients in our study. Chemotherapy, auto/allograft, anticoagulant therapy and neutropenia appear to increase the risk of developing PICC-related infections. Chemotherapy, auto/allograft, anticoagulant therapy and neutropenia are important predictors of PICC-associated infections. A careful assessment of these risk factors may be important for future success in preventing PICC-related infections.

B-0129 11:34

Endovenous laser ablation of symptomatic varicose veins: experience of a tertiary health care center in India

P. Jagia, S. Sharma, G. Gulati; *New Delhi/IN (drpjagia@yahoo.com)*

Purpose: To determine the safety and efficacy of endovenous laser ablation (EVLA) of varicose veins in a tertiary health care center in India using 1470 nm wavelength diode laser.
Methods and Materials: In a prospective, non-randomized, consecutively enrolled single center trial, 315 limbs in 254 consecutive patients were treated by EVLA using 1470 nm wavelength diode laser between August 2010-August 2013. All patients underwent a detailed pre-procedure doppler ultrasound. A total of 299 great saphenous veins (GSV) and 16 short saphenous veins (SSV) were treated by EVLA under ultrasound (US) guidance after injecting perivenous tumescent anesthesia. Patients were followed up for clinical improvement and for doppler study upto 1 year.
Results: The procedure was technically successful in 95%.The causes of failure were GSV stenosis due to prior thrombophlebitis (4), tortuous GSV (8), GSV perforation (1) and presence of CFV thrombus (3). No mortality or major adverse events (DVT, PE or nerve injury) were noted. At the end of 1-year follow-ups, overall rate of successful venous occlusion was 98.41%. Clinical improvement was seen in > 96% patients with improved symptom status and venous disability score at 1 year. A 2-year follow-up in forty-two patients showed compete occlusion of ablated veins.
Conclusion: These results re-emphasize the safety and efficacy of EVLA using 1470 nm wavelength diode laser in a tertiary health care center in India for the treatment of varicose veins. Tortuous GSV and previous thrombophlebitis emerged as major factors adversely affecting the EVLA outcome in our patients.

B-0130 11:42

A comparative study of RFA and EVLT in treatment of symptomatic varicose veins patients

K.B. Taori; *Nagpur/IN (kishortaori@gmail.com)*

Purpose: The aim of present study is to compare the technical and clinical success rate of radiofrequency ablation (RFA) and laser ablation (EVLT) on follow-up of 1 year in symptomatic varicose veins patients and to compare safety and efficacy of radiofrequency and laser ablation.
Methods and Materials: This study includes 200 patients with documented symptomatic varicose veins. Biolitec 15 Watts, 1470nm laser machine and Celon Lab POWER, (Germany) Radiofrequency generator & bipolar RFITT applicator, Philips IU 22 Doppler and ultrasound machine with linear array 7.5-10 MHz transducer and Alpha C-arm DSA were used. Statistical analysis was done by statistical software STATA version 10.0 Categorical variables were compared by Chi-square test. $P < 0.05$ was considered as statistically significant.
Results: The present study included 84% & 88% males and 16% & 12% females (median age: 42.54± 11.62) in EVLT and RFA groups respectively. Repeated Measure ANOVA test showed that in comparison with RFA, EVLT shows significant improvement in reflux elimination and occlusion rate (p=0.010). Comparing both techniques in terms of size & time EVLT shows significant improvement (p=0.011) than RFA at 12 months in ulcer healing rate. Wilcoxon rank sum test reveals significant improvement (p= 0.0463) at 12 months in EVLT in comparison to RFA in clinical CEAP. Most of the adverse effects of the both endovascular techniques were transient and self limiting.
Conclusion: Laser is more efficient mode of treatment of varicose veins as compared to radiofrequency ablation due to higher elimination of junctional reflux, occlusion & ulcer healing rate.

10:30 - 12:00 **Room G**

Genitourinary

SS 207

Gynaecological malignancies

Moderators:
M. Horta; Lisbon/PT
K. Kinkel; Chêne-Bougeries/CH

K-03 10:30

Keynote lecture

K. Kinkel; *Chêne-Bougeries/CH (karen.kinkel@grangettes.ch)*

B-0131 10:39

Analysis of the heterogenity in DCE MR imaging of adnexal masses: a new tool for improving tumoural characterisation

N. Souahli, D. Balvay, C.-A Cuenod, M. Bazot, I. Thomassin-Naggara; *Paris/FR (soualhinarimane@yahoo.fr)*

Purpose: To evaluate the value of heterogeneity perfusion parameters to distinguish benign from malignant adnexal masses.
Methods and Materials: MR database of our centre was queried to identify all adnexal masses proved by surgery which were characterised with DCEMRI between 01/01/2008 and 28/02/2010. 113 adnexal masses (52 benign and 61 malignant including 11 borderline) were retrospectively identified. Total solid component of each adnexal mass was segmented and the most vascularised portion recognised (Hot spot). Then, quantitative analysis was performed with a 4-parameter compartimental model (FT, Vb, DAT, Ve, PS), relative area under curve was calculated (rAUC) and heterogeneity parameters including standard deviation (deltaSD, deltaSDprécoce, deltaSDtardif, deltaSD/Moy, deltaSD/AIF) and interquantile (deltaIQ, deltaIQprécoce, deltaIQtardif, deltaIQ/Moy, deltaIQ/AIF) were determined. Univariate and multivariate analysis were conducted.
Results: Whatever the region of interest evaluated, FT, Vb, and rAUC are higher in malignant than in benign tumours ($p=0.01$, $p < 0.0001$, $p < 0.0001$ respectively) and DAT lower in malignant than benign tumours. All heterogeneity parameters (except deltaSD/Moy and deltaIQ/Moy) are higher in malignant tumours than benign. Multivariate analysis showed that Vb, DAT and deltaIQ/AIF as independent parameters. Vb and rAUC are lower in borderline than in invasive tumours ($p=0.003$, $p=0.001$, respectively). All heterogeneity parameters are also lower in borderline tumours (except delta SD/Moy and deltaIQ/Moy). The Vb is the only independent parameter found. No difference was found between benign and borderline tumours.
Conclusion: This study confirms the interest of microvascular quantitative parameters to characterise adnexal tumours and proposes heterogeneity parameters as a new tool, easy to use in clinical routine.

Author Disclosures:
I. Thomassin-Naggara: Speaker; GE.

B-0132 10:47

Multiparametric 18 F-Fluorodeoxyglucose/18 F-Fluoromisonidazole PET/MRI of cervix cancer: a feasibility study

K. Pinker-Domenig, P. Andrzejewski, W. Wadsak, A. Sturdza, G. Karanikas, R. Poetter, T.H. Helbich, D. Georg, P. Georg; *Vienna/AT (katja.pinker-domenig@meduniwien.ac.at)*

Purpose: To prove the feasibility of fused multiparametric PET/MRI (3 T MP PET/MRI) with T2-weighted, dynamic contrast-enhanced MRI (DCE-MRI), diffusion-weighted imaging (DWI) and 18 F-fluorodeoxyglucose (18 F-FDG) and 18 F-fluoromisonidazole (18 F-FMISO) in cervix cancer patients at 3 T.
Methods and Materials: Ten cervix cancer patients participated in this IRB-approved prospective study. All patients underwent 3 T MRI: T2-weighted SPACE, DWI EPI (b-values 50 and 850 sec/mm²), T1 VIBE sequence, i.v. 0.1 mmol/kg bw Gd-DOTA (Dotarem). 18 F-FDG/18 F-FMISO PET/CTs were performed on different days. PET and MRI registrations were performed using Mirada RTx software (Mirada Medical,Oxford,UK,ver. 1.4.0.23). 3 T MP PET/MRI was assessed for tumour volume, enhancement-kinetics, restricted diffusivity and tracer-avidity.
Results: Tumour volumes ranged from 6.2- to 40.0 cc (median 125.5 cc). All tumours demonstrated restricted diffusivity [ADC 0.56-0.92 x 10^{-3} mm^2/sec (mean 0.75 x 10^{-3} mm^2/sec)]. Six tumours demonstrated strong initial enhancement (IE) and wash-out (WO) and four tumours strong IE and plateau. All tumours were highly 18 F-FDG-avid [SUVmax 11.9-25.6 (mean 17.3)]. None of the tumours were highly 18 F-FMISO-avid (SUVmax 1.5-6.0, mean 3.3). In eight patients, 18 F-FMISO PET identified 18 F-FMISO-avid spots within tumours indicative of hypoxia. There was a strong positive correlation of 18 F-FDG and 18 F-FMISO SUVmax and of IE and ADC, a moderate negative

correlations of WO and ADC,18 F-FDG and 18 F-FMISO SUVmax, and tumour volume and ADC and a weak correlation of tumour volume and 18 F-FDG and 18 F-FMISO SUVmax, indicating that 18 F-FMISO-avidity is independent of tumour volume.
Conclusion: 3 T MP PET/MRI in cervix cancer patients is feasible and provides unique information on tumour-morphology and -biology.

B-0133 10:55

Differentiation of primary fallopian tube cancer from epithelial ovarian cancer and salpingitis on 3-T PET/MRI

S. Park, C. Kim, J. Park, J. Bae, B. Park; *Seoul/KR (psyoon09@naver.com)*

Purpose: To investigate imaging characteristics that may differentiate primary fallopian tube cancer (PFTC) from epithelial ovarian cancer and salpingitis on 3-T magnetic resonance imaging (MRI).
Methods and Materials: Enrolled in this study were 108 lesions (29 PFTCs, 63 epithelial ovarian cancers and16 salpingitis) in 79 patients (mean age, 52.7 years; age range, 19-81 years) who underwent preoperative 3-T MRI including diffusion-weighted imaging followed by surgery. Clinical variables (age and CA-125) and MRI variables [laterality (i.e., unilateral/bilateral), tumour size, configuration, T2 signal homogeneity, enhancement, sausage-like shape, hydrosalpinx and tumour apparent diffusion coefficient (ADC)] were evaluated using univariate and multivariate logistic regression analysis in differentiating PFTC from epithelial ovarian cancer and salpingitis. Receiver operating characteristic curve analysis was also performed to investigate the diagnostic performance of tumour ADC for predicting PFTC.
Results: On univariate analysis, tumour ADC, laterality, enhancement, T2 signal homogeneity, configuration, hydrosalpinx and sausage-like shape were associated with PFTC (all $p < 0.01$). Multivariate analysis revealed that the laterality ($p = 0.002$; odd ratio [OR] 57.18) and sausage-like shape ($p = 0.012$; OR 0.076) were independent predictors of PFTC. Hydrosalpinx ($p = 0.087$) and tumour size ($p = 0.093$) were independent predictors of borderline significance for PFTC on multivariate analysis. For predicting PFTC, the area under the curve of tumour ADC was 0.702.
Conclusion: On 3-T MRI, the laterality and sausage-like shape of pelvic mass appears to be independent predictors for differentiating PFTC from epithelial ovarian cancer and salpingitis.

B-0134 11:03

Sonoelastography in differentiation of the benign and malignant ovarian tumours

A.E. Khalmukhamedova, V.E. Gazhonova; *Moscow/RU (frish666@gmail.com)*

Purpose: The objective of this study was to evaluate the diagnostic possibilities of sonoelastography (SE) to differentiate benign from malignant ovarian tumours.
Methods and Materials: In 237 patients (aged 16-91 years) with ovarian tumours conventional TVU on HI VISION Preirus (Hitachi Medical Corporation) was performed. Elasticity of the ovaries with the tumour was obtained during manual freehand compressions of the tissue. Modified Tsukuba SE classification was used for evaluation of the elasticity score. Colour-Doppler and SE data were evaluated independently by two specialists. US results were compared with surgical and hystomorphological data, dynamic investigation. Elasticity score according to the degree and correspondingly distribution of the strain were established (5 point color scale: 1-4 benign, 5-6 malignant). Accuracy, specificity, sensitivity, PPV and NPV were evaluated.
Results: Based on the data of SE, 59 hysterectomies, 70 isolated resections of the tumours and 81 ovariectomies, 27 extended hysterectomies were performed and 49 patients underwent dynamic investigation.196 benign and 41 malignant ovarian tumours were revealed. Sonoelastography increased the sensitivity (from 87% to 96%) and specificity (from 83% to 93%) of US scanning. Sonoelastography showed accurate differentiation of benigh papillary cystadenomas and malignant papillary cystadenocarcinomas. In 42% cases, sonoelastography increased diagnostic confidence and helped to change the final diagnosis. The method of sonoelastography cannot itself determine the diagnosis, but in 32% cases it helped differentiating the nature of the tumour, firstly revealed with B-mode imaging.
Conclusion: Real-time sonoelastography is a valuable tool that increases diagnostic confidence in differentiation of the benign and malignant ovarian tumours.

B-0135 11:11

Differentiation of tuberculous peritonitis, and peritoneal carcinomatosis in normal-sized ovarian carcinoma in female patients on CT

S. Shim, J. Lee, Y. Jeong; *Ulsan/KR (sa0u@naver.com)*

Purpose: Tuberculous peritonitis mimicking ovarian malignancy is a serious problem in epidemic area. The purpose of this study is to analyze CT features of tuberculous peritonitis in female patient and peritoneal carcinomatosis in normal-sized ovarian carcinoma for differentiation between both groups.
Methods and Materials: We retrospectively searched the radiology information system in our department for the patients from January 2006 to January 2014. We analyzed CT features of 18 cases of tuberculous peritonitis in female patients, and 17 cases of peritoneal carcinomatosis from proven normal-sized ovarian carcinomas. CT features were analyzed about omental change, mesenteric change, parietal peritoneal thickening, ovarian CT attenuation, ovarian capsular change and lymph node enlargement, respectively.
Results: Heterogeneous hyperattenuation and capsular change of ovary were statistically more frequently seen in peritoneal carcinomatosis with normal-sized ovarian carcinoma than tuberculous peritonitis in female patients (t-test=0.002, $p < 0.001$, respectively). There were no statistical differences in omental and mesenteric changes, parietal peritoneal thickening and lymphadenopathy, respectively.
Conclusion: Tuberculous peritonitis in female patients and peritoneal metastasis with normal-sized ovarian carcinoma may be a diagnostic dilemma in differentiation on CT. But ovarian hyperattenuation and prominent ovarian capsular change could help differentiate between two disease groups.

B-0136 11:19

Haemodynamic evaluation of normal ovaries and different ovarian tumours: 3.0 T DCE-MRI study

Q. Ji; *Tianjin/CN (jiqianq@aliyun.com)*

Purpose: To evaluate the hemodynamic characteristics of normal ovaries and ovarian tumours by using 3.0 T DCE-MRI.
Methods and Materials: 33 women of child-bearing period with normal ovaries and 48 patients of different ovarian tumours were included in this study, all subjects performed plain and DCE-MRI examinations. The TIC, Ktrans, Kep and Ve values of normal ovarian mesenchyme and solid parts were obtained and compared between different menstrual cycles and different ovarian tumours, respectively. The independent-sample T test, one way ANOVA and ROC curves were analysed.
Results: The TIC of normal ovarian mesenchyme were allItype curve. The Ktrans, Kep and Ve values of normal ovarian mesenchyme at follicular phase and luteal phase were 0.182±0.084, 0.237±0.103 and 0.774±0.130, 0.189±0.124, 0.248±0.140 and 0.765±0.161, respectively. There were no significant difference of all semiquantitative and quantitative parameters between different menstrual cycle groups ($P > 0.05$). Most benign ovarian tumours presented Itype TIC, while borderline and malignant ovarian tumours mainly presented III type TIC. There were significant difference of TIC between benign and malignant ovarian tumours ($P < 0.05$). The Ktrans, Kep and Ve values of solid parts of benign, borderline and malignant ovarian tumours were 0.067±0.038, 0.154±0.093 and 0.510±0.248, 0.174±0.032, 0.353±0.080 and 0.513±0.133, 0.276±0.116, 0.428±0.314 and 0.705±0.162, respectively. There were significant difference of Ktrans values between different ovarian tumours ($P < 0.05$).
Conclusion: 3.0 T DCE-MRI can evaluate hemodynamics of normal ovaries and ovarian tumours noninvasively. There were no significant difference of hemodynamics of normal ovaries at different menstrual cycle. Ktrans values had the optimal differential diagnostic efficacy on different ovarian tumours.

B-0137 11:27

Value of DWI sequences in cervical cancer recurrence: can we skip contrast?

R.N. Lucas, J. Lopes Dias, T. Cunha; *Lisbon/PT (ritalucas1@gmail.com)*

Purpose: We aimed to evaluate the accuracy of diffusion-weighted magnetic resonance imaging (DW-MRI) in cervical cancer follow-up, by comparing T2-weighted images (T2-WI) combined with DW-MRI and T2-WI combined with dynamic contrast-enhanced MRI (DCE-MRI) in the assessment of tumour recurrence.
Methods and Materials: We enrolled 39 patients with treated cervical cancer and clinical suspicion of recurrence who underwent follow-up MRI examination on 1.5 T magnet: scanning protocol included multiplanar T2-WI, DCE sequences and DWI-MRI. MR findings were compared with pathology results. Accuracy measures were calculated and compared.
Results: Thirty-seven women (37/39) had histologically proven recurrence. The accuracy to detect recurrence was 76.9% and 92.3% on combined T2-WI/DCE and T2-WI/DWI, respectively. The addition of DCE-MRI did not significantly improve the diagnostic ability of T2-WI alone, and the combination of these two sequences misclassified 2 patients as false positive and 7 as false-negative. The combination T2-WI/DW-MRI had a positive predictive value of 100% and only 3 false-negative cases.
Conclusion: MR imaging is an effective technique for cervical cancer recurrence detection and DW-MRI combined with T2-WI resulted in a significant rise in MRI diagnostic ability, potentially leaving DCE-MRI as an optional technique in doubtful cases.

B-0138 11:35

Diffusion-weighted MRI of endometrial cavity pathologies: differentiation of benign and malign lesions and preoperative assessment of myometrial invasion

M. Cavusoglu, D. Sözmen Cılız, A. Özsoy, S. Duran, E. Elverici, C. Atalay, B. Sakman; *Ankara/TR (mehtapcavusoglu2@gmail.com)*

Purpose: The aim of our study was to investigate whether apperant diffusion coefficient (ADC) values of endometrial cancer differ from those of benign endometrial lesions in postmenopausal patients and to evaluate myometrial invasion of endometrial cancer.
Methods and Materials: 47 patients with postmenopausal bleeding and endometrial thickening were enrolled in this prospective study. T2- weighted, postcontrast T1- weighted and diffusion weighted images were obtained of all patients. The ADC values of 37 benign and 10 malign endometrial lesions were recorded. The staging accuracies of DWI and postcontrast T1- weighted images in the assessment of myometrial invasion were evaluated in 10 patients with endometrial cancer.
Results: The mean (± SD) ADC value (10^{-3} mm2/s) of endometrial cancer (0.90± 0.06) was significantly lower than that of benign endometrial lesions (1.78 ± 0.27, p=0.0001). There was no significant difference between ADC values of endometrial tissue in patients with superficial (0.89 ± 0.06, n= 5) and deep (0.90± 0.07, n=5) myometrial invasion. The staging accuracy (superficial or deep myometrial invasion) was 90% for DWI and 80% for postcontrast T1-weighted images.
Conclusion: DWI allows benign endometrial lesions to be differentiated from endometrial cancer; but they do not correlate with the dept of myometrial invasion.

B-0139 11:43

Utility of MRI findings in differentiation of type I and type II endometrial cancer: comparison of MRI and endometrial biopsy

T. Manabe, H. Yoshida, M. Yoshida, T. Kato, M. Ishikawa, S. Ikeda, Y. Arai; *Tokyo/JP (tmanabe@ncc.go.jp)*

Purpose: We try to differentiate type II endometrial carcinoma from type I using MRI and compare of the diagnostic ability with the endometrial biopsy.
Methods and Materials: One-hundred three consecutive patients with endometrial cancer (77 patients with type I and 26 with type II) were enrolled in this retrospective study.
Tumour size, ADC value, minimum ADC value and tumour to muscle ratio (TMR: tumour/gluteus maximus muscle) on Gd-enhanced T1WI were calculated and compared between type I with type II. The following MRI features of endometrial tumours were evaluated and compared between two groups: (1) heterogeneity of tumour signal intensity (2) existence of granular surface. Endometrial biopsy results were also compared with the final pathological diagnosis.
Results: TMR of type II were significantly higher than that of type I, there is no significant difference in ADC value,min ADC value and tumour size between two groups. Heterogeneous signal intensity was significantly more common in type II, but there is no significant difference in existence of granular surface. Sensitivity, specificity and accuracy of TMR cut off> 1.9 were 76.0%, 66.2%, 68.6%, those of heterogeneous signal intensity were 26.9%, 93.5%, 76.6% respectively. The presence of any one of heterogeneous intensity or TMR provides sensitivity, specificity and accuracy of 76.0%, 55.8% and 55.3% respectively.Sensitivity, specificity and accuracy of endometrial biopsy were 80.8%, 89.6, and 87.3%, respectively.
Conclusion: Although diagnostic ability of endometrial biopsy is higher than MRI, high TMR and heterogeneous signal intensity are useful for differentiating type II from type I endometrial cancer.

B-0140 11:51

Comparison of DWI and T2 TSE with gadolinium ehanced sequences for the staging of the uterine cervical cancer

V. Vinci, S. Bernardo, M. Saldari, L. Manganaro; *Rome/IT (valeriavinci87@yahoo.it)*

Purpose: To prospectively evaluate the value of diffusion-weighted (DWI) combined with T2 fast spin-echo imaging compared to gadolinium-enhanced sequences for the local staging of cervical cancer using a 3 T MRI.
Methods and Materials: In 1 year time, 32 patients with found primary cervical cancer underwent pelvic MRI on a 3 T Magnet. Standard protocol included T2 TSE sequences, DWI sequences and gadolinium-enhanced fat-suppressed T1-weighted sequences. Radiologists evaluated the extension of the pathology, and proposed a FIGO staging separately according to DWI and T2 TSE sequences, versus Post gadolinium T1 FS sequences. Diagnostic accuracy was calculated.
Results: Radiologists classified 5/32 cases on stage TIb, 11/32 cases on stage TIIa,16/32 cases on stage TIIb. Regarding the evaluation of T2TSE and DWI Radiologists obtained a diagnostic accuracy of 92%; while considering gadolinium enhancement DA was of 89%. In 2 cases with DWI and 3 with CE Radiologists overstaged the extension of the tumour in favour of a TIIb stage, this was caused by a Desmoplastic reaction of tumor into adjacent perirectal fat. There were no significant differences in the diagnostic accuracy between DWI plus T2 TSE and postcontrast enhancement, independently to the kind of Figo stage (P > 0.05).
Conclusion: Since there was no statistical difference in the local staging of uterine cervical cancer betwenne DWI plus T2TSE and post gadolinium sequences, it may be suggested to avoid the use of contrast enhancement.

10:30 - 12:00 **Room K**

Radiographers

SS 214

Musculoskeletal radiography

Moderators:
A.J. Grainger; Leeds/UK
V. Syrgiamiotis; Athens/GR

B-0141 10:30

Development and validation of a psychometric scale for the visual assessment of AP pelvis image quality

H.A.A.B. Mraity[1], A.E. England[1], A.D. Dominguez[2], P.H. Hogg[1]; [1]*Manchester/UK*, [2]*Lausanne/CH (p.hogg@salford.ac.uk)*

Purpose: To create and validate a psychometric scale for assessing AP pelvis digital image quality.
Methods and Materials: The scale was created following a standard format (Bandura's theory for self-efficacy). An initial pool of items was generated (n=29) and presented to a focus group (radiologists, radiographers and physicists, n=8) for review and modification. Initially the scale was validated using a series of seven AP pelvis phantom images each of known SNR, representing different image qualities. Then the scale was further validated using cadaver images (n=7) of known and different image qualities. Validation involved 335 participants scoring the cadaver and phantom images using the scale.
Results: Using the scale, participant aggregated mean scores increased with increasing SNR (Phantom - 62.8 to 111.9, r^2=0.94; cadaver - 63 to 97, r^2=95). Cronbach's alpha revealed scale items were consistent in measuring image quality for phantom and cadaver (α= 0.8 to 0.9; acceptable α ≥0.6). Factor analysis was conducted to examine how many factors could be extracted. Redundant items were removed because they had low correlation (i.e. acceptable r=0.2-0.4) or introduced excessive amounts of error (i.e. SD≥ 1.5). A final scale of 24 items was produced. These items had a good inter-item correlation, ≥0.2, and high factor loadings, ≥0.3.
Conclusion: This study represents the first development and validation of a visual image quality scale based on Bandura's theory. The excellent correlation between scale scores and SNR values together with excellent item factor loadings suggests the scale will have value in clinical and research applications.

B-0142 10:38

Radiography of the knee joint: a comparative study of the partial flexion PA projection and the fully extended AP projection

E. Farrugia Wismayer, F. Zarb; *Msida/MT (efar0021@um.edu.mt)*

Purpose: To compare the diagnostic information for the detection and assessment of knee pathology obtained from radiographs of the knee using either the PA standing with partial flexion projection or AP fully extended standing projection. The objectives of the study were to draw-up anatomical image quality criteria for evaluation of knee radiographs and use these criteria to evaluate and compare the two projections.
Methods and Materials: A set of 32 knee radiographs was retrospectively compiled from 16 adult patients who had been imaged over a 2-year period using both projections (PA: n=16 and AP: n=16). Repeat radiographs (n=6) were added to the image set to facilitate inter and intra observer reliability. Image evaluation was performed by 5 orthopedic specialists performing Absolute Visual Grading Analysis assessing image quality based on 6 anatomical image quality criteria. The resulting image quality scores were analysed using Visual Grading Characteristics (VGC).
Results: The results of the study show that image quality scores were higher for the PA projection but variation between the two projections was not significant (p> 0.05) overall. However, the PA projection was significantly (p < 0.05) better in the visualization of 2 anatomical image quality criteria involving the joint space width and tibial spines.

Conclusion: Both projections can be used for general evaluation of the knee joint, however the PA partial flexion projection should be preferred for the investigation of knee pathology involving visualization of the joint space width and/or tibial spines. Recommendations for minimizing variations in radiographic positioning technique are also highlighted.

B-0143 10:46

Optimisation of radiography practice in paediatric computed radiography for full spine curvature measurements: a pilot phantom study

C.S. Reis[1], J. Ndlovu[2], C. Serrenho[1], I. Akhtar[2], S. de Haan[3], J. Garcia[4], D. de Linde[5], M. Thorskog[5], L. Franco[4], C. Lança[1], P.H. Hogg[2]; [1]*Lisbon/PT*, [2]*Salford/UK*, [3]*Groningen/NL*, [4]*Lausanne/CH*, [5]*Oslo/NO (claudia.reis@estesl.ipl.pt)*

Purpose: Optimise a set of exposure factors, with the lowest effective dose (E), to assess spinal curvature with the modified Cobb method in a lateral full spine using computed radiography/(CR) for a 5-year-old paediatric anthropomorphic phantom.
Methods and Materials: Images were acquired varying sets of parameters [positioning (antero-posterior/(AP), postero-anterior/(PA), lateral), kilo-voltage peak/(kVp) (66-90), source-to-image-distance/(SID) (150-200 cm) with grid to analyse the impact on E and image quality/(IQ). IQ was analysed applying two approaches: objective [contrast-to-noise-ratio/(CNR] and perceptual, using 5 observers. Monte-Carlo modelling was used for dose estimation. Cohen's Kappa coefficient was used to calculate inter-observer-variability. The angle was measured using Cobb's method on lateral projections under different imaging conditions.
Results: PA promoted the lowest effective dose (0.013 mSv) compared to AP (0.048 mSv) and lateral (0.025 mSv). The exposure parameters that allowed lower dose were 200 cm SID, 90 kVp, broad focus and grid out for paediatrics using an Agfa CR-system made available for this study. The agreement for visualising the range of anatomical regions was good, however for some areas the level of agreement was very poor (-0.115 to 0.285). Observer 1 and 2 demonstrated a moderate agreement (0.534).
Conclusion: Cobb angle measurements can be performed using the lowest dose and the lower CNR. The variation on measurements for this context was ±2.9º and this is within the range of acceptable error without impact on clinical diagnosis. Further work is recommended on improvement to the sample size and a more robust perceptual IQ assessment protocol for observers.

B-0144 10:54

Knowledge, attitudes and organisational determinants of positioning techniques for radiography

S. Germonpré[1], P. Gemmel[2], D. Beeckman[2], J. Trybou[2]; [1]*Brussels/BE*, [2]*Ghent/BE (sofie.germonpre@odisee.be)*

Purpose: In this study we focus on the use of Fluoroscopy-Guided Positioning (FGP) techniques in radiography. In Belgium, and some other European countries, FGP is common practice. We investigate the importance of knowledge, skills and attitudes of imaging staff and organisational factors with respect to applying non-FGP.
Methods and Materials: Four case studies were performed in Belgian hospitals. To develop an in-depth understanding of imaging practices, technologists and radiologists were interviewed (n=40), complemented with non-participative observations (200 hours) and image and document analyses. Knowledge and attitudes of staff and organisational factors are considered.
Results: Organisational factors are of major importance for adequate positioning. Clinical leadership of radiologist and chief technologists as well as suitable X-ray devices and positioning aids were identified as important determinants. Furthermore a lack of skills and knowledge of (advanced) positioning techniques and negative attitudes towards non-FGP were present. More precisely, staff expressed concerns with respect to the impact on the workload and workflow. Finally, adequate supervision, regularly feedback and coaching (by radiologists, chief technologists and peers) were identified as important enabling factors for increasing the quality of the applied imaging techniques.
Conclusion: A holistic approach considering knowledge, attitudes and contextual-organisational factors is needed to improve imaging practices. Clinical leadership of physicians, supervisor and peers are important enablers.

B-0145 11:02

Air gap in hip joint axiolateral projection

S.H. Kivistö, A. Henner, U. Kuismin, M. Jaakkola, A. Kotiaho; *Oulu/FI (susanne.kivisto@ppshp.fi)*

Purpose: To find best air gap distance with low patient dose and image quality good enough in hip joint axiolateral projection.
Methods and Materials: 14 phantom tests were made with different air gap distances and different radiation doses. Patients' data of 23 examinations were collected two times in hip joint axiolateral projection with air gap. Imaging parameters were 90 kV, mAs varied between 8 mAs - 40 mAs, focus to receptor distance varied between 160 cm-200 cm and air gap varied between 20 cm-57 cm.
Results: In phantom tests with low dose conditions larger air gap was to find much better for image quality. In our first data collection patient's mean DAP was 3.5dGYcm2. Image quality was good enough for diagnoses. Patient's dose with air gap technique can be decreased significantly compared with grid in hip joint axiolateral projection. In our second patient's data collection radiologist opinion was that there were no significant differences between different air gaps.
Conclusion: In 2008 patient's data collection in hip joint axiolateral projection with grid (R=8) patient's mean DAP was 32.96dGycm2.
We found that using air gap the dose can be decreased significant compared to grid in hip joint axiolateral projection. Image quality was good enough for diagnosis. In low dose conditions larger air gap was found much better for image quality in phantom tests. We're going to continue tests to find out the best air gap distance with low dose and good enough image quality. Our imaging parameters are still too high for making the difference between x-rays.

B-0146 11:10

Balancing image quality and effective radiation dose in orbital X-ray screening for ferromagnetic IOFBs: a pilot study

S.A. Jessop[1], G. Hart[1], A.R. Santiago[2], J. Guerreiro[2], Y. Cottier[3], B. Markali[4], E.N. Andersen[4], J. Jorge[3], A.E. England[1]; [1]*Manchester/UK*, [2]*Lisbon/PT*, [3]*Lausanne/CH*, [4]*Oslo/NO (s.a.jessop@edu.salford.ac.uk)*

Purpose: To investigate whether current computed radiography (CR) X-ray acquisition factors for orbital radiographs are optimised for the detection of ferromagnetic intra-ocular foreign bodies in patients undergoing MRI.
Methods and Materials: 35 observers, at varied levels of radiography education, were asked to score 24 images, obtained with varying acquisition factors, against a clinical standard (reference image) using two-alternative forced choice (2 AFC). Observers were provided with 12 questions relating to image quality and asked to score these using a 5-point Likert scale. The scale had been previously subjected to statistical validation which included measures of scale reliability. Images which scored as equal to or better than the reference image were ranked according their corresponding effective dose (E). From this ranking the image with the lowest E was considered as the new optimum acquisition factors.
Results: Four images emerged as equal to or better than the reference in terms of image quality. Images were then ranked in order of E. Only one image had the same image quality score as the reference but with a lower effective dose (1.8microSv versus 3.31microSv).
Conclusion: Against the current clinical standard exposure factors of 70 kVp, 20 mAs and the use of an anti- scatter grid, one image proved to have a lower E whilst maintaining the same level of image quality and lesion visibility. From this it can be proposed that the new exposure factors for orbital radiography should be 60 kVp, 20 mAs and still include an anti-scatter grid.

B-0147 11:18

Orthopaedic surgery occupational exposure using active dosimeters

J. Santos, J. Francisco, N. Lopes, R. Ferreira, G. Paulo; *Coimbra/PT*

Purpose: Quantify occupational exposure on staff in the operating theather during orthopaedic surgeries and analyse the staff radiological protection knowledge.
Methods and Materials: This study was performed in a central hospital operating theatre. Six health professionals were monitoring during 2 months using a RaySafe i2™. The staff radiological protection behaviour was also observed. The anatomic region, type of procedure, personal shielding, personal dosimeter, staff positioning, exposure parameters and staff dose levels were also collected. To analyse the staff radiological protection knowledge a questionnaire was also performed.
Results: The exposure monitoring was performed in 29 Orthopaedic surgeries. The most frequent observed procedure was spine fixation (31%). The highest dose value was found for Orthopaedist 1 (17.39 µSv) and the lowest exposed was the Circulating Nurse (1.11 µSv). Some staff behaviour and questionnaire responses revealed lack of knowledge in radiation protection.
Conclusion: The staff exposure values are according to the literature, however the staff risk perception needs to be improved. Radiation protection education and training is essential to change behaviour and promote a safety culture.

B-0148 11:26

Pelvic radiography: patient orientation

L. Khaledian, J. Ebadi; *Tehran/IR (lidakhaledian@yahoo.com)*

Purpose: To evaluate the role of patient orientation on the image quality (IQ) and radiation dose for computed radiography (CR) of the pelvis.
Methods and Materials: A randomised study was performed using CR X-ray equipment. The patient orientation of head towards (HT) the outer Automatic Exposure Device (AED) chambers was compared to patients with their head away (HA) from AED chambers. Combination of source-to-skin distance, mAs and kVp data helped the calculation of effective dose (ED) and entrance surface dose (ESD).
Results: For pelvis examinations ,reversing orientation (HT to HA) reduced the mean ED and ESD by 29% ($P < 0.001$). Examinations of the hips allowed dose reductions of around 50% when switching between orientations. there were not any statistical differences in image quality between two groups.
Conclusion: Switching patient orientation to the AED chambers can help optimise radiation dose. In order to facilitate this chamber position should be marked on all equipments and patient orientation should be a consideration when tailoring individual examinations.

B-0149 11:34

Does using a lower kVp offer a greater potential for fracture detection in hip radiography?

H. Milne, A.E. England; *Manchester/UK (A.England@salford.ac.uk)*

Purpose: A reduction in bone density is one of the reasons for the increase in incidence of hip fractures within the elderly. Recent studies have shown that lowering the kV can improve visualisation of fine detail and trabecular pattern. The aim of the study was to assess if lowering kVp can improve the visualisation of the trabecular pattern of the proximal femur in adults. This could potentially aid detection of non-displaced fractures in the elderly.
Methods and Materials: Anterior-posterior (AP) right hip images were taken using an anthropomorphic phantom across a range of kVs (40-100, 5 kVp increments) using a central AEC chamber. Three regions of trabecular interest were identified and these were scored by five observers against a reference image in order to evaluate any perceptual changes in trabecular pattern appearance. Regions of interest (ROI) for these three areas were also assessed using signal to noise ratio (SNRs).
Results: Images with lower kVp (< 61) demonstrated an increase in perceptual image quality scores when compared to the reference image. The image at 40 kVp was consisently classified as being better than the reference image. With regard to SNR, there was only one ROI which demonstrated a consisent increase in SNR with a lowering of kVp.
Conclusion: Lower kV can be used in order to increase the perceptual visualisation of trabecular pattern in AP hip projections. This option may be considered in cases of suspected ocult fractures or as an alternative to other imaging.

B-0150 11:42

The effect of patient shielding in intraoral dental imaging

T. Klemenčič, N. Mekiš; *Ljubljana/SI*

Purpose: To investigate the impact of lead shielding on patient dose in adult intraoral dental imaging.
Methods and Materials: The study was conducted on a whole body anthropomorphic phantom. The breasts were simulated by breast implants in the size of 500 ml. Shield coat of 0.35 mm lead equivalent was used. The measurements were performed with and without the use of lead shielding. The dose was measured by electronic dosemeter EDD 30 placed on top of the phantom at the part of four radiosensitive organs (lung apex, centre of the breast, colon and uterus. For each organ and section of the teeth 10 exposures were performed with the use of lead coat shielding and 10 without it.
Results: The use of the lead coat shielding reduced the dose at the lung apex on average by 97 % ($p < 0.0001$), the dose at the centre of the breast and colon was reduced by more than 99% ($p < 0.0001$). The highest dose was received by the lung apex when imaging the upper canines and premolars (8.5 µGy; 8.8 µGy). The dose measurements at the uterus were below the detection of dosimeter with and without the shielding.
Conclusion: Despite the low-dose exposure even without shielding, the dose in dental imaging can be further reduced. Based on the results, we can conclude that the use of lead coat shielding is recommended in the intraoral dental radiography especially for the organs located close to the primary field.

B-0151 11:50

Musculotendinous structure changes evaluated by ultrasound in elderly population submitted to a physical activity programme

R. Santos, A. Amaral; *Coimbra/PT (rutemartinssantos@gmail.com)*

Purpose: The aim of this study is to evaluate eco-intensity and thickness of muscles and tendons in an elderly population, using ultrasonography. The musculotendinous changes caused by physical activity in elderly population were also evaluated.
Methods and Materials: During two months, 12 females, with an average age of 63.75 (± 3.98) years, performed a physical activity programme including 16 sessions (8 of fitness and 8 of dance). The 60-minute sessions occurred twice per week. Before and after the implementation of the physical programme, an ultrasound examination (GE, Logiq e, with a linear probe 7-10MHZ) was performed to evaluate upper and lower limbs muscles and tendons. Image parameters, such as depth, general earnings and time gain compensation, were maintained constant during all examinations. The structures thickness, area and the pixels gray scale (0-255) were measured using Image J software. Descriptive data analysis and Wilcoxon test were used (level of significance $p \leq 0.05$) to compare the results before and after the physical programme.
Results: Significant differences ($p < 0.05$) were observed on: the echogenicity of the external and medium extensor tendons of the right foot; and on the left medial gastrocnemius muscle and the left brachial biceps.
Conclusion: Small changes in muscle-skeletal system were detected in this study and are according to the literature findings. Ultrasound demonstrated to be an useful tool for muscular and tendinous evaluation.

10:30 - 12:00 **Room MB 1**

Head and Neck

SS 208

Advanced imaging in salivary glands and lymph nodes, including elastography

Moderators:
S.J. Golding; Oxford/UK
L. Grzycka-Kowalczyk; Lublin/PL

B-0152 10:30

Simultaneous visualisation of the intraparotid facial nerve and parotid duct using a micro-surface coil and 3D-FISP-FS sequence

G. Hong; *Guangzhou/CN (trueangel_xun@163.com)*

Purpose: To explore the effectiveness of micro-surface coil in normal parotid MR imaging, with emphasis on the clinical value of micro-surface coil combine with three-dimensional fast imaging with steady-state precession and fat-suppression (3D-FISP-FS) sequence in displaying intra-parotid facial nerve segment and parotid duct.
Methods and Materials: The parotid regions of 18 healthy volunteers were scanned by head matrix coil and small surface coil combined with 3D-FISP-FS sequence. The obtained original images were treated through MIP, MPR and CPR, and also calculated the SIR of facial nerve/parotid tissue (SIRN/P) and parotid duct/parotid tissue (SIRD/P), the results of the two groups were analyzed and compared.
Results: Parotid MR images obtained by head coil and small coil were of satisfactory. The display ratio of the main trunks, the first branches and the secondary branches of the facial nerve were 100%, 69.4%, 47.2% by head coil, compared to 100%, 93.8%, 81.3% by small surface coil combined with 3D-FISP-FS sequence, which showed a statistically significant difference ($P < 0.05$). The SIRN/P of the two groups was 1.71±0.76 and 2.06±1.24 respectively, and the SIRD/P was 1.82±0.73 and 2.47±1.74, respectively, which showed a statistically significant difference ($P < 0.05$).
Conclusion: Small surface coil performed better in parotid MR imaging with 3D-FISP-FS sequence than that of head coil, which can simultaneous clearly display the trunk and branches of the intra-parotid facial nerve and parotid duct, increase the SIR of facial nerve/parotid tissue (SIRN/P) and parotid duct/parotid tissue (SIRD/P), and had more advantages in displaying the secondary branches of the facial nerve.

Author Disclosures:
G. Hong: Research/Grant Support; National Natural Science Foundation of China (No. 81201074).

B-0153 10:38

MR sialography of sialadenitis related with radioactive Iodine treatment in patients with postoperative thyroid cancer, using 3D fast recovery fast spin echo sequence at 3 T

Y. Shin, H. Lee, N. Kim, M. Lim, Y. Kang, J. Lim, S. Cho; *Incheon/KR (ysshin86@gmail.com)*

Purpose: To describe the MR sialographic findings in patients treated with radioactive iodine therapy (RIT) after thyroidectomy, and to evaluate the relation between patient's symptoms and MR sialographic findings.
Methods and Materials: MR sialography was performed with a 3 T MR machine in 21 patients (1 males, and 20 females; mean age 46 years; range, 31-68 years), who underwent RIT for thyroid cancer. MR sialography was obtained with 3D fast recovery fast spin echo sequence after salivary secretion stimulation. The relation of patient's symptom, clinical severity of xerostomia and MR sialographic parameters were analyzed on each glands.
Results: Among 42 parotid glands and 41 submandibular glands from 21 patients, both main ducts and branches were well depicted in 32 parotid (76%) and 35 submandibular (85%), either main ducts or branches were depicted in 4 parotid (10%) and 4 submandibular (10%). 6 parotid ducts (14%) and 2 submandibular ducts (5%) from 3 patients were not visualized, suggesting insufficiency of secretion reserve. Strictures at main ducts were present in all visible 36 parotid (86%); single stricture in 61%, multiple in 25%. There was no stenotic lesion in visible submandibular ducts. MR sialographic findings were not significantly related with patient's symptoms and xerostomia severity grade ($p > 0.05$).
Conclusion: MR sialography is a useful method for evaluation of RIT-sialadenitis. RIT-sialadenitis mainly affected parotid, and all of the visible parotid ducts had stenosis in main ducts.

B-0154 10:46

Diffusion-weighted imaging (DWI) and dynamic contrast-enhanced MRI (DCE-MRI) in common parotid gland tumours with reference to histopathologic examination

K. Markiet, B. Mikaszewski, A. Smugala, D. Stodulski, B. Kowalska, C. Stankiewicz, E. Szurowska; *Gdansk/PL (karolina.markiet@wp.pl)*

Purpose: The aim of the study was to assess the value of diffusion-weighted imaging (DWI) and dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) in common parotid gland tumours in correlation with fine-needle aspiration cytology (FNAC) and histopathologic examination results.
Methods and Materials: 117 patients with parotid gland tumours, who underwent MRI of parotid glands prior to surgical treatment in years 2013 - 2014 were involved in the study. All MRI examinations were performed using the Siemens Magnetom Aera 1.5 T system. With exclusion of examinations with heavy artifacts and patients with no prior biopsy, 100 subjects were selected for further analysis - 60 females (21-88 yo, mean age 54.5) and 40 males (18-84 yo, mean age 58.5). Obtained data has been evaluated by two independent radiologist with prior experience in Head and Neck Radiology. Patients gave their written consent. Approval of The Independent Bio-ethic Committee for Scientific Research of Medical University of Gdansk was granted.
Results: With the use of the Cohen statistics we found substantial agreement between radiological and histopathologic diagnosis - kappa 0.76, while agreement in accuracy of diagnosis between FNAC and histopathologic examination was moderate - kappa 0.63. Interobserver agreement in tumour characterization was excellent with kappa value of 0.94. No significant difference was found between the efficacy of radiologic evaluation and histopathologic result.
Conclusion: DWI and DCE-MRI improve differentiation between benign and malignant parotid gland masses and allow a more precise characterization of different histological types of tumours, esp. in pleomorphic adenoma and Warthin's tumour.

B-0155 10:54

Role of perfusion computed tomography in assessing submandibular gland radiochemotherapy-induced injury

U. Lamot, K. Šurlan Popovič, M. Harej, T. Furlan, P. Popovič, P. Strojan; *Ljubljana/SI (urska_lamot@hotmail.com)*

Purpose: We aimed to detect changes in the volume and perfusion parameters of the submandibular glands during and after radiochemotherapy.
Methods and Materials: Twelve patients underwent computed tomography (CT) and perfusion CT before radiochemotherapy, after 40 Gy, after 70 Gy, and 3 months after radiochemotherapy. Submandibular gland volume, blood volume, permeability surface area product, and blood flow were quantified.
Results: Submandibular gland volumes during and after therapy were significantly lower compared with the baseline value ($P < 0.001$). Blood volume, blood flow, and permeability surface area product values showed statistically significant reduction during and 3 months after therapy. A significant linear correlation was found between changes in submandibular gland volume and of the perfusion parameter blood volume in the period between baseline and 3 months after therapy ($P = 0.012$; $Rp = -0.697$).
Conclusion: Changes in submandibular gland volume and dynamics of perfusion parameters imply that radiation-induced injury of submandibular glands develops early during radiochemotherapy.

B-0156 11:02

Comparison of fine needle aspiration and core needle biopsy under ultrasonography guidance for detecting malignancy and for the tissue-specific diagnosis of salivary gland tumours

H.-J. Eom, J. Lee, J. Baek, Y. Choi, M.-S. Ko, K. Cho, S. Nam, R. Yoon; *Seoul/KR (polestar124@naver.com)*

Purpose: To compare the diagnostic accuracy of USFNA versus USCNB for detecting malignant tumours of the salivary gland and for the tissue-specific diagnosis of salivary gland tumours.
Methods and Materials: This retrospective study was approved by our institutional review board and informed consent was waived. We enrolled 412 patients underwent USFNA (n = 155) and USCNB (n = 257) with subsequent surgical confirmation or clinical follow-up were enrolled. We compared the diagnostic accuracy of USFNA and USCNB regarding malignant salivary gland tumours and the correct tissue-specific diagnosis of benign and malignant tumours. We also tested the difference between these procedures according to the operators' experience and lesion characteristics.
Results: The inconclusive rates of USFNA and USCNB were 19% and 4%, respectively ($p < 0.001$). The overall accuracy of USCNB for diagnosing malignant tumours was significantly higher than USFNA ($P = 0.024$). The correct tissue-specific diagnosis rates of USFNA and USCNB were 95% vs. 97% for benign tumours ($P = 0.648$) and 67% vs. 80% for malignant tumours ($P = 0.310$). Trainees showed significantly lower accuracy with USFNA than with USCNB for diagnosing malignant tumours ($P = 0.021$). There was no difference between the diagnostic accuracy of USFNA and USCNB according to the internal composition of the lesions. There were no complications requiring intervention or hospitalization in our patients.
Conclusion: USCNB is superior to USFNA in detecting malignant tumours of the salivary gland and could therefore emerge as the diagnostic method of choice for patients presenting with a salivary gland mass.

B-0157 11:10

A study on serum antithyroglobulin antibodies interference in thyroglobulin measurement in fine-needle aspirationin diagnosing lymph node metastasis in postoperative patients

J. Lee, J. Kwak, H. Shin, E.-K. Kim; *Seoul/KR (EASYWG@yuhs.ac)*

Purpose: To evaluate whether serum TgAbs can affect FNA-Tg detection for diagnosing lymph node metastasis (LNM) in postoperative patients with papillary thyroid cancer (PTC).
Methods and Materials: From November 2006 to June 2011, a total of 239 LNs from 201 patients who underwent bilateral thyroidectomy and radioactive iodine ablation therapy were included. Ultrasound-guided FNAs (US-FNA) and FNA-Tg were performed to detect LNM of PTC. The logistic regression test was performed to assess interactions between FNA-Tgs and serum TgAbs. Diagnostic performances were compared between FNA with additional FNA-Tg and FNA alone according to the presence of serum TgAbs.
Results: From 106 (44.4 %) malignant and 133 (55.6 %) benign LNs, there were 207 (86.6%) LNs with detectable serum TgAbs and 32 (13.4%) LNs with undetectable serum TgAbs. In logistic regression analysis, significant negative interaction was observed between FNA-Tgs and serum TgAbs ($P = .04$). In the absence of serum TgAbs, the diagnostic performances were superior in the FNA with additional FNA-Tg than in the FNA only. However, in the presence of serum TgAbs, the diagnostic performances of the FNA with additional FNA-Tg showed decreased specificity and PPV, even with a different cutoff value of FNA-Tg.
Conclusion: Serum TgAbs may interfere with FNA-Tg studies and caution is advised, but more work is needed to understand its true impact on management.

B-0158 11:18

ShearWave elastography in lymph nodes

F. Houari, O. Lucidarme, J. Gabarre, F. Charlotte, C. Pellot-Barakat, M. Lefort, L. Chami; *Paris/FR (linda.chami@yahoo.com)*

Purpose: To correlate quantitative and qualitative patterns of shear wave elastography (SWE) with histological analysis of lymph nodes.
Methods and Materials: 131 superficial lymph-nodes (LNs) of 131 patients (mean age: 59.5 ± 20.5 years) who had undergone ultrasonography (US), SWE, and percutaneous US guided biopsy were prospectively studied using an Aixplorer® ultrasound machine (SuperSonic Imagine Ltd). B mode (ratio short/long axis (S/L), fatty hilum), US color Doppler (diffuse, central or peripheral vessels), SWE qualitative patterns as well as SWE measurements (mean elasticity in kilopascals and standard deviation) were classified and compared with histology.
Results: Final diagnosis was benign in 45% (n=59), lymphomas in 40% (n=52) (including high grades (n=23) and low grades (n=7)) and carcinomas in 15% (n=20). For benign LNs, lymphomas and carcinomas: S/L were 0.53, 0.57 (NS) and 0.65 respectively ($p < 0.05$), a fatty hilum was seen in 80% (n=47), 57% (n=30) and 15% (n=3) ($p < 0.05$), and central vessels were seen in 73% (n=38), 48% (n=23) and 6 % (n=1) ($p < 0.05$). Concerning the qualitative analysis of SWE a rim pattern of high stiffness was seen in 63% carcinomas (n=12), 16% lymphomas (n=8) and 9% benign LNs (n=5) ($p < 0.05$). Stiffness SWE values for benign LNs, Lymphomas and carcinomas were respectively, 14.0 ± 9.7, 20.3 ± 23.1 and 39.8 ± 42.0 ($p < 0.05$). **Conclusion:** Additionally to conventional US, SWE provided useful and objective informations for differentiating the LNs according to histology. SWE rim pattern is highly suggestive of carcinomas.

B-0159 11:26

'Illusion of blue'; role of ultrasound elastography in cervical lymph nodes

R. Arkar, V. Kasi Arunachalam, R. Renganathan, M. Cherian; *Coimbatore/IN (rrarkar@gmail.com)*

Purpose: Sonoelastography is used to differentiate benign versus metastatic cervical lymphadenopathy, non-invasively.
Methods and Materials: Two hundread patients underwent B-mode sonography & sonoelastography. B-mode characteristics - short axis dimension, short axis to long axis ratio, fatty hilum, calcification. Elastographic pattern of lymph node categorized to one of the five groups. All patients underwent FNAC of enlarged lymph node. Results of B-mode ultrasonography & sonoelastography compared with histopathology & analysed statistically.
Results: Histopathology: Prevalence of malignant & benign lymph nodes was 64% and 36% respectively. B- mode sonography showed 32 false positive cases which include 8 of acute suppurative inflammation, 16 of tuberculosis & 8 of reactive hyperplasia. Elastography: 40 out of 72 benign cases showed patterns I & II (reactive). Remaining 32 cases were falsely reported as metastatic & include 20 of tuberculosis, 4 of necrotizing histiocytic lymphadenopathy (Kikuchi lymphadenopathy), 5 of chronic non-specific lymphadenitis & 3 of reactive hyperplasia. Among 128 histopathologically proven metastasis cases, 120 cases were metastatic on elastogram. Diagnostic performance:The diagnostic performance of B-mode USG showed sensitivity, specificity & diagnostic accuracy of 84.4%, 55.6% & 74.0% respectively and Elastography showed sensitivity, specificity & diagnostic accuracy of 93.8%, 55.6% & 80 % respectively. The diagnostic performance of combined B-mode USG and Elastography showed sensitivity, specificity and diagnostic accuracy of 96.9%, 33.3% and 74% respectively.
Conclusion: 1.Ultrasound elastography increases sensitivity in detecting metastatic cervical lymph nodes.
2.The specificity however is significantly lower than the western literature; probably due to significant number of patients having tuberculous cervical lymphadenopathy.

Author Disclosures:
R. Arkar: Author; DMRD DNB. **V. Kasi Arunachalam:** Author; DMRD DNB. **R. Renganathan:** Author; DMRD DNB. **M. Cherian:** Author; Mathew Cherian MD PDCC.

B-0160 11:34

Role of ultrasonographic elastography in differentiating benign and malignant cervical lymph nodes

P.A.R.P. Sathiadoss, S. Narayanasamy, S. Wahab, E. Ullah, I. Ahmad; *Aligarh/IN (sparp86@gmail.com)*

Purpose: To evaluate the diagnostic performance of ultrasonographic elastography in differentiating benign and malignant cervical lymph nodes (LN).
Methods and Materials: 40 patients with cervical lymphadenopathy referred for image-guided FNAC/biopsy were examined with a multifrequency linear transducer. Subsequently, final diagnosis was established using fine needle aspiration/surgical biopsy. The single most representative LN from each patient was chosen for the study. A five-point colour code pattern was used to evaluate the elastograms. Strains of LN and surrounding muscles were measured, and the muscle-to-LN ratio (strain index) was calculated.Imaging results were compared with the final diagnosis. Appropriate statistical analysis was done and sensitivity, specificity, positive and negative predictive values for the diagnosis of malignant nodes were calculated. Appropriate cut-off values were calculated using ROC curve analysis.
Results: 45%(n=18) of the examined nodes were malignant on pathological examination. Using appropriate cut-off values (colour code pattern 3 and above, strain index values greater than or equal to 2.74 indicative of malignancy), elastography studies showed excellent sensitivity (100%) with specificity values of 81.8% (colour code pattern) and 95.5% (strain index) in diagnosing malignant LNs. Positive and negative predictive values for the studies were 81.8% and 100% for colour code patterns, 94.7% and 100% for strain index values, respectively. Mean strain index value of benign lymph nodes was 1.28± 0.77 and that of malignant lymph nodes was 5.47± 3.48, with statistically significant difference in means.
Conclusion: Elastography with its high sensitivity, may serve as a useful tool in the ultrasonographic detection of malignant cervical lymph nodes.

B-0161 11:42

Elastography and histogram of Kikuchi disease: the comparison with reactive hyperplasia of cervical lymph nodes

K. Lee, J. Ryu; *Busan/KR (lkh770429@naver.com)*

Purpose: To evaluate elastography of Kikuchi disease (KD), and to compare histogram between KD and reactive hyperplasia (RH) in cervical lymph nodes
Methods and Materials: We enrolled 27 consecutive cases of KD and 40 cases of RH in cervical lymph nodes. All patients underwent core needle biopsy or fine needle aspiration with clinical follow-up of at least 3 months. Elasticity score was classified into 4 categories; score 1: blue area of less than 10%, score 2: blue area of 10 to 50%, score 3: blue area of 50% to 90%, and score 4: blue area of more than 90%. We regarded score 1 and 2 as probable benign, but score 3 and 4 as suspicious for malignant. Strain ratio was measured. The parameters of strain histogram were as follows; mean, standard deviation, coefficient of variation, kurtosis, skewness.
Results: Average elasticity score was 1.69 in KD and 1.25 in RH ($p < 0.05$). Average strain ratio was 2.07 in KD and 1.51 in RH ($p < 0.05$). On strain histogram, the mean of strain in KD was significantly lower than that in RH (88.1 vs 111.2, $p < 0.05$). Kurtosis and skewness were not significantly different in two groups.
Conclusion: Elastography in KD reveals probable benign findings, although it shows slightly stiffer than reactive hyperplasia. Elastography can help to avoid the unnecessary biopsies for KD.

B-0162 11:50

Real-time ultrasound elastographic features of primary open angle glaucoma

Ö. Ünal, N. Cay, M. Gumus, F. Yulek; *Ankara/TR (drozlemsarici@gmail.com)*

Purpose: Value of ultrasound elastography to evaluate optic nerve in patients of primary open angle glaucoma (POAG).
Methods and Materials: This prospective, comparative case series consisted of 40 eyes of 40 patients, 20 eyes with POAG (POAG group) and 20 eyes of 20 patients without glaucoma WHO presented to general eye clinic for near vision glasses. Same physician did real-time sonographic elastography. The ratio of optic nerve head to orbital fat (RONOF) and lateral (RONLR) rectus were determined. The results were statistically analyzed by using t- test, general linear model, and the Pearson correlation test.
Results: The mean age of the patients in the study group was 65.15 ± 8.02 years (range: 48-80 years) and the mean age of the patients in the control group was 69.15 ± 7.9 years (range: 55-89 years) ($p = 0.12$). Mean RONOF of RE are 1.85 and 6.42 ($p < 0.05$); mean RONLR are 0.65 and 1.07 ($p < 0.0.5$) in POAG and control group respectively.
Conclusion: Real time elastography showed increased RONOF and RONLR in POAG patients. This can help to understand optic nerve head biomechanics and lead to clarify glaucoma damage in early glaucoma.

10:30 - 12:00 **Room MB 2**

Paediatric

SS 212

Chest imaging and dosimetry

Moderators:
E. Blondiaux; Paris/FR
C. Owens; London/UK

K-04 10:30

Keynote lecture
C. Owens; *London/UK*

B-0163 10:39

Real-time ultrasound-guided pigtail catheter placement in supine position for drainage of symptomatic pleural effusions in paediatric patients who underwent liver transplantation
M. D'Amico, R. Miraglia, L. Maruzzelli, G. Gallo, A. Luca; *Palermo/IT (Damicoma@gmail.com)*

Purpose: Ultrasound (US) guidance is currently used for thoracic wire-guided drainages placement and its use is associated with decreased risk of complications if compared to the blind access technique; however, majority of the studies on this field are performed on adult population. Aims of this study were that of reporting the technical success and complications rate observed during real-time US-guided thoracic pigtail catheter placement (PCP) in supine position, at bed side, in paediatric liver transplant recipients with symptomatic pleural effusion.
Methods and Materials: A single centre retrospective review of real-time US-guided pleural space puncture, in supine position, followed by PCP with Seldinger technique, in paediatric liver transplant recipient with pleural effusion was performed.
Results: 41 procedures were performed in 25 patients between May 2006 and June 2014. Mean age was 4.2±3.9 y/o (range 2 months - 16 y/o). Mean weight was 14.2±7.2 kg (range 4.5-33 Kg). 17 procedures were performed in intensive care unit, 8 procedures in patients under mechanical ventilation. 12 out of 41 procedures were performed in patients with altered haemostasis (platelets < 50.000 and/or INR > 1.5). Pigtail sizes raged from 5 F to 8.5 F. The technical success rate was 100% without major complications as pneumotorax or hemotorax. Accidental dislocation occurred in 4 cases in a period of 3 to 10 days after the first procedure.
Conclusion: In our experience, in paediatric patients, real-time US-guided pleural space puncture in supine position, at bed side, followed by PCP is a safe procedure with high technical success.

B-0164 10:47

CT angiography findings of cardiovascular anomalies in aortopulmonary window: a rare congenital heart disease
A. Bhatia, K.S. Sodhi, A.K. Saxena, M. Singhal, M.K. Rohit, N. Khandelwal; *Chandigarh/IN (anmol_bhatia26@yahoo.co.in)*

Purpose: To demonstrate spectrum of radiological findings in aortopulmonary window (AP window) and associated cardiovascular anomalies on CT angiography (CTA).
Methods and Materials: Retrospective analysis of CTA images of patients (n=6) with CT diagnosis of AP window done over a period of 12 months.
Results: Type I, II and III AP window were seen in 3 patients, 2 patients, and 1 patient respectively. VSD was seen in 3/6 while ASD was seen in 1/6 patients. One patient had DORV with small LV and dilated RA and RV. Non confluent pulmonary arteries were seen in 2 patients with reformation of right pulmonary artery seen from collaterals in one of these. PAH was seen in one patient. Two patients had right sided aortic arch while a double aortic arch was seen in 1 patient. Both patients with type II AP window had interrupted aortic arch and descending thoracic aorta was being reconstituted by PDA. Aberrant left subclavian artery was seen in 2 patients, of which one had associated stenosis. Bovine arch was seen in 1 patient.
Conclusion: AP window represents approximately 0.1% of all congenital heart disease. Non-invasive evaluation with ECHO may not demonstrate communication in all cases. CTA clearly demonstrates communication between aorta and pulmonary artery as well as signs of PAH. CTA also demonstrates associated congenital cardiac anomalies which are clinically and surgically important as they have a poor outcome than in patients with isolated AP window.

B-0165 10:55

Detection of pulmonary nodules in children with a free breathing MRI technique compared to CT scans
H.P. Schemuth, S. Sirin, B. Schweiger, J. Schelhorn, S. Kinner; *Essen/DE (haemi.schemuth@uk-essen.de)*

Purpose: In infants with malignancies CT scans still are the main diagnostic tool to assess pulmonary metastases, but carry a radiation burden. Breathhold MRI scans are challenging especially in this patient group. Thus, we evaluated a new radial imaging acquisition technique without the need of breath holding for detection of pulmonary nodules.
Methods and Materials: Nine oncologic patients (age 1-14 years) who underwent a staging chest CT as well as a MRI (cervical, abdominal, thoracic) were included. A free breathing chest MRI with a radial vibe sequence (StarVIBE, Siemens, Erlangen, Germany) was acquired after contrast (3 mm slice thickness). StarVIBE MRIs were evaluated separately by two radiologists in consensus concerning i) presence/absence of pulmonary nodules and ii) largest diameter of the present nodules (< 3 mm, 3-6 mm, 6-10 mm, > 10 mm). Chest CT (slice thickness 3 mm) served as reference standard.
Results: All four of nine patients, presenting with pulmonary nodules in the CT scan were correctly identified with MRI. Numbers of pulmonary lesions per patient ranged from 0 to 16. A total of 36 nodules were detected by CT (< 3 mm:6, 3-6 mm:19, 6-10 mm:6, > 10 mm:3) while MRI detected 25 nodules (< 3 mm:2, 3-6 mm:15, 6-10 mm:5, > 10 mm:3) with a sensitivity of 69% for the MRI in total (> 3 mm: 33%, 3-6 mm: 79%, 6-10 mm: 83%, > 10 mm: 100%).
Conclusion: Free-breathing pulmonary MRI with a radial vibe sequence proved feasible and shows promising results in infants to detect pulmonary lesions, especially if sized 3 mm and larger. As discrimination of patients with and without lesions was correct, it could be used as a screening tool.

B-0166 11:03

Coronary assessment in young children with congenital heart disease : comparing a novel spiral acquisition technique to the standard sequential one in coronary CT angiography with dual-source CT
A. Secinaro, T. Santangelo, C. Napolitano, B. Leonardi, M. Chinali, G. Rinelli, P. Tomà; *Rome/IT (aurelio.secinaro@opbg.net)*

Purpose: to compare diagnostic image quality between high-pitch spiral and sequential modes CCTA on dual-source CT (DSCT).
Methods and Materials: From June 2013 to August 2014, 28 patients (< 6 yo) underwent proximal coronary assessment with CCTA using second-generation DSCT. High-pitch spiral Cardio-Thorax protocol was set with a "targeted" ECG-triggered box at the aortic root. Patients were divided into two groups according to the scan technique: novel high-pitch spiral (group A n= 14) and standard sequential mode (group B n=14). Two blinded readers graded coronary artery image quality on a five-point scale. Interobserver variability was assessed and radiation dose recorded.
Results: In group A age, BSA and weight were significantly lower as compared to Group B; heart rate was significantly higher (all $p < 0.05$). All examinations were performed without sedation in group A (100% vs 77% in group B). Exams were diagnostic in both groups with no significant difference in mean image quality score between the two groups (3.65 vs 4.1, p=ns). Interobserver agreement for image quality was high for both groups (96% and 94% respectively; P=ns). In group A, radiation exposure was significantly lower than in group B (DLP 10.08 vs 21.07; $p < 0.001$).
Conclusion: Image quality of the proposed novel technique is comparable with the traditional one in the assessment of proximal coronaries in children. However, rapid spiral acquisition provides advantages in scanning younger children with higher heart rate, by no need for sedation and lower radiation dose.

B-0167 11:11

Image quality criteria for paediatric CT thorax - a useful tool?
L. Heiberg, S. Flatabo, A. Aarsnes, H. Olerud, C. de Lange; *Oslo/NO (lise.heiberg@ous-hf.no)*

Purpose: To establish a set of image quality criteria for paediatric contrast enhanced CT thorax, and to evaluate the appropriateness of these by looking for correlation between objective noise measurements, size specific dose estimates (SSDE) and radiological assessment of image quality.
Methods and Materials: : Three experienced radiologists (two paediatric- and one adult thoracic radiologist) evaluated independently, standardized and randomized 60 paediatric thoracic CT examinations in a Norwegian hospital. Based on the old EU image quality criteria for CT a set of 15 image quality criteria were developed and assessed on a four-point qualitative scale. The anonymized examinations were collected retrospectively from two multi-detector CT systems (30/30) in three age groups (6-18 months), (4-6 years), (8-12 years). Noise was measured in standardized defined regions of interest relative to patient size in the mediastinal vessels, and in the muscle. Size specific dose estimates (SSDE) were calculated. Statistical analysis was

performed using Spearman's rank correlation with significance level at ≤0.05 and Cohen's kappa statistics.
Results: There was low to moderate interobserver agreement in quality criteria scoring between the radiologists with a kappa coefficient range 0-0.6. No significant correlation between measured noise and calculated SSDE was found, or between radiological scoring and measured noise.
Conclusion: Assessment of image quality according to these criteria was not found to be objective and therefore not satisfactory to evaluate image quality. The expected correlation between noise, image scores and SSDE was found to be poor.

B-0168 11:19

Assessment of bronchiectasis in children with cystic fibrosis by comparing airway and artery dimensions to normal controls on inspiratory and expiratory spirometer guided chest computed tomography

W. Kuo[1], M. de Bruijne[1], K. Nasserinejad[1], H. Ozturk[1], Y. Chen[2], A. Perez-Rovira[1], H.A.W.M. Tiddens[1]; [1]*Rotterdam/NL*, [2]*Ningxia/CN*
(w.kuo@erasmusmc.nl)

Purpose: Bronchiectasis is currently defined as airway-artery ratio > 1. Influence of lung volume on this ratio is unclear.
Methods and Materials: Retrospective collection of spirometer guided CTs of cystic fibrosis (CF) patients and controls (normal lung evaluation on CT). Bronchial pathways were indicated semi-automatically to reconstruct 3-D bronchial trees. Per branch all visible airway-artery (AA) pairs were measured perpendicular to the airway axis. Computation of AA-inner, AA-outer, and AA-wall ratios: inner, outer airway areas and the wall area (difference between outer and inner) divided by artery area. Relationships were assessed using mixed-effects models including disease, lung volume, sex, height, age as covariates, and random effects to capture heterogeneity across individuals.
Results: CTs of twelve CF patients (median age 10.6; 5 females) and twelve controls (median age 12.4; 5 females) were selected. Demographics and lung function did not differ significantly between groups. Following results show median (IQR) of AA-outer ratios. CF group: 3528 AA-pairs in inspiration (1.14 (1.02-1.32)) and 1017 in expiration (1.09 (0.99-1.24)). Control group: 1516 AA-pairs in inspiration (1.01 (0.93-1.11)) and 700 in expiration (0.96 (0.87-1.05)). AA-outer and AA-wall ratios increased in smaller airways. Higher AA-outer and AA-wall ratios on inspiratory CTs compared to expiratory CTs for both groups ($P < 0.03$) and higher AA-outer and AA-wall ratios in CF than controls, independent of covariates ($P < 0.01$).
Conclusion: Current definition of bronchiectasis as AA-outer ratio > 1 should be reconsidered. To diagnose bronchiectasis AA-outer is more reliable than AA-inner. Visible AA-pairs in CTs of CF patients is doubled compared to controls.

B-0169 11:27

Paediatric fluoroscopic imaging - comparison of simulation results using an anthropomorphic phantom representing a 1-year old child examined on an image-intensifier and a flat-panel detector based system

M. Weidner[1], A.A. Schegerer[2], T. Diehm[1], U. Lechel[2], S.O. Schoenberg[1], G. Brix[2], K.W. Neff[1]; [1]*Mannheim/DE*, [2]*Neuherberg/DE*
(Meike.Weidner@medma.uni-heidelberg.de)

Purpose: To compare an image-intensifier (II) based fluoroscopy unit (Philips EasyDiagnost Eleva, Philips Healthcare, The Netherlands) with a flat-panel detector system (Luminos Agile, Siemens Healthcare Sector, Germany) by simulating paediatric examinations (i.e. upper gastro-intestinal investigations (UGI) and voiding cystourethrography (VCU)) using an anthropomorphic phantom representing a 1-year old child.
Methods and Materials: Typical examination protocols for VCU and UGI have been designed and performed 20 times each on the paediatric phantom by an experienced paediatric radiologist. The dose area product (DAP) was determined as well as equivalent organ doses using thermoluminescence dosimeters (TLDs).
Results: For UGI, the mean DAP was reduced for the FPD-device in comparison to the II-system (3.7±0.5 µGy*m2 vs. 8.0±1.2 µGy*m2; $p < 0.0001$). Based on the IRCP Publication 103, mean effective dose was 1.8 times higher on the II-system (0.125 mSv vs. 0.070 mSv). The organ equivalent dose e.g. to the breast tissue was 2.75 times higher on the II-system (0.120 mGy vs. 0.044 mGy). For VCU, the DAP was also reduced on the FPD-device in comparison to the II-system (1.5±0.2 µGy*m2 vs. 6.6±1.1 µGy*m2; $p < 0.0001$). Mean effective dose was 3.5 times higher on the II-system in comparison to the FPD-device (0.072 mSv vs. 0.021 mSv). The equivalent organ dose e.g. to the ovaries was 3.6 times higher on the II-system (0.300 mGy vs. 0.084 mGy).
Conclusion: The FPD-system showed a statistically significant decrease of radiation dose in comparison to the II-system in realistically simulated paediatric fluoroscopic imaging examinations of a 1-year old child.

Author Disclosures:
M. Weidner: Research/Grant Support; Research collaboration with Siemens Healthcare. **S.O. Schoenberg:** Research/Grant Support; Research collaboration with Siemens Healthcare. **K.W. Neff:** Research/Grant Support; Research collaboration with Siemens Healthcare.

B-0170 11:35

Dosimetric study of varicocele embolisation in paediatric patients

A. Gioppo, F. Melchiorre, R. Azzeroni, C. Khouri Chalouhi, G. Cornalba;
Milan/IT (andrea.gioppo@unimi.it)

Purpose: Varicocele embolization is a percutaneous procedure performed with fluoroscopic assistance. The aim of this study is to evaluate gonad radiation dose and estimate hereditary risk and lifetime fatal cancer risk in a paediatric population.
Methods and Materials: From September 2014 to date,15 paediatric patients, aged from 12 to 18 years- ld, underwent percutaneous embolization of the spermatic vein, using a "low dose" protocol. A double transmission chamber was used to measure the entrance surface dose and the dose area product. Three thermo-luminescent dosimeters were placed adjacent to the scrotum, to directly measure gonad dose. A PC-based Monte Carlo program was used to estimate effective dose from recorded DAP. The hereditary effect was made by combining the gonad doses with a risk factor for that population. The total fatal cancer risk was estimated by multiplying each organ dose by cancer risk factor for that organ and summing the results.
Results: Mean fluoroscopy time was 5 min8sec, mean DAP 3.27Gy*cm2 and mean ESD 11.07 mGy. Mean gonad dose was 0.41 mGy (deterministic threshold of sterility:150 mGy) and effective dose 1.18mSv (one year of natural backgroud radiation:2.4mSv). Hereditary risk was less than 1 case per 100000 treated (0.00099%). Radiation-induced fatal cancer risk was 2.1 cases per 10000 treated (0.021%).
Conclusion: In paediatric patients, the radiation-induced risk in varicocele embolization is content. Adequate field-limiting measures, anti-scatter grid removal, never use radiography and limited fluoroscopy are the most significant to optimise exposure. The dosimetric investigation is not limited to an "experimental speculation" but is under direct responsibility of radiologists.

B-0171 11:43

CT dose monitoring and optimisation in paediatric CT using radiation dose tracking Software

M. Twomey, F. Moloney, C. Bogue, M. Sheehy, O.J. O' Connor, M.M. Maher;
Cork/IE (mariatwomey@msn.com)

Purpose: Dose monitoring and optimisation is of key importance in paediatric MDCT. We used RDTS (Dosewatch, GEHC) to document the dose range in DLP and SSDE in a cohort of paediatric patients and identify causes of dose outliers.
Methods and Materials: 200 paediatric CT brain, skull, thorax and abdominopelvic performed over 6 months on two MDCT scanners were analysed. Individual dose reports including CTDivol, DLP and SSDE were automaticallyrecorded by RDTS. The range and mean dose values, mA, kV, isocentre analysis tool values and scan length were analysed to identify parameters for optimisation. Positive diagnostic yield and variation in dose over the study period was investigated. The local dose range was compared to international diagnostic reference levels (DRL).
Results: The DLP and SSDE range across all age categories were 240-1580 mGy.cm (DLP) and 1.9-18 mGy (SSDE) for brain examinations; 9-374 mGy.cm (DLP) and 0.3-5 mGy (SSDE) for skull; 13-150 mGy.cm (DLP) and 0.9-2.8 mGy (SSDE) for thorax and 30-400 mGy.cm (DLP) and 1.8-10.9 mGy (SSDE) for abdominopelvic CT. 92% of examinations had recorded exposures within DRL ranges ($p < 0001$).Significant differences were noted in the selection of specific protocols for the same clinical indication. 58% of CT brains were performed outside of working hours with a low positive diagnostic yield of 20%.
Conclusion: RDTS offers significant advantage in streamlining dose data analysis with automatic generation of individual SSDE and proved useful for identifying dose outliers and potential explanations for same.

B-0172 11:51

Comparison of radiation dose between an image intensifier system and a flat-panel detector system - evaluation of clinical imaging in a paediatric population

M. Weidner, C. Hagelstein, T. Diehm, S.O. Schoenberg, K.W. Neff;
Mannheim/DE (Meike.Weidner@medma.uni-heidelberg.de)

Purpose: As in the last years more and more image-intensifiers (II) need to be replaced and the question rises whether to invest in a flat-panel detector (FPD) based system, we compared radiation doses in typical paediatric investigations between an II- and a FPD-system.

Methods and Materials: Two different imaging systems - a conventional II system (Philips EasyDiagnost Eleva, Philips Healthcare, The Netherlands) and a new FPD system (Luminos Agile, Siemens Healthcare Sector, Germany)- were compared. Age-matched fluoroscopic, paediatric investigations, i.e. voiding cystourethrography (n=15) and upper gastro-intestinal investigations (n=25), were compared by the investigation time and the dose area product (DAP).
Results: A good age matching was achieved for both investigation types (p (gastro) = 0.7; p (cysto) = 0.4). Investigation time was comparable between both systems. DAP was significantly reduced on the FPD for upper gastro-intestinal investigations (DAP (II) 45±38 mGy*m2 vs. DAP (FPD) 11±9 mGy*m2; $p < 0.0001$) and for voiding cystourethrography (DAP (II) 18±20 mGy*m2 vs. DAP (FPD) 10±12 mGy*m2; p=0.04).
Conclusion: Despite similar investigation times, radiation dose was significantly reduced by the FPD-system in typical paediatric fluoroscopic investigations. The FPD system should therefore be preferably used in paediatric radiology.

Author Disclosures:
M. Weidner: Research/Grant Support; Research collaboration with Siemens Healthcare. **S.O. Schoenberg:** Research/Grant Support; Research collaboration with Siemens Healthcare. **K.W. Neff:** Research/Grant Support; Research collaboration with Siemens Healthcare.

10:30 - 12:00 **Room MB 3**

Cardiac

SS 203b

Heart rate: disorders and imaging issues

Moderators:
M. Grothoff; Leipzig/DE
R.J. Perea; Barcelona/ES

B-0173 10:30

Effect of heart rate on image quality using 320-row coronary computed tomography angiography: a pulsating cardiac phantom study
P. Kozma, C. Kendziorra, F. Richter, M. Dewey; *Berlin/DE*

Purpose: To evaluate the effect of heart rate (HR) on image quality using 320-row coronary CT angiography.
Methods and Materials: A pulsating heart phantom with simulated coronary arteries was used to perform the experiments. Images were acquired with ten HRs ranging from 45 to 120 bpm with 120 kVp tube voltage and 500 mA or 470 mA tube current using the acquisition protocols target CTA at 75%, prospective CTA from 70-80% and 40-80%. Half scan (all HRs) and multi-segment (> 65 bpm) reconstructions were used. Subjective as well as objective image quality was assessed using signal-to-noise-ratio (SNR), contrast-to-noise-ratio (CNR) and contour sharpness measurements.
Results: Using 320-row CTA single heart beat scanning may be applicable with good diagnostic image quality and approx. 70% lower radiation dose (2.8 mSv vs. 8.4 mSv) up to 80 bpm compared to prospective scan modus. Qualitative image analysis showed no significant difference in image quality based on SNR and CNR using HS reconstruction with HR ≤65 bpm and both HS and MS reconstruction with HR > 65 bpm between the respective HR groups and the three acquisition protocols ($p > 0.05$ for all). Using MS reconstruction instead of HS reconstruction with HR > 65 bpm showed significantly higher SNR and CNR ($p < 0.001$). Effective radiation dose was significantly lower using HRs < 70 bpm with both prospectively triggered scan protocols ($p < 0.01$, $p < 0.05$).
Conclusion: Coronary CTA using latest generation CT scanners may be possible in patients without arrhythmia with higher HRs and reduced dose if acquisition parameters and protocol are chosen appropriately.

Author Disclosures:
M. Dewey: Author; "Coronary CT Angiography", Springer, 2009, "Cardiac CT", Springer 2011 and 2014. Consultant; Guerbet. Grant Recipient; Heisenberg Program of the German Research Foundation (DFG) for a Professorship (DE 1361/14-1), FP7 Program of the European Commission for the randomized multicenter DISCHARGE trial (6. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, and Bayer-Schering. Other; Cardiac CT Courses in Berlin: www.CT-kurs.de; Institutional master research agreements exist with Siemens Medical Solutions, Philips Medical Systems, and Toshiba Medical Systems.

B-0174 10:38

Coronary CT angiography on 128-slice dual-source CT: comparison of incidence and location of artefacts in high-pitch spiral and prospectively ECG-gated sequential acquisitions
F. Laffranchi, D. Farina, E. Gavazzi, A. Borghesi, M. Ravanelli, R. Maroldi; *Brescia/IT (f.laffranchi@libero.it)*

Purpose: To assess rate and anatomical distribution of artefacts in coronary CT angiographies performed on a 128-slice Dual Source CT scanner using two prospectively ECG-gated acquisition modalities: high-pitch spiral (Flash) and sequential (Step-and-Shoot)I.
Methods and Materials: 858 coronary CT-angiographies performed on a DSCT scanner were retrospectively reviewed. Of them, 163 studies were performed in Flash modality, 695 in Step-and-Shoot modality. Patient group was splitted according to heart rate (HR) ≤65 bpm or > 65 bpm: low-HR group comprised 373 patients (132 Flash, 241 Step-and-Shoot), high-HR group comprised 485 patients (31 Flash, 454 Step-and-Shoot). Presence and site of artefacts hampering image quality were assessed. Difference in artefact rate and site among subgroups was tested using Fisher's exact test.
Results: The overall rate of artefacts in Flash and Step-and-Shoot groups was similar (16.5 and 17%, respectively). In low-HR group, no statistical difference in artefact rate was observed between Flash (13%) and Step-and-Shoot (8%) groups (p=0.14). Interestingly, artefacts in Flash group selectively affected right coronary artery (RCA) in 65%, while in Step-and-Shoot group artefacts affected both the sides or left coronary artery (p=0.0001). In high-HR group, artefact rate was not statistically different between two groups (32% and 22%, respectively; p=0.18); difference in anatomical distribution of artefacts between groups reflected that observed in low-HR group (p=0.014).
Conclusion: Flash acquisition is a suitable option for coronary CT-angiography in low-HR patients, allowing radiation dose sparing compared to sequential modality. However, artefacts on RCA, reflecting possible non-optimal ECG-synchronization, may hamper image quality in higher rate of cases compared to Step-and-Shoot.

B-0175 10:46

Comparison of coronary CT angiography (CCTA) for patients with high heart rates using a 512-slice new-generation MDCT and a 128-slice CT: image quality and radiation dose
L. Macron, J.-L. Sablayrolles, J. Feignoux; *Saint Denis/FR*

Purpose: To evaluate the benefits regarding image quality and radiation dose of new generation 512-slice CT scanners for CCTA in patients with a high heart rates in comparison with previous 128-slice generation.
Methods and Materials: 58 patients with a heart rate (HR) > 65 bpm during their CCTA were retrospectively included. 29 were scanned on 128-slice MDCT (group A) and 29 underwent the exam on 512-slice MDCT (Revolution CT, General Electric) (group B). Subjective Image quality and importance of motion and step artifacts were evaluated by two experienced readers using a 5-point scale and a 3-point scale respectively (3, no artifact; 1, interference with diagnosis). Percentage of assessable coronary segments was calculated and objective image quality was measured. Mean effective dose (ED) was calculated: (ED = κ.DLP; κ = 0.014mSv x mGy-1 x cm-1).
Results: The mean HR was 73.3 ± 6.9 bpm and 75.7 ± 9.9 bpm for group A and B respectively. In group A, 16% of coronary segments were not assessable, with motion artefacts rated at 1.93±0.74 and step artefacts at 2.27±0.69. For group B, it dropped to 3%, with no step artefact and motion artefacts rated at 2.41±0.62. For group B, ED was reduced by 81% (2.7±2.4 mSv vs. 14.2±4.4 mSv, $p < 0.001$) and CNR increased by 32%.
Conclusion: New generation 512-MDCT allows performing pure arterial CCTA on high heart rate patients with improved image quality and diagnostic accuracy, and reduced radiation dose, thus opening the door to of wider use of this examination.

B-0176 10:54

Coronary angiography by 320-row CT in patients with atrial fibrillation: prospective intention-to-diagnose comparison with conventional coronary angiography
E. Zimmermann[1], S. Feger[1], M. Rief[1], P. Schlattmann[2], M. Laule[1], M. Dewey[1]; [1]*Berlin/DE*, [2]*Jena/DE (elke.zimmermann@charite.de)*

Purpose: The diagnostic accuracy of noninvasive evaluation of coronary arteries is limited in patients with atrial fibrillation (AF). We evaluated coronary angiography using whole-heart 320-row computed tomography angiography (CTA) in patients with AF in comparison with conventional coronary angiography (CCA).
Methods and Materials: 54 patients with AF who were suspected of having coronary artery disease underwent 320-row CTA before clinically indicated CCA. Sensitivity, specify, positive predictive value (PPV) and negative predictive value (NPV) were calculated with CCA as the reference standard.

Results: The mean heart rate during CTA was 72±20 bpm with a range of 44-146 while the majority (54%) had an average heart rate of ≥65 bpm. Mean radiation exposure for CTA (12.5±3.7 mSv) was not significantly different from that for CCA (11.4±5.6 mSv; P=0.134, whereas the amount of contrast agent required for CTA was significantly lower (66±6 ml versus 89±27; P < 0.001). The per-patient sensitivity, specificity, PPV and NPV for CTA compared to CCA were 83.3% (15/18), 86.1% (31/36), 75.0% (15/20) and 91.2% (31/34), respectively.
Conclusion: CT with the use of whole-heart coverage has the potential to achieve high diagnostic accuracy in patients with AF with similar radiation exposure and reduced amount of contrast agent required compared with CCA.

Author Disclosures:
M. Dewey: Author; Coronary CT Angiography, Springer 2009, Cardiac CT, Springer 2011 and 2014. Consultant; Guerbet. Research/Grant Support; Heisenberg Program of the German Research Foundation for a Professorship (DE 1361/14-1), FP7 Program of the European commission for the randimized multicenter DISCHARGE trial (603266-2, HEALTH-2012.2.4.-2), European Regional Development Fund (20072013 2/05, 20072013 2/48), German Heart Foundation/German Foundation of Heart Research (F/23/08, F/27/10), Joint program of the DFG and the German Federal Ministry of Education and Research (BMBF) for meta-analyses (01KG1013, 01KG1110, 01KG1110, GE Healthcare, Bracco, Guerbet, Toshiba Medical System. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, Bayer-Schering. Other; Cardiac CT Courses in Berlin www.CT-kurs.de, Institutional master research agreemente exist with Siemens Medical Solutions, Philips Medical Systems, and Toshiba Medical Systems.

B-0177 11:02

Influence of iodinated contrast agents on heart rate variation during CT angiography of the coronary arteries after intravenous administration of beta blocker

C. Loewe, L. Reider, A. Wielandner, V. Schoepf, S. Unterhumer, D. Beitzke, F. Wolf; *Vienna/AT (christian.loewe@meduniwien.ac.at)*

Purpose: To assess the influence of different contrast agents after intravenous administration of beta blocker on heart rate variability and diagnostic image quality during CTA of the heart.
Methods and Materials: 92 patients (43 women) referred for CTA of the heart for CAD rule out and at a baseline heart rate above 70 were consecutively enrolled. Patients were randomized to receive either iodixanol (n=45) or iomeprol. Prior to CTA an intravenous beta blocker (metoprolol) was administered to lower heart rate. All patients within same body weight group (three groups) received the same amount of iodine per second for CTA. Heart rates were recorded with a mobile heart rate monitor before, during and after contrast media administration. Contrast enhancement was evaluated at four predefined anatomical regions. Image quality was rated overall and segment-wise as well.
Results: While both contrast agents raise mean heart rates within 60 seconds after injection, iomeprol elevates heart rates earlier and to higher levels with a peak heart rate change of 15 bpm (iodixanol 5 bpm). 16 seconds after start of contrast agent administration iomeprol was found to induce significantly higher heart rate changes (increases) when compared to iodixanol. No difference was found in arterial contrast enhancement and image quality between the two agents.
Conclusion: Iodixanol showed less influence on heart rate during CTA of the coronary arteries with prior administration of an intravenous beta blocker when compared to iomeprol. The difference of the heart rate increase between the two agents became significant after 16 seconds.

B-0178 11:10

Influence of atrial fibrillation on left atrial appendage movement and sizing evaluated with cardiac computed tomography angiography

F. Avogliero, A. Clemente, T. Liguori, A. Monteleone, D. Della Latta, D. Chiappino; *Massa/IT (francesco.avogliero@gmail.com)*

Purpose: To assess possible dimensional changes in left atrial appendage (LAA) ostium in patients with atrial fibrillation (AF) using cardiac computed tomography angiography in planning percutaneous LAA occlusion. LAA ostium diameters were measured by two operators using a multiphasic dataset.
Methods and Materials: Thirty-four AF patients underwent retrospective ECG-gating CCTA evaluation. Two blind operators measured the mean diameter taken by the area of the ostium in the visually estimated maximum and minimum LAA expansion of the cardiac cycle. Inter-operator correlation was evaluated.
Results: Maximal and minimal LAA expansion in 0-90% R-R interval were evidenced by both operators. In 58/68 datasets analysed (85.3%), the phases of maximal expansion selected by operators were between 30 and 60%; in 52/68 datasets (76.5%), the phase of minimal expansion was selected between 80 and 10%. A significant LAA size difference exists in the phase of major and minor filling, despite AF. The variability in measurements of LAA diameters of the ostium between maximum and minimum LAA expansion was estimated at approximately 10%. The sizing of the LAA ostium with CCTA has a high inter-operator correlation (PCC: r=0.98; p < 0.01) and low inter-operator variability (bias: 0.07 [+2.1; -1.95]).
Conclusion: A significant difference in the measurement of the LAA ostium diameters exists in the phase of maximum and minimum expansion, despite AF. The choice of the correct phase is crucial for the correct evaluation of LAA ostium diameter. The correct sizing of the ostium diameters obtained from the area of the lumen with CCTA is highly reproducible.

B-0179 11:18

Cardiac CT vs cardiac MRI for characterisation of left atrium anatomy before radiofrequency catheter ablation of atrial fibrillation: impact on radiation exposure and outcome

E. Bertella, D. Andreini, M. Petullà, E. Russo, E. Innocenti, A. Baggiano, S. Mushtaq, V. Beltrama, G. Pontone; *Milan/IT*

Purpose: The aim of this study is to compare the procedural characteristics, overall radiation exposure and clinical outcomes between radiofrequency catheter ablation (RFCA) of atrial fibrillation (AF) guided by image integration with CCT versus CMR.
Methods and Materials: 400 patients with paroxysmal or persistent AF were randomized to CT (Group 1; N: 200; mean age 61.6±10.9 yo; male:155) or MR (Group 2; N: 200; mean age 59.7±10.4 yo; male:166) for evaluation of LA before RFCA. CT was performed with 64-slices scanner and MR was performed with 1.5-T scanne using a non-triggered contrast enhancement MR angiography sequence. All patients were treated by image integration-supported RFCA.
Results: The two groups were homogeneous. The mean follow-up was similar (557±302 vs 523±265 days, respectively, p:0.24). Group 1 showed higher LA volume versus group 2 (117±46 vs 101±40 mL, p < 0.001). The procedural characteristics [fluoroscopy time (32.6±16.0 vs 35.0±16.6 min, p:0.15); procedural duration (180.2±59.0 vs 182.8±53.5, p:0.65, pulmonary veins identified (4±0.1 vs. 3.9±0.2, p:0.08); pulmonary veins targeted (3.9±0.4 vs 3.9±0.4, p: 053); pulmonary veins isolated (3.9±0.4 vs 3.9±0.4, p:0.9)] and the rate of AF recurrence (29% vs 26%, p:0.5) were similar between the two groups. Group 1 showed a higher overall cumulative radiation exposure (40.4±23.7 vs 32.8±23.5, p < 0.005). and LA volume measured by MR was the most robust independent predictor of AF recurrence at multivariate analysis [(HR: 1.08 (1.01-1.15), p:0.02].
Conclusion: MR integration-supported RFCA procedure seems to be associated with a lower overall cumulative radiation despite similar outcome in comparison with CT-guided RFCA.

Author Disclosures:
D. Andreini: Consultant; GE Healthcare. **G. Pontone:** Consultant; GE Healthcare, Heartflow, Medtronic, Bayer.

B-0180 11:26

Point-by-point correlation between electroanatomic mapping (EAM) and 3D-model from multidectector-computed tomography (3D-CT-model) in patients affected by ventricular tachycardia (VT)

C. Colantoni, A. Esposito, A. Palmisano, S. Antunes, F. De Cobelli, G. Maccabelli, P. Della Bella, G. Rizzo, A. Del Maschio; *Milan/IT (colantoni.caterina@hsr.it)*

Purpose: To create anatomical 3D-maps of the heart and of the myocardial scar from CT-data (3D-CT-MODEL) suitable to plan and guide VT-ablation and to validate it with a point-by-point correlation between 3D-CT-maps and EAMs.
Methods and Materials: 20 pts suffering from VT underwent MDCT before VT-ablation, including an angiographic-scan and a delayed-scan (80 kV). For each patient, a 3D-model of the heart, representing the cardiac cavities, aortic root, left ventricular wall and myocardial scar, was obtained by the fusion of angiographic and delayed scan, separately segmented. The 3D-CT-MODELs were uploaded on CARTO®system and co-registered with EAMs using CARTO-merge. A point-by-point correlation was performed between low-voltage areas at bipolar/unipolar EAMs and scars on 3D-CT-MODEL, using a homemade software.
Results: The analysis included 20 scars. In bipolar-maps, a correlation between 3D-CT-MODEL and EAM of 82.88% and 86.2%, respectively in ischemic and non-ischemic pts, was found; in unipolar maps, the correlation between CT-3D-MODEL and EAM was 72.39% and 71.4%, respectively in ischemic and non-ischemic pts. According to the distribution of scars at CT, at bipolar-maps, the correspondence was 43.92% for midmyocardial, 91.01% for transmural, 86.79% for endocardial and 99.15% for epicardial scars. At unipolar-maps, the correspondence was 29.28% for midmyocardial, 80.69% for transmural, 74.93% for endocardial and 94.80% for epicardial scars.

Conclusion: The optimized protocol of acquisition and post-processing set-up in this study allows to obtain a feasible integration between high resolution 3D-CT-MODELs and EAMs in all pts. Bipolar-maps had a better agreement with MDCT data; a lower correspondence was found for midmyocardial scars.

B-0181 11:34

Left atrial fibrosis in healthy volunteers and patients with and without atrial fibrillation according to LGE MRI

O. Aparina, O. Stukalova, D. Parkhomenko, N. Mironova, S.K. Ternovoj, S.P. Golitsyn; *Moscow/RU (olla_a@mail.ru)*

Purpose: Left atrial (LA) fibrosis evaluation using LGE MRI is new promising tool in airial fibrillation (AF) management strategy. Specificity of LA fibrosis in AF remains controversial. The purpose is to assess LA fibrosis in healthy volunteers (HV), patients with hypertension (Hp) and patients with AF (AFp).
Methods and Materials: 23HV, 53 AFp and 25Hp underwent CMR on 1.5 T scanner. High resolution LA LGE MRI performed 15-20 min after contrast injection. From LGE MRI images LA walls segmented semiautomatic. New enhancement indicators are developed: diffuse enhancement ratio (DER) - mean LA wall signal intensity (SI) to mean blood SI ratio; maximum enhancement ratio (MER) - maximum LA wall SI to mean blood SI ratio. LA wall pixels with SI ratio exceeding HV's MER are considered as fibrotic. Percent of all fibrotic pixels in all LA layers represented fibrosis extent.
Results: HV have lower DER and MER than AFp and Hp (0.9[0.9;1.05]vs.1.1[1.06;1.2]vs.1.1[1.07;1.1], $p < 0.05$; 1.6[1.42;1.84]vs.1.8[1.71;1.86] vs.1.7[1.1;2], $p < 0.05$). HV MER correlates with age ($r=0.65, p < 0.01$). For LA fibrosis quantification we use age-adjusted threshold. Fibrosis extent in AFp is higher than in HV (9.1%[1.7%;18.5%]vs.0.7%[0.04%;3.5%], $p < 0.05$). Fibrosis extent in Hp has intermediate values (3.8%[0.5%;9.5%]). In HV fibrosis extent correlates with age, LA volume and left ventricle ejection fraction ($r=0.65$, $r=0.42$, $r=042$, $p < 0.05$). In AFp fibrosis extent correlates with LA volume ($r=0.38$, $p=< 0.01$).
Conclusion: New enhancement indicators DER and MER reveal differences in LA LGE in HV, AFp and Hp. LA Fibrosis extent quantified using new age-adjusted quantification technique based on threshold criteria obtained from HV data is higher in AFp than in HV and Hp.

B-0182 11:42

Myocardial substrate of recurrent ventricular tachycardia: relationship between late-enhancement multidetector computed tomography (MDCT-LE) and electroanatomic mapping

A. Palmisano, A. Esposito, C. Colantoni, F. De Cobelli, G. Maccabelli, P. Della Bella, A. Del Maschio; *Milan/IT (palmisano.anna@hsr.it)*

Purpose: Catheter-ablation guided by electroanatomic mapping (EAM) is the treatment of choice for recurrent ventricular tachycardia (VT). but its low spatial resolution limits its success. Delayed-enhancement MDCT may identifiy of myocardial scar, also in patients (pts) with implantable cardioverter defibrillator (ICD). Aim of the study was to compare MDCT revealed scars with ones at bipolar EAMs (< 1.5mV).
Methods and Materials: 42 pts (35/42 pts with ICD) with VT underwent 64-MDCTwith the acquisition of an angiographic scan (120 kV) and a delayed scan (80 kV) 10 minutes after. A segment-per-segment comparison was performed between scar identified at imaging, on the bases of presence of delayed-enhancement (DE) and/or significant wall thinning (WTN), and scars at bipolar EAMs (< 1.5mV).
Results: MDCT-revealead scars in 39 pts (36/39 pts by DE, 3/39 only by WTN).Sensitivity and specificity for DE in detecting myocardial scars were 0.83 and 0.86, respectively, NPV and PPV were 0.96 and 0.61. Sensitivity and specificity for LE associated to WTN were 0.84 and 0.83, respectively; NPV and PPV were 0.96 and 0.59. MDCT scars resulted larger than ones at EAM (5±2 segments at MDCT vs 5±2 at EAM). In 90% cases catheter-ablation were performed in correspondence of MDCT revealed scar being substrates of local abnormal ventricular activities responsible of VT.
Conclusion: MDCT identified with good sensitivity and specificity myocardial scars,the high NPV suggested that MDCT could be used for a real-time guidance of EAM and ablation, because the probability to find a focus of TV outside the MDCT revealed scar at is very low.

B-0183 11:50

Effect of a novel motion correction algorithm on the image quality of low-dose coronary CTA

M. Komarova, V. Sinitsyn, E.A. Mershina; *Moscow/RU (Mary-ga@yandex.ru)*

Purpose: To assess the impact of a novel motion-correction algorithm (SnapShot Freeze reconstruction (SSF)) on image quality of prospective ECG-gating low-dose coronary CTA.
Methods and Materials: 30 patients undergoing low-dose coronary CTA were included in the study. Patients were divided into two groups: with a heart rate (HR) of ≥60 (high HR group; n=15) and < 60 bpm (low HR group; n=15). Standard prospective reconstruction and SSF were performed for each patient. We used the 4-point grading scale to assess the image quality (1-excellent, 2-good, 3-reduced, 4-nondiagnostic).
Results: The mean HR of the enrolled patients was 60±8.2 bpm (65.5±6.3 for high HR group; 53±5.2 for low HR group). A total of 90 vessels and 369 coronary segments were assessed. For all patients the overall image quality scores (IQSs) using SSF and standard reconstruction were 1.34±0.08 and 1.4±0.09 respectively (p=ns). The use of SSF didn't improve the overall IQS in the low HR group (p=ns). But in the high HR group IQS using SSF was significantly higher than those of the standard reconstruction ($p < 0.05$). The per-segment IQS was significantly higher using SSF in the poorly visualized segments of the right coronary artery (RCA) in the low HR group (p=0.02) and poorly visualized segments of RCA and LCA in the high HR group (p=0.008 and p=0.007, respectively). On per-segment analysis, IQS was improved in half poorly visualized segments (22/43).
Conclusion: A novel motion-correction algorithm can improve the image quality of low-dose coronary CTA. However, it may be more beneficial to the patients with a higher HR.

10:30 - 12:00 **Room MB 4**

Emergency Radiology

SS 217

Emergency imaging: how to be more precise

Moderators:
K.H. Nieboer; Brussels/BE
G. Schueller; Opfikon/CH

B-0184 10:30

Simple CBF grading based on MR perfusion to anticipate long-term clinical outcome in severe stroke patients due to the carotid artery occlusion

T. Mori, T. Iwata, Y. Tanno, S. Kasakura, Y. Aoyagi, K. Yoshioka; *Kamakura/JP (morit-koc@umin.net)*

Purpose: To investigate if CBF grading based on MR perfusion was useful for anticipating clinical outcome in patients with the carotid artery occlusion (CAO).
Methods and Materials: Patients 1) admitted within 24 hours between Jan 2005 and May 2014, 2) with CAO displayed by MRA, 3) treated without any reperfusion therapy. We evaluated CBF grades, any death within 120 days and clinical outcome at 90 days. CBF grade was based on time-intensity curves (TICs), which were generated at symmetrical positions of the bilateral MCA territories. According to the time to peak (TP) and the peak signal (PS) comparing the affected side (a) with the contralateral side (c), we regarded the affected-sided PSa divided by TPa as CBFa and the contralateral-sided PSc divided by TPc as CBFc. CBF grade 1 was defined as CBFa divided by CBFc (CBF%) less than 0.2, grade 2 as CBF% of 0.2 or more and CBF% less than 0.5 and grade 3 as CBF% of 0.5 or more.
Results: Sixty-three patients were analyzed. In grade 1, 2 and 3, there were 25, 25 and 13, and survival rate (SR) of the Kaplan-Meier method at 120 days was 20%, 50.4% and 76.2% ($p < 0.001$), respectively. In grade 1, 2 and 3, 0, 0 and 1 patient was in mRS of 0-2, 1, 7 and 8 patients in mRS of 3-4 and 24, 18 and 4 patients in mRS of 5-6 ($p < 0.001$).
Conclusion: CBF grading based on MR perfusion was useful for anticipating clinical outcome in CAO patients.

B-0185 10:38

Prevalence of pulmonary embolism during pregnancy

S. Schmidt, V. Dunet, R. Meuli, O. Hugli, V. Ilic; *Lausanne/CH (sabine.schmidt@chuv.ch)*

Purpose: Pregnancy is a physiological hypercoagulable state associated with an increased risk of pulmonary embolism (PE), which is the leading cause of maternal mortality in developed countries. Our aim was to determine the prevalence of PE in pregnant patients requiring computed tomography pulmonary angiography (CTPA) because of clinical suspicion.
Methods and Materials: We retrospectively included all pregnant women admitted to our hospital and investigated by CTPA for clinically suspected PE over a 10-year period from January 2004 to November 2013. All underwent a dedicated low-dose CTPA protocol. We also recorded gestational age, symptoms and D-dimers values and performed subgroup comparison using the Kruskall-Wallis test.
Results: A total of 132 patients (mean age 32 years ± 6) with a mean gestational age of 28 ± 7weeks were included. One-hundred five (80%) women had chest pain, 107 (81%) had dyspnoea and 25 (19%) had oxygen desaturation. Two scans (1.5%) were non-conclusive for technical reasons. PE

was detected in 7 of 130 analyzed patients (5.4%), consisting of lobar filling defects in 3 women and segmental or proximal sub-segmental filling defects in 4 patients. Alternative diagnoses (6.2%) revealed by CTPA included pneumonia (n=7) and rib fracture (n=1). D-dimer was available in 112 women. Gestational age, symptoms and D-dimer concentrations were not different between patients with or without PE.
Conclusion: In pregnant women, PE is often considered in the differential diagnosis of chest pain or dyspnoea. CTPA is mainly performed to exclude PE given the low percentage of positive findings.

B-0186 10:46

Intensive care patients with elevated laboratory inflammatory parameters: indications to perform a CT examination of the head, chest and abdomen to search for the focus of infection

N.N.N. Naguib, B. Dana, N.-E.A. Nour-Eldin, M. Albrecht, T. Gruber-Rouh, V. Jacobi, T.J. Vogl; *Frankfurt a. Main/DE (nagy3n@yahoo.com)*

Purpose: To assess the feasibility of using a CT-Protocol for intensive care patients including examination of the head, chest and abdomen (IC-CT) to search for focus of infection in patients with elevated laboratory inflammatory parameters.
Methods and Materials: The retrospective study was performed on 95 intensive care patients with a mean age of 60 years. We evaluated 101 IC-CT examinations. The mean hospitalisation duration was 52.5 days. All patients were referred for IC-CT to search for an infection focus and with the clinical indication recently elevated inflammatory parameters (namely CRP and IL6). In eleven examinations other clinical indications were included in the request.
Results: Of the 101 IC-CT; 76 (75.2%) examinations showed pathologies relevant to the clinical question. For the head-CT 13 (12.9%) examinations showed sources of infection namely sinusitis (n=10), otitis media (n=2) and septic embolie (n=1). For chest-CT 74 (73.2%) showed relevant pathologies. Pneumonia was encountered in 55 examinations (17 newly diagnosed cases). The remaining 19 chest examinations showed other pathologies affecting the course of treatment (12 newly diagnosed pathologies). For the abdominal-CT sources of infection were detected in 46 (45.5%) examinations with 9 already known sources of infection and 37 new cases. Enteritis (n=23, 16 newly diagnosed), pancreatitis in (n=9, 7 new cases), abscesses (n=5), cholecystitis (n=3), peritonitis (n=3), vasculitis (n=2) and spondylodiscitis (n=1).
Conclusion: CT provides an accurate tool to search for infection focus in intensive care patients. CT proved most beneficial in chest and abdomen regions. An additional ENT examination can replace the additional CT examination of the head.

B-0187 10:54

The emerging role of contrast-enhanced CT to assess esophageal necrosis after corrosive ingestion

D. Bouda, A.-M. Zagdanski, F. Sabatier, P. Bourrier, C. De Margerie, E. De Kerviler, M. Chirica, P. Cattan; *Paris/FR (damien.bouda@gmail.com)*

Purpose: Esophagectomy is the standard of care for high-grade corrosive esophageal necrosis as assessed endoscopically. However, the inaccuracy of endoscopy in determining the depth of intramural necrosis may lead to unnecessary esophageal resection, with devastating consequences. The aim of this study was to evaluate the role of computed tomography (CT) in the emergency workup of high-grade corrosive esophageal necrosis.
Methods and Materials: An early (6 hours) CT-scan before and 90 seconds after injection of 2 ml/Kg of iodinated contrast media was performed in 72 patients with endoscopically-proven high-grade corrosive esophageal necrosis. The decision for esophagectomy was based only on CT evidence of transmural necrosis, defined by at least two of the following criteria: esophageal-wall blurring, periesophageal-fat stranding, or absence of esophageal-wall enhancement.
Results: Among the 72 patients, 25 underwent esophagectomy (33%) based on CT-scan criteria. The remaining 47 underwent non-surgical conservative treatment and survived. Thirty-one of them developed esophageal strictures, within 45 days after ingestion successfully treated by endoscopic dilatation in 12. The remaining 19 underwent delayed esophageal reconstruction. Overall, 27 patients (38 %) kept a native functioning esophagus.
Conclusion: Early contrast-enhanced CT-scan allows safe and accurate assessment of esophageal intramural necrosis after corrosive ingestion and increases the rate esophageal preservation.

B-0188 11:02

Patients with acute pancreatitis: is computed tomography always necessary?

M. Karul, M. Avanesov, T. Kraus, K. Bachmann, T. Derlin, G. Adam, J. Yamamura; *Hamburg/DE (m.karul@uke.de)*

Purpose: To compare findings on computed tomography (CT) in patients with acute pancreatitis (AP) with lab tests (CRP, lipase, creatinine) considering the revised Atlanta classification 2012.
Methods and Materials: 102 consecutive patients with AP underwent contrast-enhanced abdominal CT more than 6 days after onset of acute abdominal pain. Two blinded readers assigned patients into one of three groups (GR). Patients in GR1 had no signs of AP, patients in GR2 showed edematous organ swelling and peripancreatic fluid collection and patients in GR3 showed pancreatic necrosis with lack of parenchymal contrast-enhancement. Mann-Whitney's U test was used to evaluate differences in lab findings between GR1-GR3 prior to CT. Cut-off values for CRP, lipase, and creatinine were calculated using ROC curve analysis.
Results: Using CT, 31/102 patients (30.4%) were classified as GR1, 54/102 patients (52.9%) as GR2, and 17/102 patients (16.7%) as GR3. Statistical analysis showed significant CRP differences between GR2 vs. GR3 (p=0.001; cut-off point: 82 mg/L; AUC 0.76) as well as between GR1 vs. GR3 ($p < 0.001$; cut-off point: 98 mg/L; AUC 0.84). The comparison between GR2 vs. GR3 and GR1 vs. GR3 revealed no significantly different lipase (p=0.35; AUC 0.58/p=0.85; AUC 0.52) or creatinine levels (p=0.96; AUC 0.5/p=0.24; AUC 0.6).
Conclusion: In patients with AP, CT may help when CRP values are highly elevated to rule out complications such as pancreatic necrosis. In contrast, lipase and creatinine are poor predictors. Patients with mild to moderate elevated lab parameters could be saved from unnecessary CT examinations.

B-0189 11:10

The CT "capsular sign": a specific finding of acute adrenal ischemia

M. Moschetta, M. Telegrafo, A. Pignatelli, A. Stabile Ianora, G. Angelelli; *Bari/IT (marco.moschetta@gmail.com)*

Purpose: To evaluate the diagnostic accuracy of a new CT sign in order to define or exclude an initial phase of adrenal ischemia.
Methods and Materials: 69 patients suspected of having adrenal ischemia underwent 320-row CT examination. CT multi-planar images were evaluated searching for the patency of adrenal arterial and venous vessels, adrenal gland volume and the presence of the "capsular sign" represented by the evidence of a peripheral subtle hyper-dense line around an hypo-dense enlarged adrenal gland. All CT findings were then compared with the surgical findings (n=5), follow-up examinations (n=20) or autopsy (n=4). Sensitivity, specificity, diagnostic accuracy (DA), positive predictive value (PPV) and negative (NPV) were calculated for the "capsular sign" and represented by ROC analysis.
Results: Acute adrenal ischemia occurred in 29/69 patients (42%), unilateral in 20 and bilateral in 9. Venous thrombosis was found in 20/29 (69%) and arterial hypo-perfusion in 9/29 (31%). The sign was found in 24/29 patients (83%). Sensitivity, specificity, DA, PPV and NPV values of 83%, 100%, 93%, 100% and 89%, respectively, were obtained.
Conclusion: The "capsular sign" represents a CT finding to be searched when an acute adrenal pathological condition is suspected. Its evidence correlates to acute ischemia with a 100% probability and when it is not found, the probability of a non-ischemic condition is 89%.
The proposed CT "capsular sign" could represent a specific finding of acute adrenal ischemia and it could lead to a prompt diagnosis in the early phase of the disease.

B-0190 11:18

Acute appendicitis - CT or ultrasound in patients with differing body mass indices: a comparative assessment

M. Khanna, S. Abusamaan, S. Ramanathan, H. Hena, D. Panwar, B. Rao; *Doha/QA (khanna.maneesh@gmail.com)*

Purpose: To compare the diagnostic performance of graded compression USG and CT in the diagnosis of acute appendicitis in patients with differing ranges of body mass index (BMI).
Methods and Materials: 100 adult patients with suspected acute appendicitis were prospectively evaluated with CT abdomen (with rectal and intravenous contrast) followed by USG by two separate and blinded radiologists. BMI was recorded and outcomes were correlated with histopathology.
Results: 82/100 patients were included in the study who underwent surgery and were histologically positive for appendicitis. USG was positive in 72 (87.8 %) and CT in 79 cases (96%). Irrespective of the BMI, Sensitivity, Specificity, PPV and NPV for USG was 87%, 95%, 99% and 62% and for CT it was 96%, 95%, 99% and 86% respectively. Among the 65 (79%) cases in the normal BMI range, CT was positive in all cases while USG was negative in 9 (14%) cases. Appendix was retrocecal (5) or retroileal (4) in location in these 9 USG negative cases. USG was positive in 12 (92 %) and CT in 13 (100%) cases in the high BMI group. One USG negative case had retrocecal appendix. Low BMI group had 4 (5%) cases. USG was positive in all cases whereas CT was negative in 3 cases.
Conclusion: Irrespective of BMI, USG has a comparable accuracy to CT (87 vs. 96%).It is the retrocecal or retroileal location, which reduces the diagnostic performance of Ultrasound, not the BMI. USG performs better than CT at least in low BMI group

B-0191 11:26

Is CT transrectal enema useful in staging acute colonic diverticulitis?

M. Gentiluomo, D. Artioli, G. Chirico, A. Mariani, L. Ponzini, O. Chiara, S. Sironi, A. Vanzulli; *Milan/IT (maria.gentiluomo@alice.it)*

Purpose: The aim of this study is to assess if transrectal enema can increase the diagnostic accuracy of CT in patients with acute diverticulitis.
Methods and Materials: Since May 1, 2012 to December 31, 2013, 100 patients underwent urgent CT-scan without and with transrectal enema (Gastrografin, Bayer) and with or without iv contrast, performed on a 128-slice CT (Somatom Definition; Siemens). All were independently reviewed by two expert radiologists. Reviewers were asked to classify the severity of disease according to a modified Hinchey's classification. They were blinded to clinical data and other imaging examinations. Results were compared to surgical and clinical indings.
Results: 50 patients had score 1a, 20 1b, 5 2a. 25 patients underwent surgical intervention: 10 stage 4 and 15 stage 2b or 3. All patients with score 1a and 1b were correctly staged in all image sets. Patients with score 2a were correctly staged in 94% of cases by unenhanced and enema CT; iv contrast added information about abscesses (correct stage 100%). Patients with score 2b, 3 or 4 were correctly staged with rectal constrast in 98% of cases and without rectal constrast in 93% of cases.
Conclusion: CT transrectal enema is not always useful in staging diverticulitis. It does not increase diagnostic accuracy of CT in patients with non-surgical acute diverticulitis, but can change treatment strategy in patients with surgical acute diverticulitis. So it is indicated when there is a discrepancy between clinical conditions and radiological findings or when there is an evidence of diffuse peritonitis.

B-0192 11:34

Utilising contrast-enhanced CT for detecting post-traumatic placental abruption: assessing accuracy and comparison with ultrasound

P. Jha[1], G. Melendres[2], B. Bijan[2]; [1]*San Francisco, CA/US*, [2]*Sacramento, CA/US (priyankajha1983@gmail.com)*

Purpose: 1. Assessment of post-traumatic placental abruption in pregnant patients on contrast-enhanced CT (CECT). 2. Detection of placental abruption with CECT vs Ultrasound (US) was compared.
Methods and Materials: PACS database at our Level 1 trauma center was searched using keywords pregnancy, trauma and/or placental abruption over 10 years' duration. Exclusion criteria was non-contrast imaging. CT findings were compared to US,if performed within 24-hour interval. Total 36 patients, 1 with twin pregnancy,underwent CECT. Of these, 27 had US performed within 24 hours. 2 subspecialty-trained readers blindly reviewed CT and US images. Pregnancy outcome and placental features on delivery were used as reference standard. Lack of adverse pregnancy/foetal outcome was treated as absence of abruption.
Results: 3 cases of complete & 8 cases of partial abruption were present. Sensitivity was 100% for both reviewers and specificity was 54.5% & 56.7%. Most of false positive results were misinterpreted normal placental structures such as cotyledons, venous lakes, age-related infarcts, etc. misinterpreted as abruption. On US, fetal demise was noted in all cases of complete abruption. No localized abruption demonstrated with both partial and complete abruption.
Conclusion: Abruption is accurately identified on CECT with high sensitivity but low specificity. It's crucial to avoid pitfalls from normal structures of cotyledons, venous lakes, age-related infarcts and marginal sinus, mimcking abruption. Contrast timing is important, with most optimal evaluation on delayed phases. US is a widely accepted but limited modality markedly underdiagnosing abruption.

B-0193 11:42

High-pitch low-dose paranasal sinus CT in drunken emergency room patients after assault: initial results on image quality and dose with third-generation dual-source CT

C. Frellesen, P. Dewes, B. Schulz, J.-E. Scholtz, M. Kerl, T.J. Vogl, R. Bauer; *Frankfurt a. Main/DE (c.frellesen@gmail.com)*

Purpose: Image quality benefits from high-pitch scanning in agitated patients by freezing patient motion. We compared image quality and exposure parameters in patients with suspected facial skull fractures on second- and third-generation dual-source CT (DSCT).
Methods and Materials: 30 patients of the first group were examined on a second-generation DSCT (Flash, Siemens; fixed 120 kV/50 mAs, pitch 3.0). In the second and third group, 30 patients each were examined on a third-generation DSCT (Force, Siemens) with fixed 120 kV and automated exposure control (AEC) with 50 ref.mAs and pitch factors of 2.2 and 3.0, respectively. Images in groups 2 and 3 were reconstructed with iterative reconstruction (ADMIRE), in group 1 with FBP. CTDIvol, DLP, acquisition time and subjective image quality were compared.
Results: Median CTDIvol (2.76/ 0.67/ 0.63 mGy) and DLP (55/ 13/ 12 mGycm) were significant lower in both groups scanned on the third-generation DSCT with AEC (-76%/-78%; $p < 0.0001$ for both) without significant difference among each other. Subjective image quality was rated better in group 1 and 2 than in group 3 due to strong high-pitch artefacts in the latter group (average scores: 1.62/1.67 vs. 1.80/1.73 vs. 2.27/2.20). Median acquisition time was significant faster in groups 2 and 3 (420 ms/ 360 ms/ 260 ms; $p < 0.05$).
Conclusion: Third-generation DSCT yields faster acquisition times and substantial radiation dose reduction. A pitch of 2.2 should be preferred since high-pitch artefacts can be avoided. Although AEC was used, image quality remains stable and reliable with iterative reconstruction.

B-0194 11:50

Intravenous and oral contrast vs intravenous contrast alone CT for the visualisation of appendix and diagnosis of appendicitis in adult ED patients

A. Wadhwani, L. Guo, E. Saude, H. Els, E. Lang, A. MacRae, D. Bhayana; *Calgary, AB/CA (aman.wadhwani@me.com)*

Purpose: Compare radiologist's ability to 1. visualize the appendix, 2. diagnose acute appendicitis, and 3. diagnose alternative pathologies responsible for acute abdominal pain amongst three groups of patients undergoing abdominal CT scan with: IV contrast-only; IV and oral contrast with 1 hr transit time; or IV and oral contrast with 3 hr transit time.
Methods and Materials: Data was collected from 225 patients who presented to our emergency department. 75 consecutive patients with clinical suspicion of appendicitis received 3 hr oral and IV contrast (IVO3), 75 received 1 hr oral and IV contrast (IVO1), and 75 trauma patients received IV contrast only (IV). 3 radiologists retrospectively analysed cases; documented visualisation of appendix in all 3 groups and their confidence in diagnosing appendicitis in IVO1 and IVO3. Final diagnoses were derived from a combination of surgical or pathologic reports.
Results: The average frequency of visualising appendix amongst three readers within the IV, IVO1, and IVO3 were 87.4%, 94.1%, and 93.8%. Inter-rater reliability coefficient for identifying the appendix in IV, IVO1, and IVO3 groups were 0.74, 0.84, and 0.76, respectively. Sensitivity and negative predictive value in the diagnosis of acute appendicitis in the IVO1 and IVO3 groups was 100%. Specificity for IVO1 and IVO3 were 94.1% and 96.1%, respectively, and positive predictive value for both groups was 92%.
Conclusion: No statistically significant difference was found in reader confidence in visualising the appendix in the presence or absence of oral contrast. IVO1 and IVO3 regimens have a similar diagnostic performance in diagnosing appendicitis.

10:30 - 12:00 **Room MB 5**

Neuro

SS 211b

Vascular disorders, diagnosis and treatment

Moderators:
K.D. Kurz; Stavanger/NO
Z. Merhemic; Sarajevo/BA

B-0195 10:30

Feasibility and validity of monitoring subarachnoid haemorrhage by a noninvasive MRI imaging perfusion technique: pulsed arterial spin labelling (PASL)

M. Labriffe, A. Ter Minassian, A. Pasco-Papon, S. N'Guyen, C. Aubé; *Angers/FR (matthieu.labriffe@gmail.com)*

Purpose: To evaluate the validity of pulsed arterial spin labelling (PASL) imaging with cerebral blood flow (CBF) quantification for monitoring subarachnoid haemorrhage (SAH); to describe changes in the perfusion signal in the absence of or following several classic complications.
Methods and Materials: 15 patients and 14 healthy volunteers were assigned to SAH and control populations, respectively. ASL imaging was performed three times: between Day 0 (D0, i.e., day of onset of SAH symptoms) and D3, between D7 and D9 and between D12 and D14. ASL points were classified as complicated (symptomatic vasospasm, intraparenchymal haematoma or severe intracranial hypertension) or uncomplicated. Perfusion and CBF maps were generated after automated processing. The inversion time (TI) was fixed at 1800 ms.
Results: CBF mean value of Day0-3 uncomplicated SAH patients (47 ± 11.7 mL/min/100 g) was significantly higher than that of the volunteers (36.5 ± 7.6 mL/min/100 g; p=0.014). In a case-by-case analysis, we observed a global or regional hypoperfusion pattern when SAH was complicated by vasospasm or severe intracranial hypertension, particularly at the junctional areas. Furthermore, we have faced major vascular artefacts, visible as serpiginous high signals and related to the retention of labelled protons in arteries concerning by angiographic vasospasm.
Conclusion: PASL is an interesting perfusion technique to non-invasively highlight perfusion changes in complicated SAH and can provide a new element in the decision to perform urgent endovascular treatment. However, the increase in arterial transit time makes the Buxton quantification model inapplicable and leads to false high CBF values in the single-TI PASL technique.

B-0196 10:38

Intra-arterial infusion of milrinone in the treatment of severe symptomatic cerebral vasospasm in patients with aneurysmal subarachnoid haemorrhage: first experience

F. Thaher, N. Hopf, P. Kurucz, A.-K. Hickmann, M. Aguilar Pérez, W. Kurre, O. Ganslandt, H. Henkes; *Stuttgart/DE (firas.thaher@gmail.com)*

Purpose: The treatment of cerebral vasospasm (CVS) is still a challenge in the treatment of patients with aneurysmal subarachnoid haemorrhage (SAH). Milrinone, a phosphodiesterase inhibitor, which combines vasodilating and inotropic properties may become an alternative. We report our first experiences with intra-arterial infusion of milrinone in the treatment of severe CVS secondary to SAH.
Methods and Materials: Ten patients with severe symptomatic CVS have been treated. All patients were monitored by transcranial Doppler sonography (TCD) and serial clinical evaluation of neurologic status. In intubated and sedated patients, brain tissue oxygenation (ptio2) was monitored. If symptomatic vasospasm became apparent (pathologic TCD velocity, pathologic ptiO2 value, new neurologic deficits), conservative treatment was initiated. If symptoms did not improve, CT angiography (CTA) was performed. In case of suspected vasospasm by CTA, digital subtraction angiography (DSA) was conducted for confirmation and possible intervention. In case of confirmed vasospasm, milrinone (8 mg) was administered intra-arterially in the involved cerebral territories as a single infusion over 30 minutes. Post-interventionally neurological status, TCD, vessel size by DSA, and clinical outcome using the modified ranking scale was analysed.
Results: Immediate visible increase in arterial diameter by DSA could be stated in 9 of 10 patients. Seven patients experienced neurologic improvement following milrinone infusion. In five patients, a decrease in blood flow velocity measured by TCD was documented. Two intubated and sedated patients showed a relevant increase in ptiO2. Recurrence of vasospasm was seen in 3 patients.
Conclusion: Intra-arterial single milrinone application appears to be safe with an immediate and persisting effect.

B-0197 10:46

Safety and efficacy of a new device for the treatment of wide neck bifurcation aneurysms (pCONus): initial results and long-term follow-up

M. Aguilar Pérez, W. Kurre, E. Henkes, O. Ganslandt, H. Bäzner, H. Henkes; *Stuttgart/DE (martaaguilarperez@yahoo.es)*

Purpose: Wide neck bifurcation aneurysms (WNBA) are considered to belong to the subgroup of aneurysms with increased difficulty and risks. Balloon remodelling and stent remodelling are known techniques for their treatment. pCONus is a self-expanding, retrievable, electrolytically detachable device with a proximal shaft, 4 distal petals and a nylon cross in the distal end of the shaft. The device is made to bridge the orifice of WNBA to allow coil occlusion. It combines elements of "waffle cone" stent deployment and the no longer available TriSpan Device. Our purpose was to evaluate the safety and efficacy of this device.
Methods and Materials: 50 consecutive patients underwent endovascular treatment of WNBA using pCONus between February 2012 and April 2014. Target vessels included the anterior circulation in 39 (79%) and the posterior circulation in 11 (22%). 13 patients were treated in the setting of acute subarachnoid haemorrhage (26%).
Results: Neither technical failure nor rupture was encountered. Acute thrombi formation was observed in only one patient (2%), which resolved after the administration of a body weight-adapted bolus dose of eptifibatide. After the initial procedure, total occlusion was achieved in 22 (44%) patients and a neck remnant was evident in 15 (30%). Follow-up angiography was available in 40 patients and demonstrated complete occlusion in 23 (57.5%). Evident coil compaction requiring re-treatment was observed in nine patients. pCONus also assisted re-coiling.
Conclusion: pCONus allows controlled coil occlusion of WNBA, both ruptured and unruptured. Major complications are rare.

Author Disclosures:
M. Aguilar Pérez: Consultant; phenox. **W. Kurre:** Consultant; phenox. **H. Henkes:** Consultant; phenox. Founder; phenox. Shareholder; phenox.

B-0198 10:54

Flow diverters: a curative endovascular treatment for ruptured intracranial blister-like aneurysms

S. Deepalam, S. Joseph, N. Mulimani; *Chennai/IN (saikanthdeepalam@yahoo.co.in)*

Purpose: Data on durability and success rate of Flow Diverters (FDs) as a new emerging endovascular device in treatment of ruptured blood blister aneurysms is limited. We report our clinical and angiographic outcomes of five patients with ruptured blister-like aneurysms who underwent reconstructive endovascular treatment using flow diverters.
Methods and Materials: We present 5 cases of ruptured blister-like aneurysms treated with flow diverter device during year 2013-2014. Data including demographics, aneurysm location, clinical presentation, complications, follow-up angiographic and clinical (GOS and mRS) information for up to 6 months to one year is presented.
Results: Five patients (aged between 40-60 yrs) who presented with aSAH (Fischer Grade II - 2 patients and Fischer Grade III - 3 patients) had GCS of 12/15 in 3 patients and 14/15 in 2 patients were diagnosed to have blister-like aneurysms [basilar trunk, azygos ACA, ACOM complex, pericallosal artery and cavernous ICA were treated with Flow Diverters. Median time of treatment was 4 days with no procedure related complications. Occlusion rate was 100% in four patients on six months follow-up with GOS of 5 in 4 (80%) patients and 4 in 1 (20%) patient. 1 (20%) patient developed delayed complication in the form of instent thrombosis secondary to noncompliance to antiplatelet regimen.
Conclusion: Flow diverting devices for the management of ruptured blister-like aneurysms in acute and subacute settings offer a safer and more ideal solution with low morbidity-mortality, high angiographic complete occlusion rates.

B-0199 11:02

Basilar tip aneurysms and fetal PCAs: do they really coexist?

M.C. Diogo[1], I. Fragata[1], J. Nunes[2], J. Pamplona[1], J. Reis[1]; [1]*Lisbon/PT*, [2]*Gaia/PT (mariana_cdiogo@hotmail.com)*

Purpose: Basilar tip aneurysms (BTA) are multifactorial in origin, with luminal forces playing a major role in their formation. Fetal origin of the posterior cerebral artery (fPCA) is a variant of the basilar bifurcation, present in around 20% of the population. We theorize that this variant, by diminishing sheer stress of the basilar apex wall, reduces the chances of aneurysm formation. The purpose of our study was to test the hypothesis that fPCA is less prevalent in patients with BTA then in the general population.

Methods and Materials: We retrospectively analyzed consecutive basilar tip aneurysms diagnosed by catheter angiography between July 2010 and January 2014. Anatomical variants of the distal basilar artery region were assessed. Descriptive statistics was used to characterize the population. A binomial analysis was used to test our null hypothesis (patients with BTA have the same prevalence of fPCA as general population). Probability value used was P=0.2 (from literature review).
Results: A total of 41 BTA cases were identified (N=41). No fPCA were found (x=0). We found this to be a statistical significant association with a p=0.0001. Basilar tip disposition was cranial in 43.9% and caudal in 56.1%. The most common arterial variation found was ASCA duplication (unilateral 17.1%/bilateral 4.9%).
Conclusion: Although we analysed a small population of consecutive basilar tip aneurysms, we found a statistical significant association between the absence of fPCA and BTA. The most common basilar tip configuration found in our population was caudal, which is in concordance with available literature.

B-0200 11:10

Optimising the resting state fMRI processing pipeline using a data-driven approach

L.R. Kozák, G. Dávid, Á. Szabó, G. Rudas, S. Dávid; *Budapest/HU (lkozak@mrkk.sote.hu)*

Purpose: Resting state functional MRI (rs-fMRI) examinations are gaining importance in clinical practice as they are quick, easy to perform, do not require patient cooperation, and automated processing pipelines lead to results with minimal user interaction. Still, the lack of a widely accepted processing pipeline makes comparison of results cumbersome. We aimed to determine the optimal processing pipeline for rs-fMRI analysis using a data-driven approach.
Methods and Materials: rs-fMRI data of 32 healthy participants (age: 25.3±5.3, 20 males) were collected on a 3-T Philips Achieva scanner (TR: 2000 ms, TE: 30 ms, 36 slices, 3x3x4 mm voxels, 260 volumes). Data were processed in different pipelines with different combinations of smoothing, band-pass filtering, motion correction, mean white matter / mean cerebrospinal fluid /global signal regression, anatomically derived principal component regression. Data-driven optimization was based on maximisation of derived correlation metrics within subdivisions of the default mode network and the dorsal attention system with a concurrent minimisation of correlation metrics between primary motor, visual and auditory cortices.
Results: The optimal pipeline consists of spatial smoothing, bandpass-filtering, motion regression, and the filtering of 5-5 principal components derived from white matter and cerebrospinal fluid compartments. Despite the tuning, motion regression cannot fully eliminate motion-derived spurious correlations.
Conclusion: It is possible to tune rs-fMRI processing by concurrently maximising correlations in connected networks and minimising correlations between unconnected regions of interest. It is easy to generalise our method to assess other possible processing pipelines. Residual motion-derived signal fluctuations need further investigation.

Author Disclosures:
L.R. Kozák: Grant Recipient; Bolyai Research Fellowship, Hungarian Academy of Sciences, KTIA-NAP_13-1-2013-0001, Hungary.

B-0201 11:18

Comparison of image quality and radiation dose: cerebral CT angiography (CTA) using 120 kVP vs 100 kVP protocols in patients with clipped aneurysm

H. Park, H. Choi, B.-M. Gil, J. Jang, S. Jung, K.-J. Ahn, B.-S. Kim; *Seoul/KR (cocohyeju@hanmail.net)*

Purpose: The purpose of this study was to compare image quality and radiation dose between 120 kVp and 100 kVP protocols, in both phantom study and CT angiography images in patients with clipped aneurysm.
Methods and Materials: An experimental phantom was made using saline, diluted iodine contrast media, plastic syringe, and titanium clip. The phantom was imaged by two different CT protocols: 120 kVp with 200 mAs (standard dose) and 100 kVp with 250 mAs (low-dose). Two reviewers blinded with protocol used, rated the degree of beam hardening artifact in images. Thirty patients, who underwent both CTAs with standard protocol (120kvp) and low-dose protocol (100kvp) between Jan, 2011 and Mar, 2013 were enrolled. Overall and local image quality around clipping site was scored by the five-point system. CTDIvol was calculated automatically by CT console. Paired t-test or Wilcoxon signed rank test was performed for comparison of image quality and CTDIvol.
Results: Low-dose CTA protocol did not produce significantly different degree of beam hardening artifact in the phantom study. Local and overall image quality of CTA using the low-dose protocol was not significantly different in patients with clipped aneurysm. However, CTDIvol was significantly lower in low dose protocol (21.24 vs. 28.25 mGy in phantom study; 38.79±7.70 vs. 42.88±8.68 in patient study).
Conclusion: Low-dose CTA protocol using 100 kVp was not different in terms of image quality for patients with surgically clipped aneurysm.

B-0202 11:26

Final report of the Polish multicentre study for evaluation of CT angiography in the diagnosis of brain death

M. Sawicki[1], R. Bohatyrewicz[1], A. Walecka[1], J. Walecki[2], O. Rowiński[2], J. Sołek-Pastuszka[1], Z. Czajkowski[1], P. Skrzywanek[3], M. Guziński[4]; [1]*Szczecin/PL*, [2] *Warsaw/PL*, [3]*Poznań/PL*, [4] *Wrocław/PL (msaw@pum.edu.pl)*

Purpose: To assess the sensitivity of cerebral CT angiography (CTA) as a confirmatory test for diagnosing brain death (BD).
Methods and Materials: Eighty-two patients, who fulfilled standard clinical BD criteria, were examined in 7 cooperating centres in Poland. Examination protocol consisted of two-phase CTA with a delay of 25 and 60 seconds after contrast administration. CTA was interpreted as positive, i.e. consistent with BD diagnosis if the 60-second phase revealed bilateral non-filling of cortical segments of the middle cerebral artery (MCA-M4) and the internal cerebral vein (ICV). This 4-point grading system was proposed by Leclerc et al. in 2006. Sensitivity of CTA was compared to the reference method, cerebral catheter angiography.
Results: Catheter angiography confirmed BD in all 82 cases. CTA was consistent with the diagnosis of BD in 76 cases and had the sensitivity of 92.7% (95% CI is 84 to 97%). Decompressive craniectomy predisposes to persistent filling of MCA-M4 and/or ICV in brain-dead patients causing false-negative result of CTA. The relative risk is 3.13 times higher than in patients without a craniectomy (95% CI is 1.70 to 5.77; p=0.0002). Another factor predisposing to false-negative result of CTA is SAH or pseudoSAH with the relative risk 2.98 times higher than in cases without SAH/pseudoSAH (95% CI is 1.14 to 7.78; p=0.0255).
Conclusion: CTA with the 4-point scale is highly sensitive test for BD diagnosis. Nevertheless, introduction of CTA as reliable ancillary test cannot be recommended without evaluation of specificity, which has not been comprehensively studied yet.

Author Disclosures:
R. Bohatyrewicz: Research/Grant Support; Grant from the State Committee for Scientific Research of Poland N N403 171137.

B-0203 11:34

Postmortem interval estimation: value of postmortem cerebral CT

D.H.J.L. Koopmanschap, A.R. Bayat, D. Bosboom, K. Kamphuis-Van Ulzen, W.M. Prokop, W.M. Klein; *Nijmegen/NL (dkoopmanschap@gmail.com)*

Purpose: After death a series of changes naturally occurs in the human body. Understanding these changes and the contributing factors will lead to a better understanding of the normal process of hypostasis and decomposition, a better estimation of the postmortem interval (PMI) and thus to a better diagnosis of cause and time of death. The aim of this study was to investigate the correlation between the PMI and postmortal intracranial density measurements.
Methods and Materials: We retrospectively investigated 63 postmortal cerebral CT scans. We measured the density in Hounsfield units (HU) of the dorsal part of the superior sagittal sinus, both vitreous humors, both anterior and posterior horn of lateral ventricles, left frontal lobe, left caudate nucleus, right parafalcine, left dentate nucleus and right cerebellar hemisphere. Correlation between density and PMI was determined using linear regression and is reported using the Pearson's correlation coefficient.
Results: The PMI range was 2.95-69.2 hours. All densities showed significant increase over time. The density of liquor and the density of the right cerebellar hemisphere showed the highest correlation with the PMI of all intracranial regions of interest (resp. r=0.69 and r=0.68, both $p < 0.0001$).
Conclusion: The normal postmortal changes are detectable in density of the intracranial structures. This goes especially for the HU increase of liquor during the postmortem interval. This could be of great value for forensic methods to estimate the PMI and needs further prospectively investigation, which we are currently performing.

B-0204 11:42

Evaluation of the degree of arteriovenous shunting in intracranial arteriovenous malformations using pseudo-continuous arterial spin labeling MRI

L. Sunwoo, C.-H. Sohn; *Seoul/KR (leonard.sunwoo@gmail.com)*

Purpose: Intracranial arteriovenous malformations (AVMs) display venosinus signals on arterial spin labeling (ASL) due to the presence of arteriovenous shunting. Our aim was to quantitatively correlate venosinus signal intensity on ASL with digital subtraction angiography (DSA) in AVMs.
Methods and Materials: Magnetic resonance imaging including pseudo-continuous ASL at 3 T and DSA were obtained on the same day in 40 patients with intracranial AVMs. Two reviewers assessed the nidus, venous, and sinus signal intensities on ASL images to determine the presence of arteriovenous shunting. Interobserver agreement on ASL between the reviewers was determined. Venosinus ASL signal intensity was correlated with AVM size and the time difference between normal and AVM venous transit times measured from the DSA images.
Results: Interobserver agreement between two reviewers for nidus, venous and sinus signal intensity was moderate-to-excellent (κ = 0.44, 0.66, and 0.83, respectively). Interobserver agreement regarding the presence of arteriovenous shunting was good (κ = 0.79). Sinus signal intensity showed a positive relationship with the time difference between normal and AVM venous transit times ($P < 0.0001$). Sinus signal intensity also demonstrated a positive relationship with AVM size ($P = 0.0001$).
Conclusion: Venosinus ASL signal intensity in patients with AVM correlates well with the degree of early vein opacification on DSA, which corresponds to the degree of shunting.

B-0205 11:50

Evaluation of contrast-enhanced MR angiography and time of flight MR angiography at 3 Tesla in previously coiled intracranial aneurysms

N. Khandelwal, A. Mahajan, V. Gupta, A. Kumar, S. Mathuriya, S. Gupta; *Chandigarh/IN (khandelwaln@hotmail.com)*

Purpose: To compare CE-MRA with 3D time of flight (3D TOF) MRA and DSA in the follow-up of coiled cerebral aneurysms.
Methods and Materials: In a prospective comparative study, 23 consecutive patients (17 females, 6 males; median age 49.5 years) with 24 saccular aneurysms treated with endovascular coiling underwent simultaneous 3 T TOF-MRA, CE-MRA and DSA at follow-up within 10 days of each other. Comparison of aneurysm remnant size using paired t test was done between them. The image quality was compared between MRA TOF and CE-MRA using Wilcoxon Signed Rank test.
Results: The mean size of aneurysm remnant on MRA TOF was 4.095±4.36 mm which was less than that on other modalities: - 4.57±4.50 mm on CE-MRA, 4.65±4.47 mm on 2D DSA and 5.78±4.53 mm on 3D DSA ($p < 0.001$ between TOF MRA and DSA). Quality of images on MRA TOF was graded as 1 (good) in 12 (50%) of the cases, 2 (fair) in 7 (29.1%) cases and 3 (poor) in 5 (20.8%) of the cases. There was significant difference between the image quality of the MRA TOF and CE-MRA (P=0.012).
Conclusion: CE-MRA was observed as the better imaging technique compared to MRA TOF in terms of quality, especially in case of stent-assisted coiling. CE-MRA is an excellent alternative to 2D DSA in detection of coiled aneurysm remnant and evaluation of parent vessels status also. 3D DSA is superior and MRA TOF is inferior to all other modalities in assessing the size of residual filling space in the embolised aneurysm measured at the follow-up.

14:00 - 15:30 **Room A**

Breast

SS 302a

Breast density and imaging biomarkers

Moderators:
L.A. Carbonaro; San Donato Milanese/IT
C. Colin; Lyon/FR

B-0206 14:00

Mammographic density is the main correlate of tumours detected on ultrasound but not on mammography

P.A. Fasching, B. Brehm, L. Haeberle, S.M. Jud, A. Hartmann, M. Meier-Meitinger, M. Uder, M.W. Beckmann, R. Schulz-Wendtland; *Erlangen/DE (peter.fasching@uk-erlangen.de)*

Purpose: The aim of the present study was to develop a prediction model capable of identifying women with invasive breast cancer that is invisible on mammography but detectable by ultrasound, defined as mammography failure.
Methods and Materials: A total of 1399 women with invasive breast cancer were included in this retrospective study. For inclusion, mammograms for computer-assisted assessment of percentage mammographic density (PMD) had to be available, as well as Breast Imaging Reporting and Data System (BIRADS) assessment of mammography and systematic breast ultrasound. Logistic regression analyses with detection status as the outcome and several predictors, including PMD, were carried out to estimate the probability of a tumour being detected with ultrasound alone.
Results: Tumours were only visible on ultrasound in 107 cases (7.6%). PMD was the strongest predictor for mammography failure, but age, body mass index (BMI) and previous breast surgery also modified the risk independently of the PMD. A total of 19.3% of all tumours were not detected in women with a mammographic density ≥ 50%, in comparison with only 4.2% in women with a density < 50%. Previous breast surgery, young age, and low BMI increased the risk further.
Conclusion: This article presents a predictive model for mammography failure and tumour visibility on breast ultrasound. The model could be further developed to help identify women who should be offered breast ultrasound during mammography screening.

Author Disclosures:
P.A. Fasching: Advisory Board; Novartis, Roche. Research/Grant Support; Amgen, Novartis. Speaker; Amgen, Novartis, Roche, Pfizer, Genomic Health, GSK.

B-0207 14:08

A preliminary retrospective study to determine early mammographic breast density reduction following treatment

L. Metaxa[1], L. Leong[2], S.W. Duffy[1], T. Suaris[1]; [1]*London/UK*, [2]*Singapore/SG (linda.metaxa@bartshealth.nhs.uk)*

Purpose: Endocrine therapy is associated with mammographic density (MD) reduction. However, it is unclear how early it affects MD and what ages are most affected.
Methods and Materials: All diagnostic and subsequent mammograms in a cohort of patients diagnosed with breast cancers from January to December 2008 were reviewed. MD was assessed visually and scored from 0-100%, and changes between successive mammograms measured. Both short-term and long-term changes were assessed in age subgroups, according to the type of endocrine therapy. Significance was assessed using chi-squared test.
Results: 181 patients had valid data. The patients were separated in 5 age groups (30-39.9.40-49.9.50-59.9.60-69.9 and 70-90). 20 (11%) patients demonstrated reduction in MD within the first mammogram, increasing to 42 (23.2%) after prolonged follow-up. Patients treated with tamoxifen had the greatest MD reduction compared with either aromatase inhibitors (AIs) or Herceptin subgroups. 24/ 56 (43.6%) patients receiving tamoxifen showed a reduction in MD, compared to 13/ 72 patients (18.01%) and 0 out of 7 patients (0%) receiving AIs and Herceptin, respectively. Comparing age groups identifies the greatest reduction in MD (50%) in the 30-50 years age range. 120 patients had follow-up mammograms within 12 months of starting therapy. 13 (10.8%)had MD reduction. 69.2%(9/13) of patients on tamoxifen showed a density reduction compared to 30.8%(4/13) in the Aromatase Inhibitors group ($p < 0.001$).
Conclusion: This preliminary study shows that the effects of tamoxifen on reduction of MD can occur well within 1 year of starting therapy, with greater effect in younger ages. Aromatase inhibitors also reduce MD, but in elder patients.

B-0208 14:16

Inter-rater variability for breast density classification between American and British radiologists

W. Alomaim[1], S. Foley[1], J. Ryan[1], M. Evanoff[2], L.A. Rainford[1], D. O'Leary[3]; [1]*Dublin/IE*, [2]*Tucson, AZ/US*, [3]*Hatfield/UK (WIJDAN.1984@HOTMAIL.COM)*

Purpose: Recently several American states have passed legislation that compel Radiologists to include density in the patients reports. Since the definitive cancer diagnosis is highly dependent on the breast density of the patient, it is essential to have an accurate classification. This study investigated inter and intra-observer variance in the BI-RADs classification system between expert readers.
Methods and Materials: Expert readers from two countries (UK and USA) were opportunistically recruited to review sets of anonymised mammographic images (n=170) and to subjectively rate the breast density according to the BI-RADs categorisation. Images were reviewed using standardised viewing conditions and Ziltron software. Inter-rater reliability was tested using the intra-class coefficient (ICC).
Results: The USA Radiologists (n=25) judged fewer images as being 'mostly fatty' than UK Radiologists (n=24), leading to more images being classified in the higher BI-RADs categories. The overall ICC for all image sets is very high, being > 0.9; indicating very high overall levels of agreement between the USA and UK Radiologists. When the data set is split into individual breast density categories this agreement becomes more variable without an overall discernible pattern.
Conclusion: Overall agreement levels are high between radiologists using BI-RADs classification but individual discrimination differences exist which may alter patient imaging pathway.

Author Disclosures:
W. Alomaim: Research/Grant Support; Ministry of Higher Education -Saudi Arabia.

B-0209 14:24

Comparison of two software-based methods for volumetric breast composition analysis

F. Engelken, C. Schmachtenberg, U. Bick; *Berlin/DE (florian.engelken@charite.de)*

Purpose: To compare two software-based methods for volumetric breast composition analysis, Quantra and Volpara.
Methods and Materials: We analysed 445 normal bilateral two-view digital mammograms using Quantra Version 2.0 and Volpara Version 1.4.3. Breast volume (BV), fibroglandular tissue volume (FTV) and percent density (PD) were recorded and compared. Curve fitting using linear, polynomial and logarithmic functions was performed to determine the best correlation between the results. Deming analysis was performed to obtain linear equations for mapping the results of one software to the other.
Results: Both methods agreed well on BV, but differed significantly for FTV and PD, with Quantra producing consistently higher values. Nevertheless, the results were highly correlated with Pearson correlation coefficients of 0.99, 0.91 and 0.94 for BV, FTV and PD, respectively. Linear, polynomial and logarithmic curve fitting produced similar goodness of fit. Intraclass correlation of quartiles of each parameter was 0.96, 0.86 and 0.90 for BV, FTV and PD, respectively. The association of breast density with patient age and the correlation of left and right breasts were similar for both methods. Mapping of the results onto each other using the linear equations obtained from Deming regression removed the systematic differences.
Conclusion: Although Quantra and Volpara produce very different nominal results for FTV and PD, the results are highly correlated and can be mapped onto each other using linear equations. An alternative is to use breast density and tissue volume quartiles for comparison. Results from methods correlate similarly with patient age and show similar measures of reproducibility.

Author Disclosures:
F. Engelken: Equipment Support Recipient; Matakina International Ltd.: Florian Engelken. **U. Bick:** Equipment Support Recipient; Hologic, Inc. Other; Holds a license agreement with Hologic, Inc., Receives royalties from Hologic, Inc.

B-0210 14:32

Low mammographic breast density and other mammographic characteristics are linked to Hyaluronan and HAS1-3 staining and survival in patients with early breast cancer

A.N.J. Masarwah, M. Sudah, A. Sutela, S. Oikari, M. Tammi, R. Vanninen, P. Auvinen; *Kuopio/FI (amro.masarwah@kuh.fi)*

Purpose: Low mammographic breast density (MBD) and increased Hyaluronan (HA) expression have been shown to have adverse effects on breast cancer prognosis. We aimed to study the possible underlying associations between mammographic characteristics, MBD and HA and its synthetizing isoforms in an attempt to uncover any potential underlying biological mechanisms and the possibility of a subsequent impact on patient treatment.
Methods and Materials: MBD and mammographic characteristics of 278 patients were classified according to percentile density (Very low density VLD; < 25%, Mixed Density MID > 25%) and the BI-RADS 5th edition system. Localization and expression of HA and HAS1-3 isoforms were evaluated immunohistochemically. Mammographic features were correlated with HA and HAS1-3 staining levels and their combined effect on patients' survivals were explored.
Results: VLD breasts were associated with increased levels of cellular HA, stromal HA, HAS2 and HAS3. Tumours presenting as masses had stronger staining of cellular HA and stromal HAS2, and irregular margin tumours stained stronger for stromal HA and HAS3. Only patients who combined both VLD breasts with strong HA staining showed a declining prognosis compared to weak staining (62.5% vs. 88.3%, $p < 0.001$) while no similar effect was observed in MID breasts (90.1% vs. 90.3%, p=0.995).
Conclusion: Our findings suggest a strong reciprocal relationship between low MBD and HA and its synthetizing isoforms. Moreover, both factors simultaneously are required for the adverse prognostic effect to take place which is particularly important because of the growing recent interest in HA targeted therapy and the possible substantial impact on patient treatment.

B-0211 14:40

Does the synthesised digital mammography (3D-DM) change the ACR density pattern?

P. Martínez-Miravete[1], M. Millor Muruzábal[2], P. García-Barquín[2], A. Elizalde[2], L. Pina[2], J. Etxano[2], P. Bartolomé[2]; [1]*Zaragoza/ES*, [2]*Pamplona/ES (mmillor@unav.es)*

Purpose: To evaluate the different ACR density patterns observed in Conventional Digital Mammography (2D-DM) compared to Synthethyzed Digital Mammography (3D-DM).
Methods and Materials: Two independent breast radiologists evaluated the ACR density patterns in a sample of 136 patients who underwent both 2D-DM and 3D-DM (with both views CC and MLO) in a clinical setting. Patients were classified according to their breast density pattern with 2D-DM and 3D-DM.Intraobserver and interobserver Kappa concordance indexes were calculated. All the statistical analyses were performed using SPSS 20.0 software.
Results: The distribution of the ACR density patterns for first reader was: ACR I 2D-DM=3 cases (2.2%), 3D-DM=3 cases (2.2%)(0 changes); ACR II 2D-DM=54 cases (39.7%), 3D-DM = 48 cases (35.3%) (-6 changes); ACR III 2D-DM=66 cases (48.5%), 3D-DM=61 cases (44.9%) (-5 changes); ACR IV 2D-DM = 13 cases (9.6%), 3D-DM = 24 cases (17.7%) (+11 changes). The intraobserver kappa index was 0.809 ($p < 0.001$). The distribution of the ACR density patterns for second reader: ACR I 2D-DM=12 cases (8.8%), 3D-DM =12 cases (8.8%) (0 changes); ACR II 2D-DM = 45 cases (33.1%), 3D-DM=43 cases (31.6%) (-2 changes); ACR III 2D-DM = 66 cases (48.5%), 3D-DM = 60 cases (44.1%) (-6 changes); ACR IV 2D-DM = 13 cases (9.6%), 3D-DM = 21 cases (15.4%) (+8 changes). The intraobserver kappa index was 0.882 ($p < 0.001$).
Conclusion: The intraobserver concordance was excellent for both readers. The interobserver concordance was regular,slightly better for 3D-DM. Our results showed a trend to increase the ACR density patterns when using 3D-DM.

B-0212 14:48

Automated texture scoring for assessing breast cancer masking risk in full field digital mammography

M.G. Kallenberg[1], K. Petersen[1], M. Lilholm[1], D.R. Jørgensen[1], P. Diao[1], K. Holland[2], N. Karssemeijer[2], C. Igel[1], M. Nielsen[1]; [1]*Copenhagen/DK*, [2]*Nijmegen/NL (michielkallenberg@gmail.com)*

Purpose: The goal of this work is to develop a method to identify women at high risk for having breast cancer that is easily missed in regular mammography screening. Such a method will provide a rationale for selecting women for adjunctive screening. It goes beyond current risk assessment models that are not specifically adapted to reduce the number of interval cancers.
Methods and Materials: From the Dutch breast cancer screening program we collected 109 cancers that were screen negative and subsequently appeared as interval cancers, and 327 age matched healthy controls. To obtain mammograms without signs of cancerous tissue, we took the contralateral mammograms. We developed a novel machine learning based method called convolutional sparse autoencoder (CSAE) to characterize mammographic texture. The CSAE was trained and tested on raw mammograms to separate interval cancers from controls in a five-fold cross validation. To assess the independency of the texture scores of breast density, density was determined for each image using Volpara.
Results: The odds ratios for interval cancer were 1.59 (95%CI: 0.76-3.32), 2.07 (1.02-4.20), and 3.14 (1.60-6.17) for quartile 2, 3 and 4 respectively, relative to quartile 1. Correlation between the texture scores and breast density was 0.59 (0.52-0.64). Breast density adjusted odds ratios, as determined with logistic regression, were 1.49 (0.71-3.13), 1.58 (0.75-3.33), and 1.97 (0.91-4.27).
Conclusion: The CSAE texture score is independently associated with the risk of having a breast cancer that is missed in mammography screening. As such it offers opportunities to further enhance personalized breast cancer screening.

Author Disclosures:
M. Lilholm: Shareholder; Biomediq A/S. **M. Nielsen:** CEO; Biomediq A/S. Shareholder; Biomediq A/S.

B-0213 14:56

Association of ultrasound features of invasive ductal mammary carcinoma with tumour grade and hormone receptor status

I. Rehman, I.K. Niazi, A. Murtaza; *Lahore/PK (dr_ir45@yahoo.com)*

Purpose: Work up for breast malignancy is time-consuming, ultrasound (US) features of lesions can help in predicting tumour grade and hormone receptor status with potential for early treatment planning.
Methods and Materials: One stop breast clinic patients were evaluated as per standard protocol and trucut biopsies were performed where indicated based on BIRADS; 166 lesions with invasive ductal carcinoma (IDC) on histology were included. Associations between US features, tumour grade & hormone receptor status were evaluated using descriptive statistics in SPSS20. Results were considered significant at an alpha-level of 0.05 using Chi-Square & Fisher's exact test. US features were lesion margins (circumscribed and uncircumscribed) & posterior acoustic features (enhancement, shadowing & no change in comparison with normal parenchyma at same depth). Age was grouped into below 50years & 50& above. Tumour grade was divided into low (1&2) and high (3&4). Estrogen receptor (ER) and progesterone receptors (PR) were considered positive if nuclear staining in tumour cells was >/=10%. HER-2/neu receptor status of 3+ was taken as positive.
Results: IDC with circumscribed margins is associated with higher tumour grade (p: 0.009). Association with age group and hormone status was not significant. Lesions with posterior acoustic enhancement/no change were more likely to be of higher grade ($p < 0.001$) and ER PR negative (p:0.014 and $p < 0.001$ respectively). Posterior acoustic features were not significantly associated with patient's age group (p: 0.080).
Conclusion: US features of breast lumps have significant association with tumour grade and ER PR status. This can be used for early treatment planning to decrease diagnosis to treatment delay.

B-0214 15:04

Fully automated measurement of background parenchymal enhancement using open source software

J.D. Balkman; *Lebanon, NH/US (jshining@gmail.com)*

Purpose: Background parenchymal enhancement (BPE) is part of the standardized breast MR reporting template, is associated with changes in BIRADS assignments, and is currently categorized by subjective visual assessment. At present, no standard method exists for quantifying BPE. A fully automated system for BPE measurement is developed and evaluated in this work.
Methods and Materials: An institutional review board waiver was obtained. Python open source software was used to develop automated methods for fibroglandular segmentation and quantification of BPE using 62 T1 fat-saturated pre and post-contrast axial breast MR studies. Canny edge detection was used for whole breast segmentation, Gaussian low pass filtering for normalization of MR inhomogeneity, and a combination of total variation denoising and Ostu binarization was used to segment fibroglandular tissue. Non-fibroglandular tissue signal on subtracted images was used to threshold for BPE. Computer generated measurements were correlated with radiologist's assessment of BPE using Spearman's rank correlation coefficient.
Results: Radiologists assessed the 62 breast MR exams as having minimal (22), mild (17), moderate (10), and marked (13) BPE. The automated software generated BPE percentages ranging from 4% to 91% with a mean and standard deviation of 30% and 20%, respectively. Correlation between radiologist categorical assignment of BPE and computer-generated continuous values was +0.49 (p-value < 0.001).
Conclusion: The method described for measuring BPE positively correlated with radiologist assessments, suggesting its potential for standardizing BPE quantification. Because the above technique relies on open source software, it may be easily shared between institutions or deployed as a web application.

B-0215 15:12

Triple negative breast cancer: MRI features in comparison to other breast cancer subtypes with correlation to prognostic pathologic factors

N.A.M. Chalabi, N. Osman, N. Abdraboh; *Cairo/EG (nivinechalabi@hotmail.com)*

Purpose: This study aimed at determination of the MRI predictors of triple negative breast cancer (TNBC) in comparison to other breast cancers subtypes.
Methods and Materials: The study retrospectively enrolled 185 female patients with 206 pathologically confirmed invasive breast cancers with different subtypes by immunohistochemistry. Histopathological analysis as well as MRI features of TNBC were compared to those of other breast cancer subtypes. MRI features included the tumour size, shape, margin, internal enhancement, intratumoural signal intensity on T2-WI, detectability by DW-MRI and ADC values.
Results: TNBCs showed higher histological grades ($p < 0.0001$) and younger patient age group ($p=0.006$) compared to other tumour subtypes. At MRI, TNBCs were of larger size ($p < 0.0001$), round shape ($p < 0.0001$), smooth margin ($p < 0.0001$), with rim enhancement ($p < 0.0001$) and higher incidence of T2-WI tumoural hyperintensity ($p=0.0002$) and intratumoural necrosis ($p < 0.0001$). No significant difference in tumour detectability was found by DW-MRI, however, TNBCs had higher ADC values ($P < 0.0001$).
Conclusion: In our study, TNBC patients were of younger age with higher grade malignancy. TNBC MRI predictors were unifocal rim enhancing mass with round shape, smooth margin, higher signal intensity on T2-WI, in addition to relatively larger sizes of tumours associated with high incidence of intratumoural necrosis and higher ADC values.

B-0216 15:20

Is choline concentration measured by MR Spectroscopy at 3.0 T correlated to the outcome of breast cancer prognostic indicators?

L. Camera, I. Baglio, F. Caumo, G. Meliadò, C. Cavedon, S. Montemezzi; *Verona/IT (camera.lfmad@gmail.com)*

Purpose: To test whether total choline (tCho) concentration measured by means of high-field MR spectroscopy (MRS) is correlated to the outcome of three common prognostic/predictive indicators for breast cancer: estrogen receptor (ER), progesterone receptor (PR) and HER2/neu gene amplification and/or overexpression.
Methods and Materials: 248 patients (257 lesions, range 0.05-115.45 cm3, mean 7.58 cm3) were enrolled in a multi-parametric MRI study (18-84y, mean 56.4y). All patients had breast abnormalities on mammography or sonography, confirmed by cytology and/or micro-biopsy. Single-voxel MRS was performed by means of a Philips Achieva STx 3.0 T scanner. tCho was estimated by means of the signal-to-noise ratio (SNR) of the peak at 3.2 ppm. Data collected within the study included the outcome of ER, PR and HER2/neu immunohistochemistry. Four categories of outcome were considered: three

negative indicators (NNN), two (NNP), one (NPP) and three positive indicators (PPP). Median and inter-quartile range (IQR) of SNRtCho was calculated for each category.
Results: 167 patients had acceptable spectra, of which 65 showed tCho SNR≥2. As regards SNR in the three categories, little overlap was observed between the IQR of NNN and other categories. The median SNR (IQR) for category NNN was 15.7 (8.5-26.3), for NNP it was 6.4 (3.5-11.3), for NPP it was 4.3 (3.7-5.2), and for PPP it was 4.2 (4.0-4.9).
Conclusion: SNRtCho≥2 in high-field MR spectroscopy was found to be correlated to the outcome of ER, PR and HER2/neu prognostic indicators. This correlation was strong with category NNN, while SNR range and confidence interval of the other three categories were overlapped.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 301a
Diffuse liver and pancreatic diseases

Moderators:
M.A. Bali; Brussels/BE
L. Cevasco; Genoa/IT

B-0217 14:00

Noninvasive liver iron content determination by dual-source dual-energy CT: initial results in patients suspected of liver iron-overload
X. Luo, J. Yan, W. Chai, H. Zhang, F. Yan; *Shanghai/CN (Huanzhangy@126.com)*

Purpose: To prospectively assess the feasibility of dual-source dual-energy (DSDE) CT for evaluation of liver iron content (LIC) in patients suspected of liver iron-overload and to compare its accuracy with magnetic resonance (MR) imaging.
Methods and Materials: Fifty-eight subjects with elevated ferritin and suspected of liver iron-overload were enrolled in our study. Upper abdomen DSDE CT and MR were then performed. Hepatic attenuation difference between 80 kVp and 140 kVp (ΔH) was calculated. Hepatic R2* and LIC determined by FerriScan (F-LIC) were obtained. The correlations between CT measurement (ΔH) and MR measurements (R2* and F-LIC) were analyzed. Diagnostic performance of ΔH in discriminating different LIC thresholds (1.8, 3.0, 7.0, 15.0 mg/g dry tissue) was evaluated by receiver operating characteristic (ROC) analysis.
Results: F-LIC was from 0.20 to 39.59 mg Fe/g. ΔH was correlated well with F-LIC and the Spearman's coefficient was 0.975. ΔH showed perfect linear positive with LIC (r^2=0.925, $P < 0.001$). For discriminating clinically significant LIC thresholds (1.8, 3.2, 7.0, 15.0 mg/g dry tissue), ROC analysis revealed that the corresponding optimal cutoff value of ΔH was 13.12, 16.23, 23.08, 39.35 HU, respectively. With the cutoff value of VIC= 39.35 HU, the highest sensitivity (100%) and specificity (100%) were obtained at LIC threshold of 15.0 mg Fe/g dry tissue.
Conclusion: DSDE CT can accurately quantify liver iron content with similar diagnosis performance with MR for grading clinically significant iron accumulation.

Author Disclosures:
J. Yan: Employee; Siemens Ltd China.

B-0218 14:08

Multivariable analysis of clinical influence factors on liver enhancement of Gd-EOB-DTPA-enhanced 3 T MRI
N. Verloh, M. Haimerl, C. Stroszczynski, C. Fellner, P. Wiggermann; *Regensburg/DE (niklas.verloh@stud.uni-regensburg.de)*

Purpose: The purpose of this study was to identify clinical influence factors on Gd-EOB-DTPA liver uptake by patients with healthy liver parenchyma.
Methods and Materials: A total of 124 patients underwent contrast-enhanced MRI with a hepatocyte-specific contrast agent at 3 T. T1- weighted volume interpolated breath-hold examination (VIBE) sequences with fat suppression were acquired before and 20 min after contrast injection. Relative enhancement between plain and contrast-enhanced signal intensity was calculated. Simple and multiple linear regression analyses were performed to find predictors on the basis of clinical influence factors on relative enhancement. Patients were subdivide into three groups according to their relative liver enhancement (HSV, RE ≥ 1.0; MSV, 1.0 0.5; NSV, RE ≤ 0.5) and were analyzed according to the relevant influencing factors.
Results: Simple analyses revealed patient age, transaminases (AST, ALT, GGT), liver-, spleen and delta-liver volume as significant factors influencing relative enhancement. In the multiple analysis, the transaminase AST, spleen and delta liver volume remained the significant factors influencing relative enhancement. Delta liver volume showed a significant difference between the analyzed groups.
Conclusion: Liver enhancement depends on a variety of factors. Administration of Gd-EOB-DTPA is body weight adapted and may lead to inadequate liver enhancement after 20 min epically when actual liver volume differs from expected volume. A liver volume adapted dose of Gd-EOb-DTPA may help to improve liver enhancement.

B-0219 14:16

Obliterative portal venopathy (OPV) vs. liver cirrhosis: appraisal of vascular changes on CT
A. Arora, S. Rajesh, S.K. Sarin; *New Delhi/IN (aroradrankur@yahoo.com)*

Purpose: To retrospectively appraise the arterial and venous changes in a series of 78 patients with OPV and biopsy-proven liver cirrhosis.
Methods and Materials: Patients diagnosed with OPV in last 3-years [as per the Asia Pacific Association for the Study of the Liver (APASL) consensus statement] who underwent CT at diagnosis, resulting in a total of 78 patients, constituted the study-group. Vascular changes appraised included: intrahepatic portal vein (PV) abnormalities (pruning, thrombosis, non-visualization, abrupt cut-off), intrahepatic veno-venous collaterals, extrahepatic PV abnormalities (calcification, partial/complete thrombosis), and giant recanalized paraumbilical vein with radiological-equivalent of Cruveilhier-Baumgarten syndrome. Additionally, hepatic artery inflow, perfusion abnormality, splenic artery aneurysms (intra-and extra-splenic) were assessed. Findings were compared with a control group of 78-patients with biopsy-proven cirrhosis. P values of.05 or less were considered significant.
Results: CT features seen significantly more in OPV include: intrahepatic PV abnormality (46 [59%] of 78 vs. 12 [15.3%] of 78), extrahepatic PV vein thrombosis (24 [31%] vs. 14 [17.9%] of 78), PV calcification (13 [17%] vs. 4 [5 %] of 78), intrahepatic veno-venous collaterals (12[15%] vs. none), giant recanalized paraumbilical vein with radiological-equivalent of Cruveilhier-Baumgarten syndrome (9 [11.5%] vs. 2 [2.5%]) and splenic artery aneurysms (31 [40%] vs. 6 [8%] of 78). Hepatic artery enlargement although more frequent in cirrhosis (18 [23%] vs. 13 [16%])was not statistically significant, while, perfusion abnormality (21 [27%] vs. 8 [10%]) was in the OPV group.
Conclusion: Differential vascular changes in OPV can aid the radiologist to prospectively suggest its diagnostic possibility in appropriate clinical settings.

B-0220 14:24

Acute extrahepatic infectious or inflammatory diseases are a cause of transient sinusoidal dilatation
M. Ronot[1], P.-E. Rautou[1], A. Kerbaol[1], G. Brancatelli[2], P. Bodossa[1], D. Valla[1], V. Vilgrain[1]; [1]*Clichy/FR*, [2]*Palermo/IT (maxime.ronot@bjn.aphp.fr)*

Purpose: To describe this association of sinusoidal dilatation seen on contrast-enhanced CT and/or MR as mosaic pattern (MP) with acute extrahepatic infections and inflammatory diseases, and to evaluate patient's clinical outcome.
Methods and Materials: From 2007 to 2012, patients with acute infectious or inflammatory diseases who underwent contrast-enhanced CTand/or MRI of the liver with a MP were selected. Clinical, biological, and other imaging features were collected at diagnosis and during follow-up.
Results: Sixteen patients were included (15 women, median age: 27 yrs; range 18-68). Five women (33%) were receiving oral contraceptives. None of the patients had hepatic venous outflow impairment or portal vein abnormalities. Acute infectious or inflammatory diseases included pyelonephritis (n=10), pancreatitis (n=2), pneumonia (n=1), septicemia (n=1), active Crohn's disease (n=1), and infectious colitis (n=1). Systemic inflammation was attested by a median white blood cell count of 13250/mL (11500-18000), and a median CRP of 94 mg/L (60-121). The MP was diffuse in all livers but more prominent in the subcapsular areas. Four patients (25%) underwent liver biopsy confirming sinusoidal dilatation. Eleven patients (69%) underwent follow-up contrast-enhanced CT and/or MRI showing homogeneous liver enhancement after a median 2 months in 9/11 patients (82%).
Conclusion: Acute extrahepatic infectious or inflammatory diseases should be added to the list of conditions causing sinusoidal dilatation, which appears as mosaic pattern on contrast-enhanced imaging. These lesions disappear when the triggering factor is cured.

B-0221 14:32

Can ultrasound imaging predict the outcomes of an experimental steatofibrosis model?

R. Turkay, F.A. Aydin, E. Inci, B. Bakir, E. Hocaoglu, I. Dogan-Ekici, I. Bingul, C. Kucukgergin, M. Uysal; *Istanbul/TR*

Purpose: The present study is designed to evaluate the role of ultrasound (US) imaging in an experimental two-hit steatofibrosis rat model.
Methods and Materials: Nineteen female Sprague-Dawley rats were divided into 2 groups. Control group (group 1; n=6) was fed with regular rodent diet. High fat diet-carbon tetrachloride (HFD-CCl4) group (group 2; n=13) was fed with HFD for 14 weeks. At the end of 8th week, US was performed to evaluate liver steatosis. Group 2 rats were divided in further 2 subgroups according to US results. HFD rats with liver steatosis (group 2a; n=6) and without liver steatosis (group 2b; n=7). All rats in group 2a and 2b were administered with CCl4 for the following 6 weeks. At the end of experimental period, livers were harvested. Liver triglyceride (TG) and hydroxyproline (HYP) levels were determined and histopathological examinations were performed. Kruskal Wallis and Mann-Whitney U tests were used for statistical analysis.
Results: In both group 2a and 2b; steatosis score, fibrosis score, TG levels and HYP levels were markedly higher compared to group 1. When compared with group 2b, TG and HYP levels were significantly higher in group 2a whereas steatosis score and fibrosis score were not different.
Conclusion: Experimental models are frequently used to investigate the pathophysiology of steatofibrosis and effects of potential treatments on steatofibrosis. US imaging may be useful to assess the success of a two-hit experimental steatofibrosis model. Thus, affecting the outcomes of research based on this model.

B-0222 14:40

Value of gadoxetate disodium enhanced MRI in patients with primary sclerosing cholangitis (PSC) for assessment of hepatic function

J. Hinrichs, T. Kaireit, H. Lenzen, F. Wacker, K.I. Ringe; *Hannover/DE (ringe.kristina@mh-hannover.de)*

Purpose: To assess the value of gadoxetate disodium enhanced hepatic MRI in patients with PSC for evaluation of liver function and to determine a correlation with severity of disease.
Methods and Materials: 46 patients (31m/15f; mean 44y) with confirmed diagnosis of PSC who underwent gadoxetate disodium enhanced hepatic MRI were included in this IRB-approved study. T1w VIBE sequences were acquired prior to (TP1), 19 (TP2) and 150 (TP3) minutes after i.v. contrast injection. SNR measurements were performed in each liver segment and compared (t-Test). Mean SNR changes (TP1-TP2; TP1-TP3) were calculated and correlated with liver functions tests (Spearman) obtained within 24 hours of the MRI, as well as with the MELD, AMSTERDAM and MAYO Score.
Results: Significant changes of hepatic SNR between non-enhanced and gadoxetate disodium enhanced MRI could be observed in all liver segments ($p < 0.0001$). Mean SNR prior to contrast injection was 79 (range 34-131), 19 min p.i. 166 (27-539) and 150 minutes p.i. 147 (43-296), corresponding with a mean SNR increase of 111% (TP2) and 93% (TP3). A significant correlation with serum bilirubin (p=0.0289), GOT (p=0.0178) and alkaline phosphatase (p=0.0004) could be appreciated (r=-0.322, -0.348, -0.503). Significant correlations with the MELD (p=0.041; r=-0.303) and AMSTERDAM Score (p=0.013; r=-0.449) were observed.
Conclusion: Hepatic SNR significantly increased on gadoxetate disodium enhanced MRI in patients with PSC, and further correlated with clinical scores and liver functions tests. As fluctuations of these liver function tests are common during the course of the disease, SNR changes might probably reflect severity of the disease.

B-0223 14:48

Correlation between MRI examination and biopsy of the liver in patients with primary sclerosing cholangitis: a retrospective study

J. Yamamura, C. Schramm, H. Ittrich, G. Adam, S. Keller; *Hamburg/DE (s.keller@uke.de)*

Purpose: To compare histopathological result from biopsies with MRI examination in patients with PSC.
Methods and Materials: 22 patients with PSC were retrospectively evaluated.MRI scans of the liver and bile ducts were performed on a 3-T MRI. MRCP, T2wI and contrast-enhanced T1wI of the liver in axial orientation was performed. Blood samples were taken from all patients to estimate the IgG-, alkaline phosphatse-, and liver enzyme levels. Sensitivity and specificity for detection of inflammation were determined by histopathological examinations in comparison to MRI.
Results: The median age was 40.0±10.3y. In 15/22 patients, signs of inflammation were found histologically. In 8/15 patients, inflammation was also found at the same parenchymal location in MRI. Hyperintense T2 signal was found in 9/15patients. Inflammation in left liver lobes could be found in 11/15 patients, with contrast agent enhancement seen in 6/11 patients and hyperintense signal in T2wI in 5/11 patients. Inflammation in right liver lobes could be found in 13/15 patients, with contrast agent enhancement seen in 5/13 patients and hyperintense signal in T2wI in 6/11 patients. Using the histological findings as gold standard, a sensitivity of 80% and a specificity of 60% were found for hyperintense signal in T2w imaging. A sensitivity of 92% and a specificity of 80% were found for contrast agent enhancement in MR imaging, if an inflammation was present.
Conclusion: The contrast agent-enhanced hepatic MRI can help detecting patients with an acute onset of PSC. Further study by utilising multimodal liver MRI should be considered in the future.

B-0224 14:56

Pancreatic volume, iron and fat assessment by MRI-T2* in B-Thalassemia major patients. Predictive value in development of diabetes: a retrospective study

P. Arcuri[1], M. Galati[1], G. Raiola[1], S. Roccia[2], M. Cadioli[3], G. Fodero[1]; [1]*Catanzaro/IT*, [2]*Lamezia Terme/IT*, [3]*Monza/IT (arppaolo@alice.it)*

Purpose: The aim of the study is to evaluate, retrospectively, the predictive value of pancreatic volume, iron overload and fat degeneration in the onset of diabetes in B-thalassemia major patients.
Methods and Materials: 112 thalassemic patients, between April 2008 and December 2013 underwent MRI, clinical assessment and laboratory investigations. Pancreatic T2* and Fat-content were assessed from TE-dependent region of interest based signal intensities performing water-fat chemical shift relaxometry and were compared with laboratory parameters (glucose, HbA1c, amylase and lipase). Pancreatic volume was calculated by Dixon 3D-T1-FFE sequence. Were considered only 43 thalassemic patients (age range, 38-44 years) affected by diabetes, developed in 2014, in addition to 21 healthy controls, age-matched. The statistic calculations were performed using the Wilcoxon test, the results were considered significant when the P value was less than 0.05.
Results: In the patients affected by diabetes, pancreatic iron overload was recorded in38/43 patients (88%). In 35/43 patients (81%) pancreatic fat content was identified. Pancreatic tail showed lower T2* values and higher fat content than pancreatic head. Pancreatic volume was decreased in 31/43 patients (72%). Comparison with the healthy controls showed an accuracy for T2*predicting diabetes of 87%, for fat content of 83% and decreased volume 74%.
Conclusion: Our findings suggest that predicting diabetes with pancreatic fat-content (88%) is more accurate than T2* value (81%) and pancreatic volume (72%). Besides iron accumulation, fatty degeneration might be an additional risk factor; therefore, MRI of B-thalassemic patients should be included pancreatic fat-content study, leading to a more accurate evaluation.

B-0225 15:04

Pancreatic iron assessment by MRI-R2* in patients with transfusional siderosis and haemochromatosis

J. Yamamura[1], S. Keller[1], C. Pfeifer[1], B. Schönnagel[1], R. Grosse[1], G. Adam[1], J. Wang[2], R. Fischer[1]; [1]*Hamburg/DE*, [2]*Dallas, TX/US (j.yamamura@uke.uni-hamburg.de)*

Purpose: To determine pancreatic iron and fat by using water-fat relaxometry in patients with iron overload and to compare pancreatic R2* with that of liver and heart.
Methods and Materials: 69 patients with iron overload were investigated. Heart iron was assessed as transverse relaxation rate R2* by a mono-exponential fit. In-vivo liver iron concentration was measured by SQUID susceptometry. Pancreas signal intensities were averaged from ROI positioned on the tail, body and head. Water/fat-separation technique to the in- and out-of-phase was applied. Linear regression was performed to estimate the relationship between iron loading in the pancreas. The relationship between iron loading in organs was estimated by Spearman correlation. ROC analysis was performed to determine how well pancreatic iron served as a surrogate for cardiac iron.
Results: 66/69 showed elevated liver R2* and serum ferritin (SF) levels. Pancreatic R2* was increased in 80% of the subjects; elevated cardiac R2* was only found in about 55% of the patients with ™. R2* of pancreatic tail, body and head were well correlated (tail vs. body: rs=0.92, p < 10-4; tail vs. head: rs=0.84, p 40s-1, while 57% of patients with ™ only exceeded this threshold. High significant correlation between the R2* of liver and pancreas was found. Acquired SF levels exhibited high significant correlation to the pancreatic R2* (rs = 0.49, p < 10-4) as to the hepatic R2* (rs = 0.81, p < 10-4).
Conclusion: R2* can be used for determining the iron concentration within the pancreas, although the water/fat-separation technique should be applied. There seems to be a complex coherence in the iron burden within different organs.

B-0226 15:12

Application of fat suppression in T2* relaxometry for the quantification of pancreatic iron overload

F. Terrazzino[1], A. Meloni[2], G. Restaino[3], T. Casini[4], D. Messana[1], A. Pepe[2]; [1]*Palermo/IT*, [2]*Pisa/IT*, [3]*Campobasso/IT*, [4]*Florence/IT*
(fabrizia.terrazzino@libero.it)

Purpose: Multiecho T2* MRI is a well established technique for organ-specific iron overload assessment. However, in the pancreas the fatty infiltration can influence the relaxation time. The aim of this study was to compare the capability of T2* relaxometry without and whit application of fat suppression (FS) to estimate pancreatic iron overload.
Methods and Materials: 20 patients with thalassemia underwent MRI (1.5 T GE scanner). A Gradient-Echo Multislice Multiecho T2*sequence (TEs: 2.0-21 ms with ΔTE=2.26 ms,FA=25°, matrix 192X192 pixels, FOV 40X40 cm, bandwidth 62.5KHz, slice thickness 8.0 mm) was applied T2*-NoFS; and the same sequence with the additional application of fat suppression (T2*-FS). Three regions of interest were drawn (pancreatic head, body, tail). For each ROI, the mean values of the signal intensity along all TE values were calculated. Each calculated decay curve was fit to a single exponential with a constant offset model (initial T2*).
Results: In iron-overloaded subjects examined by the T2*-NoFS sequence the signal fluctuation due to fat-parenchymal interface significantly deviated the measured decay curve from the expected decay model. Manual discard of some echoes was needed to reduce the fitting error, leading to T2* values different with respect to the ones assessed without TEs' removal. For the FS sequence the elimination of few echoes allowed to improve the fitting but without significantly modifying the T2* values.
Conclusion: The application of FS in the multiecho sequence improved the accuracy of the pancreatic iron overload assessment, avoiding the variability associated with the manual exclusion of TEs.

B-0227 15:20

Comparison of spleen stiffness in HCV-positive and healthy/non-HCV patients using Shear wave elastography (SWE): the pilot study

A. Pawluś, M. Inglot, D. Hołownia, K. Szymańska, K. Kaczorowski, A. Szymczak, J. Gąsiorowski, M. Inglot, U. Zaleska-Dorobisz; *Wrocław/PL (apawlus@wp.pl)*

Purpose: To assess the spleen stiffness values measured by shear wave elastography (SWE) in HCV-positive patients with non-significant liver fibrosis compared to healthy subjects.
Methods and Materials: 77 subjects underwent ultrasound and SWE of the liver and spleen. HCV-positive group (n=37; 17 males, 20 females), mean age 41.2 years (range 23-72) included patients without significant liver fibrosis according to METAVIR score (stages F0 and F1), divided into two subgroups: 19 subjects with stage F0, 18 with stage F1. Comparative group consisted of 40 patients (21 males, 19 females), mean age 42.3 years (range 22-76), without any clinical evidence of liver disease or portal hypertension, F0 in SWE and normal laboratory and ultrasonographic findings.
Results: The mean value of spleen stiffness in the HCV-positive group was 20.87 ± 4.47 kPa. In patients with F0 and F1 fibrosis stage mean values of spleen stiffness were 18.5 ± 3.4 kPa and 23.7 ± 4.0 kPa, respectively. The mean value of spleen stiffness in the comparative group was 16.62 ± 2.35 kPa. The differences in stiffness values between the groups were statistically significant ($p < 0.05$).
Conclusion: The spleen stiffness values in HCV-positive patients are significantly higher than in healthy subjects, even in cases of mild or absent liver fibrosis. The spleen stiffness increases with the liver fibrosis stage. The pathogenesis and relevance of this finding is unclear.

14:00 - 15:30 **Room C**

Breast

SS 302b

Risk imaging and stratification

Moderators:
E. Azavedo; Stockholm/SE
P.A.T. Baltzer; Vienna/AT

B-0228 14:00

A prospective evaluation of a multimodal screening regimen in BRCA carriers

J.C.M. van Zelst[1], R.M. Mann[1], G.H. Woldringh[1], R.D.M. Mus[1], P. Bult[1], M.J.C.M. Rutten[2], N. Hoogerbrugge[1], N. Karssemeijer[1]; [1]*Nijmegen/NL*, [2]*'s-Hertogenbosch/NL (jan.vanzelst@radboudumc.nl)*

Purpose: Despite intensive annual surveillance with MRI and mammography BRCA carriers still present with interval cancers. We devised an extended screening program, adding automated breast ultrasound (ABUS) twice yearly to annual breast MRI and mammography surveillance. This study evaluates the relative contribution of each of these modalities to the screening program.
Methods and Materials: 295 female BRCA 1/2 carriers signed informed consent for this study. They underwent 5 rounds of screening in 2 years. All examinations were read by one of 4 breast radiologists. The sensitivity, specificity, positive predictive value (PPV), recall-rate (RR), biopsy-rate (BR), and cancer detection-rate (CDR) per modality were analyzed.
Results: 196 women completed all rounds. 39 women chose for preventive mastectomy and 60 women were lost during follow-up. In 16 women a total of 19 cancers were detected. One additional DCIS was found in a preventive simple mastectomy specimen. Two interval cancers occurred. For mammography, MRI, and ABUS sensitivity was 0.50, 0.88 and 0.44, specificity 0.97, 0.95 and 0.95, PPV 0.32, 0.28 and 0.09, RR 3.7%, 7.4% and 6.7%, BR 2.4%, 5.5% and 2.4% and CDR was 11/1000, 20/1000 and 6/1000, respectively. Two cancers were detected by mammography only, both DCIS in women > 50 years. ABUS did not detect otherwise unobserved cancers.
Conclusion: Most cancers are detected by MRI. Mammography may detect additional DCIS in women over age 50, but appears not helpful in younger women. ABUS increases unnecessary recalls without additional or earlier cancer detection, and currently appears to have no role in these patients.

Author Disclosures:
R.M. Mann: Speaker; Bayer, Siemens. **M.J.C.M. Rutten:** Speaker; Siemens. **N. Karssemeijer:** CEO; ScreenPoint Medical. Shareholder; Matakina Technology, Qview Medical Inc.

B-0229 14:08

Breast cancer in women previously exposed to chest radiation therapy: single centre experience

L. Bonello, G. Trecate, F. Cartia, A. Vella, S. Viganò, G. Scaperotta, P. Panizza; *Milan/IT (luke_bonello@yahoo.com)*

Purpose: The purpose of this study was to evaluate the epidemiological-radiological characteristics of breast cancer in women previously exposed to chest radiation therapy.
Methods and Materials: From our hospital registry we retrospectively analysed all imaging characteristics of breast cancer patients who had been exposed to radiation therapy at a young age. Two radiologists reviewed the mammographic, ultrasound and MRI images in consensus.
Results: We identified 22 patients (22 females, mean age 41.4, range 27-70) with 23 tumours who performed imaging studies at our Institute. The commonest reason for irradiation was Hodgkin's lymphoma (14 cases). Mean latency period between exposure and breast cancer presentation was 21.7 years (range 13-34). Four of 23 tumours were in-situ (3 DCIS, 1 mixed DCIS-LCIS), the other 19 were invasive. Of the 19 invasive tumours 14 were ductal, 4 lobular and 1 mixed ductal-lobular type. The superior-external quadrant was the commonest tumour location (11/23 cases). Eight of 23 cases showed a periareolar location. In 20 mammograms available, 12 presented as a nodular mass (9/12 with ill defined margins) and 10 showed micro-calcifications (3 of 4 in-situ cases). In 20 US's available 15 showed a hypoechoic mass: 14/15 with a heterogenous internal echotexture, 11/15 with irregular margins. The predominant MR characteristics in 8 cases available included: 5/8 mass-like lesions, 8/8 irregular margins, 7/8 irregular internal contrast enhancement, 5/8 hyperintensity on T2-weighted images.
Conclusion: We present our single centre experience relating to the main epidemiological-radiological characteristics of breast cancers in women previously exposed to chest radiotherapy.

B-0230 14:16

Foci on breast magnetic resonance imaging (MRI) in high-risk women: cancer or not?

P. Clauser[1], A. De Nicolò[1], A. Rotili[2], B. Bonanni[2], C. Zuiani[1], M. Bazzocchi[1], E. Cassano[2]; [1]*Udine/IT*, [2]*Milan/IT (clauser.p@hotmail.it)*

Purpose: to assess how frequently foci are identified on MRI in high-risk patients, and their association with malignancy.
Methods and Materials: two readers, in consensus, retrospectively reviewed breast screening MRI of 251 high-risk women, from two Institutes, between 2009 and 2014. Eligible Patients had at least two years of screening MRI. Breast density, background parenchymal enhancement (BPE, using BI-RADS®lexicon), presence and follow-up of foci were evaluated. Clinical history of the patients was reviewed. Chi-square test was used.
Results: 151 women (age:43 years, range:23-72 years) were included with a median of 4 MRI examinations (range:2-6) during study period. Breast density was: I in 34, II in 36, III in 43 and IV in 38. BPE was: I in 111, II in 21, III in 13 and IV in 6. Foci were found in 53 women (35%, 95%CI:27-43%). Foci were more frequent in dense breasts, though the difference was not significant (p=0.079). No difference was found considering BPE (p=0.643). During follow-up: foci in 46 women remained stable (87% 95%CI:75-94%), 5 were not more visible (9%, 95%CI:3-20%), 2 increased in size (4%, 95%CI:1-13%). In these 2 cases a cancer was found (1 high-grade ductal carcinoma in situ, 1 tubular carcinoma). Overall, 7 women were diagnosed with unifocal breast cancer (5% 95%CI:2-9%), and 2 of them initially presented as foci (29%, 95%CI:4-71%).
Conclusion: foci are frequent and generally benign. Nevertheless, follow-up is mandatory, as increasing in size is the most reliable criteria to suspect malignancy.

B-0231 14:24

Determination of recall rates in women undergoing annual surveillance breast MRI: is a rate of less than 10% achievable?

N.A. Healy, K. Holohan, S. Cosgrove, T. Kwa, F. O' Driscoll, G. Offiah, Y. Roden, S. Seboui, S.A. O'Keeffe; *Dublin/IE (nualahealy@hotmail.com)*

Purpose: High recall rates from surveillance breast MRI are associated with patient anxiety and increased workload. NHSBSP guidelines recommend a maximum of a 10% recall rate with an expected rate of $< 7\%$ in high-risk women undergoing surveillance with breast MRI. Our aims were to review surveillance breast MRIs performed at our institution from 2009-2013 to determine the recall rate and cancer detection rates.
Methods and Materials: Surveillance MRIs performed in women at high risk of developing breast cancer over a 5-year period were reviewed. Breast MRI was performed using a standard protocol on a 1.5 Tesla MRI. For all patients with a BIRADS MRI 0, 3, 4 or 5 score, additional imaging, modality of biopsy and histology were recorded.
Results: 1119 surveillance breast MRIs were performed over the 5-year period. These included women with a known genetic mutation or those at high risk based on genetic assessment. 121 (10.8%) had BIRADS MRI scores which required recall for further imaging. 71 patients (58.6%) had a biopsy performed and 19 cancers were detected, giving an overall cancer detection rate of 1.7%. 11 (9%) were invasive ductal tumours. Of those recalled 74 (61%) were in the prevalent round of screening.
Conclusion: While our data compares favourably with published data, it is greater than the 7% recommended in the UK. This may be due to large numbers in the prevalent round.

B-0232 14:32

Automated detection of breast cancer as an aid in the interpretation of screening MRI

A. Gubern-Mérida[1], S. Vreemann[1], R. Martí[2], J. Melendez[1], S. Lardenoije[1], R.M. Mann[1], B. Platel[1], N. Karssemeijer[1]; [1]*Nijmegen/NL*, [2]*Girona/ES (Albert.GubernMerida@radboudumc.nl)*

Purpose: Computer aided detection (CADe) of suspect abnormalities in MRI may prevent reading errors in breast cancer screening of women at high risk. In this study, we evaluate the performance of a CADe system in detecting breast cancers missed in screening and compare this to the performance obtained on screen-detected cancers.

Methods and Materials: We collected DCE-MRI studies from 163 women participating in a high risk screening program. These data included 26 scans with screen-detected cancers, and 23 scans with 10 and 13 cancers that were retrospectively visible (BI-RADS 4/5) or minimally visible (BI-RADS 2/3) in prior MRI screening exams, but were reported to be normal. Cancers were detected at the following screening round. Furthermore, 114 normal scans with no sign of breast cancer were included. Lesions were annotated on the first post-contrast subtraction image. A CADe system was developed in-house. The detection performance was evaluated using free-response receiver operating characteristic and bootstrapping. A CADe finding was considered true positive when its center was inside a lesion annotation. The false-positive rate (FP/case) was determined on the normal cases.
Results: At 4 FP/case, the sensitivity for screen-detected lesions was 0.80 (95% confidence interval 0.62-0.96). For lesions that were visible or minimally visible in prior false-negative studies, the sensitivities were 0.69 (0.33-1.00) and 0.47 (0.18-0.75), respectively.
Conclusion: The detection performance for missed cancers of a CADe system was almost as high as for screen-detected cancers. The integration of such a system in clinical practice might aid radiologists to avoid screening errors.

Author Disclosures:
R.M. Mann: Speaker; Bayer, Siemens. **N. Karssemeijer:** Advisory Board; Matakina Ltd. CEO; ScreenPoint Medical BV. Consultant; QView Mecical Inc. Employee; Radboud University Medical Center, Nijmegen, Fraunhofer MEVIS, Bremen. Founder; QView Medical Inc., Matakina Ltd., ScreenPoint Medical B.V. Shareholder; QView Medical Inc., Matakina Ltd., ScreenPoint Medical B.V.

B-0233 14:40

A critical audit of a breast MRI screening programme for intermediate and high risk patients in clinical practice

S. Vreemann, A. Gubern-Mérida, S. Lardenoije, B. Platel, N. Karssemeijer, R.M. Mann; *Nijmegen/NL (Suzan.Vreemann@radboudumc.nl)*

Purpose: Breast MRI is used to screen for breast cancer in women at intermediate and high risk. However, contrary to common practice in mammography screening, no structural quality assessment of MRI screening is performed. The purpose of this audit was to evaluate the visibility of MR screen-detected cancers on prior MR examinations.
Methods and Materials: Patient files from all women who were diagnosed with breast cancer after a positive MRI screen between 2003 and 2013 were reviewed. We selected all cases where a previous MR examination was performed between 6 and 24 months before detection. This yielded 42 cancers (3 lobular-, 38 ductal carcinomas, 1 secretory carcinoma) in 40 women (mean age 50 years $\pm$ 9.7 years). The diagnostic and prior MRI studies were evaluated side-by-side in consensus by two dedicated breast radiologists. The visibility of the cancers on the prior scans was rated as: Visible (BIRADS 4/5), Minimal sign (BIRADS 2/3), and Occult (BIRADS 1).
Results: The mean interval between the prior and diagnostic MRI was 11.9 months $\pm$ 3.3 months. All 42 lesions were identified on the diagnostic scans. Eleven lesions (26%) were visible in the prior MRI and should have already been recalled. Thirteen lesions (31%) showed a minimal sign in the prior MRI. Only 18 lesions (43%) were completely occult.
Conclusion: In 26% of cases, evident lesions were missed in prior MRI screening exams. To prevent these errors structural double reading of MR screening examinations may be indicated.

Author Disclosures:
N. Karssemeijer: Advisory Board; Matakina Ltd. CEO; ScreenPoint Medical BV. Consultant; QView Medical Inc. Employee; RadboudUMC, Nijmegen, Fraunhofer MEVIS, Bremen. Founder; QView Medical Inc, Matakina Ltd, ScreenPoint Medical BV. Shareholder; QView Medical Inc, Matakina Ltd, ScreenPoint Medical BV. **R.M. Mann:** Speaker; Bayer, Siemens.

B-0234 14:48

Can biannual ultrasound surveillance detect cancers earlier in patients with breast cancer history?

M. Kim, E.-K. Kim; *Seoul/KR (mines@yuhs.ac)*

Purpose: To evaluate whether surveillance with biannual ultrasound (US) plus annual mammography (biannual group) for women with a history of breast cancer surgery results in earlier detection than annual US plus mammography (annual group).
Methods and Materials: Between January 2011 and December 2012, we retrospectively reviewed the clinical and imaging follow-up of 3060 patients with mammographic and US surveillance following breast cancer surgery to assess second cancers detected by local surveillance. The lesion size and the prevalence of symptoms at the diagnosis of the second cancer were evaluated. Two groups were divided according to the mean surveillance interval and compared with regard to clinicopathologic findings.

Results: There was no difference in the second cancer size between the biannual and annual groups (12.8 ±6.6 mm vs. 14.1 ±7.1 mm; *p*=0.461), and there was no significant difference between the groups for the presence of symptoms at the time of US diagnosis of the second cancer [17.0% (8 of 47) vs 10% (2 of 18); *p*=0.711]. For the patients younger than 50 years, the second cancer in biannual group was smaller than them in annual groups (10.3 ±3.5 mm vs. 15.4 ±8.6 mm; *p*=0.048).
Conclusion: Biannual US surveillance for second cancers in patients with breast cancer history does not lead to earlier diagnosis or to the detection of smaller cancers than annual US surveillance in overall patients. However, for the patients younger than 50 years, biannual US surveillance may detect earlier diagnosis to the detection of smaller cancers.

B-0235 14:56

A history of breast cancer and older age may warrant upgrade into BI-RADS 4 among patients assigned mammographic BI-RADS 3 in the diagnostic setting

M. Benndorf[1], Y. Wu[2], E. Burnside[2]; [1]*Freiburg/DE*, [2]*Madison, WI/US*
(matthias.benndorf@uniklinik-freiburg.de)

Purpose: To investigate whether risk factors can be identified for patients rated BI-RADS (breast imaging: reporting and data system) category 3 in the diagnostic setting that could justify the upgrade into BI-RADS category 4, and thereby warrant biopsy.
Methods and Materials: We analyze data from 4941 consecutive patients rated BI-RADS 3 in the diagnostic setting (single center, 5-year study period). As predictive variables we collect information regarding age, breast density according to the American College of Radiology, personal history of breast cancer, family history of breast cancer (none, weak, strong) and additional mammographic findings in the same examination. Ground-truth is established by matching with a state cancer registry. We build univariate and multivariate logistic regression models to identify risk factors for malignancy in our study population.
Results: 23 patients in our study population proved to have a malignant outcome (0.47%). Our logistic regression models (univariate and multivariate) identify a personal history of breast cancer (odds ratio: 5.53, $P < 0.001$) and older age (> 50 years, odds ratio: 12.44, $P < 0.05$) as risk factors for malignancy. In the subpopulation with both of these risk factors present, the prevalence of malignancy is > 2%, thus allowing the upgrade into BI-RADS category 4.
Conclusion: We identify a history of breast cancer and older age as independent risk factors in patients rated BI-RADS 3 in the diagnostic setting. Biopsy for these patients may be warranted. A future external validation of our results is necessary to establish applicability in clinical routine.

Author Disclosures:
M. Benndorf: Grant Recipient; DFG BE5474/1-1. **E. Burnside:** Research/Grant Support; NIH R01LM010921, NIH R01CA165229.

B-0236 15:04

Towards personalised breast screening protocols: validation of mammographic density estimation from full-field digital mammograms

M. Abdolell, K.M. Tsuruda, E.E. McDougall, S. Iles, C.B. Lightfoot, J. Caines;
Halifax, NS/CA (mo@dal.ca)

Purpose: The purpose of this study is to validate a fully automated area-based percent breast density measurement algorithm (Densitas Research Edition, Densitas Inc., available online to qualified researchers).
Methods and Materials: To evaluate face-validity, three radiologists specializing in mammography visually assessed percent density on 1823 for presentation full-field digital mammography (FFDM) images. Visual assessments were validated as 5% increments using the Intra-class Correlation Coefficient (ICC), and validated as BI-RADS 4-level classifications using the Kappa Statistic. ICCs and Bland Altman plots were used to evaluate internal reliability and agreement between algorithm-generated density measures from left and right mammography views, and between CC and MLO views on 2372 for presentation FFDM images.
Results: Agreement between radiologist assessments and the Densitas algorithm was excellent for CC and MLO views: BI-RADS classifications, K=0.837 and K=0.821; 5% increments, ICC=0.92 and ICC=0.913. The algorithm demonstrated almost perfect internal reliability between left and right views (ICC = 0.950) as well as between CC and MLO views of the same breast (ICC = 0.925 for left breast, and ICC = 0.930 for right breast). A Bland-Altman plot demonstrated negligible bias and narrow upper and lower limits of agreement between CC and MLO views.
Conclusion: The Densitas breast density algorithm demonstrates face-validity and excellent internal reliability and agreement with radiologists' visual assessments. The availability of this algorithm via the Densitas Research Edition provides a standardized and objective way for researchers to incorporate breast density measures in their research, and may lead to development of personalized breast screening protocols.

Author Disclosures:
M. Abdolell: Founder; Densitas Inc. Shareholder; Densitas Inc. **K.M. Tsuruda:** Employee; Densitas Inc. **E.E. McDougall:** Employee; Densitas Inc.

B-0237 15:12

Tabár parenchymal patterns and breast cancer risk: a case-control study adjusting for percent area mammographic density and standard risk factors

M. Abdolell, S. Iles, K.M. Tsuruda, J. Payne, C.B. Lightfoot, J. Caines;
Halifax, NS/CA (sian.iles@cdha.nshealth.ca)

Purpose: Tabár parenchymal patterns (Tabár patterns) and percent mammographic density (PD) are risk factors for breast cancer. However, this evidence from screen film mammography (SFM) has yet to be validated in a large study using full-field digital mammography (FFDM), which has a higher dynamic range resulting in improved ability to evaluate areas with dense tissue. The purpose of this study was to determine the association between Tabár patterns and breast cancer risk in the FFDM context, controlling for PD and traditional risk factors.
Methods and Materials: A case-control study using contralateral mediolateral oblique digital mammography images from 397 women with unilateral breast cancer and 826 age-matched screening controls were analyzed. PD was estimated using a fully-automated area-based breast density algorithm (Densitas Inc). and Tabár pattern measures were visually assessed. Risk factors including parity and hormone replacement therapy use were obtained from a population-based clinical database. Multiple logistic regression was used to determine breast cancer risk as a function of Tabár patterns, adjusting for risk factors and PD.
Results: Women with Tabár patterns IV/V had 1.42 times increased odds of breast cancer compared to those with patterns I/II/III. Controlling for risk factors, the odds ratio was 1.46 [95% CI (1.12, 1.92)]; additionally controlling for PD, the odds ratio was 1.38 [95% CI (1.01, 1.89)].
Conclusion: Tabár IV/V parenchymal patterns were associated with increased breast cancer risk. Neither controlling for traditional risk factors nor additionally controlling for PD appreciably altered the odds of breast cancer in women with Tabár patterns IV/V.

Author Disclosures:
M. Abdolell: Founder; Densitas Inc. Shareholder; Densitas Inc. **K.M. Tsuruda:** Employee; Densitas Inc.

B-0238 15:20

Should volumetric breast density be included in breast cancer prediction models? Proposal of an integrated quantitative and reproducible approach

S. Ciatti[1], G. Gennaro[2], V. Mungai[1], G. Nannini[1]; [1]*Prato/IT*, [2]*Padova/IT*
(stefanociatti@gmail.com)

Purpose: To analyze the relationship between volumetric breast density (VBD) and risk for breast cancer as estimated by prediction models.
Methods and Materials: The study included 249 patients who underwent CR mammography in four views (RCC, LCC, RMLO, LMLO) between Jan 2014 and Jul 2014 self referring for screening. For each patient the individual risk profile was determined using the Tyrer-Cuzick model, counting for familial and personal factors. A VBD value was computed from each mammogram (Volpara software), and averaged among the four views to obtain the mean VBD per patient. Differences in lifetime risk distributions for four groups of patients with increasing breast density (VG1: 0% - 4.5 %; VG2: 4.5% - 7.5%; VG3: 7.5% - 15.5%; VG4 > 15.5%) were compared.
Results: The overall median VBD was 10.9%, ranging between 4.6% and 30%. There was no case in VG1, 58 cases in VG2 (median VBD: 6.0%), 135 cases in VG3 (median VBD: 10.35%), and 56 cases in VG4 (median VBD: 18.2%). The median lifetime risk was 11.0% for VG2, 14.5% for VG3, and 15.6% for VG4. Differences in lifetime risk between patients in VG2 and patients in VG3 and VG4 were significant (P-values equal to 0.0011 and 0.0002, respectively), while risk was comparable for patients in VG3 and VG4 (P = 0.0931).
Conclusion: Lifetime risk increases with breast density. Volumetric mammographic density measure might be used with existing risk prediction models to identify high-risk women more precisely.

14:00 - 15:30 **Room Z**

Computer Applications

SS 305
Imaging biomarkers

Moderators:
A. Alberich-Bayarri; Valencia/ES
M. de Bruijne; Rotterdam/NL

B-0239 14:00

Choice of deconvolution algorithm: impact on the perfusion analysis of human gliomas

M. Dietzel[1], N. Thanh[2], M. Schmidt[1], S. Kloska[1], M. Essig[3], A. Dörfler[1]; [1]*Erlangen/DE*, [2]*Ottawa, ON/CA*, [3] *Winnipeg, MB/CA*

Purpose: In brain-perfusion, deconvolution is the central step of postprocessing. In theory, altering the deconvoultion-algorithm will change perfusion-parameters and might impact neuroradiological diagnosis. Accordingly, we intra-individually compared classical and advanced deconvoultion-algorithms for the assessment of human gliomas.
Methods and Materials: Patients with newly diagnosed Glioma were eligible for this prospective study (informed-consent, ethical-board approval). Patients received a standardized DSC-protocol (TA=125sec, temporal-resolution=2.5sec, matrix=0.128k, B0=3 Tesla; Gadubutrol/Gadovist®: 0.05-1 mmol/kgBW). After transfer to an off-site CRO, an independent quality-check was performed and perfusions-data were postprocessed (Olea-sphere v2.2/personal-customization). Using exactly the same presets (e.g. AIF, baseline-adaption, ROI-position/size) the software provided perfusion-parameters based on three different Singular-Value-Deconvolution methods (SVD): Standard-SVD/sSVD, circular-SVD/cSVD and oscillant-SVD/oSVD. The software was operated by an experienced MR-radiologists (8 years). Freehand-ROIs were manually defined to encircle [1] the lesion (most hyperperfused area of the tumour) and [2] the reference (contralateral white-matter). ROI-statistics (mean, ratio [lesion/reference]) of perfusion-parameters (CBF, [corrected-]CBV, MTT) were assessed for each SVD-algorithm and compared intra-individually (descriptive statistics, Wilcoxon-test, alpha=5%).
Results: 20 patients were included (WHO: II°[n=5], III°[n=4], IV°[n=11]). Mean-CBF showed systematic differences between the SVD-methods ($P < 0.05$; cSVD=49.6, oSVD=84.3, sSVD=71.4). Differences resolved, if CBF-ratio was addressed (P=n.s.; cSVD=5.7, oSVD=6.1, sSVD=6.7). Similarly, mean-MTT showed a wide range (cSVD=9.8, oSVD=6.7, sSVD=7.3; P[oSVD vs. sSVD]=n.s.; P[all other]< 0.002). Again differences were absent, if MTT-ratio was chosen (P=n.s.; cSVD=1.4, oSVD=1.5, sSVD=1.5). ROI statistics of mean-CBV showed similar results for all three SVD-algorithms (P=n.s.; cSVD=4.4, oSVD=4.6, sSVD=4.4) as did CBV-ratio (P=n.s.; cSVD=6.4, oSVD=6.6, sSVD=6.4).
Conclusion: Altering the deconvoultion-algorithm has significant impact on perfusion-analysis of human gliomas.

Author Disclosures:
M. Dietzel: Consultant; Consultant; syneed medidata GmbH Max-Stromeyer-Str. 166, 78467 Konstanz. **M. Essig:** Consultant; Consultant; syneed medidata GmbH Max-Stromeyer-Str. 166, 78467 Konstanz.

B-0241 14:08

Accurate and reproducible splenic volume estimation in patients with splenomegaly from multidetector-row CT data using a quick stereological method

M. Mazonakis, J. Stratakis, J. Damilakis; *Iraklion/GR (mazonak@med.uoc.gr)*

Purpose: Splenomegaly is an important clinical finding associated with many diseases. This study proposes a new method for estimating the volume of an enlarged spleen from MDCT images.
Methods and Materials: Twenty-four consecutive patients with splenomegaly diagnosed by MDCT were studied. The stereology involved the random placement of a computer-generated grid of test points over each MDCT image. The semi-automatic point selection procedure was adopted to count all points hitting the spleen. The software automatically calculates splenic volume and its associated error. Stereological volume estimations were performed using the entire image set containing the spleen and samples of images generated from systematic sampling intensities of 1/2.1/3.1/4 and 1/5. Three independent observers determined the reproducibility of stereology. Stereological estimations were compared with planimetric volume measurements obtained by manually delineating splenic contours on MDCT images.
Results: The application of stereology on 4-8 systematically sampled images, defined by the 1/3 sampling intensity, was the optimal approach providing acceptable volume estimations with a coefficient of error below 5 % in a minimum mean time of 2.4±0.5 min. These stereological estimations were not significantly different from planimetric measurements ($p > 0.05$). The mean difference between planimetry and stereology was quite small and equal to 17.1±37.5 ml. The two methods were well correlated (r=0.97). The intraobserver and interobserver variability of stereological estimations was 3.4 and 5.3%, respectively.
Conclusion: The optimized stereological method is time-efficient and provides splenic volume estimations with good reproducibility and accuracy by using a sample with every third MDCT image depicting an enlarged spleen.

B-0242 14:16

Impact of post-processing algorithms on the reproducibility of apparent diffusion coefficient (ADC): is it really quantitative?

M. Zeilinger[1], M. Lell[1], P.A.T. Baltzer[2], M. Uder[1], M. Dietzel[1]; [1]*Erlangen/DE*, [2]*Vienna/AT (martin.zeilinger@uk-erlangen.de)*

Purpose: ADC-assessment is a well-accepted approach for quantitative assessment of neoplasms. In the literature one can even find reference ADC-values for different cancers. However, ADC-calculation is based on complex fitting analyses. Thus the choice of post-processing algorithm could have significant impact on the final ADC-value. We aimed to investigate this matter by intra-individually comparing five methods for ADC-calculation in an oncologic patient collective.
Methods and Materials: Diffusion-weighted images of 65 solid tumours served as a basis for ADC assessment (ACD given as [$x10^{-6}$ mm^2/s]; whole-body 3 T MRI; EPI-DWI; b values: 50, 400 and 800). 2D-ROI were drawn around each lesion by an experienced observer on b800 scans (size 0.5-1.6 cm^2). Using exactly the same ROI-coordinates five different post-processing methods were used for ADC-calculation: ADC-1: Automatically generated ADC map by the scanner software (Siemens® Biograph mMR), ADC-2: Manual logarithmic calculation, ADC-3: Manual linear ordinary least squares regression analysis, ADC-4: Dedicated plug-in for Osirix® (ADC map calculation, Stanford University), ADC-5: Dedicated task card on Siemens® MMWP. Wilcoxon signed-rank tests (alpha=5%) and descriptive statistics were performed for intra-individual comparison of mean ADCs.
Results: Mean ADCs showed a wide range from 1136 (ADC-1) to 1201 (ADC-2). There were systematic and significant differences of ADCs between all evaluated methods ($P < 0.05$; coefficient of variation: 37-41%).
Conclusion: The ADC depends significantly on the choice of the post-processing algorithm. If different methods for DWI post-processing are used systematic ADC-differences are to be expected. This should be considered, if ADCs from different post-processing methods are compared in patient studies.

Author Disclosures:
M. Zeilinger: Equipment Support Recipient; Siemens Healthcare, Erlangen, Germany. **M. Lell:** Equipment Support Recipient; Siemens Healthcare, Erlangen, Germany. **M. Uder:** Equipment Support Recipient; Siemens Healthcare, Erlangen, Germany.

B-0243 14:24

Implementation of a phase detection algorithm for dynamic cardiac computed tomography analysis based on time dependent contrast agent distribution

C. Kendziorra, H. Meyer, M. Dewey; *Berlin/DE (carsten.kendziorra@charite.de)*

Purpose: An algorithm that automatically detects a phase, i.e. a specific three-dimensional (3D) dataset out of several time distributed 3D datasets from a dynamic myocardial computed tomography perfusion (CTP) dataset, with high contrast in the left ventricle and low contrast in the right ventricle, is introduced and tested.
Methods and Materials: An algorithm was developed within a software framework for four-dimensional (4D) computed tomography (CT) myocardial perfusion analysis in order to provide a phase with high contrast in the left ventricle and low contrast in the right ventricle to a subsequent algorithm, which is able to automatically align the images along the heart axis. The decision making is based on the contrast agent distribution over time. The algorithm was tested with 4D CTP datasets of 29 patients with 20±3 images.
Results: The agreement for the phase detection of the algorithm with two reference readers reached 97 % (95 % CI: 82-100 %). The mean time duration for the automated detection was 0.020 s (95 % CI: 0.018-0.022 s), which was 800 times less than the readers needed (16 ± 7 s, $p < 0.001$).
Conclusion: The algorithm is an accurate and fast tool that may allows to facilitate clinical workflow.

Author Disclosures:
M. Dewey: Author; "Coronary CT Angiography", Springer, 2009, "Cardiac CT", Springer 2011 and 2014. Consultant; Guerbet. Grant Recipient; Heisenberg Program of the German Research Foundation (DFG) for a Professorship (DE 1361/14-1). Research/Grant Support; FP7 Program of the European Commission for the randomized multicenter DISCHARGE trial (603266-2, HEALTH-2012.2.4.-2), European Regional Development Fund (20072013 2/05, 20072013 2/48), German Heart Foundation/German Foundation of Heart Research (F/23/08, F/27/10), Joint program of the DFG and the German Federal Ministry of Education and Research (BMBF) for meta-analyses (01KG1013, 01KG1110, 01KG1110), GE Healthcare, Bracco, Guerbet, Toshiba Medical Systems. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, Bayer-Schering. Other; Cardiac CT Courses in Berlin: www.CT-kurs.de.

B-0244 14:32

Large-scale objective comparison of 29 novel algorithms for computer-aided diagnosis of dementia based on structural MRI

E.E. Bron[1], M. Smits[1], F. Barkhof[2], A.J. Bastos-Leite[3], J.C. van Swieten[1], W.J. Niessen[1], S. Klein[1]; [1]*Rotterdam/NL*, [2]*Amsterdam/NL*, [3]*Porto/PT*
(e.bron@erasmusmc.nl)

Purpose: We performed a large-scale objective comparison of algorithms for computer-aided diagnosis of dementia using structural MRI. Our aim was to evaluate how well these methods can reproduce clinical diagnoses, distinguishing patients with Alzheimer's disease (AD), mild cognitive impairment (MCI) and controls (CN).
Methods and Materials: A total of 384 clinically representative T1-weighted MRI scans were acquired at the VU Medical Center (Amsterdam, Netherlands), Erasmus MC (Rotterdam, Netherlands), and University of Porto (Portugal). The diagnostic label (AD, MCI, CN) was based on clinical criteria as reference standard. The algorithms were trained on a small training set (n=30) and optionally on other data (e.g., Alzheimer's Disease Neuroimaging Initiative, Australian Imaging Biomarkers and Lifestyle flagship study of aging). The test set consisted of 354 scans with the diagnoses blinded. Via our web-based framework, http://caddementia.grand-challenge.org, 15 research teams uploaded a total of 29 algorithms. We analyzed area-under-the-receiver-operating-characteristic-curve (AUC) and accuracy of the algorithms. Confidence intervals (CI) were estimated with bootstrapping. Differences between classifiers were assessed using McNemar's test.
Results: The best performing algorithm yielded an AUC of 78.8% (CI: 75.6-82.0%) and an accuracy of 63.0% (CI: 57.9-67.5%), which was significantly better than 24 other algorithms. In general, the best performances were achieved using a combination of features that included volume, cortical thickness, shape and intensity.
Conclusion: Public large-scale validation studies, such as this work, are an important step towards the implementation of high-potential algorithms for computer-aided diagnosis of dementia into clinical practice. The web-based framework remains open for new algorithms to be compared.

Author Disclosures:
W.J. Niessen: Board Member; Quantib BV. Founder; Quantib BV. Shareholder; Quantib BV.

B-0245 14:40

Volume measurement by using super-resolution MRI: application to prostate volumetry

E. Oubel[1], H. Beaumont[1], A. Iannessi[2]; [1]*Valbonne/FR*, [2]*Nice/FR*
(estanislao.oubel@mediantechnologies.com)

Purpose: Accuracy and precision of measurements are important for patient follow-up in oncology but, unfortunately, partial volume effects introduce an undesired variability between observers. Super resolution (SR) techniques combine multiple acquisitions of an object into a single image richer in details. Herein, the use of SR for reducing variability is investigated.
Methods and Materials: Experiments were performed on phantom and prostate images. A spherical MRI phantom (General Electric) was imaged to obtain axial, coronal, and sagittal T2 images. Five sets of prostate images freely available from the National Alliance for Medical Image Computing were also employed. Isotropic SR images were created from the three perpendicular acquisitions by using an open source software (BTK). Two observers performed repeated volume measurements by using a semiautomatic method (Median Technologies) on SR images and original axial acquisitions. A comparison of intra/inter-observer variability for both images was performed by applying a Bartlett's test, after verification of normality by using a Shapiro-Wink test.
Results: For phantom images, the intra- and inter-observer variability were significantly lower ($p <= 0.05$) for the SR image (8.81 ml vs. 16.17 ml and 9.39 ml vs. 16.26 ml respectively). For prostate images, the relative differences between observers were also lower for the SR image (1.6% vs. 3.1%) with $p=0.09$. A paired t-test showed a significantly higher volume for this image ($p < 0.05$).
Conclusion: SR allowed reducing the variability of volume measurements in phantoms and prostate images. This method can be applied for lesion measurement in general, which could be of great importance in clinical trials.

Author Disclosures:
E. Oubel: Employee; Median Technologies. **H. Beaumont:** Employee; Median Technologies.

B-0246 14:48

CT perfusion studies of lung cancer: automatic detection of misleading structures and artefacts

D. Barone[1], A. Bevilacqua[2], S. Malavasi[2], G. Gavelli[1]; [1]*Meldola/IT*, [2]*Bologna/IT*
(domenico.barone@irst.emr.it)

Purpose: The aim of this work is to detect and highlight blood vessels, artefacts, and statistically unreliable blood flow values in CT perfusion (CTp) studies of lung cancer through automatic analysis of the Time-Concentration Curves (TCCs).
Methods and Materials: 16 patients with primary lung tumour underwent axial CTp, for a total amount of 24 examinations. Blood flow values were computed on fitted data after motion correction, according to the maximum slope method. The average error of the fitted TCC model with respect to the original Hounsfield Unit (HU) values are computed for each voxel and gathered into a histogram. An adaptive parametric threshold was conceived, allowing the automatic selection of voxels in perfusion maps whose model fit error is above the threshold. This study was approved by the institutional review board.
Results: Most of the highlighted voxels appeared to be arranged into connected regions, the nature of which is confirmed by two 25-year experienced radiologists operating in a blinded fashion. In particular, these regions resulted to be either physical structures, such as bronchi or vessels, or artefacts coming from reconstruction or residual motion.
Conclusion: The presence of vessels, bronchi or artefacts in perfusion maps alters the right perception of the perfusion pattern by radiologists, besides jeopardizing results from any subsequent computation or statistical analysis. In addition, the automatic exclusion of these misleading values prevents radiologists from misinterpreting the perfusion maps, possibly leading to wrong clinical considerations, this representing a step forward to clinical utilization of CTp.

B-0247 14:56

Water content calculation in cartilage through MR estimation: design and validation of a mathematical model

J.M. Shiguetomi-Medina[1], J.L. Ramirez-GarciaLuna[2], H. Stødkilde-Jørgensen[3], B. Møller-Madsen[1]; [1]*Aarhus/DK*, [2]*San Luis Potosi/MX*, [3]*Skejby/DK*
(jmshigue@gmail.com)

Purpose: Mapping of cartilage using T1 sequences provides a reliable measure on the amount of water present in it. The purpose of this method is to effectively translate the measurements into water percentage.
Methods and Materials: T1 values were obtained from tissue-mimicking gelatin samples with previously known water concentrations. We calculated absolute T1 values in real maps through inverse angle phase, and with an inverse sequence recuperation at 37 °C. Field of view and region of interest were manually delineated and its mean T1 value estimated. Data was collected and modeled in a linear regression. On in vivo samples, the area of interest at the physis was manually determined and a mean T1 value and water content estimated. Water in the tissue was totally extracted by lyophilization, obtaining the water volume. The difference between wet and dry weight was used to estimate water content in percentage. Data was compared against the predicted water content through Lin's concordance correlation coefficient.
Results: The mathematical model was highly significant against a null model ($p < 0.0001$). 97.3% of the variation in water content can be explained by absolute T1 values. The method was adjusted by 150 bootstrap repetitions. Water content in percentage can be predicted through the equation Water Content = (0.476 + T1 Signal Intensity * 0.000193) * 100.
Conclusion: This study demonstrates that a mathematical model can calculate water content, in percentage, in cartilage This method may allow early identification of degeneration of the proteoglycan matrix allowing development of predictive parameters.

B-0248 15:04

A novel approach for estimating fracture risk by computerised processing of routine proximal femur radiographs

I. Leichter, B. Fargun, O. Rozengarten, O. Safran, M. Liebergall; *Jerusalem/IL (Izhak@hadassah.org.il)*

Purpose: Bone tissue architecture has an important role in assessing bone strength. The purpose of the study was to estimate fracture risk by processing routine proximal femur radiographs and analysing the spatial frequencies of bone trabeculae.
Methods and Materials: 17 radiographs of in-vitro femurs and routine proximal femur radiographs of 27 patients (13 with fractures) were analysed. The bone mineral content (BMD) for all bones was assessed by DXA. The critical force required to fracture the in-vitro femurs was measured. A region of interest (ROI) was defined in the femoral neck, containing primary tensile and secondary compressive trabeculae. Two-dimensional Fourier transform (FFT) of each ROI provided a power spectrum image of the bone trabeculae. A bone index was calculated for each trabecular group, reflecting the relative contribution of trabeculae with high-spatial frequencies. Multiple regression analysis was performed to develop a combined bone index, representing both trabecular groups. The performance of the calculated bone index was analysed by "Chi-square" test.
Results: For the in-vitro bones, the mean value of the combined BI of femurs with high critical force was significantly higher than that of the weaker bones (33% difference, P=0.002). The mean combined bone index of subjects without fractures was higher by 23% than that of the osteoporotic patients (P=0.003). The combined bone index estimated the fracture risk with 92.9% sensitivity, 78.6% specificity and an accuracy of 85.2%.
Conclusion: Computerized image processing of routine proximal femur radiographs may estimate the fracture risk with high sensitivity and accuracy. This method provides additional information regarding bone tissue architecture, complementary to DXA which measures only the BMD.

B-0249 15:12

Clinical applicability of advanced trabecular microarchitecture assessment using multi-detector computed tomography

A. Valentinitsch[1], L. Fischer[2], J.M. Patsch[2], J.S. Bauer[1], F. Kainberger[2], G. Langs[2], M. DiFranco$_2$; [1]*Munich/DE*, [2]*Vienna/AT (alexander.valentinitsch@tum.de)*

Purpose: Motivated by promising clinical applications of computational assessment of trabecular microarchitecture (TMAC) in osteoporotic women and lung transplant recipients using high-resolution peripheral quantitative computed tomography (HR-pQCT), we extend the method to multi-detector-CT (MDCT) in order to enhance the clinical relevance by validating their reproducibility at lower, anisotropic resolutions.
Methods and Materials: Twelve forearms were scanned with HR-pQCT and MDCT (UH1:150 mAs;UH2:300 mAs). TMAC assessment resulted in "bone quality maps", which represent the following features: TMAC1 is rich in thick trabeculae with low intertrabecular spacing. TMAC2 is characterized by trabeculae of intermediate morphometric properties. TMAC3 contains thin, inhomogeneous trabeculae and demonstrates high intertrabecular spacing. To assess variability between TMACs from different modalities and protocols, cluster volume fraction (CL.V/TV) was calculated and compared using a repeated measures ANOVA with subsequent Bonferroni correction.
Results: Post hoc tests revealed no significant difference in TMAC1 compared to HR-pQCT (UH2:−8.8%,p=0.175;UH1:−9.1%,p=0.166). No significant differences were found for TMAC2 (UH2:+2.2%,$p > 0.5$;UH1:−0.4%,$p > 0.5$). However, for TMAC3, there was a significant increase in UH1 (+16.2%,p=0.005). When considering radiation dose, we noted that MDCT protocol UH2 outperformed UH1 in terms of agreement by < 2%, but effective dose (ED) was 81.8 µSv for UH1 and 163.5 µSv for UH2. This result also suggests that TMAC-based maps can be reliably generated at lower doses.
Conclusion: We demonstrated that TMAC is applicable to MDCT despite having poorer spatial resolution and contrast. TMACs could be used to assess the bone microarchitecture in clinical MDCT images at peripheral and skeletal sites, which complement the diagnosis of osteoporosis with DXA.

14:00 - 15:30 **Room M**

GI Tract

SS 301b

Gastro-oesophageal and small bowel imaging

Moderators:
S. Bickelhaupt; Heidelberg/DE
P.R. Ros; Cleveland, OH/US

B-0250 14:00

Metabolic volumetric parameters assessed with 18 F-FDG PET/CT are superior to SUVmax and CT volumetry for predicting long-term outcome in patients with esophageal cancer after neoadjuvant chemotherapy and resection

D. Tamandl, B. Fueger, M. Paireder, A. Haug, S. Schoppmann, A. Ba-Ssalamah; *Vienna/AT (dietmar.tamandl@meduniwien.ac.at)*

Purpose: We assessed the prognostic value of metabolic volumetric parameters derived from contrast-enhanced CT and PET/CT, such as CT tumour volume, metabolic tumour volume (MTV), and total lesion glycolysis (TLG), in patients with neoadjuvant chemotherapy (NACT) and potentially curative resection for esophageal cancer (EC).
Methods and Materials: We retrospectively analysed patients with locally advanced EC, treated with NACT and resection between 2007 and 2013. CT volumetry and 18 F-FDG PET/CT (maximum standardised uptake, SUVmax, MTV, and TLG) were analysed before and after NACT. A uni- and multivariable analysis using a Cox proportional hazards model was used to assess the prognostic impact of the relative change during treatment (ΔMTV, ΔTLG, etc). on overall survival (OS). For correlation to clinical parameters, the Spearman test, the Mann-Whitney-U test, or one-way ANOVA was used.
Results: Eighty-six patients were assessed using CT volumetry; of those, 52 also had PET/CT before and after NACT. Baseline parameters did not influence survival, while low post-treatment CT volume and thickness, MTV, TLG, and SUVmax were all prognostic for improved OS in the univariate analysis ($p < 0.05$). The relative change during NACT, ΔCTthickness, ΔMTV, ΔTLG, and ΔSUVmax also had a prognostic influence on OS ($p < 0.05$). In the multivariate analysis, only ΔMTV (Hazard ratio, HR 2.52, p=0.005) and ΔTLG (HR 3.89, p=0.006), and surgical margin status ($p < 0.05$), remained as independent predictors of OS.
Conclusion: Metabolic volumetric parameters are independent prognostic factors for survival in patients after NACT and resection for EC. Further studies that investigate the potential of those markers are warranted.

B-0251 14:08

The application of magnetic resonance imaging in the staging of oesophageal cancer: ready for clinical use?

F. Giganti, E. Orsenigo, E. Mazza, L. Albarello, C. Staudacher, A. Del Maschio, F. De Cobelli; *Milan/IT (giganti.francesco@hsr.it)*

Purpose: Preoperative staging in oesophageal cancer (OC) is critical in order to prompt a surgical (T1-T2 stages without nodal involvement) or neo-adjuvant therapy (NT) (T3-T4 stages with nodal involvement). The aim of this study was to investigate the diagnostic performance of Magnetic Resonance (MR) for the preoperative loco-regional staging of OC.
Methods and Materials: Twenty-eight patients with biopsy-proven OC (16 directly treated with surgery and 12 addressed to NT) underwent preoperative 1.5 T MR (T2, diffusion-weighted and dynamic contrast enhanced sequences with cardiac and respiratory gating) before and, for the NT group, even after NT. According to local invasion (T1-2 vs T3-4) and nodal involvement (N- vs N+), MR-staging results were compared with histopathological findings (7th TNM Edition). Sensitivity, specificity, positive (PPV) and negative (NPV) predictive value and accuracy were calculated for the surgery-group (referring to 1st MR) and NT group (according to 2nd MR).
Results: For T staging, sensitivity was 60%, specificity 100% and accuracy 88% in the surgery group and 50%, 83% and 66%, respectively, for the NT group. For N staging, sensitivity was 75%, specificity 67% and accuracy 69% in the surgery group and 80%, 71% and 75%, respectively, for the NT group.
Conclusion: MR has the potential to correctly stage organ-confined lesions according to the high specificity (for the T stage) and to rightly assess pathological nodal involvement (for the N stage) thanks to the good sensitivity, representing a promising tool in the preoperative management of OC.

B-0252 14:16

Dynamic contrast-enhanced CT of gastric cancers: relationship between enhancement pattern and histological type

D. Tsurumaru, M. Miyasaka, Y. Nishimuta, S. Kawanami, Y. Asayama, A. Nishie, H. Honda; *Fukuoka/JP (tsuru-d@radiol.med.kyushu-u.ac.jp)*

Purpose: Histological type is known to have an influence on the prognosis of patients with gastric cancers. The purpose of this retrospective study was to examine whether dynamic contrast-enhanced computed tomography (CECT) can differentiate between the histological types of gastric cancers.
Methods and Materials: Sixty-four consecutive patients with pathologically proven advanced gastric cancers, 18 tubular adenocarcinomas (TA) and 46 undifferentiated adenocarcinomas (UA), were enrolled. Preoperative CT images were obtained 40s (arterial phase), 70s (portal phase) and 240s (delayed phase) after injection of nonionic contrast material. For subjective analysis, enhancement pattern were categorized into washout, persistent, and gradual pattern. For objective analysis, mean attenuation value of the lesion in the arterial, portal, and delayed phases were measured. Among these findings, significant CT variables to differentiate between TA and UA were determined with the chi-square, Fisher exact, and Student t tests.
Results: There was significant association between enhancement pattern and histological type (P = 0.0007). Gradual enhancement pattern was highly sensitive findings for UA. The mean attenuation value of TA was significantly lower than that of UA in the delayed phase (85.4 HU vs 111.3 HU, P <.0001). There were no significant differences in mean attenuation values in the arterial and portal phases.
Conclusion: Dynamic CECT can differentiate between the histological types of gastric cancers.

B-0253 14:24

Application of spectral CT on T staging of gastric carcinoma: evaluation of iodine concentration of perigastric fat tissue adjacent to tumour for diagnosing serosal invasion compared with pathological T staging

J. Xing, H.H. Limbu, J.B. Gao; *Zhengzhou/CN (xingjj89@163.com)*

Purpose: To analyse the iodine concentration (IC), normalized iodine concentration (nIC) and water concentration (WC) of the perigastric fat tissue adjacent to the tumour and correlate their value for differentiating between T3 and T4a staged gastric carcinoma.
Methods and Materials: Forty-three patients with pathologically proven T4a (group A,n=26) and T3 (group B,n=17) staged gastric carcinoma (classified according to 7th AJCC edition) located on the lesser curvature who had undergone spectral CT imaging (GE Discovery CT750 HD) were retrospectively selected. IC, nIC and WC of perigastric fat tissue adjacent to the lesion were measured during Arterial phase (AP) and Venous phase (VP). Two-sample t tests were used to compare the three parameters between two groups during AP and VP. Receiver operating characteristic (ROC) was used to determine the threshold of IC for differentiating T3 and T4a staged gastric carcinoma.
Results: Significantly higher IC and nIC values were obtained in group A than in group B (IC -3.36±1.56 vs. -5.55±0.96μg/cm^3 in AP; -1.30±1.29 vs. -3.84±0.90μg/cm^3 in VP; nIC -0.03±0.01 vs. -0.04±0.01 in AP; -0.02±0.02 vs. -0.06±0.12 in VP) (P &lt 0.01). There was no significant difference in water concentration during both AP and VP (p &gt 0.05).When IC value &gt -5.03 during AP, the sensitivity and specificity of staging T4a were 88.5% and 76.5% respectively. During VP, when IC value &gt -2.90, the sensitivity and specificity of staging T4a were 88.6% and 94.1%.
Conclusion: The iodine concentration of perigastric fat tissue adjacent to the tumour can effectively differentiate state of serosal invasion.

B-0254 14:32

Role of diffusion-weighted imaging and apparent diffusion coefficient in prediction of metastatic regional lymph nodes in gastric cancer: comparison with morphological criteria

Y. Mao, F. Lv, Z. Wang; *Chongqing/CN (maoyun1979@163.com)*

Purpose: To figure out the diagnostic value of diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) on metastasis of gastric regional lymph node (GRLN) as well as comparing with traditional morphological criteria.
Methods and Materials: 27 enrolled patients with gastric cancer undertook preoperative gastric magnetic resonance (MR) and computed tomography (CT) scans. All detected GRLNs on MR and CT images were carefully one-by-one matched with pathological results, as well as the corresponding detectabilities of two imaging modalities were calculated. Seven imaging indicators of GRLN, including border, enhancement pattern, short diameter (SD), short/long diameter ratio (SLR), signal/noise ratio (SNR), contrast/noise ratio (CNR) and ADC were evaluated and compared among normal, non-metastatic and metastatic groups (the data of normal group came from the prior study of gastric MR in healthy population). Additionally, the diagnostic abilities of these indicators on metastatic nodes were analyzed by logistic regression model and receiver operating characteristic curve.
Results: Results: DWI owned higher detectability of GRLN compared to CT. ADC decreased in an order from normal, non-metastatic to metastatic group, 1.672±0.541 vs.1.314±0.298 vs.1.014±0.188 (x10-3 mm2/s), with p value less than 0.001 between any two groups. Metastatic group presented larger SD and higher CNR than those of other two groups. SD and ADC were identified as the independent predictive factors for node metastasis with a reasonable diagnostic accuracy (AUC above 0.7), which could further increased to a good rank (AUC above 0.9) with a combination indicator of SD and ADC.
Conclusion: DWI is a useful detective method for GRLN. ADC combining with size standard could provide more accurate prediction on GRLN metastases.

B-0255 14:40

PET/MR enterography for the assessment of the small bowel: first experience

K. Beiderwellen[1], S. Kinner[1], B. Gomez[1], P. Heusch[2], L. Umutlu[1], A. Bockisch[1], T.C. Lauenstein[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE*
(karsten.beiderwellen@uk-essen.de)

Purpose: We aimed to implement a protocol using integrated PET/MR enterography for a multimodal assessment of the small bowel.
Methods and Materials: 17 patients with solid malignancies or fever of unknown origin (male: n=12, female: n=5; mean age: 57 ± 14 years) underwent PET/MR enterography using an integrated PET/MR scanner (Biograph mMR, Siemens Healthcare, Erlangen, Germany) with either [18 F]FDG (n=12) or [68Ga]-DOTATOC (n=5). For small bowel distension a contrast solution (1500 cc of mannitol and locust bean gum) was ingested. All patients received a dose of 20 mg scopolamine i.v. to minimize bowel motion artifacts. The following sequences were acquired: a) TrueFISP coronar; b) T2w HASTE with fat saturation coronar; c) T1w VIBE coronar post gadolinium; d) T1w FLASH 2D coronar and axial post gadolinium. All datasets were reviewed by two readers in consensus with regard to overall image quality, coregistration of small bowel structures and visualization of pathologies using a 4-point scale (1: non-diagnostic - 4: excellent quality).
Results: PET/MR enterography was well tolerated by all patients. Overall image quality was rated good (mean: 3.2) with equally good coregistration of PET and MRI (mean: 3.0). PET/MR enterography allowed for an excellent visualization of both enteral as well as extraintestinal pathologies including lymph node metastases (mean: 3.8).
Conclusion: PET/MR enterography is technically feasible and offers good coregistration in small bowel structures. This new method enables a multimodal assessment of small bowel lesions in malignant and inflammatory disease.

Author Disclosures:
K. Beiderwellen: Speaker; Siemens, Healthcare Sector. **L. Umutlu:** Consultant; Bayer Healthcare. Speaker; Bayer Healthcare.

B-0256 14:48

Clinical significance of pneumatosis of the bowel wall: correlation of MDCT findings with patients' management and outcome

S. Schmidt, J.-F. Knebel, A. Denys, R. Meuli, M.-O. Treyvaud; *Lausanne/CH (sabine.schmidt@chuv.ch)*

Purpose: To evaluate the clinical significance of pneumatosis intestinalis (PI) including the influence on patients' management and outcome.
Methods and Materials: Two radiologists in consensus reviewed CT examinations of 149 consecutive emergency patients (53 women, mean age 64) with PI of the stomach (n=4), small (n=68) and/or large bowel wall (n=96). Extent of PI and possibly associated portomesenteric venous gas (PMVG) were correlated with other MDCT-findings, patients' symptoms, risk factors, clinical management, laboratory, histopathology, final diagnosis and outcome.
Results: The most frequent cause of PI (n=80, 53.7%) was bowel ischemia, followed by infection (n=18.12.1%), obstructive (n=12, 8.1%) and non-obstructive (n=10, 6.7%) bowel dilatation, unknown aetiologies (n=8.5.4%), drugs (n=8, 5.4%) inflammation (n=7.4.7%), and others (n=6.4%).
Overall mortality was 41.6% (n=62), most frequently occurring with ischemia (n=39.54.2%) despite surgery in 51 patients (63.8%). The association of PMVG with PI significantly correlated with underlying ischemia (p=0.001), as did the distribution of PMVG (p= 0.004). Absent wall enhancement was the only MDCT-feature significantly associated with ischemia (p=7.484x10^{-6}), unlike wall thickening, target sign, and luminal dilatation. The degree of calcified atherosclerosis, evaluated on MDCT, significantly correlated with ischemia (p=0.024), unlike other cardiovascular risk factors (p=0.723). Patients with PI due to ischemia had a significantly higher fatal outcome (p=0.003), regardless of their age.
Conclusion: In emergency patients, PI is caused by various intestinal disorders. Ischemia remains the most common aetiology with the highest mortality despite frequent surgery. PI with associated PMVG should alert the radiologist to think of ischemia.

B-0257 14:56

Differentiate intestinal tuberculosis and Crohn's disease on CT Enterography: an initial experience

S.R. Agrawal; *New Delhi/IN (agrawalshailesh@ymail.com)*

Purpose: To differentiate small bowel tuberculosis and crohn's disease on the basis of image morphology on MDCT enterography.
Methods and Materials: 110 patients, with the clinical suspicion of small bowel diseases underwent CT enterography on 256 slice MDCT, using 5%(w/v) isoosmotic mannitol as neutral oral contrast agent. The findings were recorded and diagnosis was made by consensus of two radiologists. 40 cases of intestinal tuberculosis and eight cases of Crohn's disease were included in our study after their diagnosis was confirmed by histo-cytopathology or improvement on clinical follow-up after appropriate therapy.
Results: The key differentiating points were 1)Disease distribution Thickening of both terminal ileum and caecum were present in 24 cases (60%) of tuberculosis, cecum was not involved in crohn's disease. 2)Length of involvement : Long segment (> 3 cms) thickening was seen in six cases (75%) of crohn's disease and in two cases of tuberculosis (0.5%) 3)Lymph node morphology: Necrotic, conglomerated and calcified lymphnodes were exclusively present with intestinal tuberculosis (60%) 4)Mural stratification with smudged serosa was seen in intestinal tuberculosis. Crohn's disease showed sharply defined serosa. 5)Mucosal hyperenhancement and prominent vasa recta were observed in 16 cases (40%) and 12cases (30%) respectively in intestinal tuberculosis.
Conclusion: Cecal involvement, necrotic conglomerated or calcified nodes, short segment involvement of small bowel, smudged appearance of serosa are more common in tuberculosis. Absence of cecal involvement with long segment involvement of disease in terminal ileum, with sharply defined serosa point towards crohn's disease. Prominent vasa recta and mucosal hyperenhancement are seen in both conditions.

Author Disclosures:
S.R. Agrawal: Author; Lalendra Upreti, Sunil Kumar Puri, Satbir Singh, Amit Verma, Richa Yadav, Prabhuddha Jyoti Das.

B-0258 15:04

Redefining the mesenteric swirl sign (MSS) in the diagnosis of internal herniation (IH) after Roux-Y gastric bypass (RYGBP)

J. Maier, A. Floyd; *Køge/DK (jefm@regionsjaelland.dk)*

Purpose: The MSS has been found to be the best single predictor of IH in patients with RYGBP. It is defined as "swirled appearance of mesenteric fat or vessels at the root of the mesentery". Attempts to define the amount of rotation needed for diagnosing IH have not been fruitful. The MSS is therefore not entirely objective. We suggest to also check for compression of the main stem of the superior mesenteric vein (SMV): identifying this vein at the portal confluence and following its course caudally, the sign is positive if the vein gets completely effaced.
Methods and Materials: We retrospectively analysed the CT scans of 81 consecutive patients with antecolic RYGBP referred for suspicion of IH. Of the 23 patients with surgically proven IH in this group, 10 were found positive for both MSS and SMV compression. One patient had MSS alone, two patients had SMV compression alone. There were no false positives for these two signs. The remaining patients were positive for other known signs of IH.
Results: There is a considerable overlap between MSS and SMV compression. The sensitivity of MSS, SMV compression, and the and/or combination of both signs, for diagnosing IH, were 48%, 52%, and 56% respectively.
Conclusion: Apart from being an objective sign of IH, SMV compression may prove to be an indicator of severity. Our data suggest that a combined use of MSS and SMV compression facilitates the diagnosis of IH in patients with RYGBP.

B-0259 15:12

Mesenteric panniculitis: review of abdominal MDCT examinations with a matched-pair analysis

L. Protin-Catteau[1], G. Thiefin[1], P. Soyer[2], M. Belkebir[1], S. Deguelte[1], C. Hoeffel[1]; [1]*Reims/FR,* [2]*Paris/FR (laure.04@wanadoo.fr)*

Purpose: To investigate prevalence of mesenteric panniculitis (MP) on abdominal multidetector row computed tomography examinations (MDCTs), using systematic review. To study the relationship between MP and malignancy thanks to a matched control group, as well as 5-years outcome of patients with MP.
Methods and Materials: Retrospective review of consecutive abdominal MDCTs in 3054 patients to identify MP. Patients with inflammatory, oedematous or neoplastic disease that might have been responsible for mesenteric infiltration and with abdominal lymph nodes larger than 1 cm were excluded. Each patient of the MP group was matched by gender and age with the two patients with the following MDCTs without MP. MDCT-indications, concomitant diseases, and history were recorded. Two radiologists reviewed patients' examinations to grade MP. Comparisons were made between MP and control groups.
Results: After exclusion of 64 patients, study group included 96 patients (64 males, 32 females, 65.42 ±14.95 years; 32.83-92.24), and the control group 192. Prevalence of MP was 3.14%. 58 (60.4%) and 114 (59.4 %) patients had a neoplastic disease in the MP and control group, respectively. There was no significant difference between the two groups regarding association with cancer or other disease (p=0.86).Most MP were discrete (66.7%). There was no difference between the two groups in terms of further development of cancer (p=0.15).
Conclusion: In this first study using systematic MDCTs review with a matched-pair analysis, we did not find any association between MP and neoplastic diseases, nor significant trend to further development of cancer with a 5-year follow-up.

B-0260 15:20

Lower stage migration rate of early gastric cancer with a new reconstruction algorithm of images in dual energy CT: preliminary study

C. Shi, H. Zhang, J. Yan; *Shanghai/CN (huanzhangy@126.com)*

Purpose: To evaluate the impact of the advanced image-based techniques used to calculate monoenergetic dual energy computed tomography (DECT) on image quality, visibility and stage migration of early gastric cancer (EGC).
Methods and Materials: In total, 31 EGC patients (19 men, 12 women; age range, 38-81 years; mean age, 57.2 years) who underwent a three-phasic DECT scan were retrospectively enrolled in this study. The CT findings were compared with surgical and pathological results. Conventionally reconstructed polyenergetic images (PEIs) at 120 kV and virtual monoenergetic images (MEIs) and advanced monoenergetic images (AMEIs) at 6 different kiloelectron volt (keV) levels (from 40 to 90 keV) were evaluated from the 100 and Sn 140 kV dual energy (DE) image data, respectively. The visibility and stage migration of EGC for all three image datasets were evaluated using multiplanar reconstruction (MPR) and statistically analyzed. The objective and subjective image qualities (contrast-to-noise ratio (CNR), organ specific diagnostic performance, image noise and visual sharpness) were also evaluated.
Results: AMEIs at 40 keV showed the best visibility (80.7%) and the lowest stage migration (35.5%) for EGC. The stage migration for AMEIs at 40 keV was significantly lower than that for PEIs (P =.008). AMEIs at 40 keV had statistically higher CNR in both the arterial and portal phases, gastric-specific diagnostic performance and visual sharpness compared with other AMEIs, MEIs and PEIs (all P <.05).
Conclusion: Advanced image-based calculated virtual 40 keV images significantly increase the CNR of EGC, leading to significantly lower stage migration of EGC.

14:00 - 15:30 **Room N**

Cardiac

SS 303a

Coronary atherosclerosis

Moderators:
N.R. Mollet; Turnhout/BE
M. Urbanczyk-Zawadzka; Krakow/PL

K-05 14:00

Keynote lecture

R. Vliegenthart; *Groningen/NL*

B-0261 14:09

Calibration of Agatston calcium score using iterative image reconstruction (AIDR 3D) at 120, 100 and 80 kVp instead of the standard reference protocol (FBP at 120 kVp)

J. Blobel, J. Mews, J.D. Schuijf, W. Overlaet; *Zoetermeer/NL (Joerg.Blobel@toshiba-medical.eu)*

Purpose: We performed an anthropomorphic phantom study (QRM GmbH, Germany) to calibrate and evaluate the Agatston calcium score (AS) using Adaptive Iterative Dose Reduction (AIDR3D) at 80, 100 and 120 kVp instead of Filtered Back-Projection (FBP) at 120 kVp (reference protocol).
Methods and Materials: ECG-gated scans with 32 dose steps were performed on two 320-row CT`s (Aquilion ONE^{TM} (CT1)/Aquilion ONE ViSION Edition (CT2)). CTDI thresholds that still provide accurate AS were determined using 120 kVp for FBP and 120/100 kVp (CT1), 80 kVp (CT2) for AIDR3D reconstructions. The CT number thresholds for calcium identification were calibrated. The AS averages with standard deviation (σ) of the 3 remaining calibrated groups were tested for 3σ-outliers, for normal distribution by

Kolmogorov-Smirnov test and with reference group by Kruskal-Wallis test. The 4 groups were finally averaged and AS deviations with 2σ-ranges graphed by Bland-Altman plot.
Results: The CT number thresholds were calibrated for the three AIDR3D groups to be 130 HU (120 kVp), 133 HU (100 kVp) and 160 HU (80 kVp). The performed calibration method ensures an equivalent AS average 696±9 (p=0.311) of the 4 groups compared to 698±11 of reference group. By using AIDR3D instead of FBP, exposure can be reduced with 69% (120 kVp), 73% (100 kVp) and 83% (80 kVp). The related pixel noise thresholds were determined for FBP to be 26 HU (120 kVp) and for AIDR3D to be 23 HU (120 kVp), 23 HU (100 kVp) and 31 HU (80 kVp).
Conclusion: Agatston scoring can be accurately performed at reduced kVp levels in combination with AIDR3D using kVp specific calibrated CT number thresholds with up to 83% dose reduction.

B-0262 14:17

Coronary calcium scoring at low radiation dose using iterative reconstruction: intraindividual comparison with standard dose scanning using filtered back projection

A. Lembcke[1], R. Luhur[1], J. Mews[2], B. Hamm[1], J. Blobel[2]; [1]*Berlin/DE*, [2]*Zoetermeer/NL (alexander.lembcke@gmx.de)*

Purpose: To evaluate the accuracy of Adaptive Iterative Dose Reduction (AIDR3D) for coronary calcium scoring with low radiation dose.
Methods and Materials: 120 patients underwent twofold scanning using 320-row detector CT (AquilionONE) in this ethic committee approved study. However, additional radiation exposure was avoided using the following scan strategy: At first, a low dose scan of 14 cm standard scan length was performed with 75% reduced tube current. Using anatomical information of this scan, a second standard dose scan was performed with routine tube current but narrowed scan length of 10 cm. The standard dose data set was reconstructed with filtered back projection (FBP) and low dose data sets with FBP and in addition with AIDR3D.
Results: Compared to standard dose scanning (reference) image noise increased in low dose scanning with FBP (from ±16.6 HU to ±34.2 HU) but not with AIDR3D (±16.6 HU vs. ±18.4 HU). The mean Agatston score showed a systematic increase in low dose scanning with FBP (from 207.4 to 238.2) but no consistent difference was found with AIDR3D (207.4 vs. 206.4). A total of 32 patients (27.5%) were assigned to a different cardiovascular risk category in low dose scanning with FBP but only 8 (6.7%) patients when using AIDR3D. Out of 30 patients with no calcium (score 0) 14 patients (46.7%) were false positive with low dose scanning using FBP but no false positive case was found with AIDR3D.
Conclusion: Coronary calcium scoring at 75% reduced radiation dose cannot be recommended for FBP reconstructions whereas dedicated iterative reconstructions preserve measuring accuracy.

Author Disclosures:
J. Mews: Employee; Toshiba Medical Systems Europe. **B. Hamm:** Research/Grant Support; Siemens, Philips, Toshiba. **J. Blobel:** Employee; Toshiba Medical Systems Europe.

B-0263 14:25

Detectability of small calcifications in patients of different sizes: a stationary phantom study

M. Vonder[1], G. Pelgrim[1], S.E.M. Huijsse[1], M.J.W. Greuter[1], J.C. Gratama[2], M. Oudkerk[1], R. Vliegenthart[1]; [1]*Groningen/NL*, [2]*Apeldoorn/NL (m.vonder@umcg.nl)*

Purpose: Calcium scoring depends on scan protocol and patient size. It is unknown whether these factors also affect detectability of calcifications. In this phantom study we analyzed detectability of small calcifications in sequential and high-pitch spiral mode dual-source computed tomography (CT) for different patient sizes.
Methods and Materials: A cylinder with 100 small calcifications varying in size and density was inserted into an anthropomorphic thorax phantom (Thorax, QRM, Möhrendorf, Germany). Phantom rings were used to simulate medium and large patients. The phantom was scanned with dual-source CT (Definition Flash, Siemens, Erlangen, Germany) in sequential and high-pitch spiral mode, at 120 kV and 90 ref mAs. Acquisitions were repeated five times. Reconstructed slice thickness/increment were 3.0 mm/1.5 mm, obtained with filtered back projection. Calcifications were determined automatically using a MATLAB script. As reference, published Electron Beam Tomography (EBT)-based detectability for small patient size was used. Mann-Whitney U test was used to analyze differences in detectability.
Results: Only 8-14% of calcifications were detected. Mean number of detected calcifications for sequential mode were: 10.6, 11.0, 9.8 (p=n.s). and for high-pitch spiral mode: 12.0, 11.8, 10.0 (p=0.047) for small, medium and large patient size respectively. For the same patient size, calcium detectability did not differ significantly between sequential and high-pitch spiral mode (p-value range: 0.22-0.84). Detectability of calcifications was 35.3-43.0% lower for dual-source CT protocols compared to EBT.
Conclusion: Calcium detectability decreased with increasing simulated patient size for high-pitch spiral mode acquisition, but not for sequential mode acquisitions. However, both modes were less sensitive than EBT.

Author Disclosures:
R. Vliegenthart: Research/Grant Support; NWO.

B-0264 14:33

The impact of Sn-filter on detection and quantification of coronary calcification using third generation dual-source CT at ultra-low dose: a phantom study

M. Vonder[1], G. Pelgrim[1], S.E.M. Huijsse[1], M. Meyer[2], M.J.W. Greuter[1], M. Oudkerk[1], T. Henzler[2], R. Vliegenthart[1]; [1]*Groningen/NL*, [2]*Mannheim/DE (m.vonder@umcg.nl)*

Purpose: Use of 100 kV with Sn-filter on third generation dual-source computed tomography (CT) scanners decreases radiation dose compared to 120 kV. The purpose of this study was to analyze the calcium detectability derived from third generation dual-source CT with and without a Sn-filter for different patient sizes.
Methods and Materials: A cylinder with 100 small calcifications varying in size and density was inserted into an anthropomorphic thorax phantom (Thorax, QRM, Möhrendorf, Germany). Phantom rings were used to simulate medium and large patients. The phantom was scanned with third generation dual-source CT (Force, Siemens, Erlangen, Germany) in high-pitch spiral mode at 100 and 120 kV, 90 ref mAs and 100 kV with Sn-filter, 180 mAs. Acquisitions were repeated four times. Reconstructed slice thickness/increment were 3.0 mm/1.5 mm, obtained with filtered back projection. Calcium detectability and Agatston score were determined automatically using a MATLAB script. Kruskal-Wallis testing was used to analyze differences in detectability.
Results: The mean computed tomography dose index was 0.16-0.65 at 100 kV with Sn-filter and 0.38-2.60 and 0.43-2.44 at respectively 100 kV and 120 kV without Sn-filter. The mean number of detected calcifications was 8.4-9.8 at 100 kV with Sn-filter, this was 38.1-40.3% and 22.0-28.6% lower than at respectively 100 kV and 120 kV without Sn-filter. Additionally, the Agatston score was 67.6-70.3% and 52.2-54.6% lower at 100 kV with Sn-filter compared to 100 and 120 kV without Sn-filter.
Conclusion: Use of a 100 kV Sn-filter scan protocol in third-generation dual-source CT resulted in lower calcium detectability and lower Agatston score compared to tube voltage settings without Sn-filter.

Author Disclosures:
R. Vliegenthart: Research/Grant Support; NWO.

B-0265 14:41

Approaches to ultra-low radiation dose coronary artery calcium scoring using 3rd generation dual-source CT: a phantom study

G. Muscogiuri, C.N. De Cecco, A. McQuiston, F.G. Meinel, J.L. Wichmann, A. Varga-Szemes, P.M. Cannaò ', U.J. Schoepf; *Charleston, SC/US (carlodececco@gmail.com)*

Purpose: To investigate whether a novel 3rd generation dual-source CT (DSCT) scanner allows performing accurate coronary artery calcium scoring with substantially decreased tube current comparing the standard 120 kV prospective CCTA acquisition with with tin filtered (Sn)Sn100 kV and 120 kV ultra high pitch UHP acquisitions.
Methods and Materials: Image acquisition was performed using a calcium scoring phantom. Prospective 120 kV sequential, 120 and Sn100 kV UHP helical acquisitions were performed with four reference tube currents of 80, 60, 40, 20 mAs. Images were reconstructed using filtered back projection (FBP) and 3rd generation iterative reconstruction (IR). Contrast-to-noise ratio (CNR), subjective image quality, calcium volume and Agatston score were measured for each reconstructed series. Radiation dose was calculated for all acquisitions. For statistical analysis Friedman test and Wilcoxon rank sum test were used.

Results: No significant difference in Agatston score (p=0.4) or volume (p=0.08) was observed among the three acquisition techniques using different tube currents with FBP reconstruction. IR reconstruction caused an underestimation of the calcium volume and Agatston score ($p < 0.01$) compared with standard FBP data-sets. The Sn100 and 120 kV UHP acquisitions allow a reduction of ED by 95-54% in comparison with 120 kV prospective acquisition.
Conclusion: 3rd generation DSCT enables a reduction of the tube current both in the prospective and UHP acquisitions without affecting the coronary calcium assessment. The tin filtration allows an accurate quantification of calcium score at 100 kV without any correction of the HU threshold.

Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0266 14:49

Impact of iterative reconstruction algorithms on calcified plaque quantification with coronary computed tomography angiography

M. Károlyi[1], B. Szilveszter[1], M. Kolossváry[1], R. Raaijmakers[2], W. Giepmans[2], P. Kitslaar[3], T. Horváth[1], B. Merkely[1], P. Maurovich-Horvat[1]; [1]*Budapest/HU*, [2]*Best/NL*, [3]*Leiden/HU (mihaly.karolyi@cirg.hu)*

Purpose: To evaluate the impact of iterative-model-reconstruction (IMR) on quantification of calcified atherosclerotic plaque in coronary computed tomography angiography (CCTA) as compared to hybrid-image-reconstruction (HIR) and filtered-back-projection-reconstruction (FBR) algorithms.
Methods and Materials: Raw data of 52 consecutive patients (39 male, age 64.7±9.3 years) who underwent 256-slice CCTA were reconstructed with IMR, HIR and FBR. Plaques exhibiting calcified components were included in the analysis. An automated plaque quantification software was used to assess plaque dimensions. Plaque components (calcified, fibrous, fibro-fatty, necrotic-core) were differentiated based on HU values using fix threshold settings.
Results: A total of 41 plaques were evaluated. No difference was found in vessel lumen dimensions between the three reconstructions (206.4±109.8 vs. 205.4±111.3 vs. 210.2±121.0 mm3 for FBR, HIR and IMR, p=0.23). Mean plaque volume was lower with HIR as compared to FBR, and further reduced by IMR (154.1±72.1 vs. 144.9±67.8 vs. 130.8±66.9 mm3 respectively, $p < 0.05$ all). Calcified plaque volume was highest with FBR and lowest with IMR (127.6±63.2 vs. 118.8±61.6 vs. 108.2±58.6 mm3, respectively, $p < 0.05$ all). Fibrous plaque volume yielded similar values with FBR and HIR (p=0.8) however it was lower with IMR (13.5±9.9 vs.13.9±12.9 vs. 11.0±9.0 mm3, $p < 0.05$ both). No difference was detected in fibro-fatty and necrotic-core plaque dimensions between FBR, HIR and IMR (10.3±8.6 vs. 9.4±7.9 vs. 7.6±6.4 mm3 and 3.0±3.5 vs. 3.0±4.1 vs. 2.9±5.2 mm3 respectively, p=0.22 and 0.67).
Conclusion: Lower calcified and fibrous plaque volumes measured with IMR may emphasize its potential to better delineate atherosclerotic lesions. Our findings need to be validated against intravascular-ultrasound.

B-0267 14:57

Coronary CT angiography: combined use of low kilovoltage and IMR

C. Lee, J. Seo, S. Chong, Y. Kim; *Seoul/KR (I8704@naver.com)*

Purpose: To investigate the effect of knowledge-based iterative model reconstruction (IMR) on image quality (IQ) and radiation dose of low-tube voltage (80 kVp) coronary CT angiography (CCTA) images with prospectively ECG gating mode.
Methods and Materials: Forty five patients (N=45, M:F=28:17, Age: 56.2 ±10.3, Group A) with BMI < 30 for 4 months who underwent CCTA using 80KVp,were prospectively enrolled. Images were reconstructed with FBP, iDose and IMR in group A. Another 45 patients (Group B) matched by age, sex, BMI and average heart rate, and underwent CCTA using 100 kVp and iDose, were retrospectively included for 6 months. Qualitative and quantitative IQs for CT images were compared in each group.
Results: In group A, the CNR and SNR of the coronary vessels were higher with IMR than iDose and FBP ($p < 0.017$). Qualitative IQ for coronary vessels such as image noise, vessel sharpness, beam hardening artifact and overall image quality were better with IMR than iDose and FBP (3.64 ± 0.61 vs 2.78± 0.52 / 2.98 ± 0.41, 2.22± 0.52, $p < 0.017$). The IQ parameters in group A were significantly better with IMR, but not iDose, and radiation doses were significantly lower, as compared with group B (27.01 ± 6.59 vs 52.35 ± 13.33 mGy-cm, p=0.05).
Conclusion: IMR can provide significantly improved IQ and less radiation dose in CCTA even using a low tube voltage (80 kVp) compared to iDose using 100 kVp.

B-0268 15:05

Optimising radiation dose by using advanced iterative reconstruction in high-pitch coronary CT angiography

S. Gordic[1], D.B. Husarik[1], S. Wildermuth[2], H. Alkadhi[1], S. Leschka[2]; [1]*Zurich/CH*, [2]*St.Gallen/CH*

Purpose: To evaluate the potential of advanced iterative reconstruction (IR) for optimizing radiation dose of 3rd generation 192-slice dual-source CCTA with prospective ECG-gating in the high-pitch mode.
Methods and Materials: CCTA at a pitch of 3.2 was performed in 50 consecutive patients (heart rate 49-74 bpm). In the first 25 patients (group 1), high-pitch CCTA was performed according to standard settings (reference tube voltage 100 kVp, reference tube current-time product 270 mAs/rot). Images were reconstructed with FBP and advanced modelled IR (ADMIRE,levels 1-5). In the latter 25 patients (group 2), CT protocol parameters were adapted according to results from group 1 (reference tube current-time product 156 mAs/rot); images were reconstructed with ADMIRE level 4. In ten patients of group 1, image sharpness using signal intensity profiles across vessel borders were analyzed and the full-width-at-half-maximum (FWHM) was calculated. Image quality was assessed; radiation dose parameters were noted.
Results: Inter-observer agreements were excellent (r=0.88/0.85,p <.01). None of the studies was of non-diagnostic quality. In group 1, the least IR-related image appearance was encountered with ADMIRE level 1. Images with ADMIRE level 4 were most often selected by both readers as preferred dataset, with an average noise reduction of 40% compared to FBP. Signal intensity profiles showed an increasing sharpness of vessel borders with increasing levels of ADMIRE (p <.05). Radiation dose in group 2 (0.3±0.1mSv) was significantly lower than in group 1 (0.5±0.3mSv; p <.05).
Conclusion: IR can be used for optimization of radiation dose in 192-slice dual-source CCTA in the high-pitch mode, resulting in an effective dose of 0.3mSv.

B-0269 15:13

CT coronary angiography with iterative image reconstruction and low iodine (270 mgI/mL) concentration: comparison of image quality and injection pressure with standard (320 mgI/mL) iodine concentration

L. Faggioni, M. Gabelloni, E. Galati, M. Bianchi, P. Marraccini, E. Neri, C. Bartolozzi; *Pisa/IT (michela.gabelloni@libero.it)*

Purpose: To assess intravascular density, overall image quality, and contrast medium (CM) injection pressure of CT coronary angiography (CTCA) examinations performed using iterative image reconstruction and low iodine concentration CM.
Methods and Materials: Seventy-three nonobese patients underwent CTCA on a 64-row CT scanner. Out of them, in 38 patients (52%) 80-90 of 270 mgI/mL iodixanol were injected intravenously at 6.7 mL/s flow rate, while in the remaining 35 (48%) the same volume of 320 mgI/mL iodixanol was administered at 5.6 mL/s flow rate, thus ensuring an iodine delivery rate of 1.8 gI/s in all cases. All CTCA studies were performed using an adaptive statistical iterative reconstruction algorithm (ASIR™, General Electric). CM injection pressure was monitored using dedicated software (Certegra™, Bayer Healthcare, Leverkusen, Germany). Circular regions of interest were placed at the origin of the main coronary arteries, and intracoronary density and signal-to-noise ratio (SNR) were recorded. Diagnostic image quality was rated visually by two independent readers using a semiquantitative score (1=nondiagnostic, 2=adequate, 3=excellent).
Results: Mean arterial density and SNR were comparable between iodixanol 270 mgI/mL and 320 mgI/mL (508±86 vs 510±105, p=0.86 and 12.8±3.3 vs 14.1±6.0, p=0.71, respectively). Overall image quality was good and comparable with either iodixanol 270 mgI/mL or 320 mgI/mL (2.9±0.3 vs 2.8±0.2, p=0.89). Injection pressure was significantly lower with iodixanol 270 mgI/mL than with iodixanol 320 mgI/mL (130±80 vs 221±58 psi, $p < 0.002$).
Conclusion: CTCA with iterative image reconstruction can be successfully performed using an iodine concentration as low as 270 mgI/mL with the advantage of a significantly lower injection pressure compared with standard (320 mgI/mL) iodine CM.

B-0270 15:21

Dose reduction with iterative reconstruction for cardiac computed tomography angiography: a systematic review and meta-analysis

A.M. den Harder[1], M.J. Willemink[1], Q.M.B. de Ruiter[1], P.A. de Jong[1], A.M.R. Schilham[1], T. Leiner[1], R.P.J. Budde[2]; [1]*Utrecht/NL*, [2]*Rotterdam/NL (a.m.denharder@umcutrecht.nl)*

Purpose: To investigate the achievable radiation dose reduction for cardiac computed tomography angiography (CCTA) with iterative reconstruction (IR) in adults and the effects on image quality.
Methods and Materials: PubMed and EMBASE were searched and original articles concerning IR for cardiac CT in adults were included. Primary outcome

was the effective dose using filtered back projection (FBP) and IR. Secondary outcome was the effect of IR on image quality.
Results: The search yielded 1,616 unique articles of which 54 studies (6704 patients) were included. The pooled effective dose of 28 studies investigating different dose levels was 4.71 mSv with standard dose (using FBP) and reduced with 45% to 2.61 mSv (using IR) at reduced dose levels. The remaining studies investigated one dose level with a pooled effective dose of 2.81 mSv. The pooled effective dose was 4.81 mSv with retrospective scans and 2.00 mSv for prospective scans. No correlation was found between publication date and effective dose. Furthermore, effective dose did not differ significantly between IR algorithms. Objective and subjective image quality was equal or improved with IR in most studies, even at reduced dose.
Conclusion: IR allows for CCTA acquisition with an effective dose below 3 mSv with preserved image quality, which can be further reduced to 2 mSv with prospective ECG-triggering.

Author Disclosures:
A.M. den Harder: Research/Grant Support; The Utrecht University Medical Center Department of Radiology received Research Support from Philips Healthcare. **M.J. Willemink:** Research/Grant Support; The Utrecht University Medical Center Department of Radiology received Research Support from Philips Healthcare. **P.A. de Jong:** Research/Grant Support; The Utrecht University Medical Center Department of Radiology received Research Support from Philips Healthcare. **A.M.R. Schilham:** Research/Grant Support; The Utrecht University Medical Center Department of Radiology received Research Support from Philips Healthcare. **T. Leiner:** Research/Grant Support; The Utrecht University Medical Center Department of Radiology received Research Support from Philips Healthcare. Speaker; Payment for lectures (Philips Healthcare, Bayer, Braeco).

14:00 - 15:30 **Room L 1**

Vascular

SS 315
Innovations in vascular imaging

Moderators:
D. Brisbois; Liège/BE
H. Hoppe; Berne/CH

B-0271 14:00
Non-enhanced ECG-gated quiescent-interval single shot MRA (QISS): image quality and stenosis assessment in an improved 3 Tesla version compared with contrast-enhanced MRA and DSA
A. Holden; *Auckland/NZ (andrewh@adhb.govt.nz)*

Purpose: The early experience with an improved version of QISS at 3 T is reported in a clinical cohort with image quality and stenosis assessment compared to CE-MRA in all and DSA in some cases.
Methods and Materials: Ethics Committee and institutional Research Office approval was obtained for this study. At the time of abstract submission, 25 consecutive patients with symptomatic lower limb arterial disease underwent combined peripheral MRA protocol on a 48-channel 3 T MR system (MAGNETOM Skyra, Siemens AG, Erlangen, Germany). The protocol consists of table movement CE-MRA, time-resolved MRA of calf arteries and a prototype of QISS-MRA. DSA correlation was available in 12 patients. Image quality and degree of stenosis was assessed by 3 experienced Vascular Radiologists. Sensitivity and specificity of QISS-MRA was evaluated with CE-MRA and DSA serving as the standards of reference and compared using the Fisher exact test.
Results: Image quality with QISS-MRA was similar to CE-MRA with only 4.7% of imaged arterial segments not well visualized on QISS-MRA compared to CE-MRA. Arterial visualization was superior on QISS-MRA than CE-MRA in another 4.7%, primarily due to venous contamination in the tibial station. There was excellent agreement between CE-MRA and QISS-MRA in assessment of stenosis severity. In patients who underwent DSA, sensitivity (100%) and specifity (87.5%) of QISS-MRA compared to DSA was excellent.
Conclusion: Image quality and stenosis assessment of QISS-MRA at 3 T is comparable to that of CE-MRA and DSA. This should provide an excellent alternative to CE-MRA in patients with contraindications to Gadolinium.

B-0272 14:08
Non-contrast 3D and QISS magnetic resonance angiography for pre-operative TAVR evaluation
P.M. Cannaò[1], A. Varga-Szemes[1], G. Muscogiuri[1], C.N. De Cecco[1], M. Renker[1], S. Mangold[1], D. Piccini[2], S. Giri[3], U.J. Schoepf[1]; [1]*Charleston, SC/US*, [2]*Lausanne/CH*, [3]*Chicago, IL/US*
(paola.m.cannao@gmail.com)

Purpose: To evaluate two novel investigational non-contrast MRA techniques regarding their potential for preoperative TAVR planning.
Methods and Materials: Non-contrast MRA was performed in 7 subjects (5 healthy volunteers and 2 patients) on a 1.5 T system. A prototype 3D self-navigated whole-heart radial MRA sequence was used to assess cardiac anatomy and the aortic root (FOV 220 mm^3, TR/TE 3.1/1.5 ms, flip angle 90°). For the evaluation of the abdominal aorta and the femoral access route, both the 3D whole-heart (FOV 400 mm^3, TR/TE 3.1/1.5 ms, flip angle 90°) and the prototype quiescent-interval singleshot (QISS) MRA pulse sequence (FOV 400x260 mm^2, TR/TE 3.5/1.4 ms, flip angle 90°, acquisition length 144 mm, number of stations 3-4) were evaluated. For aortic root, abdominal aorta and femoral runoff the diameter and contrast- to-noise ratio (CNR) were assessed.
Results: The acquisition time for the 3D whole-heart, abdominal 3D, and abdominal QISS image acquisition was 6.4±1.2 min, 6.3±1.1 min, and 3.1±0.5 min, respectively. There were no significant differences regarding diameter, perimeter, and area of the aortic root between the 3D whole-heart and the 2D bSSFP cine acquisitions. No significant difference was found for evaluation of femoral runoff between 3D and QISS acquisitions. CNR was not significantly different between images obtained by 3D and QISS MRA.
Conclusion: A non-contrast protocol combining 3D whole-heart acquisition to assess the cardiac and aortic root anatomy and QISS MRA for substantially faster evaluation of the femoral access route, if feasible, could be used for pre-operative TAVR evaluation.

Author Disclosures:
D. Piccini: Employee; Siemens Healthcare. **S. Giri:** Employee; Siemens Healthcare:Employment. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0273 14:16
Free breathing navigated 3D T1w black-blood MRI at 3 T for the diagnosis of thoracic large vessel vasculitis
T. Saam[1], S. Maurus[1], N.N. Kammer[1], H. Kooijman[2], M. Treitl[1], E. Coppenrath[1], M.F. Reiser[1], K.M. Treitl[1]; [1]*Munich/DE*, [2]*Hamburg/DE*
(tobias.saam@med.uni-muenchen.de)

Purpose: To evaluate the feasibility of a novel, commercially not available T1w isotropic three-dimensional black-blood turbo spin echo (TSE) sequence with variable flip angles for the diagnosis of thoracic large vessel vasculitis.
Methods and Materials: 17 patients with suspected large vessel vasculitis and 17 controls were imaged at 3.0 T using 1.2 x 1.2 x 1.4 mm3 fat suppressed T1w Volumetric ISotropic TSE Acquisition (VISTA) pre- and post-contrast. Applying a navigator and peripheral pulse unit triggering, the effective scan time was 5-6 minutes. Aortic arch, ascending and descending aorta, left and right subclavian and pulmonary arteries were evaluated by two readers in consensus decision for presence /absence of concentric wall thickening and contrast enhancement.
Results: Good to excellent image quality was achieved in 30 out of 34 exams (88.2%). 37 out of 92 (40.2%) arterial segments in patients with suspected vasculitis showed contrast enhancement and 38 out of 92 (41.3%) concentric wall thickening. Contrast enhancement was strongly correlated with CWT (Spearman´s $R=0.894$; $P < 0.001$). Both findings were found in 15 distinct patients with clinically confirmed vasculitis. Only one out of 97 (1.0%) arterial segments of the control group showed concentric wall thickening and contrast enhancement.
Conclusion: Free breathing navigated black-blood MRI is feasible in less than 12 minutes scan time and allows to accurately diagnosing thoracic vasculitis. Future studies will be necessary to evaluate the utility of this sequence for monitoring of anti-inflammatory therapies.

Author Disclosures:
T. Saam: Research/Grant Support; Pfizer Inc, Diamed Medizintechnik. Speaker; Philips Healthcare. **H. Kooijman:** Employee; Philips.

B-0274 14:24

Diagnostic accuracy of contrast-enhanced T1 free-breathing GE sequences in the assessment of aortic disease: comparison with standard T1 breath-hold GE 3D angiographic sequences

C.R.G.L. Talei Franzesi, D. Ippolito, P.A. Bonaffini, D. Fior, M. Colombo, S. Sironi; *Monza/IT (ctfdoc@hotmail.com)*

Purpose: To compare the diagnostic performance of contrast-enhanced T1 free-breathing gradient echo sequences with standard MR-angiographic sequences, in the assessment of aortic disease.
Methods and Materials: From January 2012 to July 2014.45 patients (27men;mean age60.4years) with known or clinical suspicious of aortic disease were evaluated.All patients underwent an MR angiography (MRA) study of aorta on a 1.5 T magnet (Achieva, Philips), using a phased array multi-coil,after the intravenous injection of 0.1 mL*Kg of gadobutrol,with standard protocol with 3D-angiographic T1 gradient-echo fat-suppressed (3D-HR) sequences. Moreover multiplanar T1 free-breathing gradient-echo fat-suppressed (THRIVE-FB) sequences were also performed. For each patient two blinded radiologists independently compared the diagnostic quality of the different angiographic sequences, in terms of visualization of aortic wall and lumen and main branches. The vascular diameters at different levels were also calculated, compared and statistically analyzed between the different sequences. The interobserver agreement was then evaluated using the Intraclass Correlation Coefficient (ICC).
Results: THRIVE-FB sequences showed high diagnostic accuracy in the evaluation of vascular diameter and walls,having higher sensitivity and specificity in the assessment of vascular plaques, thrombus and adjacent structures, in comparison with 3D-HR. The 3D-HR sequences better visualized the vascular lumen with lower flow artefacts, than THRIVE-FB sequences. Not significant differences were obtained in terms of overall diagnostic quality between 3D-HR and THRIVE-FB sequences and a high interobserver agreement was found, with an ICC of 0.97.
Conclusion: Contrast-enhanced T1 free-breathing gradient-echo fat-suppressed sequences (THRIVE-FB) were able to correctly visualize and evaluate the aorta and its major branches, without significant differences in comparison with standard breath-hold angiographic sequences, allowing also large volume coverage, even in not compliant patients.

B-0275 14:32

3D black-blood T1-weightet turbo spin-echo technique for the diagnosis of deep vein thrombosis: a viable alternative to contrast-enhanced MRI

K.M. Treitl[1], M. Treitl[1], N.N. Kammer[1], E. Coppenrath[1], H. Kooijman-Kurfuerst[2], M.F. Reiser[1], T. Saam[1]; [1]*Munich/DE*, [2]*Hamburg/DE*
(karlamaria.treitl@med.uni-muenchen.de)

Purpose: To evaluate a three-dimensional turbo spin-echo (TSE) technique with isotropic-resolution in the context of the diagnosis of deep vein thrombosis (DVT) and to compare it to contrast-enhanced magnetic resonance imaging (CE-MRI).
Methods and Materials: Thirteen patients (8 male, 17-93 years) with DVT detected in duplex ultrasound (N=11) or with pulmonary embolism and suspicion for DVT (n=2) were imaged at 3.0 Tesla with 1.2 cm isotropic-resolution Volumetric ISotropic TSE Acquisition (VISTA) using standard body coils. Sensitivity (SE), specificity (SP), positive and negative predictive values (PPV, NPV), Cohen`s kappa (κ) and accuracy of VISTA-MRI were calculated and compared to contrast-enhanced MRI (CE-MRI) as a standard of reference. Image quality and diagnostic confidence were evaluated on a four-point scale.
Results: The diagnostic confidence level and the image quality of VISTA-MRI and CE-MRI were comparable (3.80 ± 0.44 vs. 3.77 ± 0.54; P=0.11; 3.54 ± 0.56 vs. 3.55 ± 0.60, $P < 0.65$). Using CE-MRI as the standard of reference, there was high agreement between the CE-MRI and the VISTA examinations for the detection of DVT, with κ=0.89 for reader I and κ=0.88 for reader II (both $P < 0.001$). The SE, SP, PPV, NPV and accuracy of VISTA-MRI were 92.5%, 97.9%, 89.3%, 98.6% and 97.1% for reader I and 90.7%, 97.9%, 89.1%, 98.3% and 96.8% for reader II.
Conclusion: VISTA-MRI can detect DVT with excellent agreement compared to CE-MRI. It might be useful when contrast media is prohibited and in patients with suspected thrombosis of the iliac veins, which can be hard to detect in sonography.

B-0276 14:40

Aortic haemodynamics after valve-sparing aortic root replacement with a physiologically shaped sinus prosthesis analysed by 4D Flow MRI

T.H. Oechtering[1], J. Haegele[1], P. Hunold[1], C. Schmidtke[2], H.-H. Sievers[1], J. Barkhausen[1], A. Frydrychowicz[1]; [1]*Lübeck/DE*, [2]*Bad Segeberg/DE*
(Thekla.Oechtering@uksh.de)

Purpose: The anatomically formed sinus prosthesis ("SP", Uni-Graft®W SINUS, Braun) used for valve-sparing aortic root replacement promises to preserve physiological sinus vortex formation believed to grant physiologic valve function. Using 4D Flow MRI we analysed haemodynamics in patients with SP in comparison to straight grafts ("SG") and volunteers ("VOL").
Methods and Materials: 15 patients after David procedure (12 SP [1f, 55±15y], 3 SG [1f, 51±13y]) and 15 age-matched healthy volunteers [13f, 51±11y] were examined at 3 T (Philips Achieva) with a retrospectively ECG-gated 4D-phase-contrast-sequence. Using GTFlow (GyroTools) blood flow was visualized using streamlines and particle traces. Secondary flow patterns (vortices, helices) were evaluated according to their presence, magnitude, and orientation. Aortic geometry, diameter, and cardiac function were assessed.
Results: In SP and VOL sinus vortices were predominantly small or medium (SP:22%, 50%; VOL:64%, 33%) and physiologically configured. SG displayed no (22%) or small, abnormally rotated vortices (78%). In the ascending aorta, secondary flow patterns were more frequent in patients (SP n=1.5±0.8; SG n=1.7±0.6 per subject) than in volunteers (n=0.3±0.5; $p < 0.001$); no difference in aortic arch or descending aorta was detected (SP n=1.4±0.7, SG n=1.3±0.6, VOL n=0.9±0.8). Volunteers typically presented with a round arch (13/15) whereas patients exhibited mostly cubic and gothic forms (SP:10/12, SG:3/3). Postprosthetic dilatation was observed in every patient (SP:0.7±0.3 cm; SG:0.7±0.4 cm).
Conclusion: Near-physiologic vortex formation was confirmed in sinus prostheses as opposed to straight grafts. Altered geometry and compliance may contribute to increased secondary flow patterns in patients, potentially associated with future vasculopathy and therefore subject to ongoing studies.

Author Disclosures:
P. Hunold: Speaker; Bayer AG Speaker, Koninklijke Philips NV. **H. Sievers:** Patent Holder; Royalities from B. Braun Melsungen AG.

B-0277 14:48

New ECG-gated CTA technique coupled with computational flow analysis in ascending thoracic aortic aneurysm

A. Pasta, C. Parisi, S. Maggio, A. Luca; *Palermo/IT (apasta@ismett.edu)*

Purpose: Despite current diagnostic imaging techniques, an ascending thoracic aortic aneurysm (ATAA) is a life-threatening cardiovascular emergency with remarkable morbidity and mortality. However, ATAAs with smaller diameters than indicated by the surgical paradigm may rupture or dissect unpredictably, in 0-23% cases for diameter < 55 mm (Parish, 2009). These data emphasize the inadequacy of using aortic size as the sole factor for estimating the risk of ATAAs. This study aims to assess morphological variables of ATAAs associated with disturbed haemodynamic flow evaluated by computational modelling. ECG-gated CTA will be used to measure not only aortic diameter but also valve parameters as orifice area and valve orientation.
Methods and Materials: For this study, we used a GE Lightspeed VCT 64 detectors. All exams were acquired with retroprospective ECG-triggering technique and administration of intravenous iodinated contrast agent. Computational modelling was used to evaluate ATAA with BAV (n=10) and TAV (n=18).
Results: Marked valve orientation determines disturbed flow, with remarkable pressure in the anterolateral region of ATAA. Reduced orifice area as measured by ECG-gated CTA is associated with helical blood flow in ATAAs with BAV and in ATAAs with stenotic TAV.
Conclusion: ECG-triggering CTA combined with computational modelling represents a promising technique to assess the haemodynamic disturbance in ATAAs with different valve morphologies (i.e. BAV vs TAV). Reduced orifice area and marked aortic valve orientation are associated with altered haemodynamic of ATAAs. These findings can be used to identify a high-risk subgroup of patients with ATAAs that may clinically benefit from early imaging screening.

B-0278 14:56

Assessment of wall shear stress in patients without aortic disease, with aortic aneurysms and with penetrating aortic ulcers using velocity encoding 4D MRI

M. Rasper, J. Rudolph, B.M. Gramer, C. Maegerlein, C. Reeps, B. Lutz, H.-H. Eckstein, E.J. Rummeny, A. Huber; *Munich/DE*
(michael.rasper@tum.de)

Purpose: To determine whether patients with aortic aneurysms and penetrating aortic ulcers have and increased or reduced peak average wall shear stress magnitude compared to patients without aortic disease.
Methods and Materials: 26 patients (10 patients without aortic disease, 8 patients with aortic aneurysms (AA) and 8 patients with penetrating aortic ulcers (PAU)) underwent velocity-encoding time resolved 3D MRI (4D PC MRI) of the aorta after contrast (0.15 mmol/kg gadobenate-dimeglumine) application during contrast-enhanced MRA of the aorta. 4D PC MRI was performed using ECG-gating and navigator based respiratory gating. Data acquisition was accelerated by parallel imaging (SENSE). The spatial resolution was 1.5x1.5x1.5 mm3. The temporal resolution was 40 ms. The peak velocity and the peak average wall shear stress magnitude were determined using the software GT-Flow (Version 2.0.10, Gyrotools, Switzerland).
Results: The peak velocity was 71.6 ± 6.8 cm/s in patients without aortic disease, 35.6 cm/s ± 3.2 cm/s in patients with PAU and 18.2 ± 2.7 cm/s in patients with AA. The peak average wall shear stress magnitude was 0.35 ± 0.09 N/m2 in patients without aortic disease, 0.13 ± 0.004 N/m2 in patients PAU and 0.07 ± 0.018 N/m2 in AA patients. Both patients with PAU and patients with AA showed lower mean values for peak velocity ($p < 0.001$ and $p < 0.00001$) and peak average wall shear stress magnitude ($p < 0.01$ and $p < 0.004$) compared to healthy patients.
Conclusion: Compared to patients without aortic disease, peak velocity and wall shear stress were reduced in patients with penetrating aortic ulcers and patients with AA.

B-0279 15:04

Transcranial doppler ultrasonography in Beta-thalassemia major patients without and with thrombocytosis

A. Shariat, M. Nazeri, A. Abolhasani Foroughi, M. Karimi; *Shiraz/IR*
(Amin11849@Yahoo.com)

Purpose: The aim of this study was to investigate whether the risk of a future stroke secondary to cerebral artery stenosis can be predicted with the use of transcranial Doppler ultrasound in beta-thalassemia major patients.
Methods and Materials: This study included 54 beta-thalassemia major patients divided into 2 groups; group A consisted of 28 patients who have thrombocytosis secondary to a previous splenectomy and group B comprised of 26 patients who did not have a splenectomy with normal platelet count, as well as a control group of 30 healthy individuals.
Results: Transcranial Doppler ultrasound of the cerebral vessels were performed in all participants, and the results for each group were compared with the controls. In addition, patients were evaluated for evidence of high flow velocity in the cerebral vessels that met the clinically significant criteria of ≥ 50% stenosis. Transcranial Doppler ultrasound velocity criteria for > 50% stenosis, indicating a risk of stroke, were not documented in any patients but increase in cerebral blood velocities in many arteries in group A and in some arteries in group B were revealed.
Conclusion: Following splenectomy, thrombocytosis can predispose the patients to an increase in cerebral blood velocities more than respected with anemia. But by transcranial doppler ultrasonography no evidence of significant stenosis were found in intracerebral arteries to conclude that the beta-thalassemia major patients were more prone to the development of stroke secondary to this abnormality

B-0280 15:12

Efficacy of knowledge-based iterative reconstruction on CT abdominal angiography

K.K.-P. Lau, A. Kuganesan, K. Buchan, T. Lau; *Melbourne/AU*
(kenkplau@gmail.com)

Purpose: The latest knowledge-based iterative reconstruction (KBIR) breaks the linkage between noise and radiation dose, allowing for relatively noise-free images, and therefore, improving image resolution and lesion characterization. This prospective study aimed to assess the efficacy of KBIR in vessel clarity improvement, calcification blooming artefact and pulsation artefact reduction on CT abdominal angiogram (CTAA).
Methods and Materials: Adult patients of all age and genders who presented for CTAA were included. Images were reconstructed using standard statistical iterative reconstruction (SIR) and KBIR. Vessel clarity, calcification blooming artefacts, pulsation artefact of aorta, coeliac axis, superior mesenteric, inferior mesenteric, renal and iliac arteries were assessed using 5-point scale by 2 blinded radiologists randomly. The degrees and locations of arterial stenoses if present were recorded.
Results: Fifty patients (mean age: 59.5) had 183 calcified arterial segments and 79 arterial stenoses were recruited. Paired student t-test was conducted for result comparisons. There was significant difference between the two groups with KBIR performing significantly better for vessel clarity (mean scores of 3.19 for SIR and 4.39 for KBIR, $p < 0.001$) and calcification blooming artifact reduction (Mean score of 3.24 for SIR and 4.22 for KBIR, $p < 0.001$), with no statistically significant difference in pulsation artefact reduction. 21.5% of stenotic segments showed higher grade stenosis on KBIR due to reduced calcification artefact and better non-calcified plaque visualization. Arterial stents and coils were better characterized on KBIR.
Conclusion: KBIR offers improved vessel wall clarity and less calcification artefacts on CTAA, which aids assessment of arterial stenosis and vessel wall pathology.

B-0281 15:20

Nephrogenic systemic fibrosis in patients with chronic kidney disease undergoing MRI with the injection of gadobenate dimeglumine or gadoteridol: findings from prospective cohort studies

G. Soulez[1], D.C. Bloomgarden[2], N.M. Rofsky[3], M. Smith[4], H.H. Abujudeh[4], D. Morgan[5], M.A. Kirchin[6], G. Pirovano[7], A. Spinazzi[7]; [1]*Montreal, QC/CA*, [2]*Milwaukee, WI/US*, [3]*Dallas, TX/US*, [4]*Boston, MA/US*, [5]*Birmingham, AL/US*, [6]*Milan/IT*, [7]*Monroe, NJ/US*

Purpose: To determine the incidence of Nephrogenic Systemic Fibrosis (NSF) in patients with chronic kidney disease (CKD) and moderate-to-severe impairment of kidney function not previously exposed to gadolinium-based contrast agents (GBCAs) or referred for routine contrast-enhanced MR imaging examinations with gadobenate dimeglumine (MultiHance) or gadoteridol (ProHance).
Methods and Materials: Two multicenter, prospective cohort studies were designed to observe and compare the incidence rates of unconfounded NSF in patients with stage 3 CKD (eGFR between 30 and 59 mL/min/1.73m^2 [cohort 1]) or with stages 4 or 5 CKD (eGFR < 30 mL/min/1.73m^2 [cohort 2]) following injection of either gadobenate dimeglumine (Study A) or gadoteridol (Study B). Patients were contacted at 1, 3, 6 and 18 months to detect any sign/symptom suggestive of NSF and were monitored with clinic visits at 1 and 2 years.
Results: The final NSF analysis populations for Studies A and B comprised 363 and 171 patients, respectively (318 and 159 in Cohort 1 of each study, respectively; 45 and 12 in Cohort 2 of each study, respectively). No signs/symptoms of NSF were ever reported or detected during the 2-yr patient monitoring period. No signs/symptoms of NSF have been reported subsequent to the 2-yr monitoring period.
Conclusion: Consistent with literature reports, no association of gadobenate dimeglumine or gadoteridol with unconfounded cases of NSF has yet been established.

Author Disclosures:
M.A. Kirchin: Employee; Bracco. **G. Pirovano:** Employee; Bracco. **A. Spinazzi:** Employee; Bracco.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 310

Fractures, spinal injuries and spine

Moderators:
L.B.O. Jans; Ghent/BE
G. Scheurecker; Linz/AT

B-0282 14:00

Extremity CT and ultrasound in the assessment of ankle injuries - occult fractures

D.J. Wilson, G.M. Allen, S. Bullock; *Oxford/UK (georgina.allen@gtc.ox.ac.uk)*

Purpose: To determine the frequency of occult fractures in patients with an ankle injury and normal radiographs.
Methods and Materials: In a prospective study approved by the Oxford Research and Ethics Committee we recruited 100 patients who had suffered an ankle injury in the previous two weeks. All were examined by 4 experienced musculoskeletal radiologists by ultrasound examination (GE LOGIX Q E9) and low dose extremity cone beam CT (Verity Planmed). Patients with small avulsion fractures continued in the study but those with substantial fractures we referred to the trauma service. All patients were reviewed by a physiotherapist and radiologist at 3 months and 6 months with a repeat ultrasound examination and an assessment of function and pain. We excluded patients under the age of 18 or those with previous ankle surgery.
Results: 19/100 patients were found to have substantial fractures - talar neck, anterior process of calcaneus, posterior malleolar, that were not visible on conventional radiographs. Although many small avulsion fractures were identified by ultrasound examination alone some of the significant fractures were only visible on the CT study. The presence or absence of an ankle effusion is not predictive of substantial fractures.
Conclusion: Occult substantial fractures are common in patients who have suffered an ankle injury when conventional radiographs are normal. Our study suggest that the incidence is around 4 times the frequency expected by previous publications. Our ongoing study is investigating the impact of these injuries on recovery time.

Author Disclosures:
D.J. Wilson: Board Member; British Institute of Radiology. Owner; St Lukes Radiology Oxford. Shareholder; European Imaging London. **G.M. Allen:** Owner; St Lukes Radiology Oxford.

B-0283 14:08

Diagnostic value of DW-SSFP and DW-EPI sequences in differential diagnosis of vertebral osteoporotic fractures from the pathological neoplastic fractures

J.H. Shin, J. Lim, J. Park; *Seoul/KR (Ciprofloxashin@hotmail.com)*

Purpose: We test the hypothesis that since conventional MRI sequences encounter challenges in differentiating the malignant vertebral fractures from the benign vertebral fractures, DWI-SSFP sequence proves to be a valuable tool in differentiation and that DW-EPI can be another valuable tool by correlating its diagnostic results with the DWI-SSFP sequence.
Methods and Materials: 26 osteoporotic fractured patients and 13 pathological fractured patients were selected. (M:F = 24:15, mean age: 67 years-old) Utilizing the 3 T Skyra, DW-SSFP (DW-PSIF in Siemens) and DW-EPI images were obtained. For the DW-SSFP, signal ratio of fractured sites and the normal bone marrow intensity were compared between the two groups. For the DW-EPI, ADC values at the fractured sites were compared between the two groups. Mann-Whitney U test between the two groups and the linear correlation between the DW-SSFP ratios and the DW-EPI's ADC values were performed.
Results: The malignant group had higher DW-SSFP median ratios (7.0) than the benign group (2.4). ($P < 0.05$) DW-EPI's median ADC values were higher in the benign group (1.3 x 10–3) than the malignant group. (0.74 x 10–3). ($P < 0.05$) Positive linear correlation between the DW-EPI ADC values and the DW-SSFP ratios were observed in both pathological and benign fractures (R2= 0.64, 0.76).
Conclusion: First, DW-EPI sequence well correlated with the DW-SSFP sequence in terms of evaluating the fractured sites in the two groups. Second, DW-SSFP sequence and DW-EPI sequence may provide an excellent supplemental tool in differentiation between the benign osteoporotic fractures and the pathological vertebral fractures.

B-0284 14:16

Assessing the performances of the trabecular bone score (TBS) on EOS images for the discrimination of osteoporotic fractures

A. Feydy, K. Briot, N.-E. Regnard, A. Etcheto, S. Kolta, C. Roux; *Paris/FR (antoine.feydy@cch.aphp.fr)*

Purpose: The EOS radiological system allows whole body simultaneous acquisitions in frontal (AP/PA) and lateral views in the upright position, at low dose. The trabecular bone score (TBS) assessed by DXA is related to the bone microarchitecture and fracture risk. A prototype version of the TBS has been adapted to the EOS system. Our goal was to assess the discriminative value of the TBS measured on EOS X-ray images (TBS_EOS) for osteoporotic fractures.
Methods and Materials: Our case-control study included 26 patients with severe osteoporotic fractures (11 vertebrae, 10 humeri, 2 hips and 3 proximal tibia fractures) and 51 patients without fracture. TBS_EOS were computed on AP full-body EOS images, focusing on the lumbar spine. The patients were also scanned with a DXA densitometer (Hologic Inc). providing spine, total hip and femoral neck areal BMD (aBMD, in g.cm-2). Discriminative values of TBS_EOS and aBMD for fractures were assessed using ROC curves analysis (AUCs).
Results: Prevalence of osteoporosis was similar in fractured and non-fractured groups (68 % vs 78.4%, p=0.97). aBMD measurements were similar at lumbar spine (0.78 vs 0.79, p=0.92), total hip (0.73 vs 0.71, p=0.26) and femoral neck (0.60 vs 0.61, p=0.75). TBS_EOS values were significantly lower in fractured patients compared to non-fractured patients (0.646 vs 0.734, p=0.03). The TBS_EOS was associated with the presence of fractures with a significant AUC of 0.665.
Conclusion: We demonstrated the feasibility of estimating the TBS from low-dose EOS X-ray images. TBS_EOS was successful in discriminating patients with osteoporotic fractures from controls.

B-0285 14:24

Trabecular bone microstructure assessed by low-dose MDCT and iterative reconstruction predicts vertebral bone strength

T. Baum, F. Kopp, R.A. Nasirudin, E. Grande Garcia, R. Burgkart, E.J. Rummeny, J.S. Bauer, P.B. Noël; *Munich/DE (thbaum@gmx.de)*

Purpose: MDCT-based trabecular bone microstructure analysis has improved the prediction of bone strength beyond BMD measurements in the context of osteoporosis. However, the clinical application of this method is currently limited due to the relatively high radiation exposure. Therefore, the purpose of our study was to investigate the effects of low-dose MDCT and iterative reconstruction algorithms on trabecular bone microstructure parameters.
Methods and Materials: Twelve thoracic vertebrae were harvested from three fresh human cadavers. MDCT imaging of each vertebra was performed in a water bath to simulate the soft tissue environment. Images were obtained by using a clinical 64-row MDCT scanner with a tube load and current of 120 kV and 220 mAs (normal-dose protocol, ND) and 120 kV and 70 mAs (low-dose protocol, LD), respectively. Voxel size and slice thickness amounted to 300x300µm² and 600µm in both protocols. Images were reconstructed by using standard filtered back-projection (FBP) and in-house developed fully iterative reconstruction (IR) algorithms. BMD and trabecular bone microstructure parameters were determined in the MDCT images and correlated with failure load (FL) as assessed by destructive biomechanical testing of the vertebrae.
Results: BMD significantly correlated with FL ($r=0.92$; $p < 0.05$). Trabecular bone microstructure parameters showed correlations with FL in the range of r=0.84-0.94 (ND-FBP), r=0.80-0.94 (ND-IR), r=0.84-0.89 (LD-FBP), and r=0.88-0.96 (LD-IR) ($p < 0.05$). However, the absolute values of the trabecular bone microstructure parameters as assessed in ND-FBP, ND-IR, LD-FBP, and LD-IR were significantly different ($p < 0.05$).
Conclusion: Trabecular bone microstructure parameters as assessed by low-dose MDCT and iterative reconstruction algorithms adequately predicted vertebral bone strength.

B-0286 14:32

Effect of ROI size and positioning on interobserver variability, sensitivity and specificity in the differentiation of acute benign and malignant vertebral body fractures with quantitative diffusion-weighted MRI

T. Geith[1], B. Margarita[1], M. Notohamiprodjo[1], A. Biffar[1], G. Schmidt[1], H. Duerr[1], S. Sourbron[2], M.F. Reiser[1], A. Baur-Melnyk[1]; [1]*Munich/DE*, [2]*Leeds/UK (tobias.geith@med.uni-muenchen.de)*

Purpose: To evaluate the effect of different sizes and positioning of regions of interest (ROIs) on the inter-observer variability, sensitivity and specificity in differentiating acute benign and malignant vertebral body fractures with quantitative diffusion-weighted MRI.

Methods and Materials: 26 acute benign (31.5-86.2 years) and 20 malignant vertebral fractures (24.7-86.4 years) were evaluated. Standard sequences and a diffusion-weighted single-shot turbo-spin-echo-sequence at different b-values (100,250,400,600 s/mm²) were acquired at 1.5 T. Two readers independently evaluated ADCs of the fractured vertebrae based on regions of interest (ROIs), manually adapted to the whole extension of hyperintense areas on STIR, to the whole outer shape of the fractured vertebrae, and to small spots within each hyperintense area on STIR. Significant differences were determined with Student's t-test. ROC analysis was used to determine sensitivity and specificity. Interobserver correlation was tested with the Intraclass-Correlation-Coefficient (ICC).
Results: ICC was high for all ROI-sizes (ICC=0.80-096). Highest AUC (0.803) was found for the ROIs on the whole outer vertebral contour (sensitivity=68%,specificity=88%). ROIs exactly adapted to the extension of high signal on STIR had the highest sensitivity (74%) at a specificity of 83% (ADCmalignant< 1.48×10-3 mm2/s).
Conclusion: ROIs exactly adapted to the extension of bone-marrow edema (hyperintense on STIR) provide the highest sensitivity to differentiate acute benign and malignant vertebral body fractures and should be used in quantitative diffusion-weighted MRI.

B-0287 14:40

'The value of DEXA assessment in patients with a possible osteoporotic vertebral fracture' - a retrospective analysis

O. Azmat[1], N. Lee[1], C. Groves[2]; [1]*Leeds/UK*, [2]*Bradford/UK*
(omar.azmat@nhs.net)

Purpose: To assess value of Dual-energy X-ray absorptiometry (DEXA) scanning in cases referred directly from the radiology department after the diagnosis of a vertebral fracture.
Methods and Materials: Between January and July 2014, 81 Dual-energy X-ray absorptiometry (DEXA) scans were performed following a direct referral from the radiology department using a short code. These codes were attached to reports of an incidental or low trauma vertebral fracture in patients over 50 years. DEXA reports for 50 consecutive cases were reviewed. The lowest T scores were recorded and whether a specific treatment regimen was recommended based on the T-scores, clinical risk factors and demographic features.
Results: This review revealed 25 patients (50%) with a T score for osteoporosis. 17 patients (34%) had T scores within the osteopenic range and considered to be at risk of progression to osteoporosis. Based on a review of risk factors, 40 patients (80%) were considered to be at a significant risk for further fractures and recommended medical treatment, including bisphosphonate therapy and lifestyle advice plus optimization of calcium Levels.
Conclusion: Given the massive NHS costs going towards management of osteoporotic fractures [£1.73 billion each year (NOGG 2010)], optimum treatment in at-risk patients would lead to financial benefits and reduce patient morbidity and mortality. The use of a short code in radiology reports has a significant pick-up rate for low bone mineral density. Its use has also raised awareness of osteoporosis issues within the department, and will hopefully contribute towards improving bone health in the Bradford population.

B-0288 14:48

DECT evaluation of acute bone marrow contusion in the spine with MRI correlation

D. Na[1], S.-J. Hong[1], C. Kang[1], B. Kim[2], K.-S. Ahn[1], S. Lee[2], Y. Jang[1];
[1]*Seoul/KR*, [2]*Gyeonggi-do/KR (oproom11@hanmail.net)*

Purpose: To evaluate the benefit of HU ratio, which is calculated from calcium subtraction images reconstructed from dual-energy computed tomography (DECT), for the diagnosis of bone marrow contusion in patients with acute spinal compression fracture, correlated with spinal MRI.
Methods and Materials: Between January 2012 to July 2014, among the patients who visited our emergency department due to spinal injury, total 38 patients (M:F=25:13, mean age:55.6years, range:28-82) who underwent both DECT (100 kVp and 135 kVp) and MRI were included, prospectively. DECT data were postprocessed by subtraction of calcium using material axis of calcium. In the group with spinal compression fracture identified on MRI, we calculated the ratio of HU values of fracture level to normal next vertebra in calcium subtraction image. In the group without fracture, we obtained the ratio of normal two adjacent vertebra. The ratios were compared between the 2 groups.
Results: Fracture lesions were confirmed in 24 regions from 22 patients, and 16 patients had no fracture. The mean HU ratio of the fracture group was 1.74, 1.76, and that of the non-fracture group was 1.06. 1.06, in the low and high energy images, respectively. The HU ratio is higher in the fracture group than the non-fracture group (p=0.001, p=0.001).
Conclusion: In the vertebrae with acute compression fracture, bone marrow HU values of calcium subtraction image showed relatively higher than in the vertebrae without fracture. Therefore, using HU ratio may help detection the bone marrow edema/hemorrhage/microfracture in acute spinal trauma.

B-0289 14:56

MRI following whiplash injury is improved by routine imaging of the cranio-cervical junction in addition to the cervical spine

F.W. Smith[1], S. Morgan[2]; [1]*Aberdeen/UK*, [2]*Bristol/UK*
(franciswsmith@hotmail.com)

Purpose: To improve diagnosis in patients following whip-lash injury.
Methods and Materials: 40 patients 15 - 72 yrs. (Mean 48 yrs), previously investigated following hyperextension injury of the neck normal MRI examination of the cervical spine were entered in to the study. Previous MRI examinations comprised sagittal T1 & T2 & axial T2 weighted images from C2 to T1. Patients were studied seated, using the sequences above. Additional coronal and axial proton density images were obtained from the skull base down to the C2/3 level, with further axial images with the head rotated to the right and the left were made. Spinal alignment, disc integrity, alignment of the atlanto axial joints and atlanto-occipital joints, alar and cruciate ligament integrity and cerebellar tonsillar station were assessed in all cases, together with measurement of the clivo-axial angle, Harris interval and Grabb-Oaks measurements.
Results: In over 50% of patients (22), no additional information was gained. In the other 18 patients, 16 showed ligamentous damage at the atlanto-axial joint, of which 10 had dislocation, 2 of which showed instability on the rotation images. 2 had atlanto-occipital joint dislocation. Cerebellar tonsillar ectopia was seen in 10 patients.
Conclusion: When cost implications of under diagnosis of mechanical damage at the cranio-cervical junction is very large, the current practice of limiting imaging to below C2 is inadequate and under-estimates the incidence of post traumatic ligamentous damage. For thorough MRI examination, imaging of the cranio-cervical junction is important, to find or exclude ligamentous damage.

Author Disclosures:
F.W. Smith: Advisory Board; EUROPEAN SPINE JOURNAL, THE SPINE JOURNAL. Consultant; MEDSERENA UK. **S. Morgan:** Consultant; MEDSERENA UK.

B-0290 15:04

Percutaneous vertebroplasty for single or multiple thoracolumbar compression fractures

A.R. Shah, A.M. Highland; *Sheffield/UK (asad_rabbani@hotmail.com)*

Purpose: Short-to-medium term follow-up results after percutaneous vertebroplasty for single or multiple thoracolumbar compression fractures and the effect of cement leak were assessed.
Methods and Materials: Prospective study of single operator percutaneous vertebroplasties (PVP's) performed at a tertiary care centre between April 2009 to March 2014. The follow-up VAS and ODI scores at 6-8 weeks, 3-4 ad 6 months were analysed using a locally maintained database.
Results: 93 Patients underwent percutaneous vertebroplasties at 178 Levels.Scores for 69 patients with 135 levels were used for analysis. 65 were osteoporotic fractures, 2 multiple myeloma and 1 each post-traumatic and metastatic renal cell carcinoma. 35 were a single level and 34 were multiple level procedures. 52 % procedures were at the thoracolumbar junction (T11:19, T12:27 and L1:23). Mean VAS scores were 8 vs 5.6; 7.6 vs 5.3 and 7.6 vs 6.0 and mean ODI scores were 51.6 vs 46.9; 50.9 vs 39.3 and 47.9 vs 36.6 at 6-8 weeks, 3-4 months and 6 months respectively. Scores at 3 months for patients having single or multilevel vertebroplasties were: 7.5 to 5.8 vs 7.7 to 4.7 and 48.4 to 43 vs 52.4 to 36.6.The VAS scores at three months were 7.6 to 5.2 and 5.6,and the ODI scores were 50.4 to 37.6 vs 44.8; in patients with and without cement leaks (30% cases).
Conclusion: No outcome difference was found in patients with single or multi-level PVP's procedures except a high starting point in the later. Patients with disc leaks have less short term improvement.

B-0291 15:12

Moiré fringe technique and bi-planar radiography of the spine: accuracy to detect vertebral rotation of mild scoliotic patients

A. Hocquelet, F. Cornelis, L. Castaings, F. Petitpierre, C. Fournier, O. Hauger;
Bordeaux/FR (nonobdx@gmail.com)

Purpose: To evaluate the accuracy of novel 3D spine reconstruction method based on Moiré fringe technique coupled with biplanar X-rays to detect vertebral rotation of the spine of mild scoliotic patients.
Methods and Materials: From august to november 2012, 62 consecutive mild scoliotic patients from a single institution were included. Frontal and sagittal calibrated low-dose biplanar x-rays (EOS imaging) were coupled simultaneously with an optical Moiré back surface based technology (BIOMOD

3S; AXS MEDICAL). The 3D reconstructions were performed by two radiologists. Readers used two different semi-automatic methods using template (method 1) or Moiré projections based technique (method 2). Inter-reliability and intra-reliability were estimated for different parameters: thoracic kyphosis, lumbar lordosis, Cobb's angle, pelvic morphologic and positional parameters, and axial rotation.
Results: Intraclass correlation coefficient showed good or very good agreement for most of the measurements. For method 1 and for both readers, the 95% prediction limits was approximately 4° degrees for the measurements of spinal curves and pelvic parameters, and 3° for axial vertebral rotation. For method 2, the 95% prediction limits was approximately 3° degrees for the measurements of spinal curves, pelvic parameters and axial vertebral rotation. In term of reconstruction time, method 1 was faster than method 2 for the 2 readers (13.4 vs 20.7 and 10.7 vs 13.9; both p=0.0001).
Conclusion: Moiré fringe based technique coupled with biplanar X-rays is an accurate and reliable tool to perform 3D reconstruction of the spine in weight bearing position and to quantify the vertebral rotation in mild scoliotic patients.

B-0292 15:20

Clinical correlation of a new and practical magnetic resonance grading system for cervical foraminal stenosis assessment
H.J. Park, C.H. Han; *Seoul/KR (49han@hanmail.net)*

Purpose: We evaluated whether the new magnetic resonance (MR) grading system for cervical neural foraminal stenosis (CNFS) correlates with clinical manifestations and to propose a modified grading system more useful for clinical practice.
Methods and Materials: We examined 356 patients who visited our institution and underwent MRI of the cervical spine. The presence and grade of cervical foraminal stenosis at the maximal narrowing point was assessed using the new grading system suggested by Kim et al. (Kim system) and the grading system we modified (modified Kim system). Results were correlated with clinical manifestations and neurologic physical examination findings.
Results: Among patients who were modified Kim system grade 2, 19 and 20 patients evaluated by radiologists 1 and 2, respectively, were neurologic sign negative. Inter-observer agreement for the modified Kim system was slightly superior to the Kim system. Correlation coefficients of the modified Kim system were higher than those of the Kim system. Statistically significant differences were seen at C4-5 ($P < 0.05$).
Conclusion: The Kim system showed moderate clinical correlations. The modified Kim system showed moderate but slightly stronger correlations. In both systems, grade 0 denoted negative neurologic manifestations. Although a considerable number of grade 1 and 2 cases in both systems showed PNM, fulfilling the criteria for grades 1 and 2 CNFS does not perfectly predict PNM.

14:00 - 15:30 **Room E2**

Neuro

SS 311a

Brain trauma, degenerative and spine diseases

Moderators:
P. Barsi; Budapest/HU
J. Hodel; Lille/FR

B-0293 14:00

Cerebral perfusion disturbances in traumatic brain injury: direct and indirect effects on memory and psychoemotional outcome
E. Papadaki, S. Demetriou, E. Kavroulakis, S. Papadopoulou, P. Simos, A. Karantanas; *Iraklion/GR (fpapada@otenet.gr)*

Purpose: To investigate possible correlation between haemodynamic changes and psychoemotional/cognitive status in patients with chronic traumatic brain injury (TBI).
Methods and Materials: Dynamic susceptibility contrast magnetic resonance imaging (DSCMRI) perfusion technique was applied to 22 patients with chronic TBI and 25 healthy volunteers. Patients were divided into moderate/severe or mild TBI groups, according to clinical syndromes. Episodic memory indices and depression/anxiety scores were estimated. Cerebral blood flow (CBF), cerebral blood volume (CBV) and mean transit time (MTT) values were measured in normal appearing white matter (NAWM) and normal appearing deep grey matter (NADGM) regions bilaterally, including those involved in episodic memory and psychoemotional status.
Results: The two groups differed significantly on episodic memory indices. Significantly reduced CBV and CBF values were detected in the moderate/severe TBI group compared to controls ($p < .001$) in both temporal, right frontal and left parietal NAWM and the semioval centre. Perfusion reduction in the mild TBI group reached significance compared to controls only in the left temporal WM ($P < .002$). Substantial negative correlations were found between depression/anxiety scores and CBV values in the mesial temporal lobes (MTL) bilaterally.
Conclusion: Patients with moderate/severe chronic TBI are characterised by significant lower perfusion in NAWM regions involved in episodic memory. Elevated anxiety symptoms were directly associated with reduced CBV in MTLs, resulted in suppressed capacity to memorise verbal material for subsequent recall.

B-0294 14:08

Development of a common MRI protocol for the collaborative European neuro trauma effectiveness research in TBI study
P. Pullens[1], J. Verheyden[2], W. van Hecke[2], A. Maas[1], P.M. Parizel[1]; [1]*Antwerp/BE*, [2]*Leuven/BE (pim.pullens@uantwerpen.be)*

Purpose: CENTER-TBI is an international consortium study, which aims to improve care for patients with traumatic brain injury (TBI). A key component is neuroimaging to characterize the disease course. Over the next years, 1,800 patients with mild, moderate and severe TBI will undergo dedicated (follow-up) MRI sessions from as early as 72 hours after presentation up to 2 years. MRI scans will be collected at 38 European sites. The challenge is to develop standardized imaging protocols to be used in a clinical setting using 3 T MRI vendor sequences.
Methods and Materials: The MRI protocol consists of 3D-T2, 3D-FLAIR, 3D-T1, 3D-SWI, DTI and rs-fMRI. The protocol was based on recommendations from TRACK-TBI and adapted for a multi-vendor environment including 3 T scanners by GE, Philips and Siemens. The same volunteer was scanned in each system.
Results: Highly similar 3D-T2, 3D-FLAIR and 3D-T1 images were obtained, but adjustments of stock sequences were needed. For DTI, gradient tables could not be equalized. At Siemens we obtained 2x30 directions, on Philips 2x32 and on GE 2x32. SWI was implemented as a custom sequence. Due to hardware differences, the number of rs-fMRI slices had to be adjusted to obtain full brain coverage within TR=2550 ms. Total scan times for the entire protocol were: Siemens: 40:05, Philips: 47:10, GE 46:48.
Conclusion: Development of a standardized MRI- protocol for patients with TBI, in a multicenter, multivendor consortium requires careful adjustments in order to obtain similar image quality. Vendor specific sequence implementations and software release versions cannot be ignored.

Author Disclosures:
J. Verheyden: Employee; icoMetrix NV. **W. van Hecke:** Employee; icoMetrix NV.

B-0295 14:16

Prognostic value of DWI and DTI in severe traumatic brain injury: a prospective cohort of 56 patients
H. Derbel, S. Haddar, A. Maalej, A. Chaari, H. Chelly, K. Ben Mahfoudh, M. Bouaziz; *Sfax/TN (haythamedecine@yahoo.fr)*

Purpose: To precise respective values of diffusion weighted imaging (DWI) and diffusion tensor imaging (DTI) in the assessment of medium-term prognosis in severe traumatic brain injury.
Methods and Materials: 56 consecutive severe trauma brain injury (mean age 30 years, Sex ratio: 7/1) prospectively underwent MRI evaluation with average post-traumatic delay of 7 days. Examination protocol was standardized and included DWI (EPI, b1000) and DTI (EPI, b1000, 25 directions). In DWI, the mean ADC of normal appearing white matter (NAWM) was measured by averaging the ADC at 3 regions of interest (ROI) (semi-oval centres and pons). In DTI, we measured fractional anisotropy (FA) in 9 ROI placed at the corticospinal tracts and the corpus callosum. Prognostic evaluation was conducted within 6 months, based mainly on the Glasgow Outcome Scale (GOS). Statistical evaluation was performed with SPSS 18.0 software and comprised univariate and multivariate analysis using Student t test.
Results: ADC decreasing below 0.77 10-3 mm^2/sec in NAWM has been strongly correlated with a poor outcome ($p = 0.001$, RR 164.3). In DTI, decreased FA was correlated with a poor outcome at the right internal capsule ($p = 0.024$, RR= 11.9), right cerebral peduncle ($p = 0.009$, RR= 23.7) and genu of corpus callosum ($p = 0.016$, RR= 13). In addition, decreased FA in the splenium and pyramidal tracts was inversely correlated with the duration of intensive care unit stay.
Conclusion: Several multimodal parameters were identified through our study as strong prognostic predictors of unfavourable outcome of brain injury trauma.

B-0296 14:24

Prognostic correlation of MRI findings with levels of parasitemia in cerebral malaria

A.K. Udiya[1], A. Jha[1], U. Chauhan[2], S. Singhal[2]; [1]*Lucknow/IN*, [2]*New Delhi/IN (alok.udiya@gmail.com)*

Purpose: 1. To describe the common MRI findings in cerebral malaria. 2. To correlate these findings with level of parasitemia and assess the prognostic value of these findings.
Methods and Materials: This prospective study was conducted on 51 patients during September 2011-August 2013, with blood smears positive for malaria parasite. Parasitic Index (PI) was estimated by counting the number of parasitized red blood cells (RBCs) among 1000 RBCs. The parasitic load was graded on a scale of I-IV corresponding to 0-5%, 6-10%, 11-20% and > 20%, respectively. All patients underwent MRI on Siemens 1.5 T MAGNETOM AVANTO.
Results: The MRI findings were normal in majority of the cases (62.7%), whilst the commonest abnormality was non-specific white matter abnormalities (13.7%). Other notable findings were Cortical and deep gray matter infarcts (11.7%), cerebral petechial haemorrhages (9.8%). Uncommon findings included focal gyral thickening (3.9%) and dural venous sinus thrombosis (1.9%). Only one case with reversible splenial lesion was encountered, which was seen in association with microbleeds. The findings correlating with high parasitic index included cerebral microbleeds and infarcts, whilst non specific white matter abnormalities correlated well with low parasite load. The poorest prognosis was noted in cases with cerebral microbleeds (Mortality:80%) and sinus thrombosis (100%), whilst best prognosis was seen in cases with non-specific white matter abnormalities (Mortality: 14%).
Conclusion: Majority of cases have normal MRI appearance. Cerebral microbleeds and sinus thrombosis are the most serious manifestations correlating with high parasitic index, whilst non specific white matter lesions and reversible splenial lesions have best prognosis.

B-0297 14:32

"Power button sign": a new typical MR imaging pattern of focal cortical dysplasia in the central region

C. Melleiro, P. Roca, F. Chassoux, J. Meder, C. Oppenheim; *Paris/FR (c.mellerio@ch-sainte-anne.fr)*

Purpose: Type 2 focal cortical dysplasia (FCD2) is one of the main causes of refractory partial epilepsy, but often remains overlooked by MR imaging (MRI), even with optimized protocol. This study aimed to analyze and characterize sulcal abnormalities near lesions located in the central region and especially to evaluate a new sulcal pattern ("power button sign").
Methods and Materials: Four readers reviewed the 3DT1 MR images of 37 patients (among which 13 had negative MRI) with histologically proven FCD2 of the central region and 44 controls using a three-dimensional, mesh-based reconstruction of cortical folds (BrainVisa-Anatomist). Power button sign referred to the interposition of a precentral segment between a small unusual branch ascending anteriorly from central sulcus and the central sulcus itself (cf. figure). Inter- and intra-observer reliability, specificity, sensitivity were calculated.
Results: Power button sign was found in 62% of the patients (70% when MRI was positive and 49% if not) near the lesion, but was found in only on control (Specificity = 98%, Sensitivity = 62%). FCD2 was located precisely in the depth of the abnormal branch in 60% of the patients with power button. In other cases, FCD2 was located in its immediate vicinity. Inter- and intra-observer rate were excellent (0.87 and 0.92 respectively). Other sulcal variations were more frequent in patients than in controls, such as the number of side branches ($p < 0.001$) and connections ($p=0.01$).
Conclusion: Sulcal abnormalities and especially "Power button sign" can provide additional criteria for FCD2 detection and localization, especially when MRI is negative.

B-0298 14:40

Apparent diffusion coefficient map can help the voxel-based morphometric diagnosis of Alzheimer's disease

H. Takahashi[1], K. Ishii[2], Y. Watanabe[1], H. Tanaka[1], T. Murakami[2], N. Tomiyama[1]; [1]*Suita/JP*, [2]*Osaka-Sayama/JP (hiroto.takahashi07@gmail.com)*

Purpose: To investigate the clinical usefulness of the apparent diffusion coefficient (ADC) map in the diagnosis of Alzheimer's Disease (AD) with voxel-based analysis.
Methods and Materials: This study included 25 patients with probable AD (Group A) and 20 patients without dementia (Group B) which underwent both three-dimensional T1W imaging and EP-DW imaging at 3 T. The volume and ADC of the regional gray matter (GM) were calculated using an automatic volumetric measurement of segmented brain image system (AVSIS) in the bilateral hippocampi, precunei, and the anterior and posterior cingulate gyri. The significance of the differences in volume and ADC of all regional GM of the two groups was tested using ANOVA with Bonferroni correction. The regional GM differences between both groups in each volume and ADC were evaluated using SPM.
Results: In Group A, the volumes of the precunei [mean-value (cm3): Group A/B = 18.57/21.56] and the anterior cingulate gyri [mean-value (cm3): Group A/B = 6.17/8.20] were significantly less than in Group B ($P < 0.05$). The ADC in Group A was significantly larger than that in Group B in the bilateral hippocampi [mean-value (x10-6 mm2/sec): Group A/B = right 1012.85/868.84; left 1067.68/891.77] and posterior cingulate gyri [mean-value (x10-6 mm2/sec): Group A/B = 1016.46/874.54] ($P < 0.05$). SPM ($P < 0.001$) showed that the areas of increased ADC in Group A were more extended in the bilateral hippocampi, precunei, and posterior cingulate gyri than the areas of decreased volume in Group A compared with those in Group B.
Conclusion: Regional water diffusivity can provide clinically useful information in the morphometric evaluation of AD.

B-0299 14:48

Use of MR tractography and T2* perfusion for differentiating neoplastic and inflammatory cervical cord lesions

M.S. Abdelgawad[1], M.S.R. Reda[2], N.A.M. Abdelmonsef[2]; [1]*Menofyia/EG*, [2]*Alexandria/EG (ihabsreda@hotmail.com)*

Purpose: Use of MR Tractography and T2* perfusion in order to differentiate cervical cord tumours from inflammatory demyelinating diseases.
Methods and Materials: 16 patients with different cervical cord lesions were enrolled in this study including 7 tumours (3 astrocytomas, 2 ependymomas,1 GMB and 1 hemangioblastoma as proved by biopsy) and 9 inflammatory lesions (7 MS and 2 Devic's disease as proved by clinical, laboratory data and follow-up for 6 months). All patients were subjected to conventional MRI including sagittal and axial T1 & T2. Diffusion tensor imaging was performed and tractography reconstructed for all cases. Contrast administration was used for T2* perfusion, followed by T1 post contrast series. Post processing mean curve calculation was performed on separate work station.
Results: All cases of cervical cord tumours resulted in variable degrees of cervical tracts deviation, with (n=4) or without (no=3) fibers interruptions. All cases (no=7) of cervical tumours showed variable degrees of hyperperfusion in relation to the adjacent normal cord parenchyma. No tracts deviation was recorded in any case of demyelinating white matter disease, while variable degrees of tracts attenuation and diminished girth was seen, while still remaining of parallel course. All cases demyelinating disease showed iso or hypoperfusion in relation to the normal cord parenchyma. Lower values of fractional anisotropy (FA) were recorded in Devic's disease than MS.
Conclusion: MR tractography and T2* perfusion are very promising tools for differentiate cervical cord tumours from inflammatory process.

B-0300 14:56

Natalizumab related PML: atypical neuroradiological findings

S. Gerevini[1], G. Caliendo[1], M. Cava[1], R. Capra[2], N. De Rossi[2], A. Falini[1], M. Cosottini[3]; [1]*Milan/IT*, [2]*Brescia/IT*, [3]*Pisa/IT (gerevini.simonetta@hsr.it)*

Purpose: Progressive multifocal leukoencephalopathy (PML) is a possible complication in patients with multiple sclerosis treated with natalizumab. MRI detects PML in a pre-symptomatic phase even months before clinical symptoms occur. Aim of the study is to describe peculiar or initial imaging findings of PML in the italian sample of natalizumab induced PML.
Methods and Materials: From Italian database we select the first MR examination of 18 patients where a suspected PML lesion appeared. Lesion appearance, borders, size, hemispheric involvement, mass effect, location, contrast enhancement, appearance on T1, T2 and Diffusion-weighted images were described. Three radiologic patterns were defined: Anergic (A), mainly white matter (WM) not enhancing lesions, Inflammatory (B) white matter lesions with punctate or curvilinear enhancement and Atypical (C).
Results: Lesions prevail in the left frontal lobe. Focal lesions involved the subcortical WM in 16 patients, the deep WM in 10 and the grey matter 8 cases. PML lesions were hypointense on T1w and hyperintense on DWI in 14 pts. All patients have hyperintense lesions on T2w images. Focal lesions enhanced in 5 cases. At the beginning of the disease pattern A was observed in 3 patients and pattern B in 3 cases. The "atypical pattern" with cortical involvement was detected in 9 patients and with "milky way sign" in 5.
Conclusion: Natalizumab related PML needs to be accurately monitored with MRI since a large number of early MR examinations exhibited an atypical pattern of PML lesions with a not negligible incidence of cortical involvement.

B-0301 15:04

Cortical gray matter localisation of initially diffusion-positive lesions is associated with no MRI-visible 8-week scar in a cohort of transitory cerebral ischemic attack patients

I. Havsteen, C. Ovesen, J. Damm Nybing, J. Marstrand, A. Christensen, H. Christensen; *Copenhagen/DK (achr0019@regionh.dk)*

Purpose: In a prospective transitory cerebral ischemic attack patient cohort we investigated rates of presence or absence of MRI-visible scarring of DWI-positive lesions 8 weeks after ictus. Preliminary data.
Methods and Materials: We investigated patients with clinical WHO-defined transitory cerebral ischemic attack and performed 3 T-MRI including diffusion and T2-FLAIR within 72 hours and at 8 week follow-up. We defined scarring as presence of 8-week MRI T2-FLAIR hyperintensity or atrophy in the area of initial DWI-lesion. We used Fischer's exact test for analysis.
Results: Of 200 planned now 111 patients with 126 events completed 8-week MRI. 46 lesions were initially DWI-positive and 41 lesions of these were initially ADC-confirmed whereas 5 smaller ones were not. 32 lesions showed hyperintensity or atrophy on 8-week follow-up T2-FLAIR. 14 lesions were not visible on 8-week FLAIR, hereof 13 in cortical gray matter including all the smaller not ADC-confirmed lesions. Initial DWI-lesion localization in cortical gray matter was associated with absence of visible scarring on 8-week MRI, p=0.003.
Conclusion: 30% of initially DWI-positive and 22% of initially ADC-confirmed lesions showed no visible scarring on 8-week follow-up T2-FLAIR. Cortical gray matter localization was associated with scar absence; this may reflect better collateral flow cortically including greater proximity to leptomeningeal collaterals than in deeper tissue.

B-0302 15:12

Stress MRI for the assessment of lumbar canal stenosis in degenerative disc disease: comparison with routine MRI

S. Goel; *Delhi/IN (docsudhirgoyal@gmail.com)*

Purpose: MR imaging in psoas relaxed (routine) posture may carry considerable risk of underestimating or even missing lumbar canal stenosis so a novel method to examine the lumbar spine by using a MR compatible axial compression device is introduced which simulate the erect position. The present study compares the change in dural cross-sectional sac area (DCSA) at the levels of degenerated lumbar intervertebral discs on MRI performed without and with axial loading (Stress MRI).
Methods and Materials: During a period of more than 1 year, 48 patients were examined with a clinical suspicion of spinal stenosis. The degenerated intervertebral discs were identified and the DCSA was measured before and after applying axial load at these levels. The DCSA was determined on axial T2 W images using the standard measurement tools.
Results: In total of 48 symptomatic patients studied, 98 degenerative discs were identified.There was significant decrease in the dural sac area at the level of degenerated disc level after applying the axial load. The other valuable information disclosed after applying axial load were increase in spondylolisthesis, ligamentum flavum thickening, etc.
Conclusion: MRI spine with axial loading is useful to assess the severity of degenerative spinal stenosis. However, it is difficult to say whether Stress MRI helps the clinician in making treatment decisions or not, since surgical decisions are mostly taken on the basis of severity of the patient's symptoms and response to medical management.

B-0303 15:20

Dynamic lumbosacral MRI compared to upright myelography: comparison in the detection of segmental dural compression

S. Leschka[1], M. Benndorf[1], M. Vicari[2], S. Meckel[1], M. Schumacher[1], M. Weigel[3], C. Taschner[1]; [1]*Freiburg/DE*, [2]*Bremen/DE*, [3]*Basle/CH*

Purpose: The purpose of this study was to determine the accuracy of dynamic lumbosacral-MRI compared to upright myelography to detect segmental dural compression.
Methods and Materials: 95 patients were screened for the study. Seventeen patients complaining of low back pain and clinically suspected dural compression qualified for the study. These patients underwent myelography and dynamic lumbosacral-MRI with an open-configuration 0.25 T tilting system. Images were obtained in supine and upright position for both modalities. Two independent readers evaluated the myelography images and the lumbosacral-MRI on a persegment basis with regard to segmental dural compression. Reference standard was a consensus reading of myelography in upright position. Reader agreement was assessed by correlation statistics (Cohen's kappa) and diagnostic accuracy was calculated on a persegment basis.
Results: Myelography in upright position showed 35 segmental dural compressions. Lumbosacral-MRI showed 30 segmental dural compressions in supine and 33 in upright position. The agreement between the readers for Myelography in supine and upright position was 0.881 and 0.808 respectively. The inter-rater agreement for MRI in supine and upright position was 0.895 and 0.747. MRI sensitivity/specificity in upright position were 80%/92% for reader 1 and 74.3%/96% for reader 2; in supine position 77.1%/96% for reader 1 and 74.1%/98% for reader 2.
Conclusion: Dynamic MRI with an open-configuration, low-field tilting MRI system is a feasible and promising tool to study lumbosacral dural compression. We demonstrated that this MR technology performed highly specific compared to upright myelography, but had some limitations regarding sensitivity. Interobserver agreement was comparable to myelography.

Author Disclosures:
M. Vicari: Employee; ESAOTE.

14:00 - 15:30 **Room F1**

Oncologic Imaging

SS 316

Molecular imaging and new agents

Moderators:
A. Pomoni; Lausanne/CH
A.E. Sundin; Stockholm/SE

B-0304 14:00

Diagnostic performance of 68Ga-PSMA-PET/MRI versus 68Ga-PSMA-PET/CT in the evaluation of lymph node metastases of metastatic prostate cancer

M.T. Freitag, J. Radtke, B. Hadaschik, H.-P. Schlemmer, U. Haberkorn, M.C. Roethke, A. Afshar-Oromieh; *Heidelberg/DE (m.freitag@dkfz.de)*

Purpose: To systematically compare the diagnostic performance of 68Ga-PSMA11-PET/CT and 68Ga-PSMA11-PET/MRI in patients with lymph node (LN) metastases of prostate cancer.
Methods and Materials: Twenty high-risk patients with a history of prostate cancer were included. All patients underwent PET/CT 1h and PET/MRI 3h after injection of PSMA11 (Prostate-specific membrane antigen, HBED-CC). PET/MRI sequences included T1w FLASH3D native and contrast-enhanced, T2w-fatsat (turbo-spin-echo) and diffusion-weighted sequences (b50,b800). In every LN with focal PSMA11-uptake, the conspicuity (0-3) of a morphological correlate was evaluated by two independent readers. In PET-positive LNs, SUV values were quantified and correlated (Spearman). Control SUV values (background signal) were obtained from liver and gluteal muscle. The short axis diameter of each LN was quantified.
Results: Comparing 68Ga-PSMA11-PET/MRI and -PET/CT, the number of PET-positive nodes was comparable (PET/MRI n=68, PET/CT n=65). We observed a significant linear correlation between both methods of SUV values for 65 PET-positive LNs (ρSUVmax=0.88, $p < 0.0001$; ρSUVmean=0.87, $p < 0.0001$). SUVmean was correlating in liver tissue (ρSUVmax=0.4, p=0.075; ρSUVmean=0.62, $p < 0.004$), whereas no significant correlation was observed in gluteal muscle (ρSUVmax=0.24, p=0.306; ρSUVmean=0.35, p=0.135). Mean visibility scores were 2.34±0.70 (CT), 2.46±0.63 (T1w-native), 2.53±0.55 (T1w-CE-fatsat), 2.78±0.33 (T2w-fatsat) and 2.87±0.30 (DWI-b800). Visibility was significantly better in MRI for LNs using T1w-CE-fatsat (p=0.014), T2w-fatsat (p=0.0001) and DWI (p=0.0001) sequences compared to CT. 74% (n=48) of PET-positive LNs were smaller than 1 cm in short axis diameter.
Conclusion: The results indicate that multiparametrical 68Ga-PSMA11-PET/MRI provides a higher diagnostic accuracy together with less radiation exposure to detect LN metastasis of prostate cancer compared to 68Ga-PSMA11-PET/CT.

B-0305 14:08

Diagnostic performance of ^{68}Ga PSMA-ligand PET/CT in prostate cancer patients with biochemical relapse

C. Uprimny, A. Kroiss, C. Decristoforo, L. Geraldo Roig, D. Kendler, D. Putzer, W. Horninger, W.R. Jaschke, I.J. Virgolini; *Innsbruck/AT (Christian.UPRIMNY@uki.at)*

Purpose: Prostate cancer (PC) cells show high expression of prostate-specific membrane antigen (PSMA). ^{68}Ga-labelled Glu-NH-CO-NH-Lys-HBED-CC is a PSMA-ligand that binds specifically to this cell surface protein. The aim of this study was to assess the diagnostic power of PET/CT imaging using this novel radiotracer in PC patients with biochemical recurrence.
Methods and Materials: 60 PC patients with biochemical relapse (median PSA: 1.40 ng/ml) referred for ^{68}Ga-PSMA-PET/CT were analysed retrospectively. PET/CT-scans were acquired 60 minutes after injection of ^{68}Ga-PSMA ligand (median activity: 141 MBq). PET images were analysed visually and semiquantitatively by calculating maximum standardized uptake values. A focal uptake higher than background activity not corresponding to areas with physiologic uptake was considered suspicious of tumour lesion.

Results: ^{68}Ga-PSMA-PET/CT could reveal 106 pathologic foci consistent with tumour lesions in 40 patients, whereas PET/CT was negative or equivocal in 20 patients. In total 16 local recurrences, 74 lymph node metastases (median size: 8.0 mm) and 16 distant metastases were detected. PSA values were significantly lower in PET negative patients (median PSA: 0.81 ng/ml; range: 0.21-5.00 ng/ml) compared to those with positive findings (median PSA: 2.39 ng/ml; range: 0.14-35.07 ng/ml). 85% of patients with a PSA-value equal or higher 1.0 ng/ml presented with at least one pathologic lesion.
Conclusion: ^{68}Ga-PSMA-ligand based PET/CT seems to be a very sensitive method for detection of recurrences in PC patients with biochemical relapse even at very low PSA levels.

B-0306 14:16

18 F-FLT PET in the assessment of chemotherapy in locally advanced breast cancer: a new approach

B. Malkowski[1], E. Chmielowska[1], E. Srutek[1], P. Szlezak[1], T. Gorycki[2], K. Gwozdziewicz[2], M. Czarnowska-Cubala[2], A. Szymanska-Dubowik[2], M. Studniarek[3]; [1]*Bydgoszcz/PL*, [2]*Gdansk/PL*, [3] *Warsaw/PL*
(mstud@gumed.edu.pl)

Purpose: The purpose of the study is to assess background subtraction in SUVmax and SUVmean measurements as a new approach to quantification of FLT uptake in the tumour.
Methods and Materials: 32 women with locally advanced breast cancer had an initial FLT PET/CT scan that was repeated after the first cycle and after the whole standard neoadiuvant inductive chemotherapy. Patients were divided into four groups according to patomorphological postsurgical evaluation. From the FLT PET/CT scans tumour maximum and mean standardized uptake values (SUVmax and SUVmean) were calculated. Next the subtraction was performed using the FLT uptake in normal breast gland, and SUVsubmax and SUVsubmean were withdrawn, respectively.
Results: Mean SUVmax, SUVmean, SUVsubmax and SUVsubmean were calculated in all four groups of patients. Before treatment the indexes reached following values: 10, 5, 9.5 and 10, respectively, except 4 patients with Ki 67 below 0.15. In five cases the respective values were higher after the first cycle of chemotherapy, while after the whole treatment they were on the level of background values (0.97, 0.62, 0.44 and 0.79) in all patients. In remaining 28 patients there were no significant differencies in the estimated indexes in all phases of treatment.
Conclusion: Subtraction of the background FLT uptake, related to normal cell proliferation, does not show expected enhancement of FLT uptake and tumour cell proliferation correlation. The FLT accumulation after the first cycle of treatment is different, and cannot be used as a predictive factor of the final chemotherapy response.

B-0307 14:24

Diagnostic accuracy of ^{11}C-Choline PET/CT in hepatocellular carcinoma (HCC)

E. Lopci, D. Poretti, A. Palmisano, E. Lanza, L. Rimassa, G. Torzilli, A. Chiti;
Rozzano/IT (egesta.lopci@gmail.com)

Purpose: In our study we investigated the diagnostic role of ^{11}C-Choline PET/CT in patients with suspicion of HCC and compared findings with CT/MRI.
Methods and Materials: We enrolled 45 consecutive patients (M:F=37:8; mean age 63.5 years) referred to our Cancer Center with clinical/instrumental suspicion of HCC. In all cases, we performed a whole-body ^{11}C-Choline PET/CT and compared findings with dedicated contrast enhanced CT or MRI scanning for a total of 50 paired scans. The reference standard for imaging validation was either histology or a multidisciplinary monitoring. Diagnostic accuracy was determined on a scan-based (SBA) and lesion-based analysis (LBA).
Results: The overall sensitivity and specificity for PET was 88% and 90% respectively for SBA vs. 78% and 86% for LBA. When combining results of the two imaging modalities, the diagnostic accuracy was the highest: 92% and 96% respectively for SBA and LBA. Overall we investigated 168 disease sites, of which 100 in the liver and 68 in extra-hepatic sites. When considering only liver lesions, ^{11}C-Choline PET/CT and CT/MRI showed an accuracy of 66% and 85% respectively. For extra-hepatic lesions, PET showed an accuracy of 99% and CT/MRI of 32%. In both cases, there was a statistically significant difference in accuracy for the two modalities ($p < 0.01$). In 11 patients (24%), PET findings modified the therapeutic strategy, resulting appropriate in 10 of them.
Conclusion: ^{11}C-Choline PET/CT demonstrates an overall good accuracy in patients with suspicion of HCC, which can lead to a treatment modification in almost one fifth of the patients.

B-0308 14:32

Diagnostic value of quantitative perfusion map, with CT-perfusion technique in monitoring of tumour response to sorafenib treatment in patients with advanced HCC lesions: preliminary results

D. Ippolito, G. Querques, C. Talei Franzesi, P.A. Bonaffini, S. Sironi; *Monza/IT (davide.atena@tiscalinet.it)*

Purpose: To investigate the role of dynamic contrast-enhanced CT-perfusion (CT-p) imaging in evaluation of blood flow changes related to therapeutics effects of sorafenib, by quantitative assessment of tumour vascularization parameters, in advanced HCC lesions.
Methods and Materials: Seventy-three CT-p study were performed in 31 patients with diagnosis of advanced HCC lesion that underwent to target antiangiognetic therapy. Perfusion studies were performed at baseline and during treatment follow-up (every 3 months) on 256 multidetectorCT (iCT, Philips), with following parameters:100 Kv, 100 mAs;16 dynamic slices/scan;40 dynamic scans; 50 ml of contrast medium. The lesions and surrounding parenchyma were evaluated using a dedicated perfusion software which generated a quantitative colour map of arterial and portal perfusion. Following perfusion parameters were considered: hepatic perfusion (HP); arterial perfusion (AP); blood volume (BV); hepatic perfusion index (HPI) and time to peak (TTP) and statistically compared between responders (stable disease or partial response) and non-responders.
Results: At baseline in HCCs lesions, the following quantitative data were obtained: HP (ml/sec/100 gr) 37.2; BV (ml/100 mg) 12.4; AP (ml/min) 38.5; HPI (%) 67.7;TTP (sec) 18.6. After sorafenib treatment in responders patients median value of perfusion were: HP 29.1; BV 9.7; AP 31.2; HPI 57.3; TTP 19.2; while in group with progression disease the same values were: HP 70.1; BV 28.3; AP 67.8; HPI 97.7; TTP 13.9. A significant higher perfusion values ($p < 0.001$) was obtained for all parameters evaluated in non-responders patients than those with stable or partial response,due to residual arterial high vascularity that supports tumour growth.
Conclusion: Quantitative analysis of perfusion parameters could provide an in-vivo early biomarker for predicting target treatment response in patients with HCC lesions, offering information related to tumour blood supply.

B-0309 14:40

Diagnostic value of first-pass CT-perfusion study in the quantitative vascular assessment of primary and metastatic liver lesion: preliminary results

O. Minutolo, D. Ippolito, C. Talei Franzesi, M. Mumoli, P.A. Bonaffini, S. Sironi;
Monza/IT (orazio.minutolo@hotmail.it)

Purpose: To determine the value of CT-Perfusion technique as diagnostic tool in the assessment of lesions vascularization parameters of patients with neoplastic liver disease.
Methods and Materials: A total of 50 lesions histologically proven for hepatocellular carcinoma and 30 for liver metastases were evaluated with CT-perfusion technique examination by using 256-slice scanner (Brilliance iCT Philips). Perfusion CT images were created at a single liver level, acquiring a total of 16 slice/scan for a total of 40 scans during intravenous bolus injection of 50 ml of iodinated contrast agent (Xenetix 350) with flow rate of 5 ml/sec. Philips's workstation was used to generate colour permeability maps showing perfusion of enhancing tumours. After creation of quantitative maps of arterial and portal perfusion, the following parameters were calculated: hepatic perfusion (HP), peak enhancement intensity (PEI), time to peak (TTP) and blood volume (BV). Correlation between CT-perfusion parameters and clinical pathological classification was performed.
Results: In HCCs lesions, the quantitative analysis showed the following values: HP (ml/s/100 g): 47±13.8; PEI (HU): 39.6±30.1; TTP (sec): 18.7±4.1 and BV (ml/100 mg): 22.5±4.6. The corresponding values calculated in liver metastases were: HP (ml/s/100 g): 16.1±14.3, PEI (HU): 24.23±26.25, TTP (sec): 15.58±4.90, BV (ml/100 mg): 3.47±3.85. A significant ($p < 0.001$) decrease of HP, PEI, TTP and BV values was observed in liver metastases for all of the patients in comparison with HCCs, due to neoangiogenesis HCC-related and necrotic phenomenon that typically occur in metastatic lesion.
Conclusion: CT-Perfusion technique proved to be a complementary diagnostic tool in offering quantitative information about the microvascular structures related to biological behaviour in liver tumours.

B-0310 14:48

Feasibility of 10-min delayed hepatocyte phase imaging with 30° flip angle in Gd-EOB-DTPA-enhanced MR imaging for the detection of liver metastases, compared with 20-min delayed imaging with 10° flip angle

D. Lee, E.-S. Cho, I. Jeon; *Seoul/KR (cooldhl@yuhs.ac)*

Purpose: The purpose of this study was to compare 10-minute delayed hepatocyte phase imaging using a 30° flip angle (hereafter, 10 min-FA30) and 20-minute hepatocyte phase imaging using a 10° flip angle (hereafter, 20 min-FA10) in gadoxetic acid-enhanced MRI, regarding focal hepatic lesion (FHL) detection and lesion-to-liver contrast-to-noise ratio (CNR) in patients with liver metastases. In addition, we determined whether 10 min-FA30 could replace 20 min-FA10, saving 10 minutes of scanning time.
Methods and Materials: 74 patients with 439 FHLs (size range, 0.2-13.9 cm; metastases, n =193; benign, n =246) underwent Gd-EOB-DTPA-enhanced MRI with 10 min-FA30 and 20 min-FA10 using 3D T1-weighted gradient echo sequence. Lesion-to-liver CNRs of both two image sets were calculated. Two radiologists assessed the presence of FHLs independently using a four-point scale. The values were compared with paired t-test and Wilcoxon signed-rank test.
Results: There was no significant difference in detection sensitivity of focal hepatic lesions between 10 min-FA30 (mean, 95.6%) and 20 min-FA10 (mean, 95.4%) in two readers. The mean CNR on 10 min-FA30 (255.9 ± 112.7) was significantly higher than that of 20 min-FA10 (191.0 ± 81.0).
Conclusion: The 10 min-FA30 in Gd-EOB-DTPA-enhanced MRI had higher lesion-to-liver CNR with no difference in lesion detection sensitivity compared with the 20 min-FA10. This result indicates that 10 min-FA30 could replace 20 min-FA10 with a better diagnostic performance for detection of liver metastases and also allows 10 minutes of time-saving.

B-0311 14:56

Reproducibility of dynamic contrast-enhanced MRI in oncology: 2D vs 3D approach

S. Hibat Allah, M. Wagner, S. Raslan, O. Lucidarme; *Paris/FR (salimahibat@hotmail.com)*

Purpose: To compare the inter and intra-observer reproducibility of region of interest (ROI) versus volume of interest (VOI) for DCE parameters computation.
Methods and Materials: 28 DCE MR imaging studies of metastatic cancer defined the study group. ROI and VOI analysis were performed independently by 2 readers, twice by one of them. Four DCE parameters were computed with Tofts extented statistical model using Olea Sphere software: the area under the curve AUC, the volume transfer constant Ktrans, the extracellular and extravascular volume fraction Ve and the rate constant Kep. Intraclass correlation coefficient and coefficient of reproducibility were computed. Blandt and Altman analysis was performed.
Results: For both intra and inter-observer reproducibilty, for all parameters and for the 2 approaches, the ICC were above 0.75 indicated a high correlation. For the intra-observer and inter-observer reproducibility analysis, the biases were lower than 5% and 8% respectively. The 3D approach allowed dividing the coefficient of reproducibility by 1.69 to 3.25 and by 1.42 to 2.07 in comparison to the 2D approach, and decreased the 95% limits of agreement. For both intra and inter-observer reproducibility analysis, the gain in reproducibility is maximal for the AUC and minimal for Ve. In both 2D and 3D approaches, the transfer constant Ktrans is the less reproducible parameter.
Conclusion: A VOI placement can provide a reduction in inter and intraobserver variability for DCE MR imaging parameters.

B-0312 15:04

HANP/PTX treatment

L. Zhu, L. Zhang, J. Wang; *Xiamen/CN (zeh.ray82@gmail.com)*

Purpose: The aim of our study was to investigate whether the early therapeutic response of HA based naodrug, HANP/PTX, could be monitored by integrin-specific PET tracer 18 F-RGD2 and 18 F-FDG.
Methods and Materials: Subcutaneous MDA-MB-435 breast cancer bearing mice were treated with HANP/PTX (5 mg/kg every other day), Abraxane (30 mg/kg every other day), free PTX (5 mg/kg every other day) or phosphate-buffered saline respectively. Tumour volume was monitored by caliper measurement. PET scans were obtained before and at different times after the start of treatment (days 0, 3, 7, 14, and 21) using 18 F-FPPRGD2 and 18 F-FDG.
Results: In vivo, HANP/PTX treatment significantly inhibited the tumour growth, and an obvious difference in tumour volume could be seen after the initiation of treatment. The tumour uptake of 18 F-RGD2 in the HANP/PTX - treated group was significantly lower on days 7 than at baseline but returned to the baseline level at days 21, indicative of relapse of the tumours after the treatment was halted. Immunohistologic staining confirmed that the change of 18 F-RGD2 uptake correlated with the variation of integrin level in the tumour vasculature induced by HANP/PTX treatment. No significant change of tumour (rather than vascular) integrin expression was observed throughout the study.
Conclusion: HANP/PTX is an effective nanodrug for treatment of tumours and the therapeutic response could be monitored by 18 F-FPPRGD2 PET as early as 7 days after treatment, suggesting HANP/PTX is potential to be translated into clinic.

B-0313 15:12

Theranostic application of a cyanine-based linker functionalised with temozolomide using solid phase chemistry

D. Komljenovic, M. Wiessler, R. Pipkorn, W. Waldeck, K. Braun; *Heidelberg/DE (d.komljenovic@dkfz-heidelberg.de)*

Purpose: Reliable theranostics require efficient and irreversible ligation routes and excellent safety profile. Here, we synthesized a bi-modal fluorescent dye-based conjugate functionalized with the methylating agent temozolomide (TMZ) by applying solid phase peptide synthesis combined with the inverse electron demand Diels-Alder reaction (DARinv) and assessed its effects on rat prostate carcinoma cells in vitro.
Methods and Materials: Firstly, we synthesized a control conjugate - Cy7-norbonenyl-cell penetrating peptide (CPP). Dunning R3327 rat prostate carcinoma cells were incubated for 24 and 48 hours with Cy7-norbonenyl-CPP followed by wheat germ agglutinin (cell membranes) and DAPI (cell nuclei) staining to assess cellular localization and cell stability using confocal laser scanning microscopy (CLSM). Secondly, we functionalized Cy7-norbonenyl-CPP with TMZ employing DARinv to yield a theranostic conjugate TMZ-Cy7-CPP. Effects of TMZ-Cy7-CPP on R3327 cell cycle distribution and phenotype changes were assessed by flow cytometry and CLSM.
Results: CLSM revealed no morphological changes in membranes of R3327 cells after 24 and 48 hours incubation with a control conjugate. However, 24 hours incubation with TMZ-Cy7-CPP resulted in initial morphological changes of R3327 cells whereas after 48 hours an apparent damage to cell membranes and marked decrease of the cell fraction in the G0/G1 phase were noted. Amount of cellular debris in control cells remained at a low level.
Conclusion: Cyanine-based linker functionalized with a methylating agent TMZ using DARinv-based ligation chemistry displays properties of an effective theranostic conjugate. Click-reaction ligation methodology shown here enables simple, fast and efficient synthesis of theranostic agents aiming for a patient-specific cancer diagnosis/therapy.

B-0314 15:20

CT perfusion imaging in the evaluation of response to treatment of radiofrequency thermal ablation (RFA), in patients with lung cancer

A. Infante, A. Contegiacomo, A. del Ciello, A.R. Larici, R. Iezzi, L. Bonomo; *Rome/IT (amatoinfante@gmail.com)*

Purpose: The aim of this study was to prospectively evaluate quantitative modifications of CT-perfusion imaging parameters (Blood Flow, BF; Blood Volume, BV; Mean Transit Time, MTT; Permeability Surface, PS; Peak Enhancement Intensity, PEI) in lung cancer patients treated with RFA, to identify early predictive parameters of recurrence and persistence of disease.
Methods and Materials: 10 histologically demonstrated lung cancer patients planned to be treated with RFA underwent CT-perfusion imaging examinations 3 days before RFA, within 72h after RFA and 6 months after RFA. BF (Blood Flow), BV (Blood Volume), MTT (Mean Transit Time), PS (Permeability Surface) and PEI (Peak Enhancement Intensity) were measured in tumour area before and after RFA treatment and compared between all CT controls.
Results: We observed a statistically significative association ($p < 0.05$) between PEI and BF on the CT-perfusion imaging performed at 48h after RFA with the value of the same parameters at 6 months. No correlation was found for BV, MTT and PS.
Conclusion: In conclusion, this preliminary results suggest that BF and PEI quantitative evaluation at perfusion imaging performed within 72h from RFA are predictive of persistence of disease at 6 months.

14:00 - 15:30 **Room F2**

Physics in Radiology

SS 313

Advances in MR technology

Moderators:
E. Atalar; Ankara/TR
J. Theysohn; Essen/DE

B-0315 14:00

Fast field-cycling magnetic resonance imaging: a new imaging modality

D.J. Lurie, L.M. Broche, G.R. Davies, N.R. Payne, K.J. Pine, J. Ross, V. Zampetoulas; *Aberdeen/UK (d.lurie@abdn.ac.uk)*

Purpose: Fast Field-Cycling (FFC) MRI has been demonstrated as a novel imaging modality. In FFC, the magnetic field is switched rapidly between levels during a scan, allowing the dependence of T1 on magnetic field strength to be exploited for the first time as a contrast mechanism.
Methods and Materials: In FFC-MRI the magnetic field strength is switched between two levels. High field polarises the spins. Then the field is switched to a lower value ("evolution") at which T1 is to be measured, for a duration ~T1. The field returns to the high value for the application of gradients and signal detection. A technical challenge is to switch field rapidly (~20 ms) while maintaining field stability and repeatability. Two prototype whole-body human FFC scanners have been built in our laboratory, using different technologies. One uses a hybrid magnet, with a permanent magnet (59mT) for polarisation and detection, offset by a coaxial resistive magnet for evolution. Another uses a single, 200mT resistive magnet with a switchable power supply (~2000 A) under control of the console.
Results: Both scanners proved capable of obtaining FFC-MRI images, with data showing T1 dispersion in the range 1mT to 100mT. The hybrid scanner showed better immunity to magnetic field instability, albeit with SNR than the purely resistive scanner. Data was obtained from a range of phantoms, tissues and volunteers, exhibiting novel contrast through FFC.
Conclusion: FFC-MRI is a novel imaging technique which can exploit T1-dispersion as a contrast mechanism. Early results show promise as a new clinical imaging modality.

Author Disclosures:
D.J. Lurie: Board Member; Physics in Radiology. Speaker; ECR.

B-0316 14:08

Magnetic resonance spectroscopy, dual-phase and multi-echo gradient-echo MRI in the quantitative assessment of liver steatosis

G. Besutti, L. Nocetti, G. Ligabue, C. Stentarelli, S. Zona, R. Scaglioni, G. Guaraldi, P. Torricelli; *Modena/IT (giulia.besutti@libero.it)*

Purpose: To evaluate different MR techniques in the quantitative assessment of liver steatosis, using 1H MR Spectroscopy (MRS) as the reference standard.
Methods and Materials: 45 HIV-infected patients underwent MR examination for steatosis assessment. Liver Fat Content (LFC) was estimated by means of (MRS) and two MR Imaging (MRI) techniques: Dual-Phase T1-weighted Gradient-Echo and Multiecho Gradient-Echo. For this last technique, LFC was calculated both on the same single voxel used for Spectroscopy (SV-Multi-LFC) and on the whole liver parenchyma with two different methods: selecting 12 elliptical Regions of Interest on three different slices (12ROI-Multi-LFC) and selecting three free-hand ROIs comprehending the whole liver volume on the same slices (WV-Multi-LFC). Statistical analysis was performed with Wilcoxon matched-pairs signed-ranks test as well as measuring the association between LFC calculated with different techniques by using univariate linear regression analysis after normalization of non-normally distributed variables.
Results: Wilcoxon matched-pairs signed-ranks test showed significant differences between MRS LFC and Dual-Phase LFC ($p < 0.001$) and between 12ROI-Multi-LFC and Dual-Phase LFC (p=0.015). Strong associations were found between MRS LFC and SV-Multi-LFC ($R^2=0.96$; $p < 0.001$, ß=0.95), 12ROI-Multi-LFC ($R^2=0.94$; $p < 0.001$, ß=1.23), WV-Multi-LFC ($R^2=0.91$; $p < 0.001$, ß=0.96), and Dual-Phase LFC ($R^2=0.96$; $p < 0.001$, ß=0.93), without statistically significant differences among these associations.
Conclusion: MRI techniques are reliable in quantitative assessment of liver steatosis when compared with MRS. All techniques were found with strong relationship with respect to MRS LFC. Nevertheless Dual-Phase was found to overestimate LFC by a 25%, whereas other techniques showed more accurate (< 7%) values.

B-0317 14:16

Hepatic lipid measurement: dual ratio Dixon technique vs MR spectroscopy at 3 T scanner

M. Abd Ellah[1], B. Henninger[1], C. Kremser[1], S. Kannengießer[2], X. Zhong[3], W.R. Jaschke[1]; [1]*Innsbruck/AT*, [2]*Erlangen/DE*, [3]*Malvern, PA/US (dr_m_hamdy2006@hotmail.com)*

Purpose: To evaluate feasibility and effectiveness of a two-echo Dixon sequence with automated liver sampling and dual-ratio signal discrimination for the estimation of hepatic lipid content compared to both a conventional in and out of phase gradient echo (IOP-GRE) method and MR spectroscopy.
Methods and Materials: 116 patients (47 females and 69 males), 15-86 years (mean ± std 55.9 ±16.4) were included in the study, referred to our MRI unit for different reasons. MRI was done using a 3 T whole body scanner (Magnetom Skyra, Siemens, Germany). In all patients a standard IOP-GRE sequence was performed and fat fractions calculated off-line for four different ROIs. A 3D dual-echo Dixon sequence with dual-ratio signal discrimination (Siemens work in progress package 809) was performed in 115 patients in single breath-hold. Multi-echo, T2 corrected single-voxel spectroscopy was done in 107 patients (Siemens work in progress package 787). The obtained results from the IOP-GRE sequence in addition to the automatically reported results of the dual-echo Dixon sequence and spectroscopy were recorded and statistical analysis was done. A resulting fat content ≥ 5% was considered as pathologic fatty liver.
Results: The results of the dual-echo Dixon sequence showed good correlation against both IOP-GRE and spectroscopy (r=0.863, and r=0.923 respectively).
Conclusion: The used 3D dual-echo Dixon sequence allows full coverage of the liver during one single breath hold and a fast assessment of liver fat content with good correlation to spectroscopy. This method has the potential to become a fast routinely used liver screening technique.

B-0318 14:24

Proton-density fat fraction in an ultra-high-field MR scanner: a feasibility study

J.-P. Kühn, B. Mensel, K. Kindermann, S. Hadlich, S. Otto, N. Hosten; *Greifswald/DE (kuehn@uni-greifswald.de)*

Purpose: To investigate the feasibility of assessing the proton-density fat fraction (PDFF) in livers of leptin-deficient ob/ob mice using ultra-high-field magnetic resonance imaging (MRI).
Methods and Materials: The study was approved by a governmental committee on animal welfare using guidelines conforming to the National Institute of Health (NIH) Guide for the Care and Use of Laboratory Animals. Twenty-two ob/ob mice (aged 81.6±32.6 days; 47.9±12.7 g) and ten controls (aged 105.7±23.2 days; 29.9±2.6 g) were imaged with a T1-independent six-echo GRE sequence in a 7.1 Tesla animal scanner. The proton-density fat fraction (PDFF) was calculated after correction of T2* decay and consideration of multispectral complexity of fat. Liver PDFF was measured and correlated with histopathologic fat content.
Results: The mean PDFF of ob/ob mice was 13.4±4.8% and was significantly higher than the 0.1±1.8% PDFF of control mice (p=0.001). There was a linear relationship between PDFF and histopathologic fat content with an excellent correlation (Pearson`s correlation coefficient 0.951).
Conclusion: Measurement of PDFF is feasible using high-field 7 Tesla MRI and offers new applications for animal research as an accurate imaging biomarker of hepatic steatosis.

B-0319 14:32

Simultaneous reconstruction of attenuation and activity distributions in PET/MRI from PET emission data using MR prior information

T. Heußer[1], C. Rank[1], T. Beyer[2], M. Kachelrieß[1]; [1]*Heidelberg/DE*, [2]*Vienna/AT (thorsten.heusser@dkfz-heidelberg.de)*

Purpose: To improve PET quantification by simultaneous reconstruction of attenuation and activity distributions from PET emission data for non-TOF PET/MRI.
Methods and Materials: Current PET/MRI systems use MR-based attenuation maps for attenuation correction (AC), which result in an underestimation of the PET activity especially in the vicinity of bone. We propose an extension of the maximum-likelihood reconstruction for attenuation and activity (MLAA) algorithm for non-TOF PET/MRI using anatomical information from the MR images. The MR images are used 1) to obtain an initial attenuation map and 2) to create a voxel-dependent prior representing a probability distribution of expected attenuation coefficients. The prior favors pre-selected attenuation coefficients, e.g., for air or bone, and helps driving the algorithm towards a meaningful solution. We evaluated our algorithm using three sets of co-registered MR-CT data of head patients. PET emission data including several hot lesions were simulated accounting for Poisson noise and the (scaled) attenuation according to the CT. Reconstruction of the emission data was

performed using the proposed algorithm making use of MR prior information, standard MR-based AC, and AC using the true attenuation.
Results: Compared standard AC to AC using the true attenuation, SUVmean values in hot lesions in all 3 patient data were underestimated by 32%, 18%, and 16%, respectively. The proposed algorithm significantly decreases the underestimation, reducing the underestimation to 9%, 6%, and 6% only.
Conclusion: The proposed extension of the MLAA algorithm using MR prior information allows for an improved quantification of PET/MRI.

B-0320 14:40

Quality control for quantitative multi-center whole-body PET/MRI studies

R. Boellaard[1], I. Rausch[2], T. Beyer[2], G. Delso[3], S. Ziegler[4], M. Yaqub[1], H.H. Quick[5], B. Sattler[6]; [1]*Amsterdam/NL*, [2]*Vienna/AT*, [3]*Zurich/CH*, [4]*Erlangen/DE*, [5]*Duisburg-Essen/DE*, [6]*Leipzig/DE (r.boellaard@vumc.nl)*

Purpose: Integrated PET/MRI systems derive the PET attenuation correction (AC) from dedicated MR sequences. While MR-AC performs reasonably well in clinical patient imaging, it may fail for phantom-based quality control (PQC). We assess the applicability of different protocols for PQC in multi-centre PET/MR imaging.
Methods and Materials: The NEMA NU2 2007 Image Quality phantom was imaged on three combined PET/MRI systems: a Philips Ingenuity TF PET/MR, a Siemens mMR and a GE Signa PET/MR prototype system. The phantom was filled according to the EANM FDG-PET/CT guideline 1.0 and scanned for 5 min over 1 bed. Two imaging protocols were tested: standard clinical procedures and a dedicated protocol for phantom tests. Depending on the system the dedicated phantom protocol employs a 2-class (water, air) segmentation of the MR data or a CT-based template. Differences in attenuation- and SUV recovery coefficients (AC, RC) are reported.
Results: Using the clinical protocol substantial errors and artifacts in the generated AC-maps were seen, resulting in underestimations of the reconstructed PET activity of up to 27%, depending on the PET/MR system. Using the special protocols these biases decreased to -8%. Mean and max SUV RC met EARL multi-center PET performance specifications for most contrast objects, but only when using the special protocol.
Conclusion: Phantom based multi-center quality control of PET/MRI systems, similar to those of the EANM PET/CT guideline 1.0, may be performed but only with dedicated phantom acquisition and processing protocols.

Author Disclosures:
R. Boellaard: Advisory Board; EARL advisory board. Research/Grant Support; Philips Collaborative Research Grants. **T. Beyer:** CEO; CMI Experts. **G. Delso:** Employee; GE Healthcare. **H. Quick:** Research/Grant Support; Siemens AG, Healthcare Sector. **B. Sattler:** Research/Grant Support; German research council and the Max-Planck-Society.

B-0321 14:48

Do we need MRI quality assurance: experience from a multi-unit imaging center with 14 MRI systems

L.J. Kuusela, M. Timonen, T. Mäkelä, J. Peltonen, T. Ihalainen, J. Uusi-Simola, T. Kaasalainen, S. Savolainen, O. Sipilä; *Helsinki/FI (linda.kuusela@hus.fi)*

Purpose: An effective quality assurance (QA) protocol is essential for an imaging center with 14 MRI systems and approx. 63000 clinical studies each year. The purpose of this work is to describe and evaluate our QA protocols.
Methods and Materials: During the past year, QA was performed on all systems: three 3.0 T and eleven 1.5 T systems (incl. 3 mobile and 1 dedicated extremity). QA consisted of three parts: 1) A daily test included a single slice spin-echo image of a homogeneous phantom acquired daily before clinical studies and automatic analysis of the signal-to-noise ratio, ghosting and image intensity uniformity. 2) Annual American College of Radiology (ACR) phantom test was carried out according to ACR site scanning instructions, including standard and site specific sequences. Data was semiautomatically analyzed in line with ACR instructions. 3) Annual manufacturer specific coil tests of approx. 170 coils.
Results: In daily test, exceptions were observed in 3 scanners. The ACR phantom test was not passed for standardized sequences on 3 systems, problems mainly concerning spatial resolution, ghosting and geometric accuracy. Inferior results, especially in T1 image resolution and T2 image slice thickness, were observed for 10 scanners for the site specific sequences. Five faulty coils were observed with the annual coil tests, that had not been observed otherwise.
Conclusion: QA is necessary and our procedure appears to be sufficient to detect faults and inferior image quality. Also, we are able to manage the quality of a large number of scanners in a resource-efficient way.

B-0322 14:56

Does MRI influence blood coagulation?

P. Seyfer, V. Klingmüller, M. Voelker, A.H. Mahnken, T. Stief; *Marburg/DE (seyfer@med.uni-marburg.de)*

Purpose: Magnetic resonance imaging (MRI) is often favoured over computer tomography and other diagnostic modalities for its ability to create detailed images using no ionizing radiation. Several previous studies have already shown that surface energy can trigger intrinsic coagulation. The purpose of our study was to analyse the impact of MRI on blood coagulation, using the recalcified coagulation activity assay (RECA) with its high sensitivity for detection of procoagulant plasma changes.
Methods and Materials: 1 mL samples of pooled normal plated poor citrated plasma were exposed to 7 T MRT for 0-13 min at 23° C. Afterwards, the RECA was performed to detect procoagulant plasma changes in the 13 plasma cups compared to the control probe with no MRT exposure.
Results: There was no significant increase in recalcified thrombin generation (TG) within the first 4 min of MRI exposure. The maximum TG was reached after 7 min of MRI exposure and was 33-fold higher than the control thrombin generation at 0 min MRT exposure. Within 1 min after the thrombin peak the TG decreased by 50%. Within 3 min after the thrombin peak the amount of TG was similar to the control probe.
Conclusion: MRT has to be considered as a risk factor for the development of a change of normal intravascular coagulation to slightly pathologic or to pathologic.

B-0323 15:04

Parallel-transmit-accelerated spatially-selective excitation MRI for reduced-FOV diffusion-weighted imaging of the pancreas

K.M. Thierfelder[1], W.H. Sommer[1], O. Dietrich[1], F.G. Meinel[1], P.M. Paprottka[1], M.F. Reiser[1], K. Nikolaou[2]; [1]*Munich/DE*, [2]*Tübingen/DE (kolja.thierfelder@med.uni-muenchen.de)*

Purpose: To find out whether the use of accelerated 2D-selective parallel-transmit excitation MRI for diffusion-weighted EPI (pTX-EPI) offers advantages over conventional single-shot EPI (c-EPI) in pancreatic imaging.
Methods and Materials: The MRI examinations of 33 consecutive patients were evaluated in this prospective study. PTX-EPI was performed with a reduced (zoomed) FOV of 230×118 mm. The 2D-RF pulse of pTX-EPI was accelerated, i.e. shortened by a factor of 1.7. C-EPI used a full-FOV of 380×285 mm. In a qualitative analysis, two experienced readers evaluated 3 different aspects of image quality on 3- to 5-point Likert scales. Additionally, apparent diffusion coefficients (ADCs) were determined in both c-EPI and pTX-EPI in normal-appearing pancreatic tissue using regions of interests (ROIs). Mean ADC values and standard deviations were compared between the two techniques.
Results: The reduced-FOV pTX-EPI was superior to c-EPI with respect to overall image quality ($p < 0.0001$) and identifiability of the pancreatic ducts ($p < 0.01$). Artifacts were significantly less severe in pTX-EPI ($p < 0.01$). The mean ADC values of c-EPI ($1.29\pm0.19\times10^{-3}$ mm^2/s) and pTX-EPI ($1.27\pm0.17\times10^{-3}$ mm^2/s) did not differ significantly between the two techniques ($p=0.44$). The variation within the ROIs as measured by the standard deviation was significantly lower in pTX-EPI (0.095×10^{-3} mm^2/s) than in c-EPI (0.135×10^{-3} mm^2/s), $p < 0.05$.
Conclusion: PTX-accelerated EPI with spatially-selective excitation and reduced FOV leads to substantial improvements in DWI of the pancreas with respect to different aspects of image quality without significantly influencing the ADC values.

B-0324 15:12

Method to determine dynamic in vivo material properties of the achilles tendon using ultrafast MRI sequence

T.J. Vogl, M. Kardeh, G. Silber; *Frankfurt a. Main/DE (kardeh@fb2.fh-frankfurt.de)*

Purpose: To determine dynamic in vivo material properties of the Achilles tendon. For this a method using LIveView sequence (ultra-fast MRI sequence) was developed.
Methods and Materials: The force-displacement data of the Achilles tendon in three healthy subjects was measured during isometric plantar flexion of the foot. The LiveView sequence provided an imaging matrix of 256x256 pixels and a temporal resolution of 111 ms per frame. The Achilles tendon force at the calcaneus was applied using an MR-compatible device and a noninvasive optical force sensor. Compared to ultrasonography, a more extensive area was assessable, allowing Calcaneus movement to be detected. To minimize measurement error, the tendon length from the calcaneus insertion to the soleus was evaluated.

Results: At a strain of 4% the maximum Achilles tendon was 2063N. The maximum tendon displacement was 2.5 mm. Based on the measured force displacement data, nonlinear material parameters of the Achilles tendon were determined according to the OGDEN material model using a numerical optimization algorithm and the inverse Finite Element Method. Thus, the nonlinear hyperelastic material parameters of the Achilles tendon could be evaluated using the constitutive model Ogden. The parameters for this model were: a=63.22 MPa; μ=57.09; D= 0.00043M-1Pa-1.
Conclusion: This method allows measurements encompassing the entire Achilles tendon in the sagittal plane as well as force measurement during dynamic movement. Potential lies in recording changes in tendon structure or properties with different defined loads before and after injury or disease.

B-0325 15:20

Texture analysis of R2 map in the assessment of renal function: is this a promising tool?
L. Pelliccia, S. Carbone, L. Mazzoni, L. Volterrani; *Siena/IT (lcpelliccia@gmail.com)*

Purpose: To evaluate texture analysis of R2 maps (TAR2m) in the assessment of renal function.
Methods and Materials: Axial multi-echo FGRE sequence on upper Abdomen was acquired in 11 patients with renal parenchymal diseases at different renal function stages; 7 subjects without renal disease were used as controls. Serum Creatinine (sCr) of all the subject was obtained and eGFR was calculated by MDRD formula. A hand-made ROI on central slice R2 map was used to sample renal parenchyma, including renal cortex and medulla, and finally mean, median, kurtosis, skewness, density were calculated by using an open source texture analysis software.
Results: sCr and skewness were found to have a significant relationship ($p < .05$). Significant differences were found between stage 1 and 2 for density ($p=0.045$) and nearly significant between stage 2 and 3 for skewness ($p=0.067$).
Conclusion: TAR2m of kidney seems to be not able to stratified renal impairment except the skewness and density. These latter parameters seems to be very promising and further studies on a large population are needed to best estimate the present preliminary data.

14:00 - 15:30 **Room D1**

Chest

SS 304

Interventional procedures and follow-up

Moderators:
I. Vollmer; Barcelona/ES
J.E. Wildberger; Maastricht/NL

B-0326 14:00

Computed tomography characteristics predictive for radial EBUS-miniprobe guided diagnosis of pulmonary lesions
W. De Wever, C. Guvenc, J. Yserbyt, D. Testelmans, F. Zanca, C. Dooms; *Leuven/BE (walter.dewever@uzleuven.be)*

Purpose: To identify CT characteristics affecting success rate of radial endobronchial ultrasonography miniprobe (rEBUS-MP) in the evaluation of pulmonary lesions.
Methods and Materials: 760 consecutive patients who underwent chest CT and rEBUS-MP examination between January 2011 and December 2013 were retrospectively evaluated. CT characteristics including lesion size, lesion location and bronchus sign were analyzed against two defined outcomes (visualization yield and diagnostic yield). Lesion location was determined on CT scan by allocation of the lobar segment, and by measuring the lesion-to-pleura and the lesion-to-carina distance. Univariate analysis was employed to examine the individual effects of CT parameters on visualization and diagnostic yield. Multivariate logistic regression was performed to identify significant predictors of the diagnostic yield.
Results: 760 lesions were included. The mean lesion diameter was 43±2 mm. rEBUS-MP could visualize 83% and a definitive diagnosis was established in 62%. In a multivariate analysis, largest axial lesion diameter > 20 mm (OR 2.14 and $p < 0.026$), distance lesion-to-carina > 40 mm (OR 0.64 and $p < 0.046$), malignant lesion (OR 5.01 and $p < 0.001$) and segment (1, 3, or 6, respectively) were determined to be significant factors predicting diagnostic yield. Bronchus sign influenced indirectly the diagnostic yield through enhancing visualization yield ($p < 0.001$).
Conclusion: Multivariate analysis revealed that malignant status, lesion size, distance to carina and segment were predictors of diagnostic yield. The presence of a bronchus sign substantially increased the diagnostic yield through the visualization yield.

B-0328 14:08

CT-guided FNAB and biopsy of pulmonary nodules: predictive factors for diagnosis and pneumothorax occurrence
F. Rosella, M. Chiappetta, L.M. Pomes, V. dall'Armi, P. Granone, T. Pirronti, L. Bonomo; *Rome/IT (francesco.rosella.md@gmail.com)*

Purpose: To evaluate the variables that could predict a positive diagnosis during CT-Guided FNAB, analysing which characteristics of the patient or of the lung nodule suspected for cancer are favourable to obtain a diagnosis with low complication risk and when is better to perform surgery with intraoperative diagnosis.
Methods and Materials: Data from 249 patients who underwent FNAB in our department from 2009 to 2011 were analysed, focusing on nodule, patient characteristics and FNAB technique. Risk factors for complications were analysed to discover conditions with high risk of pneumothorax or bleeding.
Results: Tumour location, nodule diameter, needle diameter, presence of necrosis or cavitation, node-chest wall distance, number of passages, presence of emphysema were analysed. Only nodule diameter was predictive of a successful diagnosis. OR for a 20-30 mm tumour was 2.51 (95% OR:1.24-5.08, p-value=0.011), for a 30-50 mm tumour was 2.39 (95% OR:1.22-4.69, p-value=0.011),and for a tumour larger than 50 mm was 4.44 (95% OR:1.89-10.44, p-value = 0.001). Post-procedure pneumothorax occurred in 62 patients (25%), with chest drain insertion in 16 cases (6%). Determinant factors for pneumothorax occurrence were emphysema with an OR of 6.87 (95% CI: 1.07-44.10, p-value=0.04), and the number of pleural passages with an OR of 5.47 (95% OR: 1.92-15.58), 7.44 (95% OR: 2.58-21.5), 6.13 (95% OR: 2.07-18.11) p-value=0.001 for one, two, three or more of three passages, respectively.
Conclusion: In our experience, only dimension of nodule predicts diagnostic outcome after FNAB, while number of passages and presence of emphysema were risk factors of pneumothorax occurrence. So in patient with emphysema and a single small nodule, diagnostic and eventually curative surgery at first may be taken into account to avoid complication and get quick diagnosis.

B-0329 14:16

Complications of transthoracic CT-guided lung biopsies: a systematic review and meta-analysis
W.J. Heerink, G. de Jonge, R. Vliegenthart, M. Oudkerk; *Groningen/NL (w.j.heerink@umcg.nl)*

Purpose: To determine the complication rates and factors affecting the complication rates of transthoracic CT-guided pulmonary biopsy (CTB).
Methods and Materials: A literature search was performed in Pubmed, Web of Science and Embase from January 2000 to February 2014. After an initial screening on title and abstract, two reviewers assessed the full-text of 626 papers for inclusion. All studies mentioning complication rates of CTB were included in the systematic review. Characteristics of the studies were extracted by one reviewer. Inclusion criteria for the meta-analysis were: study size > 50 patients and adequate complication control. Pooled complication rates were determined and meta-regression analysis was performed to identify factors affecting complication rates.
Results: 176 articles (71.061 participants) were included in the systematic review, and 51 articles (13.493 participants) in the meta-analysis. The pooled rates of pneumothorax, pneumothorax requiring intervention, pulmonary hemorrhage and hemoptysis were 26.6%, 6.8%, 17.3% and 2.9% respectively. Pooled complication rates for core biopsy were on average 1.9 times higher than for fine needle aspiration. The major factors affecting the pneumothorax rate were the mean nodule diameter and the mean traversed lung parenchyma, with Pearson correlation coefficients of -0.66 and 0.48 respectively. The rate of severe complications (pneumothorax requiring intervention and hemoptysis) was predominantly affected by the mean nodule diameter with a Pearson correlation coefficient of -0.34.
Conclusion: The rate of severe complications for CTB was relatively low. Major factors affecting the complication rates were mean nodule diameter and traversed lung parenchyma.

B-0330 14:24

In CT-guided transthoracic lung biopsy the contribution of FDG PET/CT in biopsy planning and diagnostic accuracy
Y. Dadali[1], O. Ozmen[2], U. Calıkoglu[2], &. Bursali[2], F. Demirag[2]; [1]*Kirsehir/TR*, [2]*Ankara/TR (yelizdadali@gmail.com)*

Purpose: Computed Tomography-guided transthoracic needle biopsy (CT-TNB) is a prior diagnostic tool of lung and mediastinal masses. When applied with success it eliminates the need for the more invasive methods such as thoracoscopy, mediastinoscopy and thoracotomy. The purpose of this study is to investigate the diagnostic value of the guidance of FDG PET/CT in CT-TNB.
Methods and Materials: 200 patients with the suspicion of lung cancer were admitted to our hospital's radiology unit for biopsy between January 2013 and

September 2013. While only CT-guided biopsy applied in 100 patients both CT and PET/CT-guided biopsy applied in others.
Results: Biopsy applied in 200 (34 females,166 males) with a mean age of 62.27 (22-87) years. In PET/CT (ø) group 32% of lesions were consolidation and 68% were nodule and the average size of the nodules were 4.6 cm and in 47% necrosis was present. Biopsy results were evaluated as malign in 45 patients, benign in 43 patients and insufficientmaterial was considered in12 patients. In PET/CT (+) group 23's% of lesions were consolidation and 77% were nodules with an average size of 4.5 cm and necrosis was present in 57%. Biopsy results were evaluated as malign in 67 patients benign in 31 patients and 2 patients were considered as insufficient material. When biopsy results were compared, in PET/CT (+) group the final diagnostic ratio had significantly higher accuracy.
Conclusion: Necrosis are monitored more frequently in malignant lesions and affect the success of diagnosis. The FDG PET/CT may contribute in planning biopsy by showing areas of necrosis more clearly.

B-0331 14:32

Radiofrequency ablation of malignant pleural mesothelioma plaque
G.G. Taverna, F. Brucculeri, E. Oppezzo, G. Gola, C.M.S.O. Tappero, S. Barbero; *Casale Monferrato/IT (giacomo82@fastwebnet.it)*

Purpose: Patients with malignant pleural mesotelioma often develop pain symptoms due to chest wall infiltration. We experienced a new palliative therapy using radiofrequency ablation.
Methods and Materials: We have included actually in our study 13 patients. Using CT guide after placing the patient second the most suitable decubitus, a needle for radiofrequency ablation was positioned into the target lesion. The average lenght of each cycle of treatment was about 8 minutes. After removing the needle a control CT scan was performed; then the patient, after an observational period of about 2 hours, was discharged.
Results: Using VAS and Karnofsky scales to assess the degree of pain and the performance status before and after treatment we got the following results: no mortality within 30 days after treatment neither complications that have required prolonged hospitalization or surgical or radiological intervention; in only one case (7.7 %) a protracted pain symptoms has requested the intervention of the anesthesiologist. All the patients were submitted to a CT re-evaluation at 1 month after procedure. In 92.3% of cases (12/13 patients) has been demonstrated the dimensional stability of treated lesion. The re-evaluation by VAS and Karnofsky scales showed a good resolution of pain symptoms and reduced degree of invalidity. In the remaining case (7.7 %) the CT control showed dimensional growth of the lesion with worsening of discomfort and disability.
Conclusion: The possibility to use a minimally invasive procedure, repeatable, could make the radiofrequency treatment a valid tool to control pain symptoms in selected cases.

B-0332 14:40

The diagnostic value of chest MRI in the follow-up of lung cancer patients treated with radio frequency ablation
E. Skondras[1], A. Fusco$_2$, J. Beeson[1], P. Dalal[1]; [1]*London/UK*, [2]*Rome/IT (E.Skondras@rbht.nhs.uk)*

Purpose: To assess if MRI can be used as the sole modality for follow-up of primary and secondary lung cancer post ablation treatment.
Methods and Materials: We retrospectively analysed CT and MRI images of 30 patients during routine follow-up post RF ablation in the last 6 months. Two radiologists independently compared the CT and MR images of the post ablative zones and screened the lungs for new nodules.
Results: Review of the CT images showed: 67 lesions, 27 primary lesions (26 post ablative - 1 new), 38 metastatic lesions, 2 benign. Independent review of the MR images showed: 63 lesions, 27 primary lesions, 35 metastatic lesions, 1 benign lesion. In the primary lesion group, the size range was 6-76 mm on both modalities. In the metastatic lesions group, the size range was: CT:3-44 mm, MRI:5-44 mm. Three lesions were not visible on MRI: two in the left upper lobe (3 and 4 mm each) and one in the right lower lobe (3 mm). There were 2 benign lesions measuring < 5 mm (not visible on MRI) and 8 mm (visible on MRI). The MRI sensitivity for primary lesions was 100% and the sensitivity for the metastatic lesions was 92%.
Conclusion: MRI showed excellent sensitivity (100%) for the evaluation of primary lesions. The MRI sensitivity for the secondary lesions was 92% (all unseen lesion were < 5 mm in diameter).
It can therefore be reliably used for ablation zone follow-up and new nodule detection with appropriate frequency of scanning.

B-0333 14:48

Percutaneous treatment of parapneumonic effusions and complex empyemas with drainage and fibrinolytic therapy
S. Roy-Choudhury, G. Gupta, S. Roy Choudhury, R. Dhar; *Kolkata/IN (shuvrorc@googlemail.com)*

Purpose: Complex parapneumonic effusions (PPE) and empyema thoraces have high morbidity and mortality, upto 30% at 3 months untreated, or, 5%, when treated with VATS or open decortication. Earlier randomised trials comparing fibrinolytic therapy (FT) to placebo failed to show any conclusive benefits.
Methods and Materials: 43 patients (M:F = 29:14), mean age: 42 years (range 25 - 69) were treated between January 2012 and January 2014. Inclusion criteria were complex multiloculated or multiseptated effusion on ultrasound or empyema (pleural thickening > 5 mm). Percutaneous pigtail catheters (8.5 to 16 F) were inserted under US± CT guidance under LA. Fibrinolysis was started at mean of 36 hours post insertion and was performed with 250,000 U of streptokinase lasting 3 hours. 36 patients had 3 sessions, 3 patients had 4, 2 patients had 5 and 2 patients had two sessions.
Results: 30 day mortality was nil. 7 patients had 2 tubes. No residual fluid was seen on follow-up ultrasound. Subjective improvement occurred in all patients. CXR 'normalised' in 18 patients. Residual minimal and significant pleural thickening persisted in 17 and 8 patients, respectively. > 30% improvement in FVC occurred in 24 patients. 2 patients needed decortication. Large effusions, loculated effusions, presence of empyema or a pleural fluid ph of < 7.2 predicted worse response. At mean follow-up of 16 months hospital readmission rate was 8%.
Conclusion: Compared to existing literature, targeted therapy with FT improved outcome in patients with PPE and empyema thoraces with significant reduction in mortality and rate for surgical decortication.

B-0334 14:46

CT assessment of fissure completeness in target lobe selection for endobronchial volume reduction therapy in COPD
J.B. Seo, S. Shin, S. Lee, S. Lee, S. Oh, N. Kim, Y.-M. Oh; *Seoul/KR (joonbeom.seo@gmail.com)*

Purpose: To evaluate the fissure completeness at CT and to compare the results with Chartis test and target lobe collapse on follow-up CT after endobronchial volume reduction therapy (EVR) in COPD patients.
Methods and Materials: Volumetric inspiration CT scans were performed in 50 consecutive patients (M:F=49:1, mean age 68 yr) to evaluate the feasibility of EVR. Two radiologists were asked to determine the completeness of fissures independently. To match the result with Chartis test, right major fissure was subdivided into upper and lower portion, comprising 4 fissures in each patient. They also measured the maximal axial and sagittal diameter of incomplete fissure area independently. The agreement of decision and measurement by two readers was assessed with kappa statistics and interclass correlation coefficient (ICC). The fissure completeness was compared with the presence of collateral ventilation (CV), assessed by Chartis test in 71 lobes. In 17 patients, the final result of EVR was assessed with 3-month follow-up CT.
Results: The results between two readers agreed in 173 fissures (90 complete and 83 incomplete fissures, kappa, 0.74). ICC values of measured axial diameter, sagittal diameter, and defect area (mean 4.3 cm, 6.4 cm, 22.6 cm^2) were 0.80, 0.86, and 0.79, respectively. When compared with Chartis test, the sensitivity, specificity were 68%, 89%, and 79%, respectively. All (12/12) of treated lobes without CV on Chartis with complete fissure showed results of more than partial collapse.
Conclusion: The evaluation of fissure completeness in CT showed good interreader agreement, accuracy in determining target lobe of EVR.

Author Disclosures:
J.B. Seo: Consultant; Guerbet Korea.

B-0335 15:04

Anatomical and functional lung changes after endobronchial lung volume reduction therapy: evaluation with combined xenon ventilation and iodine contrast perfusion dual energy CT
J.B. Seo, S. Shin, S. Lee, S. Oh, N. Kim, S. Lee, Y.-M. Oh; *Seoul/KR (joonbeom.seo@gmail.com)*

Purpose: To assess the anatomical and functional changes of the whole, ipsilateral and contralateral lung after endobronchial lung volume reduction therapy (EVR) with combined xenon ventilation (V) and iodine contrast perfusion (Q) dual energy CT (DECT).
Methods and Materials: Twenty COPD patients underwent combined V and Q DECT scans before and after EVR (mean interval = 110 days). Endobronchial valves were inserted in the bronchi of 9 LLLs, 8 RULs, 1 RML, 2 RLLs, 1 RUL+RML, and 1 LUL. The lung volume, mean V and Q values and sum of V

and Q values in the whole lung, each lobe, ipsi- and contralateral lung were measured in both initial and follow-up DECT. Each measured values on initial and follow-up CT were compared with paired t-test. The ratios of change in lung volume, V and Q in ipsi- and contralateral lung were compared.
Results: After treatment, the mean of V and sum of V values in the whole lung increased significantly (all $p < 0.05$, paired t-test). The increase in mean V and mean Q values in ipsilateral lung were significantly higher than those of contralateral lung of treatment. However, there was no difference in sum of V between ipsi- and contralateral lung, because of volume loss of ipsilateral lung.
Conclusion: Regional ventilation and perfusion change after EVR can be visualized and quantified with V and Q DECT. Ventilation and perfusion of the lung significantly improved after EVR. The improvement of V and Q was more pronounced in aerated ipsilateral lung.

Author Disclosures:
J.B. Seo: Consultant; Guerbet, Korea.

B-0336 15:12

Metal artifact reduction on chest CT examinations: comparison of the IMAR (iterative metallic artefact reduction) algorithm and monoenergetic approach

J. Pagniez, L. Legrand, J.-B. Faivre, S. Khung, J. Remy, M. Remy-Jardin; *Lille/FR (julien.pagniez@gmail.com)*

Purpose: To evaluate the respective performance of a dedicated algorithm (IMAR) applicable to single-energy images and a dual-energy approach to reduce metal artifacts.
Methods and Materials: 17 pulmonary arteriovenous malformations (PAVMs), treated by endovascular deposition of metallic coils within feeding arteries, were evaluated with dual-source, dual-energy CT in the clinical context of post-embolotherapy follow-up. From each acquisition, 3 types of reconstructions of the occluded artery were generated: (a) averaged images from both tubes (i.e., polychromatic images) reconstructed with filtered-back projection (i.e., reference images (Group 1); (b) averaged images from both tubes (i.e. polychromatic images) reconstructed with IMAR (Group 2); and (c) high-energy images (i.e., images reconstructed at 120 keV) (Group 3). Two radiologists independently evaluated the presence and severity of metal artifacts.
Results: Group 1 images showed metal artifacts around all PAVMs (17/17; 100%), generating marked hypoattenuated areas (mean artifact density: 951 ±72.3 HU), that precluded any analysis of the surrounding lung parenchyma. Compared to Group 1, Group 2 ($p < 0.0001$) and Group 3 ($p=0.01$) images showed significant reduction in the mean artifact severity score, significantly improving the score of analyzability of the surrounding bronchovascular structures (Group 2: p= 0.0002; Group 3: p=0.02). Metal artifact reduction was significantly more pronounced in Group 2 than in Group 3 on subjective (mean artifact severity score: 0.76 ±0.31 vs 1.2 ±0.91; p=0.04) and objective (mean artifact density: -853±59 HU vs -933 ±72.3 HU; p=0.002) analyses.
Conclusion: IMAR reduces metal artifacts more efficiently than monoenergetic imaging.

14:00 - 15:30 **Room D2**

Interventional Radiology

SS 309

Musculoskeletal interventions

Moderators:
J.L. del Cura Rodriguez; Bilbao/ES
T. Lehnert; Frankfurt a. Main/DE

B-0337 14:00

MR-guided high intensity focused ultrasound for non-invasive treatment of osteoid osteoma

G. Cartocci, A. Napoli, G. Brachetti, F. Zaccagna, B. Cavallo Marincola, V. De Soccio, C. Catalano; *Rome/IT (gaia.cartocci@gmail.com)*

Purpose: To determine the feasibility and initial clinical efficacy of MR guided Focused Ultrasound (MRgFUS) for treatment of patients with osteoid osteoma.
Methods and Materials: This prospective, IRB approved study involved 25 consecutive patients (21 m; 4 f; mean age, 23) with clinical and imaging diagnosis of Osteoid Osteoma; all patients underwent MRgFUS ablation (ExAblate, InSightec). Lesions located in the vertebral body were excluded, while lesions in proximity to joints or neurovascular bundles were included. Treatment success was determined at clinical and imaging follow-up at 1, 3, and 6 months post-treatment. A visual Analog Pain Score (VAS) was used to assess changes in symptoms.
Results: Treatment was carried out using a variable number of sonications (mean 4±1.8) with a mean energy deposition of 866±211 J. There were no treatment- or anesthesia-related complications. A statistically significant ($p=0.001$) difference was noted between the overall pre- and post-treatment mean VAS scores (8.3±1.6 and 0.6±1.5, respectively). Three of the 25 patients received a second treatment for pain recurrence and all were completely clinically successful. At imaging, edema and hyperemia associated with typical osteoid osteoma, gradually disappeared in all lesions. No apparent relationship between nidus vascular extinction and successful outcome was found.
Conclusion: MRgFUS ablation represents an effective and totally non-invasive therapeutic option for osteoid osteoma management, without treatment-related adverse events.

B-0338 14:08

MR guided focused ultrasound surgery (MRgFUS) vs radiofrequency thermoablation (RFA) in the imaging-guided treatment of osteoid osteoma: clinical and imaging results

F. Arrigoni, S. Mariani, A. La Marra, L.M. Gregori, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (arrigoni.francesco@gmail.com)*

Purpose: To evaluate effectiveness and safety of minimally invasive treatment of Osteoid Osteoma (OO) with two imaging-guided techniques: Magnetic Resonance guided Focused Ultrasound Surgery (MRgFUS) and RadioFrequency thermoAblation (RFA) with a 2 years follow-up.
Methods and Materials: From March 2011 we treated 34OO, 17 with MRgFUS and 17 with RFA. Fourteen OO were treated with MRgFUS in the lower arm and 3 in the upper arm (humerus). The treatments lasted a mean time of 110 min. The lesions treated with RFA were 14 in the lower arm, 1 in the upper arm and 2 in the vertebral body (L3 and L5) and were treated in a mean time lower than 100 min. The follow-up was performed by MRI and CT, the clinical evaluation by VAS scale.
Results: All patients, except one treated with MRgFUS, showed a disappearance of painful symptomatology. The mean hospitalization time was 2 days for patients treated with MRgFUS and 2.6 days for those submitted to RFA. Both the procedures were effective (improvement of mean VAS values: 98%). One week after the procedure, patients treated with MRgFUS showed a lower mean VAS value (2.0) than RFA (2.5). The results of MRI and CT, showed in all cases the disappearance of bone edema (MRI) and of some of the typical findings of the osteoid osteoma.
Conclusion: Our study demonstrates the safety and effectiveness of these two techniques in the treatment of OO. The MRgFUS shows a lower rate of invasiveness than RFA, but requires specific inclusion criteria.

B-0339 14:16

Vertebral augmentation in extreme vertebral fractures: comparison between standard and augmented vertebroplasty

M. Tsitskari, D.K. Filippiadis, G. Velonakis, L. Reppas, E. Brountzos, N. Kelekis, A.D. Kelekis; *Athens/GR (mariadote@hotmail.com)*

Purpose: To compare safety, efficacy and long term stability between standard and augmented (peek polymer cage) vertebroplasty in patients with extreme (split/incomplete burst or large osteonecrotic vertebral cavities) vertebral fractures
Methods and Materials: During the last 42 months, we retrospectively compared 2 groups (15 patients each) suffering from painful extreme vertebral fracture treated with standard (Group A) or augmented (Group B) vertebroplasty.Standard x rays and CT scans were performed during follow-up. Pain prior, the morning after and at last follow-up (average follow-up 12 months) were compared by means of a numeric visual scale (NVS) questionnaire. Cement or implant migration were recorded.
Results: Group A: mean pain value of 8.87±0.99 prior and 2.27±3.35 NVS units post treatment, with a mean decrease of 6.60±3.07 NVS units ($p < 0.001$); progress of vertebral body damage, widening of fracture line or PMMA migration, subsequent vertebral fracture) in 3/15 patients (20%) with 2/15 being surgically operated (13.3%).Group B: mean pain value of 8.73±1.03 prior and 1.40±1.40 NVS units post treatment, with a mean decrease of 7.33±1.45 NVS units ($p < 0.001$); no implant change or migration.Pain reduction difference between two Groups was not statistically significant ($p=0.72$). PMMA versus implant migration between two groups was marginally insignificant ($p=0.068$).Overall mobility improved in 13/15 patients in Group A and 15/15 patients in Group B.
Conclusion: Both standard and augmented vertebroplasty seem to reduce pain in patients with extreme vertebral fractures. Preliminary results show potential tendency for widening of fracture line or PMMA migration and subsequent vertebral fracture in the vertebroplasty Group.

B-0340 14:24

Cone-beam computed tomography guided unipedicular central stentoplasty of the thoracolumbar spine: early experience and results

K. Huang, U. Pua; *Singapore/SG (kuang_hsin_huang@ttsh.com.sg)*

Purpose: Conventional vertebral body stenting involves the insertion of two stents through a bipedicular approach. A novel unipedicular vertebral body stenting technique, which we term 'central stentoplasty', was recently developed at our institution. With this technique, only a single vertebral body stent was deployed percutaneously in the midline of the vertebral body using cone-beam CT (CBCT)guidance. We present our early experience and results of this new technique.
Methods and Materials: Eighteen patient with 20 fractured vertebral bodies were included. All fractures were Type A1.2 or A3.1. Information about vertebral body deformity, vertebral angle and anterior vertebral height ratio were collected and analyzed.
Results: There were 3 male and 15 female patients with mean age of 71.1 years (54 - 83 years). The mean pre-procedure vertebral angle was 10.3° compared to post procedure vertebral angle of 7.9°. The mean change in angle was 2.4°. The mean pre-procedure anterior vertebral height ratio was 0.78 and the post procedure anterior vertebral height radio was 0.85. The mean height restoration was 0.08. The complications encountered include cement extravastation and small hematoma formation at the puncture site.
Conclusion: Unipedicular 'central stentoplasty' is a novel vertebral augmentation technique, which demonstrates satisfactory vertebral angle and anterior vertebral height correction. The use of CBCT facilitates the accurate deployment of the stents. This technique has the same complications as standard vertebral body stenting procedure, and appears to have promising results. However, longterm follow-up and further experience with larger patient population is required to validate these results.

B-0341 14:32

The use of cone-beam CT in achieving unipedicular spinal cement augmentation

T.C. Hui, G. Tan, U. Pua; *Singapore/SG (terrencehui123@gmail.com)*

Purpose: Our study aims to assess the feasibility of cone-beam computed tomography (CBCT) in achieving unipedicular access during spinal cement augmentation procedures.
Methods and Materials: Retrospective review of all patients who underwent CBCT-guided unipedicular percutaneous spinal augmentation procedures between 1st January 2012 and 3 1st August 2014 was performed. Unipedicular spinal augmentation was performed in 33 patients (24 women and 9 men; mean-age, 71.0 years; range, 53-90 years) in 40 vertebral levels (T5-T9 n=7, T10-L2 n=21, L3-L5 n=12). Aetiologies include osteoporosis (n=33), metastases (n=6) and multiple myeloma (n=1). Technical success was defined as midline crossover of the cement/stent complex on CBCT or antero-posterior fluoroscopy. Degree of crossover in contralateral hemi-vertebral body, complications and 30-day mortality were recorded.
Results: Ninety-three percent (37/40) of procedures (stentoplasty n=23, kyphoplasty n=13, vertebroplasty n=4) were technically successful. Two procedures (kyphoplasty n=1, stentoplasty n=1) failed due to vertebral sclerosis; one kyphoplasty procedure required the second pedicle (bipedicular) after midline crossover of cement failed. For vertebroplasty, all cases (4/4) demonstrated crossover filling of cement, and 75% (3/4) showed cement crossover > 50% of contralateral half. For kyphoplasty, all cases (11/11) demonstrated balloon-cement crossover > 50% of contralateral half. For stentoplasty, all cases (22/22) showed stent-cement crossover and 77.3% (17/22) exhibited stent-cement crossover > 50% of contralateral half. There was no major complication or mortality. Minor complications included: asymptomatic cement extravasation (12.5%, n=5) and self-limiting hematoma. (2.5%, n=1).
Conclusion: CBCT allows for unipedicular access in a range of vertebral body augmentation procedures and represents the natural "next step" in spinal augmentation technique.

B-0342 14:40

Percutaneous vertebroplasty in malignant spinal fractures with posterior vertebral column and/or epidural involvement. Feasibility and results: a review of 63 cases

A. Pellegrin[1], G. Gallo[1], A. Caudal[1], P. Foti[1], O. Hauger[2], N. Amoretti[1];
[1]*Nice/FR*, [2]*Bordeaux/FR (giacomo.gallo83@gmail.com)*

Purpose: To evaluate the feasibility and safety of percutaneous vertebroplasty in the treatment of malignant compression fractures with posterior vertebral column involvement to achieve vertebral consolidation.
Methods and Materials: 661 consecutive cimentoplasty procedures were performed between December 2010 and November 2013. Inclusion criteria included malignant fractures of the spine with posterior vertebral column involvement and/or epidural space infringement, with high pain level or with high fracture risk. We evaluated: procedure feasibility, spine stabilization, local and general complications.
Results: A total of 63 vertebrae in 52 patients were included: 44% metastases, 40% myeloma, 16% angioma. 54% of the procedures were dorsal, 41% lombar and 5% cervical. 70% were osteolytic lesions, 27% mixed and 3% were osteoblastic lesions. 73% of patients were unstable before treatment (Kostuik score ≥ 3). Cement leakage appears in 65.1% of procedures, without complication (intra-vascular for 25.4% and extra vascular for 55.6% of procedures with 7.9% intracanal and 3.2% in foramen). None of these required surgery or emergency treatment. One patient was reported with a paravertebral hematoma (at the site of punction).
Conclusion: Contrary to contraindication of cementoplasty with vertebral posterior column involvement in literature data, our study shows a very good feasibility and safety of this treatment, even in case of epidural space involvement. Vertebroplasty is an easy, fast, safe, minimally invasive and inexpensive technique that is well tolerated under local anesthesia and prevents prolonged immobilisation in critical patients. It allows bone biopsy and could be associated with other local treatments.

B-0343 14:48

Preliminary study for analysis of modification of disk volume and disk fragment in patients with lumbar contained disk herniation treated with CT-guided ozone-oxygen injection

M. Federici, A. Maira, M. Marconi, I. Iacucci, P. Mancini, M. Polito,
C. Simonetti, G.R. Ferreri, A. Bellelli; *Rome/IT (marghe.federici@libero.it)*

Purpose: To quantify volume changes in lumbar disk, considered as the entire disk volume inclusive of disk herniation, and in disk fragment alone, after Computed Tomography-guided intradiscal ozone-oxygen injection; the results were related with the symptoms, according to the rating scales of pain.
Methods and Materials: From March to December 2013, 38 patients and a total number of 40 disk herniation were evaluated, all presented with clinical signs of lumbar disk nerve root compression, with MR evidence of contained disk herniation. All patients were treated with intradiscal ozone-oxygen injection. We divided the patients into two groups: patients evaluated after 3 months (Group A) and after 6 months (Group B).The changes of disk volume and disk fragment were evaluated on T2 sagittal MRI imaging using OsiriX. Clinical outcome was evaluated with visual analogue scale and the Oswetry disability index.
Results: The group A showed disk volume reduction of 16.1% (median; range -6.5%,-25.7%), while the group B showed a reduction of 7.3% (median; range -4.9%, -19.5%); the disk fragment's shrinkage in the group A was of 35.6% (median; range -21.4%, - 49.8%), in the group B was of 40.8% (median; range -13.0, -68.6%). Study results were found to be statistically significant (pvalue < 0.05). Both groups showed a positive correlation with improvement of symptoms (pvalue < 0.05).
Conclusion: In our study, ozone-oxygen discolysis provides a statistically significant reduction of the volume of the disk, of the disk fragments and of the symptoms.

B-0344 14:56

Combined microwave ablation and cementoplasty in patients with painful bone metastases at high risk of fracture

C. Pusceddu, R. Fele, B. Sotgia, N. Ballicu, L. Melis; *Cagliari/IT (clapusceddu@gmail.com)*

Purpose: The purpose of this study was to retrospectively evaluate the effectiveness of CT-guided percutaneous microwave ablation (MWA) and cementoplasty in patients with painful bone metastases at high risk of fracture.
Methods and Materials: Thirty-five patients with 37 metastatic bone lesions underwent Computer Tomography (CT) -guided MWA combined with cementoplasty [polymethylmethacrylate (PMMA) injection]. The primary end point was pain relief evaluated by a visual analogue scale (VAS) before treatment and at one week and at 1, 6 and 12 months from the procedure. Functional outcome was assessed according to the evolution of their walking ability. Radiological evaluation was performed at baseline and after 3 and 12 months from the treatment.
Results: A reduction of pain, was observed already one week from the treatment in all patients. On average, the mean reduction of VAS score was 84%, 90%, 90% and 90 % at one week, one month, six months and one year from the treatment. Improvement at walking ability was obtained in 100%, 98 % and 100% of the cases respectively at 1, 6 and 12 months after the treatment. Any patient evidenced local tumour recurrence or progression and any pathological fracture in the treated site were observed.
Conclusion: Our results suggest that combined treatment with MWA and osteoplasty of bone metastases is a safe and effective procedure. The number of surviving patients at yearly evaluation may represent the actual need of an effective and long-lasting treatment

B-0345 15:04

Role of CT guided spinal injections in management of chronic low back pain

S.A.Z. Khodair, E. Mashaly, H. Sameer; *Qwuesna/EG (samehkhodair@gmail.com)*

Purpose: To evaluate the role of CT guided spinal injections in management of chronic low back pain.
Methods and Materials: Ninety five Patients with chronic low back pain after failure of adequate conservative treatment for at least 6 months were enrolled in this study. We excluded patients with intervertebral discs, motor deficit, previous operation of lumbar spine and bleeding tendency. All our study population were subjected to pain scoring by Revised Oswestry disability index before and after 1 month of injections, Standard x-rays, MRI of the lumbar spine and appropriate CT guided spinal injection was done using a combined solution of anesthetic and long acting steroid.
Results: 70 % of our patients had radicular pain versus 30% with non radicular pain. We performed unilateral facet joint injection in 50% of our patients, selective nerve root block in 30% and sacroiliac joint injection in 20% of our patients. The mean value of Revised Oswestry disability index before injections was 27.6 and 16.9 after injections.Only one patient underwent 2 sessions of facet joint injection over 2 consecutive months. There was overall significant improvement in pain relief as well as physical, occupational and psychological status during 6 months follow-up.
Conclusion: CT guided facet joint injection, sacroiliac joint injection, selective nerve root block could be effective modality in management of chronic low back pain and its sequels.

B-0346 15:12

Safety of cervical transforaminal steroid injections under CT guidance: a five-year experience in 248 cases

D. Krause, P. Pottecher, P.-Y. Genson, L. Estivalet, S. Favelier, R. Loffroy; *Dijon/FR (denis.krause@chu-dijon.fr)*

Purpose: To assess the safety of transforaminal steroid injection under computed tomography (CT) guidance for cervicobrachial neuralgia due to disk disease. We especially described CT findings after in situ contrast injection just before steroid injection and we identified peculiar aspects associated with intravascular injection, generally considered as a cause of potential severe complications.
Methods and Materials: We retrospectively evaluated 248 cervical foraminal steroid injections done at the university hospital in Dijon, Bocage Central, France in 2008-2012, to treat cervicobrachial neuralgia inadequately improved by optimal medical treatment for at least 3 weeks. Features describing the opacification patterns were recorded.
Results: Five main non-vascular opacification patterns were indentified: clumps of contrast agent outside the foramen (16 %), crab-claw pattern surrounding the ganglion (13%), French circumflex-accent pattern (15%), reflux along the needle (7%), and facet-joint capsule opacification (22%). Intravenous injection occurred in 25% of patients, with a crab-claw pattern in half the cases and a clump pattern in half the cases. Naturally, the needle position was changed in the event of intravenous injection (25% of cases). Intraarteriolar injection was note only in 2 patients and required also absolutely a change in needle position followed by repeat CT control
Conclusion: CT after in situ contrast injection ensures proper needle positioning outside the blood vessels (mainly by foraminal veins, and the veins within soft tissues, all around the spine) before steroid injection. Penetration of the needle tip into a vein is very common, whereas arteriolar puncture is extremely rare.

B-0347 15:20

CT-guided (with wide-volume acquisition) cryoablation in the management of bone and soft tissues lesions with multiple cryoprobes: the advantage of a 3D and real time planning of treatment

F. Arrigoni, A. La Marra, S. Mariani, L.M. Gregori, F. Smaldone, L. Zugaro, A. Barile, C. Masciocchi; *L'Aquila/IT (arrigoni.francesco@gmail.com)*

Purpose: To evaluate safety and efficacy of percutaneous CT-guided cryoablation using multiple cryoprobes in the treatment of bone and soft tissue lesions.
Methods and Materials: From July 2010 to September 2014, we treated 18 patients with percutaneous CT-guided cryoablation. 17 patients had osteolytic bone metastases; one patient had a recurrence of aggressive fibromatosis of the shoulder. Before treatment, patients were evaluated by VAS scale for pain with a mean value of 7.6. We placed, with fluoroscopic guide, from three to six cryoprobes for each lesion, to perform a faster procedure. The area of cryoablation (iceball) was verified during the procedure with a wide-volume acquisition. No major complications occurred during the procedures.
Results: Follow-up at 3 and 6 months performed with CT, showed no significant increase in volume of the treated lesions.We recorded a reduction in pain in all patient (mean VAS dropped from 7.6 to 1.9) one week after treatment; this value remained substantially unchanged until the end of follow-up (6 months).
Conclusion: Our results show the effectiveness of cryoablation in terms of tumour mass control and pain relief. The main advantages are the possibility to treat all the lesion at the same time with the use of multiple cryoprobes and the possibility to check in real time the volume treated; instead the main limit is represented by the low number of patients recruited and in the short time of follow-up, even if all but one patients, were cancer patients and so a long term follow-up was not possible.

14:00 - 15:30 **Room G**

Genitourinary

SS 307

Prostate MR imaging

Moderators:
D. Junker; Innsbruck/AT
J. Rørvik; Bergen/NO

K-06 14:00

Keynote lecture

H.-P. Schlemmer; *Heidelberg/DE*

B-0348 14:09

Prostate cancer: assessing the effects of androgen-deprivation therapy using quantitative multi-parametric MRI

A.M. Hötker, Y. Mazaheri, J. Zheng, C.S. Moskowitz, M.J. Zelefsky, H. Hricak, O. Akin; *New York, NY/US (Andreas.Hoetker@uni-mainz.de)*

Purpose: To investigate the ability of multi-parametric MRI in assessing the effect of androgen-deprivation therapy on prostate cancer and benign prostatic tissue to monitor treatment response.
Methods and Materials: This IRB-approved, HIPAA-compliant study included 30 men with histopathologically-confirmed prostate cancer undergoing MRI prior and after start of androgen-deprivation therapy from 2009 to 2012. 34 tumours and regions of benign prostatic tissue were assessed to calculate apparent diffusion coefficient (ADC, n=32) and transfer constant (K^{trans}, n=18) values. Changes in MRI parameters through therapy and correlations with clinical parameters (change in prostate-specific antigen (PSA), duration of treatment, PSA nadirs) were assessed using the Wilcoxon signed rank test, Spearman correlation coefficients and logistic regression.
Results: Prostate volume and PSA values decreased significantly through therapy ($p < 0.001$). ADC values significantly increased in tumour ($p < 0.001$), but decreased in benign tissue ($p \leq 0.022$). Both relative changes and post-therapeutic values of ADC were found to be significantly different between tumour and benign tissue ($p < 0.001$). K^{trans} decreased in both tumour and benign tissue; however, this decrease was only statistically significant in tumours ($p < 0.001$) and relative changes/post-therapeutic K^{trans} values did not differ significantly between tumour and benign prostate. The relative change of tumour ADC correlated significantly with the decrease in PSA, but changes in ADC or K^{trans} were not associated with treatment duration or PSA nadirs.
Conclusion: Androgen-deprivation therapy causes measurable changes to ADC and K^{trans} values in both tumour and benign prostate. Multi-parametric MRI may help to monitor treatment response in these patients.

Author Disclosures:
A.M. Hötker: Grant Recipient; Peter Michael Foundation. **J. Zheng:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748). **C.S. Moskowitz:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748).

B-0349 14:17

Multiparametric MRI (mpMRI) significantly predicts anterior prostate carcinoma (APC) in patients with prior negative biopsy

A.B. Malik, M. Musch, K.U. Waltering, J.L. Hohenhorst, D. Kröpfl, J.A. Koch; *Essen/DE (a_b_malik@hotmail.com)*

Purpose: Detection of APC via TRUS-guided biopsy remains technically challenging. Hence we evaluated the importance of mpMRI in detection of APC following prior negative biopsy.
Methods and Materials: 168 patients (mean age:65; prior negative biopsies:273) underwent mpMRI on a 3 T MAGNETOM Skyra (T1-weighted, T2-weighted, diffusion-weighted, spectroscopy, dynamic contrast enhanced). 373 lesions were evaluated using PI-RADS classification. MR/US-fusion targeted biopsy was then performed. Only lesions detected in the anterior zone were included in this analysis. Dividing the prostate gland in thirds (ventral (v), central (c), dorsal (d)) and taking the craniocaudal dimension (apex, mid, base) into consideration, the location of lesions was documented.

Results: 83 lesions in 71 patients were located in the anterior zone (v:44, vc:33 vcd:6). 45 lesions were classified as indeterminate (PI-RADS 3; group1) and 38 lesions as probably malignant or highly suspicious of malignancy (PI-RADS 4, 5; group2). Using four parameters, lesions in group1 had a mean total PI-RADS score of 11 and in group2 of 14. Overall, APC was detected in 38.6% of lesions after MR/US-Fusion targeted biopsy. APCwas detected in significantly more lesions of group2 compared to group1 (63.2 vs. 17.8%, respectively) ($p < 0.05$). Prostate needle biopsy specimens reported no significant difference concerning Gleason grades in both groups ($p > 0.05$).
Conclusion: MpMRI can be used for improved detection of APC especially in cases with prior negative biopsy. Higher PI-RADS scores were significantly associated with malignancy, whereas no correlation regarding tumour significance in terms of Gleason grade was found.

B-0350 14:25

Agreement between the Roach III equations (RE) and multiparametric 3.0 T MRI in assessing the T stage of prostate cancer before external beam radiotherapy (EBR)

M. Pancot, R. Girometti, M. Signor, C. Zuiani, S. Fongione, B. Massimo; *Udine/IT (martypancot@libero.it)*

Purpose: Based on prostate-specific-antigen level and Gleason score, RE indirectly estimate the T-stage of prostate cancer by assessing the risk of extracapsular extension (ECE) and invasion of the seminal vesicles (ISV). We investigated the agreement between RE and MRI in assessing the T-stage of disease.
Methods and Materials: Over a 20-months period, forty-six patients (mean age 66.3 years) with biopsy-proven prostate cancer and previous RE assessment prospectively underwent multiparametric MRI on a 3.0 T magnet before EBR. Two readers analysed images in consensus using PI-RADS criteria. We then assessed the agreement between RE and MRI in defining ECE, IVS and the whole T-stage (≥T3 vs.T≤2). For the purpose of analysis (Cohen's kappa), ECE and ISV were dichotomized (present vs. absent) using:(i) a RE cut-off of > 50.0% and > 20.0%, respectively;(ii) a PI-RADS score ≥4 vs. ≤3.
Results: Cancers were staged T≤2 and ≥T3 in 45.6%(95%C.I.31.8-59.6) and 54.4%(95%C.I.40.4-68.2) cases according to RE, and 71.7%(95%C.I.59.4-84) and 28.3%(95%C.I.16-40.6) cases according to MRI, respectively. Low agreement was found in assessing ECE (k=0.25) and ISV (k=0.39) separately, as well as ≥T3-stage as a whole (k=0.25). In particular, compared to RE, MRI: (i) downstaged ECE in 15/46 cases (32.6%), IVS in 7/46 (15.2%) and ≥T3-stage in 15/46 (32.6%); (ii) upstaged ECE in 3/46 cases (6.5%).
Conclusion: The agreement between RE and MRI in assessing the T-stage of prostate cancer is low, suggesting tumour overestimation by RE. Since it is more objective in nature, MRI should replace RE in the pre-EBR planning.

B-0351 14:33

MR-guided in-bore biopsy: the gold standard of targeted prostate biopsy procedures?

M. Quentin, L. Schimmöller, D. Blondin, F. Dietzel, T. Ullrich, C. Arsov, R. Rabenalt, P. Albers, G. Antoch; *Düsseldorf/DE (micha.quentin@gmail.com)*

Purpose: To evaluate MR-guided in-bore biopsy (IB-GB) with regard to cancer detection rate, tumour localization and lesion size.
Methods and Materials: Institutional review board approval and written informed consent was obtained. All patients received diagnostic prostate MRI (T2WI, DWI, DCE) at 3 T. All lesions described on MRI were biopsied with IB-GB and examined histologically. In total, 1,602 biopsy cores from 297 consecutive patients (66.1±7.8y; median PSA 8.2 ng/ml; prostate volume 58±30 ml) who were either biopsy naïve (n=160) or who had undergone at least one previous negative trans-rectal ultrasound-guided biopsy (n=137) were evaluated in this retrospective study.
Results: In 148 patients, overall 511 cores were positive for prostate cancer (PCa). Clinically significant PCa was found in 82.4% (any Gleason pattern ≥4). PCa detection rate for patients with primary biopsies was 55.6% and 43.1% for secondary biopsies. In patients with primary vs. secondary biopsies, PCa was located peripherally in 62.5% vs. 49.5% (p=0.04), in the transition zone in 27.3% vs. 27.5% (p=0.53), and in the anterior stroma in 10.2% vs. 22.9% ($p < 0.01$). Higher grade PCa (Gleason score ≥4+3=7) occurred apically in 38.5% (p=0.01). PCa detection rates for patients with smaller prostate volumes (50 ml; p0.5 cm3 vs. 0.5-0.25 cm3 vs. < 0.25 cm3; $p < 0.01$) were significantly higher.
Conclusion: MRI-guided in-bore biopsy led to high detection rates in primary and secondary prostate biopsies. PCa detection rates were significantly higher for larger lesions and smaller prostate glands. In secondary biopsies, PCa was anteriorly located at a significantly more frequent rate.

B-0352 14:41

Diagnostic performance of the ESUR PIRADS scoring system for multiparametric MRI of the prostate: systematic comparison of four parameters vs three parameters for detection and grading of prostate cancer

S. Polanec, K. Pinker-Domenig, T.H. Helbich, P. Brader, M. Susani, D. Georg, P.A.T. Baltzer; *Vienna/AT (stephan.polanec@meduniwien.ac.at)*

Purpose: To assess the diagnostic performance of ESUR PIRADS scoring system for MRI of the prostate by comparing four versus three parameters in detection and grading of prostate cancer (PCa).
Methods and Materials: 64 consecutive patients (mean age 66.7 years, mean PSA 13 ng/ml) were included in this prospective 3 T MP-MRI study (without endorectal coil, including T2w, DWI, DCE and MRS). Reference standard was obtained by MR- or US-guided biopsy or whole mountain histopathology. Two readers (O1, O2) independently evaluated the images according to the ESUR scoring (PI-RADS). A sum score was assigned for three parameters (PS3sum: T2w, DWI and DCE) and for four sequences (PS4sum: T2w; DWI; DCE; MRSI). The score´s performance for diagnosis of PCa and for PCa grading (Low-grade PCa: Gleason score ≤ 7; high-grade PCa Gleason score > 7) was compared using ROC analysis.
Results: In 52 (81.3%) out of 64 patients histopathology confirmed a PCa (44.2% low grade PCa and 55.8% high grade PCa). The diagnostic performance of PS4sum (O1: 91.7%, O2: 91.3%) equaled that of PS3sum (O1: 92.8%, O2: 92.2%, P> 0.05, respectively). Prediction of high grade PCa by PS4 sum (O1: 75.1%, O2: 74.7%) was as good as with PS3sum (O1: 75.1%, O2: 72.8%, P> 0.05, respectively). Kappa agreement between the two readers was substantial (0.734 PS4sum) to moderate (0.558 PS3sum).
Conclusion: The ESUR-PIRADS scoring system can accurately detect PCa and shows potential for prediction of tumour grade. An approach omitting MRS results does not decrease the diagnostic performance of MP-MRI in this setting.

B-0353 14:49

Prostate-MRI: experience of the observer and technical conditions influence the prostate cancer (PCa) detection rate

S. Rödel[1], S. Blaut[1], E. Dürig[1], M. Burke[2], R. Paulick[3], G. Haroske[1], F. Steinbach[1], T. Kittner[1]; [1]*Dresden/DE*, [2]*Solingen/DE*, [3]*Heidenau/DE (DRSTROEDEL@aol.com)*

Purpose: Analysis of the characteristics of identifiable lesions in mpMRI retrospectively in order to show the influence of the increasing experience of the observer and modified technical conditions.
Methods and Materials: 56 patients (pat). with mostly at least one prior negative TRUS-guided biopsy and persistent suspicion of PCa with at least one mpMRI-defined identifiable cancer suspicious lesion between 2012 and 2013. MpMRI: 1.5 T/e-coil/T2WI/DWI, b-values 2012: 0-1500, 2013: 100-1500/DCE-MRI]. MRGB: in-bore. Characteristics of lesions (ADC, ESUR PIRADS) were statistically correlated with core needle biopsy results (ROC).
Results: Pat. (2012/2013): MRGB rate of mpMRI 49%/33%; detection rate of PCa by MRGB 37%/69%. Detection rate of suspicious lesions (2012/2013): all 33%/58%; in peripheral zone 45%/50%; in transitional zone 14%/67%. The ROC curve area difference was statistically significant for 2012/2013 for ADC 0.65/0.83 (P=0.008) and PIRADS SUM 0.68/0.81 (P=0.046). The cut-off values [cut-off (sensitivity; specificity)]: 2012/2013: ADC 836 (0.58;0.58) / 651 (0.72;0.71); PIRADS SUM 9.5 (0.51; 0.83) / 9.5 (0.63; 0.92). 2013: PIRADS DWI 3.5 (0.57;1.0), PIRADS DCE 3 (0.63;0.69), PIRADS T2 3.5 (0.71;0.86).
Conclusion: Modified DWI in order to exclude microcapillary perfusion effects leads to lower cut-off value and higher diagnostic value of the ADC. The greater experience lowers the MR-guided biopsy rate of mpMRI patients. The increasing experience of the observer improves the evaluation of the transitional zone considerably. The combination of the modified technical conditions and increasing experience of the observer leads to higher sensitivity and specificity of the overall mpMRI prostate evaluation and prostate cancer detection rate.

Author Disclosures:
M. Burke: Employee; GE Healthcare. **R. Paulick:** Employee; Saegeling Medizintechnik Service- und Vertriebs GmbH.

B-0354 14:57

PIRADS analysis of prostate cancer at multiparametric MR Imaging: correlation with pathological results

F. Castelli, V. Di Paola, R. Manfredi, R. Pozzi-Mucelli; *Verona/IT*
(fedicastelli@gmail.com)

Purpose: To compare PIRADS score (Ps) with pathological results for characterization of prostatic lesions at multiparametric MRI.
Methods and Materials: Two hundred thirty-eight patients who underwent multiparametric MRI (T2-weighted, diffusion weighted and dynamic contrast enhanced MRI) of the prostate were included in this prospective study. Inclusion criteria: patients with prostate lesions ≥4 mm in maximum diameter at any site of the gland; biopsy performed within 3 months after MRI. Exclusion criteria: patients without biopsy (n=36) and biopsy performed before MRI examination (n=87). The final study population included 115 patients (mean age=62.47, range=45-78 years). Two readers independently scored the prostatic lesions they described by using the Ps. Sensitivity,specificity,diagnostic accuracy were evaluated for prostatic lesions with Ps≥3 and ≥4. Cohen's kappa correlation between each parameter and the malignancy of the lesion examined pathologically was then assessed.
Results: 3/134 prostatic lesions were classified as PIRADS=2, 38/134 as PIRADS=3, 73/134 lesions as PIRADS=4 and 20/134 as PIRADS=5. The most consistent groups were lesions with Ps=3 and among these 17/38 confirmed benign, 11/38 malignant with GS 6-7 and 10/38 as PIN and ASAP. Concerning Ps=4, 69/73 lesions were confirmed malignant, 1/73 as ASAP and 4/73 benign (inflammation). In prostate lesions with Ps≥3 sensitivity was 83%,specificity 49%,diagnostic accuracy 74% and Cohen's kappa=0.349. In lesions targeted with Ps≥4 sensitivity was 72%,specificity 82%,diagnostic accuracy 75% and Cohen's kappa=0.470.
Conclusion: The specificy of Ps in predicting malignant lesions was significantly higher for PIRADS≥4 than for PIRADS≥3 (82% vs 49%) with higher concordance with malignancy (K= 0.470 and 0.349).

B-0355 15:05

Transrectal ultrasonography of prostate gland using elastography in differential diagnostics of hypoechoic foci in patients with borderline PSA values

I. Aboian, E. Usenko, M. Rodzyanko; *Rostov-on-Don/RU*
(aboyan@center-zdorovie.ru)

Purpose: To determine the possibilities of prostate transrectal ultrasonography (TRUS) using elastography in differential diagnostics of hypoechoic foci in patients with borderline PSA values.
Methods and Materials: Within January 2010 - January 2014, a total of 72 patients (aged 58-73) were evaluated using TRUS with elastography (Toshiba Aplio XG 500). Based on prostate TRUS results, hypoechoic foci > 5 mm in peripheral zone and in transition zone were identified in 34 patients and 38 patients, respectively, with PSA 4-10 ng/ml. We divided patients into 2 groups: Group 1 (24 patients) - hypoechoic foci with high level of hardness (elasticity coefficient > 5), Group 2 (48 patients) - hypoechoic foci of moderate hardness (elasticity coefficient - 0.27-3). In all patients, conventional 12-cores biopsies and targeted hypoechoic foci biopsies were performed.
Results: Diagnosis according to the biopsy Results: Group 1: 7 patients with BPH associated with chronic prostatitis manifestations, atrophy areas and urothelial metaplasia, 17 patients with BPH and PIN foci of high and low degree (including 5 patients with adenocarcinoma). Group 2: 18 patients with BPH and chronic prostatitis manifestations, 7 patients with active chronic prostatitis and microabscesses, 23 patients with BPH and PIN foci of high and low degree. Thus only Group 1 patients were diagnosed with adenocarcinoma, i.e. in case of elesticity coefficient > 5.
Conclusion: We conclude that prostate TRUS using elastography is accurate in selection of patients for prostate biopsy (where the elasticity coefficient > 5 is the most specific to prostate adenocarcinoma) and in localization of targeted biopsy areas.

B-0356 15:13

Mechanical imaging of the prostate by multifrequency MR-elastography

M. Haas, J. Braun, J. Guo, S. Ipek-Ugay, I. Sack, B. Hamm, P. Asbach;
Berlin/DE (Matthias.Haas@charite.de)

Purpose: Multiparametric MR-imaging of the prostate currently includes functional techniques assessing cellularity und vascularisation. A method for mechanical MR-imaging of the prostate by multifrequency magnetic resonance elastography is introduced.
Methods and Materials: A total of 22 screening patients (mean PSA 9.4 ng/ml; mean 67 years, standard deviation (SD) 8.2 years) were included in this prospective IRB approved study. A three-dimensional multifrequency magnetic resonance elastography (3D-MMRE) technique was performed on a 3 Tesla scanner with multichannel surface coils. 9 contiguous slices with 2.5 mm cubic voxel resolution were acquired at 7 mechanical excitation frequencies from 60 to 80 Hz (5 Hz increments) using an echo planar imaging (EPI) pulse sequence. An analysis of the data with multifrequency dual elasto-visco (MDEV) inversion was done to calculate mechanical parameter maps of the pelvis including the prostate. The magnitude |G*| and the phase angle φ of the complex shear modulus were calculated. Values for the obturator internus muscle were calculated for comparative purposes.
Results: The group-averaged mean |G*| of the whole prostate was 4.12 kPa (mean SD 1.05 kPa), mean φ was 0.44 (mean SD 0.24). Transitional zone (average 4.30 kPa, mean SD 0.93 kPa) and peripheral zone (average 4.31 kPa, mean SD 1.05 kPa) did not show significant difference. |G*| of the obturator internus muscle was 2.83 kPa (mean SD 0.47 kPa).
Conclusion: Mechanical MR-imaging of the prostate is a feasible functional MRI technique. It provides mechanical characteristics of the prostate and should be further evaluated as a tool for imaging prostate cancer.

Author Disclosures:
B. Hamm: Consultant; Toshiba Medical Systems.

B-0357 15:21

Pain levels in MR-guided in-bore and MRI/ultrasound fusion-guided prostate biopsies

F. Dietzel, M. Quentin, L. Schimmöller, D. Blondin, C. Arsov, A. Hiester, R. Rabenalt, P. Albers, G. Antoch; *Düsseldorf/DE*
(Frederic.Dietzel@med.uni-duesseldorf.de)

Purpose: To investigate the patient comfort during MR-guided in-bore and MRI/ultrasound (MRI/US) fusion-guided prostate biopsy.
Methods and Materials: The study was approved by the institutional review board and informed consent was obtained from all patients. 260 patients with MR-guided in-bore biopsy and prior intrarectal instillation of 2% lidocaine gel (group A, n=67) or periprostatic nerve block (PPNB) with 2% mepivacaine (group B, n=128), and patients with MRI/US fusion-guided biopsy plus additional systematic transrectal ultrasound-guided biopsy and prior application of PPNB with 2% mepivacaine (group C, n=65) were included. The maximal procedural pain (MPP) on a 0-10 visual analog scale and the operating room time (ORT) were recorded for each biopsy session.
Results: Patients in group A had significantly higher biopsy-related MPP scores (3.1±2.1) compared to subjects in group B (2.0±1.9; $p < 0.01$) or group C (1.8±1.7; $p < 0.01$). Pain did not significantly differ between group B and group C (p=0.84). Biopsies in group C required significantly less time (29.4±11.3 minutes) compared to biopsies in group A (41.4±10.8; $p < 0.01$) and group B (39.3±10; $p < 0.01$). There was a weak correlation between MPP scores and ORT (rS=0.25, rS=0.22 and rS=0.27 for groups A, B and C, respectively), but no correlation between MPP scores and number of targeted cores or prostate volume. Increased experience led to a reduction of the mean ORT in each biopsy technique.
Conclusion: Both biopsy techniques do not significantly differ in terms of MPP, provided that the same analgesic technique is used. The MRI/US fusion-guided biopsy takes significantly less time.

14:00 - 15:30 **Room K**

Radiographers

SS 314

Quality issues

Moderators:
J. McNulty; Dublin/IE
J. Wieczorek; Warsaw/PL

K-07 14:00

Keynote lecture
J. McNulty; *Dublin/IE*

B-0358 14:09

Evaluating the use of oral contrast media for abdominopelvic CT for general oncological indications
E. Buttigieg, K. Borg Grima, F. Zarb; *Msida/MT*
(erica-lauren.buttigieg@gov.mt)

Purpose: Evaluating the impact of oral contrast media (OCM) for abdominopelvic CT. The objectives were to establish anatomical image quality criteria, including bowel evaluation, for abdominopelvic CT; use these criteria to evaluate and compare image quality using positive, neutral, and no OCM and evaluate possible benefits for the medical imaging department.
Methods and Materials: Forty-six adult patients attending for a follow-up abdominopelvic CT for general oncological indications and who had a previous abdominopelvic CT with positive OCM were recruited to this experimental study. Previous patient CT images with positive OCM (n = 46) comprised the control group. The same patients were placed into either the water (n = 25) or no OCM (n = 21) groups prospectively in an alternative fashion when attending for their follow-up CT examination. Three radiologists performed absolute visual grading analysis (VGA) assessing image quality by grading the fulfilment of 24 anatomical image quality criteria. Costs were computed by calculating the monetary expenditure related to OCM administration.
Results: Visual grading characteristics (VGC) analysis of the data showed comparable image quality with regards to reproduction of abdominal structures, bowel discrimination, presence of artefacts, and visualisation of the amount of intra-abdominal fat for the 3 OCM protocols. The use of water or no OCM would provide an annual cost saving of approximately 8000 without compromising diagnostic efficacy.
Conclusion: All 3 OCM protocols provided similar image quality for follow-up abdominopelvic CT for general oncological indications. This paper was accepted for publication in European Radiology.

B-0359 14:17

Compression in high volume mammography screening: comparing applied force measurements with image evaluations scores
I.H.R. Hauge, R. Hammond, M. Hauge; *Oslo/NO (robham@ous-hf.no)*

Purpose: Examine ranges of applied compression force between radiographers and how they compare to the total average. Investigate how the applied compression forces correlate to individual PGMI scores (images are evaluated as either perfect (P), good (G), moderate (M) or inadequate (I)).
Methods and Materials: From July 2011 to June 2014, a total of 10391 2D and/or 3D images, craniocaudal (CC) and mediolateral oblique (MLO), for 28 radiographers were evaluated using the PGMI image classification system. Compression force was noted during these evaluations, and total averages were estimated for applied compression force for each radiographer. Linear regression was used to find the correlation between PGMI scores (percentage of perfect (P) plus good (G) images) and applied compression forces.
Results: The total average compression force applied was 12.3 daN [12.3-0.3 daN, 12.3+0.3 daN] (95% confidence interval (CI)) for CC images (range: 11.1-15.5 daN) and 13.2 daN [13.2-0.4 daN, 13.2+0.4 daN] (95% CI) for MLO images (range: 11.5-15.9 daN). 32.1% (9/28) and 39.3% (11/28) of the radiographers applied an average compression for CC and MLO, respectively, which was less than or equal to the total average compression. For the CC images (5196) there was no linear correlation (R2=0.14) between compression and the PGMI scores; while for the MLO images (5195), a poor correlation between increasing compression force and decreasing PGMI scores was observed (R2=0.61).
Conclusion: Individual variations in the applied compression force was observed. It is possible to use less compression, more comfortable for women, and still achieve higher PGMI evaluation scores.

Author Disclosures:
R. Hammond: Advisory Board; Hologic, Inc. 2012.

B-0360 14:25

Iodinated porphyrins in contrast media agents: a new approach, first indicators
R.M.S.C. Pereira[1], M.P.M.S. Neves[1], P.V. Coelho[2], R.M.P. Fernandes[2], M.F. Faustino[1]; [1]*Aveiro/PT*, [2]*Oporto/PT (ruimpereira@ua.pt)*

Purpose: Pitfalls, like Contrast Induced Nephropathy, presented by Contrast Media (CM) commercially available, makes CM target of a lot of studies, where multimodal and theranostic substances are some of the novel approaches. Low dark toxicity, neoplastic tissue affinity and synthetic accessibility are important properties that make porphyrins, already use in Photodynamic Therapy, a study target to applications in medical area.It is proposed to synthesize new iodinated-porphyrin contrast agent that shown appropriate X-ray beam attenuation,low toxicity and which can be potential used as theranostic or as multimodal contrast agent.
Methods and Materials: Iodinated-porphyrin (RP1) and the corresponding metalloporphyrins (RP2 (Mn) and RP3 (Gd)) were prepared according the literature. X-ray beam attenuation was assessed exposing compounds to standardised Computed Tomography scan and measuring Hounsfield Units (HU). Cellular toxicity was assessed by cellular differentiation of pre-adipocytes 3 T3-L1 exposed to iodinated-porphyrins and Iomeprol during 3 days (Protocol A) and 10 days (Protocol B) after confluence.
Results: RP1, RP2 (Mn) and RP3 (Gd) were achieved in moderate to good yields. X-ray beam attenuation (RP1: 454.67±0.75 HU, RP2 (Mn): 465.67±0.75 HU, RP3 (Gd): 472.50±1.26 HU), was similar to Iomeprol (472.83±0.69 HU). RP1, RP2 (Mn) and RP3 (Gd) and Iomeprol shown, under Protocol A, significant increase in cellular differentiation (range 117%-167%), when compared with control cells. Under Protocol B, RP1 does not affect cellular differentiation (96.26%) and Iomeprol, altought not statistically significant, seems to decrease cellular differentiation (72.63%). In the presence of metalloporphyrins, cellular differentiation remains increased.
Conclusion: The first evaluations of RP1 showed good X-ray beam attenuation and promissory toxicological assays, although only cellular differentiation was assessed.

B-0361 14:33

Optimisation of image quality of the Codman Hakim programmable valve, by different phantom positions
V. Harsaker, M. Berger, A. Holberg, B. Ween; *Oslo/NO*
(vanja.harsaker@hioa.no)

Purpose: The CODMAN® HAKIM® Programmable Valve is an implantable device that provide constant intraventricular pressure and drainage of cerebrospinal fluid (CSF) for the management of hydrocephalus. To verify the CSF pressure it is important to routinely image the shunt Valve device settings. The Codman Hakim procedure guide (2011) refers to the correct imaging procedure, where the implemented side of the patient's head points towards the x-ray tube. This study compare the image quality and dose for different phantom positions.
Methods and Materials: The Codman Hakim Programmable Valve was fixed on an anthropomorphic head phantom. The head phantom was imaged with a Philips Multi Diagnost Eleva Flat Detector (DR) with six different positions; three options of pillow (regular pillow, foam pillow or without pillow) and the valve towards or against the detector. The six images were ranked by 22 radiographers at a Norwegian hospital, due to sharpness presentation of the valve. The Dose Area Product (DAP) was registered for each image to compare radiation dose. The PCXMC program was used to calculate the effective dose.
Results: 81.8% rated the sharpest valve as being placed towards the detector. Surprisingly 64% rated best sharpness when the phantom was placed on a regular pillow. There were only a slight difference in DAP measurements, and the calculations of the effective dose shows an estimate of 7-8 µSv.
Conclusion: The results implies that positioning the valve toward the detector provides the sharpest image. However, the use of a pillow seems to provide a better ranking.

B-0362 14:41

Frequency and dose levels of paediatric image guide fluoroscopy procedures in Portugal
D. Almeida[1], N. Carvalho[1], B. Esteves[1], C. Almeida[2], G. Paulo[1], J. Santos[1]; [1]*Coimbra/PT*, [2]*Lisbon/PT (joanasantos@estescoimbra.pt)*

Purpose: To establish national Diagnostic Reference Levels (DRLs) for the most common paediatric fluoroscopic procedures based on the 75th percentile value of Dose Area product (DAP), per age categorisation in the two exclusively paediatric national hospitals.
Methods and Materials: Digital Imaging and Communications in Medicine (DICOM) headers for brain, digestive, urological and orthopaedic fluoroscopy procedures performed during 2013 were analysed and compared with literature.

Results: The most common procedures were urological (36%) and digestive (34%). The dose values obtained for the age groups of [0.1[, [1.5[, [5.10[, [10.15[and ≥15 were 338, 304, 430, 380 and 390cGy cm^2 for urological studies and 480, 559, 530, 560 and 415cGy cm^2 for digestive studies, respectively.
Conclusion: The exposure values obtained in this study are heterogeneous across the age groups and intuitions. To reduce these differences optimisation procedures are needed in order to reduce the risk of radio-induced pathology in children.

B-0363 14:49

Post-mortem evaluation of drowning with whole body computed tomography
S. Vander Plaetsen, K. Verstraete; *Ghent/BE (koenraad.verstraete@ugent.be)*

Purpose: The aim of this study is to investigate the value of whole body computed tomography (WB-CT) in bodies recovered from water by analysis of the imaging findings after drowning. In addition, to estimate the post-mortem interval and to provide characteristics for identification of the body.
Methods and Materials: The bodies of 41 drowning victims and 9 persons who died from mechanical asphyxia by hanging underwent post-mortem whole body computed tomography. Statistical analysis (frequencies, comparisons, correlation and significance) was performed with SPSS.
Results: Fluid in the paranasal sinuses (98%), nasal pharynx (98%), oropharynx (95%), trachea (83%), ground glass opacities in the lung (89%), pleural fluid (71%), pericardial fluid (59%), esophageal fluid (81%), stomach fluid and distension (71%), duodenal (34%) and jejunal distension (31%) were the most frequent drowning related imaging findings which significantly differed from the group of mechanical asphyxia by hanging. In cases of fresh water drowning haemodilution was present in 79%. New and up to now unpublished findings were lower density in the spleen, indicative for haemodilution and detection of a pronounced amount of pericardial fluid, only seen in drowning victims. Age determination was up to 5 years accurately in 47% and post-mortem interval (PMI) could be determined well in 66%.
Conclusion: There are a series of signs of fluid on abnormal sites of the body and haemodilution that more frequently occur in drowning than in hanging. The determination of PMI with WB-CT is moderately accurate, while the age determination was more precise.

B-0364 14:57

Facial traits reconstruction with MDCT
C. Dionisi[1], E. Fontebasso[1], E. Stefani[2], S. Barbera[3], F. Cavalli[4]; [1]*Treviso/IT*, [2]*Conegliano/IT*, [3]*Biella/IT*, [4]*Trieste/IT (clizia.dionisi@gmail.com)*

Purpose: to demonstrate the validity of facial traits reconstruction starting from a MDCT cranial digital cast, through a computer-assisted process.
Methods and Materials: three cases were analyzed: a living young man, an old man and a cranium belonged to Ulrik I of Celje.(XIV century). Methods used involves the scan of skull with MDCT and the reconstruction of the facial traits with the use of three software: Amira for the segmentation obtaining a 3D triangular mesh object, 3DStudioMax to fix the thickness of soft parts at the level of cranial landmarks and FaceGen to obtain the facial traits of our subjects.
Results: in the former two cases the reconstructions showed a congruence between the face obtained and the photos of subjects. In the third cases the reconstruction produced a regular face features of a relatively young adult subject. However, in the former two cases not all landmarks corresponded with the thickness of the final face. This seems to be due to the fact that the thickness of soft parts used at the level of the landmarks represented the local thickness of an average face.
Conclusion: Facial traits reconstruction of these three cases shows that subsists a congruence between the facial reconstruction and the facial morphology of subjects and shows that the hypothetical thickness of the soft parts used is sufficiently congruent. It must be remembered that the aim of our work is to reach a mere resemblance between the traits reconstruction and the real face of the subject.

B-0365 15:05

Lidocaine utilisation in mammography exams
A. Santos[1], T. Figueiredo[1], L.P. Ribeiro[1], A.F.C.L. Abrantes[1], S. Rodrigues[1], J.P. Pinheiro[1], R.P.P. Almeida[1], C.M.L. Abrantes[2], O. Lesyuk[1]; [1]*Faro/PT*, [2]*Pilsen/CZ (oksanalesyuk@gmail.com)*

Purpose: Study of the lidocaine effect in the mammography exams and its influence on compression pain.
Methods and Materials: The study was made with a sample of 51 patients (n=51). A placebo or lidocaine was applied on the breasts and a survey form was delivered before and after the exam, to obtain information on patient's level of pain. The mammograms performed respected the imaging criteria and standards in accordance with American College of Radiology.
Results: We defined that the experience of prior mammalgia influences the level of pain felt by the participants with a Spearman correlation of 0.369 ($p < 0.05$). Results support the hypothesis that lidocaine 4% reduces pain associated with mammography and its use leads to a greater acceptance for future exams in about 72.5% of patients.
Conclusion: Lidocaine application decreases the level of pain reported and enables a greater acceptance of a future exam under the premise of using the product.

B-0366 15:13

Comparison between the image quality and the radiation dose in CT scanning for the detection of pharyngo-esophageal foreign bodies
I. Simonetto[1], S. Barbera[2], G. Addonisio[3], C. Dionisi[3]; [1]*Spresiano/IT*, [2]*Biella/IT*, [3]*Treviso/IT (ilaria.simonetto91@gmail.com)*

Purpose: The objective of this work, in accordance with the principle of optimization, has been to identify the best compromise between dose and image quality in the CT examination for the diagnosis of the foreign body pharyngo- esophageal. Researching the limit of detection of various types of foreign body exposure modes when the data changes, it was wanted to provide to clinicians with objective means of assessment of the methodology and of the CT technique, which, in this specific clinical context stands as a valid competitor to the traditional examination contrastographic of the upper digestive tract.
Methods and Materials: The evaluation of the image quality was achieved by various CT acquisitions, performed with a chilovoltaggio (kV) fixed at 80 (the least that allows you to set the machine) and a range of milliampere (mA) ranging from 10 to 40. A guinea pig animal was used, in which inside were positioned 7 foreign bodies with different densities and characteristics. The visibility of foreign bodies has been demonstrated through, both qualitative and quantitative analysis signal using dedicated software. Finally dosimetric comparisons were made between traditional radiological examination and the CT acquisition with the various technical conditions exposimetric previously described.
Results: The visibility of 5 foreign bodies has already been demonstrated at 10 mA, corresponding to a dose of 0.20 mGy. The dose measured by a conventional X-ray examination is 4.33 mGy.
Conclusion: The dose administered to the patient, with this experimental procedure, appears 20 times lower than the traditional radiological examination.

B-0367 15:21

Premature and neonatal chest images' quality variations
B. Ween, M. Skoglund, P. Parameswaran, H. Eieland; *Oslo/NO (borgny.ween@hioa.no)*

Purpose: To verify image quality variations in premature and neonatal chest images. Radiographers might not be too familiar with performing images in incubators. Optimal quality needs for an accurate diagnosis.
Methods and Materials: A blinded subjectively image quality assessment study was performed by three radiographers experienced in paediatric image was performed for ten indicators in each one of 150 examinations, all together were 4.500 evaluations made. A criteria document created for the purpose contained visualization of positioning and radiographic techniques. Detector used was Canon CXDI-50C DR-system. Images were stored, presented and evaluated on the Shimadzu's screen.
Results: Two third were non-intubated and one-third were intubated. Centering and field exposed were good. Majority of the images lacked side markers. Lordosis was the most common failure with respect to positioning, and rotation were present on nearly the half. Artifacts were of different types.
Conclusion: Quality variations were common. Some of them could lead to unsure diagnosis, or even false positive results.

14:00 - 15:30 **Room MB 1**

Head and Neck

SS 308

Temporal bone and temporomandibular joint imaging and new MRI techniques

Moderators:
J. Frühwald-Pallamar; Vienna/AT
S. Petrovic; Nis/RS

B-0368 14:00

Role of CBCT in visualisation of ear anatomy

C. Gueldner, R. Weiß, S. Draeger, I. Diogo; *Marburg/DE*
(gueldner@staff.uni-marburg.de)

Purpose: In the last years, CBCT has been used in imaging of chronic ear diseases, but precise definition of advantages and limitations in visualization of the anatomy at a relevant number of patients is still missing.
Methods and Materials: The data sets of the CBCT imaging of the middle ear of 228 patients were analyzed regarding the visualization of 23 different anatomic structures. All analyses were performed by in otology and radiology experienced surgeons.
Results: The bony coverage of the facial nerve could be evaluated completely at the mastoid part in 95%, at the tympanic in 40% and at the vestibular part in 98%. A precise evaluation of the middle ear structures was only possible in less than 50% of the cases (joint space incus-malleolus: 50%; joint space incus-stapes: 46%; head of the stapes: 28%; posterior crib of stapes: 20%; anterior crib of stapes: 17%). Bigger structures of the middle and inner ear could be detected in a more sufficient way (long process of incus: 96%; posterior semicircular canal: 99%; anterior: 97%; superior: 99%; jugular bulb: 98%). The bony coverage of the lateral skull base (middle ear as well as mastoid) could be determined in all cases in excellent way.
Conclusion: Even CBCT shows limitations in visualization of small structures of the middle and inner ear. Overall, CBCT seems to be better than conventional CT in daily routine, but comparative studies of both methods are still missing. In future, these should be performed by radiologists and otologist together.

B-0369 14:08

Recurrent vertigo: is MRI useful for diagnosis of endolymphatic hydrops in clinical practice?

A. Attye, G. Dumas, I. Tropres, M. Roustit, A. Karkas, E. Banciu, J. Pietras, S. Schmerber, A. Krainik; *Grenoble/FR (aattye@chu-grenoble.fr)*

Purpose: Isolated recurrent peripheral vertigo (IRV) is a major public health problem, yet the etiology remains unclear. Recent developments in MRI of endolymphatic hydrops (EH) allow a better understanding of inner ear disorders. We intended to study the prevalence of EH in patients with IRV, in comparison to those with Meniere's disease (MD).
Methods and Materials: Study ethics approval was obtained for a retrospective work. MR scans were performed 4 hours after intravenous injection of gadoteric acid injection in 132 patients with IRV (IRV group, n=64) and MD (MD group, n=68). A 3D-FLAIR sequence was performed with the following parameters: TR: 8000 ms, TE: 316 ms, TI: 2400 ms, 0.8 mm isotropic acquisition voxel size and a scan time of 9'. Two radiologists retrospectively studied the prevalence and localization of EH in both groups. Inter-rater agreement on grading and detecting EH was estimated for the 3D-FLAIR sequence before and after subtraction with the T2 heavy-weighted sequence.
Results: We identified EH in 31 patients out of 64 and in 61 patients out of 68 in the IRV and MD groups respectively. There was a significant difference regarding the number of subjects with EH between the two groups ($p \leq 0.01$), with a higher average number of hydrops localization in the MD group ($p \leq 0.01$). Inter-rater agreement was estimated as being 0.62 on the 3D-FLAIR sequence before subtraction process and 0.72 after.
Conclusion: We defined an imaging pattern for patients with IRV secondary to EH, suggesting that MRI could be useful for clinical investigation or classification of disease types.

B-0370 14:16

CT pre-operative planning of Bonebridge™: a new semi-implantable bone conduction hearing device

E.K.C. Law, W.S.S. Tsang, M.C.F. Tong, S. Lin, K.S.S. Bhatia; *Shatin/HK*
(drkbhatia@cuhk.edu.hk)

Purpose: Bonebridge™ (BB) is a novel semi-implantable bone conduction hearing device indicated for patients with conductive or mixed hearing loss. Accommodating the BB within the temporal bone presents new challenges for pre-operative surgical planning. This study describes the utility of multi-slice CT in pre-operative assessment of BB implant in a consecutive single center series.
Methods and Materials: Retrospective review of patients with pre-operative CT planning from January 2012 to September 2014. The optimal device position (transmastoid, retrosigmoid, or none) was determined, and the potential need for depression of the sigmoid sinus and/or device elevation was recorded. Unidimensional bony measurements on bone thickness and AP diameter of mastoid cavity were acquired, and the final operation records were compared with our simulated proposed site for Bonebridge placement.
Results: 16 pre-operative CTs were performed (6 males & 10 females, average age 42 ± 16 years). 8 and 5 candidates were deemed suitable for the transmastoid and the retrosigmoid approaches respectively, and 3 patients were deemed radiologically unsuitable. The mean AP diameter of the mastoid cavity was 14.6 mm for the transmastoid group and 4.6 mm for the retrosigmoid group ($p < 0.05$). Contracted mastoid and/or prior surgery were pre-disposing factors for unsuitability for BB placement.
Conclusion: A high proportion of patients being considered for BB have contracted or operated mastoids, which reduces the feasibility of the transmastoid approach. The challenges in placement illustrate the importance of CT assessment and use 3D software that enables precise simulation and positioning of the FMT.

B-0371 14:24

Auditory brainstem implant: computed tomography assessment of electrods dislocation

F. Spagnolli, N. Cardobi, R. Cerini, M. Barillari, V. Colletti, R. Pozzi-Mucelli; *Verona/IT (federica.spagnolli@gmail.com)*

Purpose: the main goal of our study was to evaluate the contribution of Computed Tomography to demonstrate Auditory Brainstem Implant (ABI) electrodes dislocation.
Methods and Materials: from 2008, out of 75 patient with ABI implant positioned in our Hospital, 7 patients with malfunctioning ABI were selected and retrospectively revised. CT examination was performed on our 64 slices CT scanner (Philips Brilliance 64, Philips Eindhoven, The Netherlands) at implant activation, usually 15 days after surgery and repeated later to verify any electrodes dislocations. Implant dislocation was defined as electrodes array rotation and/or translation. Rotation was defined as change in angulation, measured in degrees, of electrodes plate in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Translation was defined as displacement in millimetres of electrodes plate's iso-center, in each plane examined, between the CT examination performed at the ABI activation and subsequent follow-up CT. Electrodes translation and rotation were measured on fusion CT image in each plane and then compared to number of active electrodes of the array.
Results: CT was able to identify electrodes plate rotation and/or dislocation in all patients. In 3/7 patients there were electrodes plate rotation and translation. In 2/7 patients there was only electrodes plate translation. Maximum rotation measured was 44.9°; maximum dislocation was 3.6 mm.
Conclusion: CT was able to identify electrodes plate rotation and/or dislocation in all patients.

B-0372 14:32

Value of MRI in patients with temporomandibular joint dysfunction: correlation of MRI and clinical findings

T.J. Vogl[1], H.C. Lauer[1], T. Lehnert[1], N.N.N. Naguib[1], H. Soekamto[1], N. Fillmann[1], P. Ottl[2]; [1]*Frankfurt a. Main/DE*, [2]*Rostock/DE*
(t.vogl@em.uni-frankfurt.de)

Purpose: To evaluate correlation between magnetic resonance imaging (MRI) findings and clinical findings in patients with temporomandibular joint dysfunction (TMD).
Methods and Materials: In total, 794 patients (546 females, 248 males; mean: 38.7 years) were included in this study who were clinically diagnosed with TMD and examined by MRI (T1- and T2-weighted images, parasagittal and paracoronal slices). A questionnaire as well as radiological and clinical findings were analyzed for statistically significant correlations. The analyzed parameters included gender, age, disk position, joint degeneration, arthralgia, mouth opening, condyle position and clinical progress.
Results: In 492 patients (62%) of all TMJ's 62% physiological disc position was documented, in 278 of these patients (35%) anterior and in 24 patients (3%) posterior disc position. Modification of therapy occurred in 158 patients (20%) and alteration of diagnosis was found in 254 patients (32%). Anterior disc displacement with reduction showed a specificity of 88% and a sensitivity of 78%, whereas anterior disc displacement without reduction showed a specificity of 84% and a sensitivity of 73%. A significant correlation between disc length, condyle morphology and disc displacement was found. With the increase of intra-articular liquid as seen on MRI the level of arthralgia significantly increased as opposed to mouth opening.

Conclusion: Specificity and sensitivity for anterior disc displacement and osseous changes in TMJ were highly acceptable. Our results confirmed the use of MRI as a gold standard in diagnostic imaging of TMJ.

B-0373 14:40

Comparison of a 32-channel head coil and a 2-channel surface coil for MR imaging of the temporomandibular joint at 3.0 Tesla

A. Manoliu[1], G. Spinner[1], M. Wyss[2], S. Erni[1], D. Ettlin[1], D. Nanz[2], E.J. Ulbrich[2], L.M. Gallo[1], G. Andreisek[1]; [1]*Zurich/CH*, [2]*Zurich/CH*
(a.manoliu@googlemail.com)

Purpose: Surface coils are still standard for imaging the temporomandibular joint (TMJ), but commercially available head coils would be much more user-friendly. Purpose was to quantitatively and qualitatively compare a 32-channel head coil and a standard 2-channel surface coil for MR-imaging of the TMJ at 3.0 T.
Methods and Materials: IRB approved study with written informed consent. A spherical phantom and 22 asymptomatic volunteers underwent high-resolution MR-imaging of the TMJ at 3.0 T (Ingenia 3.0 T, Philips) using a 32-channel head coil (SENSE Head coil 32-elements, Philips) and a 2-channel surface coil (SENSE FlexS, Philips). Imaging protocol included sagittal and coronal fast spin echo sequences. For quantitative analysis, pixel-by-pixel signal-to-noise ratio (SNR) maps of the phantom were calculated using Matlab routines (Natick, USA). For qualitative analysis, images were evaluated by two independent readers using 5-point Likert scales. Both coils were compared using t-tests.
Results: The quantitative analysis showed significantly higher SNR for the head coil compared to the surface coil (surface coil: mean±SD, 57.18±12.79; head coil: 102.97±17.03; $p < 0.001$). For the qualitative analysis, inter-rater reliability ranged from "substantial" to "almost perfect" (Kappa, 0.804-0.965). Compared to the surface coil, the head coil showed significantly better visibility of anatomical structures of the TMJ, including the temporomandibular disk, bilaminar zone, mandibular fossa, mandibular condyle and pterygoid muscle and better overall image quality ($p < 0.05$, corrected for multiple comparisons).
Conclusion: Quantitative and qualitative data show higher SNR and increased visibility of anatomical structures using the 32-channel head coil compared to a standard 2-channel surface coil.

B-0374 14:48

MR imaging of the temporomandibular joint at 7.0 Tesla: a feasibility study using novel high-permittivity dielectric pads

A. Manoliu, G. Spinner, M. Wyss, S. Erni, D. Ettlin, D. Nanz, E.J. Ulbrich, L.M. Gallo, G. Andreisek; *Zurich/CH (a.manoliu@googlemail.com)*

Purpose: MR imaging of the TMJ at 7.0T using a clinically feasible setting has not been shown before. Purpose was to quantitatively and qualitatively evaluate the use of high-permittivity dielectric pads for enabling clinical MR imaging of the temporomandibular joint at 7.0T.
Methods and Materials: IRB approved study with written informed consent. Sixteen TMJ in 8 volunteers were imaged at 7.0 T (Achieva, Philips) using a commercially available 32-channel head coil with and without high-permittivity dielectric pads which contained barium titanate in deuterated suspension. Imaging protocol consisted of coronar and oblique sagittal PDw-TSE sequences. For quantitative evaluation, B1 maps were calculated on a voxel-wise-basis using Matlab routines (Natick, USA). For qualitative evaluation, MR images were assessed by two readers in consensus for image quality and visibility of relevant anatomical structures using 5-point Lickert scales. Assessments performed with and without pads were compared using t tests.
Results: The quantitative analysis showed significantly higher B1+ for the scans performed with dielectric pads compared to those without pads ($p < 0.05$). The qualitative analysis showed significantly better image quality and better visibility of all subregions of the articular disc (anterior band, intermediate zone and particular band) as well as surrounding anatomic structures when using the dielectric pads ($p < 0.05$ and $p < 0.001$, respectively; $p < 0.05$, corrected for multiple comparisons). In particular, in most volunteers, many anatomic structures were not visible without pads.
Conclusion: The application of high-permittivity dielectric pads improves the B1+ field and consecutively enables clinical MR imaging of the TMJ at 7.0T.

B-0376 14:56

Automatic segmentation of head and neck deep spaces using morphing techniques

S. Boussouar[1], O. Bouhelal[1], B. Gilles[2], F. Faure[2], C. Vaniet[1], P. Halimi[1], C.-A. Cuenod[1]; [1]*Paris/FR*, [2]*Montpellier/FR (samiaboussouar@gmail.com)*

Purpose: To clinically evaluate automatic segmentation of head and neck deep spaces in CT and MRI using a new type of deformable model segmentation.
Methods and Materials: Among 72 patients with CT and MRI images, from our Picture Archiving and Communication System (PACS), we have selected 5 patients with no visible head and neck lesion. The images of one patient have been carefully segmented in 3D in order to create a source-mesh. The source-mesh has been projected on the images on the other patients'images (target-data) using a new type of deformable model taking into account bone, muscle and fat deformation. This registration including the segmented spaces allows to produce an automatic segmentation of the target patients. Independently to this process, the images of the target patients have been manually segmented using ITKSnap software. The manual and automatic segmentation of the target patients have been compared.
Results: The automatic registration and segmentation using the framed-based deformable model was very fast: 90seconds. The automatic segmentation performs visually very well. Quantitative evaluation using the Dice Similarity Coefficient (DSC) varies among the different spaces, form 0.71 for the masticator space, to 0.53 for the sub-mandibular space.
Conclusion: This new fully automatic segmentation using deformable model is very fast and yields striking results concerning soft structures. It can avoid hours of manual segmentation, for example for conformational radiotherapy. There is still room for improving the method by manually putting nodes in specific regions.

B-0377 15:04

Volumetric quantification of cervical adiposity: a novel anthropometric tool

H.S. Maresky, Z. Sharfman, P. Gottlieb, S. Tal; *Zeriffin/IL*
(maresky@gmail.com)

Purpose: Obesity represents a growing epidemiological concern; however no anthropometric tool has been established as a "gold standard" for classifying obesity, and crude BMI measurements are increasingly thought to be an incorrect and inaccurate measurement. A method of radiologic quantification of cervical adiposity volume is introduced as a new possible anothropometric tool.
Methods and Materials: Using post-processing software, the adipose tissues of all patients' necks who underwent CT and CTA of the head and neck in our hospital during 2013 were volumetrically quantified (n=519; CT 148, CTA 371). These patients' necks were measured axially at two separate levels: at the level of soft palate for the upper neck, and at the level of the thyroid cartilage for the lower neck.
Results: A strong correlation between volumetric quantifiation of neck fat and radiologically measured axial neck cross sectional area was observed (0.73 and 0.76, respectively). Volumetric quantification of 519 subjects yielded a mean of 771.2 cc of neck fat (CT 566.6 cc, CTA 856.8 cc); intrer-reader validation studies yielded a 95% Confidence Interval of 1.03 and 0.96 cc in CT and CTA, respectively. A correlation of 0.53 was established between rendered Cervical Adiposity (in cc) and BMI.
Conclusion: Volume reconstruction and quantification is a quick, novel and objective approach to measure the cervical adiposity. Cervical adiposity may prove to be a strong indicator for obesity and its comorbid associations, and is likely more specific than BMI; further clinical investigation and correlations are warranted.

B-0378 15:12

Does MRI help to distinguish between odontogenic cysts and keratocystic odontogenic tumours?

U.G. Mueller-Lisse, F.A. Probst, M. Probst, E. Kaltsi, S. Otto, S. Schiel, M. Troeltzsch, M. Ehrenfeld, P.C. Cornelius; *Munich/DE*
(ullrich.mueller-lisse@med.uni-muenchen.de)

Purpose: Both odontogenic cysts (OCs) and keratocystic odontogenic tumours (KCOTs) present as radiolucent lesions at panoramic radiography of the jaw. However, KCOTs demonstrate high-recurrence rates and require more aggressive surgical treatment than OCs. We tried to find MR-imaging features that would help to distinguish between OCs and KCOTs.
Methods and Materials: Two radiologists blindly reviewed respective signal intensity (SI; low versus intermediate or high) and signal homogeneity (SH; homogenous or heterogeneous) in short-tau-inversion-recovery (STIR), T1- and T2-weighted (T1WI, T2WI) and fat-suppressed, contrast-enhanced (CE-MRI) MR-images in 20 consecutive patients with oval, radiolucent lesions of the mandible at panoramic radiography who subsequently underwent mandibular surgery with histopathology confirming either OC (n=10) or KCOT (n=10). Fisher's exact test was statistically significant at $p < 0.05$.
Results: Delineation of a contrast-enhancing cyst-wall with high SI distinguished OCs (9/10 and 8/10 respectively) from KCOTs (3/10, p=0.02, and 1/10, p=0.01, respectively). One radiologist each found SH to be more often homogenous in OCs at unenhanced T1WI (OC, 9/10, KCOT, 3/10, p=0.02) and at CE-MRI when an enhancing cyst-wall was present (OC, 7/9, KCOT 0/3, p=0.01). There were no other significantly distinguishing MRI features.
Conclusion: Intermediate-to-high SI of wall enhancement at CE-MRI appears to be a feature that may distinguish OC from KCOT.

14:00 - 15:30 **Room MB 2**

Paediatric

SS 312

Bone and soft tissue imaging

Moderators:
O.J. Arthurs; London/UK
A. Kanavaki; Athens/GR

B-0379 14:00

Correlation of fetal MRI with postmortem imaging and histology in cases of thanatophoric dysplasia

C. Mitter, G.M. Gruber, U. Nemec, P.C. Brugger, G. Kasprian, D. Prayer;
Vienna/AT

Purpose: Thanatophoric dysplasia (TD), a perinatal lethal form of chondrodysplastic dwarfism, includes both skeletal and brain malformations. Although both can be diagnosed before 24 gestational weeks (GW) by fetal MRI, a complete diagnostic workup should include postmortem confirmation of intrauterine findings. We aimed to investigate the potential of several postmortem examination methods to confirm and refine the intrauterine diagnosis of TD.
Methods and Materials: We included 6 cases between GW17 and 23 with an intrauterine diagnosis of TD. Fetal MRI was performed on 1.5T and 3 T clinical MRI units. Postmortem imaging included postmortem MRI at 3 T in 2 cases, postmortem CT in 2 cases and postmortem X-ray in 3 cases. In 3 cases an autopsy and histological analysis with H&E-staining was performed.
Results: Skeletal findings in fetal MRI included short, bowed long bones, micromelia and narrow thorax and were confirmed by postmortem CT and X-ray. Additional skeletal abnormalities revealed by postmortem imaging included platyspondyly and pelvic bone alterations. Enlargement of the temporal lobe with abnormal sulcation was seen in 5 of 6 cases in fetal MRI and was confirmed in 2 cases both with postmortem MRI as well as at autopsy. In contrast in 1 case in which fetal MRI revealed unsuspicious temporal lobes histological analysis confirmed normal temporal lobe anatomy.
Conclusion: Although TD can be reliably diagnosed with fetal MRI, postmortem examination in case of fetal demise has the potential to both confirm intrauterine findings and reveal additional pathologies that currently can't be sufficiently assessed by fetal MRI.

B-0380 14:08

Dynamic contrast-enhanced MR imaging for the evaluation of soft tissue tumours of trunk and limbs in the children

A. Barbashova; *Moscow/RU (afina.barbashova@mail.ru)*

Purpose: To analyze DCE-MRI in the characterization of soft tissue tumours.
Methods and Materials: Dynamic MR Imaging was performed on 27 patients with soft tissue tumours: 19 have malignant lesions, 8 have benign lesions. MR imaging was performed using a SIEMENS MAGNETOM AVANTO 1.5 T and SKYRA 3 T (Germany). We were evaluated statistically characteristics of tumours. There are types of enhancement (peripheral, by partitions, diffuse), time-signal intensity curves, DCE-MRI parameters (peak enhancement, steepest slope, slope, mean of enhancement, start of dynamic enhancement).
Results: 10 (52.6%) of 19 malignant tumours have peripheral type of enhancement; benign tumours do not have this type ($p < 0.05$). For benign tumours, 7 (87.5%) patients have a typical diffuse type of enhancement ($p < 0.05$). Starting of dynamic enhancement in the malignant tumour showed lesser than 6 sec; for the benign tumours, this parameter was greater than 6 sec ($p < 0.05$). Peak enhancement for the malignant tumours was two times lower than that of the benign ($p < 0.05$))., type III and V curves were typical for the recurrent of malignant tumours ($p < 0.05$). Peripheral type of enhancement was seen only in the recurrent of malignant tumours ($p < 0.05$), a diffuse type of enhancement was more typical for the scar ($p < 0.05$).
Conclusion: The type of enhancement, start of dynamic enhancement and peak enhancement have the significant difference between benign and malignant tumours, which can help in detecting a recurrent malignant tumour. DCE-MRI has a 100% sensitivity for detection of malignant tumours and specificity of 80%, PPV - 89.5%, NPV - 100%.

B-0381 14:16

Simultaneous whole-body PET/MR Imaging in paediatric sarcomas and malignant soft tissue tumours: preliminary results

J.F. Schäfer, S. Gatidis, I. Tsiflikas, G. Seitz, M. Ebinger, M. Reimold, C. La Fougère, N. Schwenzer, K. Nikolaou; *Tübingen/DE (juergen.schaefer@med.uni-tuebingen.de)*

Purpose: To evaluate the clinical impact of PET/MRI in paediatric sarcomas and malignant soft tissue tumours.
Methods and Materials: 21 patients (6 female, mean age 10.1 ± 5.6 y) with diagnoses of Ewing sarcoma (n=6), rhabdomyosarcoma (n=4), MPNST (n=5), softpart sarcomas (n=2), and others (n=4) were included. Written informed consent was obtained. Two protocols were performed (A/B). In A, 11 examinations in 10 patients were carried out using PET/CT (Biograph mCT, Siemens) and PET/MRI (Biograph mMR, Siemens). Data were acquired on the same day after administration of 161±88 MBq 18 F-FDG. In B, 15 examinations in 11 patients were performed using PET/MRI, after administration of 115±76 MBq 18 F-FDG and an additional low dose chest CT. Histopathology and follow-up served as reference standard. Findings of PET/MRI were evaluated by the institutional paediatric tumourboard regarding further clinical management (e.g. changing of surgical approach).
Results: A: The rate of focal uptake on PET/MRI was equivalent to PET/CT (52 vs. 53). Local staging (4/11), anatomic allocation (2/11) and relevant additional findings were clearly improved by MRI. B: Findings of PET/MRI affecting clinical management were found in 5 /10 follow-up examinations, but not in baseline imaging (n=5). Compared to chest CT, MRI detected equal numbers of metastases in 4 and lower numbers in 3 patients. In other 3 patients with nodules smaller than 3 mm and no evidence of pulmonary malignancy MRI was negative.
Conclusion: PET/MRI improves the clinical management in paediatric soft tissue tumours and both, local and systemic staging is possible in one approach.

B-0383 14:32

When to make a postmortem babygram and when not

K. Kamphuis-van Ulzen, D.H.J.L. Koopmanschap, W.M. Klein; *Nijmegen/NL (karin.kamphuis-vanulzen@radboudumc.nl)*

Purpose: Radiography after foetal or perinatal death has become a routine part of postmortem diagnostics. However, only a selected subset of these foetal postmortem skeletal surveys (FPSS) give useful information for the diagnosis. We investigated the criteria for when a babygram is indicated, and when not.
Methods and Materials: We investigated the babygrams in a 10-year period 2002-2012 in our university hospital that were routinely made in cases of intra-uterine death, termination of pregnancy and perinatal death up to 7 days after birth. We categorized for the FPSS contribution to the diagnosis (no - minor - major - pathognomonic contribution) and used regression analysis to find the selection criteria for a useful FPSS.
Results: 333 FPSS were included. 302 (91%) showed no or minor malformations and were not helpful in setting a diagnosis. 13 (4%) FPSS had major malformations that gave direction to the diagnosis or cause of death. In 18 (5%) cases the diagnosis was based on the pathognomonic skeletal malformations on the babygram. Regression analysis showed that the presence of multiple skeletal malformations on prenatal ultrasound or at post-mortem external inspection was indicative of a diagnostic FPSS ($p < 0.05$).
Conclusion: The majority of the FPSS has no contribution in the diagnostic process, therefore routine use in not useful. Multiple skeletal malformations on prenatal ultrasound or post-mortem external inspection are indicative for a diagnostic FPSS, and this should be the main selection criterion for a post-mortem skeletal survey.

B-0384 14:40

Fetal short femurs: interest of three-dimensional computed tomography in prenatal management

M. Blouet, F. Belloy, G. Benoist, J.-P. Pelage; *Caen/FR (blouet-m@chu-caen.fr)*

Purpose: Osteochondrodysplasia (OCD) gather anomalies of the growth or the structure of the bones or the cartilages which precede them. The objective of our study is to estimate the performances of fetal bone computed tomography in management of short femur, to discriminate OCD and other etiologies (IUGR, constitutional short stature).
Methods and Materials: From 2006 to 2012, 59 consecutive fetal bone examinations were performed at our center. Image analysis was conducted by a paediatric radiologist and the images evaluated by a multidisciplinary team who proposed a diagnosis.The radiological diagnosis was compared to postnatal or post-mortem radiographs.

Results: In management of fetal short femurs, CT had a sensitivity of 90 % and a specificity of 99.6 % to differentiate OCD from other etiologies. The association ultrasound/computed tomography made an accurate diagnosis in 70% of cases, CT provided additional evidence confirming diagnosis in 60% of the cases, and changed diagnosis in 50% of the cases. CT alone was better than ultrasonography to diagnose abnormalities of the spine and hipbone. Conversely, CT was less accurate for the study of hands feet and skull. The threshold < 1 percentile seems accurate to avoid unnecessary irradiation of the fetus having no OCD.
Conclusion: Our study confirms the importance of fetal bone scan in prenatal diagnosis of OCD including the indication of short femurs. A threshold < 1 percentile seems relevant to perform CT when short femurs are isolated.

B-0385 14:48

Dynamic contrast-enhanced MRI of the wrist in patients with juvenile idiopathic arthritis: a feasibility study

C.M. Nusman, C. Lavini, R. Hemke, M.W.A. Caan, D. Schonenberg, K.M. Dolman, J.M. van den Berg, T.W. Kuijpers, M. Maas; *Amsterdam/NL (c.m.nusman@amc.uva.nl)*

Purpose: To determine whether dynamic contrast-enhanced (DCE)-MRI of the wrist is feasible in juvenile idiopathic arthritis (JIA) patients and to describe the differences in DCE-MRI measures between JIA patients with clinically active and inactive disease.
Methods and Materials: Thirty-two JIA patients with wrist involvement underwent (DCE) MRI on an open-bore 1.0 T scanner. Informed consent was obtained and patients were classified into clinically active (n=27) or inactive (n=5) disease group. DCE-MRI outcome measures included conventional descriptive parameters and the classification into time-intensity-curve (TIC) shapes, which represent the patterns of signal intensity change over time. Mann-Whitney U test was used to analyze the differences in DCE-MRI outcome measures between active and inactive disease.
Results: Our method for the use of DCE-MRI in JIA patients with wrist involvement proved to be technically feasible. The descriptive measure 'maximum enhancement' differed significantly between clinically active and inactive disease (p=0.019). We observed an increased proportion of quickly enhancing TIC-shapes in active disease, although this difference was not statistically significant due to the small group of inactive patients (p=0.310 and p=0.166).
Conclusion: DCE-MRI parameters are different in clinical active and inactive disease in the wrist of JIA patients. TIC-shapes with faster enhancement patterns seem to be characteristic of active disease. Larger cohorts of JIA patients and adequate follow-up are warranted to determine the added value of DCE-MRI for the individual patient in daily practice.

B-0386 14:56

Single radiograph of the pelvis for non traumatic hip pathology: what do we miss?

S. McGurk, E. Lindell, D. Broomfield; *Edinburgh/UK (gerkin7@yahoo.com)*

Purpose: Following a previous study in 2008, investigation of suspected non traumatic hip pathology in our department changed from AP and Frog leg lateral (FLL) radiographs to single FLL. This study seeks to investigate whether this imaging strategy is adequate.
Methods and Materials: Data on all hip radiographs performed over a two year period were obtained. Follow-up studies, studies for assessment of developmental dyspalsia and traumatic presentations were excluded. The reports of the remaining cases were evaluated and follow-up imaging and findings documented. In addition, the hospital electronic patient records were interrogated for information on outcome of initial presentation, repeat presentation and final disposition.
Results: After exclusions, 392 patients had FLL in initial evaluation. Of these 8 (2%) had further plain film evaluation of the pelvis. In 1/392 cases (0.3%) an abnormality was identified on AP radiograph not seen on FLL. The AP radiograph was performed after MRI had demonstrated femoral neck abnormality. In the remaining cases there was no evidence that a further AP radiograph would have aided diagnosis either because there was no abnormality or the pathology was occult on plain radiography.
Conclusion: Single frog leg lateral radiograph of the pelvis provides adequate evaluation in children with atraumatic hip pathology compared to AP and FLL radiographs. Radiation dose is halved compared to conventional imaging strategies. In the one case where pathology was not seen, the patient would have required additional imaging with or without normal initial radiograph.

B-0387 15:04

Tibial bowing in children: what is normal? A radiographic study

I. Zbinden[1], E. Rutz[1], J.A. Jacobson[2], O. Magerkurth[1]; [1]*Basle/CH*, [2]*Ann Arbor, MI/US*

Purpose: To characterize normal values describing physiological tibial bowing with easy to define landmarks in all age groups on plain film of the lower leg.
Methods and Materials: IRB approval was obtained. Patients with normal plain films of the lower leg in anteroposterior (ap) and lateral (lat) views were included. Distance from the proximal to the distal corner of the metaphysis of the tibia (A), two lines proximal (prox) and distal (dist), each connecting the corners of the metaphysis (B, C) and a tangent (D) to the apex of the curved tibia were defined. Following measurements were obtained: Angle between A-B, angle between A-C, distance between line A-D (depth of curve). Normal values with 95% confident intervals were calculated by linear regression. Intra-/Interreader agreement were tested by using the paired-t-test and a Pearson-correlation.
Results: Over a 6years period 526 out of 4227 patients were included (292 males, 234 females, mean 6 years, range:0.1-16.8). Tibial angle ap was proximal 80°-100° (mean 87) and distal 82°-107° (mean 95). Tibial angle lat was prox 81-107° (mean 95) and dist 76°-102° (mean 88). Percentage of depth of curve was ap 0-11% (mean 7) and lat 2-13% (mean 7). Interreader-agreement showed no statistical significant difference and a high correlation (p=0.3180, r=0.9997). Intrareader-agreement was similar for Reader 1 (p=0.2404,r=0.9990), and Reader 2 (p=0.1021,r=0.9720).
Conclusion: Presented measurements assessing tibial shape allow reproducible results with high intra-- and interreader reliability. Normal values calculated in this study may allow to define abnormal tibial bowing in patients.

B-0388 15:12

Hand bone age determination: quantitative radiographical evaluation method for in 0-59 months aged children

V. Taravari, I. Özyavuz, E. Yilmaz, O.B. Erol, F. Ertem, R. Sarifov, M. Bulakçi, B. Bulakçi, E. Yekeler; *Istanbul/TR (i.ozyavuz@hotmail.com)*

Purpose: Bone age determination has an important role in management of endocrinological diseases. The most commonly used reference is Greulich-Pyle atlas which allows us visual comparison for bone age estimation. The aim of our study is quantitatively evaluate carpal and epiphyseal development in children aged 0-59 months.
Methods and Materials: A total of 635 (311 female and 324 male) left hand radiographs obtained by proper technique were retrospectively evaluated in children aged between 0-59 months. Carpal bones were measured in horizontal plane and divided by the mid-shaft width of 3 Th metacarpal bone and all epiphyseal lengths were divided by adjacent metaphyseal shaft width. The obtained epiphyseal/metaphyseal ratios were classified into three stages as less than one-third (stage I), more than one-third and less than two-third (stage II), and more than two-third (stage III).
Results: Carpal/metacarpal ratio was lower than 1 between 0-11 months, slightly higher than 1 between 12-23 months, and near to 1.5 between 47-59 months. Epiphyseal/metaphyseal ratio was stage 2 in proximal phalanges and stage 1 in the others between 0-11 months; the ratio was stage 3 in proximal phalanges and stage 2 in the others between 24-35 months. Epiphyseal/metaphyseal ratio was stage 2 in all phalanges between 12-23 months and stage 3 in all phalanges between 36-47 months.
Conclusion: In children under 5 years of age, hand bone age estimation can be quantitatively made by obtaining carpal/metacarpal and epiphyseal/metaphyseal ratios.

B-0389 15:20

Ultrasound evaluation of thyroid gland pathologies after radio- and/or chemotherapy during childhood

A. Lollert, C. Gies, K. Laudemann, J. Faber, D. Jacob-Heutmann, C. Düber, G. Staatz; *Mainz/DE (andre.lollert@unimedizin-mainz.de)*

Purpose: The purpose of this work is to evaluate correlations between malignancy treatment by radio- and/or chemotherapy during childhood and the occurrence of pathologies of the thyroid gland detected by ultrasound in the follow-up.
Methods and Materials: Sonographically detected parameters of the thyroid gland (volume, echogeneity, perfusion, pathologies) in 120 children with malignant diseases (73 boys, 47 girls, median age 6.79 years, median follow-up 51 months) were retrospectively correlated with clinico-therapeutic data (age, sex, diagnosis, type of therapy, thyroid gland dose).

Results: A significant reduction of the thyroid gland volume occurred more often in children with tumours of the central nervous system (p=0.004) and after radiotherapy ($p < 0.001$). Volume reduction of more than two standard deviations below the age norm was significantly correlated with the thyroid gland dose in univariate (p=0.002) and in multivariate analysis for doses above 25 Gy (p=0.025). An increase in echogeneity was associated with lymphoma (p=0.008) and age (p=0.002). Benign pathologies occurred more frequently after radiation (p=0.005) and were associated with the thyroid gland dose (p=0.039). Approximately two thirds of the changes occurred during the first five years of follow-up.
Conclusion: A volume reduction and the occurrence of sonographically detectable changes and pathologies of the thyroid gland after radio- and/or chemotherapy of malignant tumours during childhood are associated with the diagnosis, the type of therapy and particularly the thyroid gland dose. Ultrasound follow-up examinations should be performed for at least five years after the end of the treatment.

14:00 - 15:30 **Room MB 3**

Cardiac

SS 303b
Cardiac function and flow

Moderators:
P. Croisille; Saint-Etienne/FR
P. Donato; Coimbra/PT

B-0390 14:00
Accuracy of cardiac MRI single - and non-breath-hold compressed sensing data for right ventricular volumetry
H. Haubenreisser, S. Sudarski, S.O. Schönberg, T. Henzler, T. Papavassiliu; *Mannheim/DE (Holger.Haubenreisser@medma.uni-heidelberg.de)*

Purpose: To evaluate a 2D real-time CINE TrueFISP sequence featuring sparse sampling and compressed-sensing (CS) image reconstruction with k-t regularization for accuracy of right ventricular (RV) volumetry compared to the reference standard.
Methods and Materials: Patients scheduled for ECG-triggered cardiac MRI on a 3 Tesla system (Magnetom Skyra, Siemens Healthcare Sector, Germany) underwent a single-breath-hold undersampled CS sequence (BH), a non-breath-hold undersampled CS sequence (NBH) and a fully-sampled multi-breath-hold sequence as reference standard (RS). The total acquisition time for the BH sequence was 43 ± 8s, 32 ± 6s for the NBH sequence and 350 ± 29s for RS. RV volumetry was performed using a dedicated software (cvi42, Circle Cardiovascular Imaging Inc., Calgary, Canada). Agreement of CS and FS for RV ejection fraction (EF) and RV endsystolic (RVESV) and enddiastolic (RVEDV) volume were assessed with Bland-Altman analysis and paired t-test.
Results: 50 patients (31 men; 52 ± 16 years) were enrolled. No significant differences were observed when comparing BH with RS (EF: 50±6% vs 51±7; RVEDV 144±51 ml vs 143±49 ml; RVESV 73±30 ml vs 72±21 ml $p > 0.05$) as well as NBH with RS (EF: 50±6% vs 51±5; RVEDV 141±52 ml vs 143±49 ml; RVESV 71±31 ml vs 72±21 ml $p > 0.05$).
Conclusion: Our results suggest that accurate RV volumetry with sparse CS data is feasible in clinical routine with substantial decrease of overall scan time from minutes to a single breath hold.

Author Disclosures:
H. Haubenreisser: Speaker; Siemens Healthcare. **T. Henzler:** Speaker; Siemens Healthcare.

B-0391 14:08
Influence of late-Gadolinium enhancement on accuracy of quantitative left ventricular assessment in cardiac MRI single breath-hold undersampled input data
S. Sudarski, H. Haubenreisser, C. Dösch, S. Haneder, T. Henzler, S.O. Schönberg, T. Pappavassiliu; *Mannheim/DE (sonja.sudarski@medma.uni-heidelberg.de)*

Purpose: To investigate in a 2D real-time CINE TrueFISP undersampled sequence with compressed-sensing (CS) image reconstruction possible influence of presence of late-gadolinium enhancement (LGE+) indicating structural inhomogeneity with regard to accuracy of left ventricular (LV) volumetric assessment.
Methods and Materials: Patients undergoing cardiac MRI on a 3 Tesla system underwent a single-breath-hold undersampled CS sequence and a fully-sampled multi-breath-hold reference standard sequence (RS). Mean data acquisition time was 25 s vs. 350 s. LV-assessment was performed with dedicated software (Argus, Siemens Healthcare Sector). Agreement of CS and RS for the 4 volumetric LV parameters ejection fraction, stroke volume, enddiastolic and endsystolic volume was assessed with Bland-Altman-analysis in both the LGE+ and the LGE- subgroup.
Results: 57 patients (37 men; 57 ± 14 years; 27 LGE+; 30 LGE-) who underwent LGE-imaging and LV volumetric assessment with the RS and CS sequence were investigated. Ejection fraction and endsystolic volume were significantly overestimated in the LGE- group with CS compared to RS. Enddiastolic volume and stroke volume were not differing from RS when assessed with the CS sequence in neither subgroup.
Conclusion: In LGE+ patients, volumetric measurements performed in CS datasets were not significantly differing from LV assessment with the RS datasets and data acquisition was accelerated by factor 14.

B-0392 14:16
Feasibility of real-time magnetic resonance imaging in assessment of ventricular volumes and function in paediatric patients with congenital heart disease
T. Zitzelsberger, A. Hornung, P. Krumm, B. Klumpp, J.F. Schäfer, L. Sieverding, U. Kramer, K. Nikolaou, F. Bamberg; *Tübingen/DE (tanja.zitzelsberger@med.uni-tuebingen.de)*

Purpose: To determine the feasibility of real-time magnetic resonance cine imaging (MRI) with high temporal resolution in paediatric patients with congenital heart disease (CHD) in comparison with standard gated cine SSFP technique.
Methods and Materials: Paediatric patients with various corrected CHD were prospectively enrolled. All participants underwent standard 1.5T MRI cine imaging (SSFP, TE 1.2-1.7, TR 35-39, Pixel bandwidth 1184, FOV 192*280-239*319, Matrix 54*128-166*192) followed by real-time cine imaging using a two-dimensional turbo-flash-sequence in combination with parallel imaging (iPat3+, TE 1.07-1.25, Pixel bandwidth 1502, FOV 206*300-247*360, Matrix 54*128-75*144). The effective temporal resolution of the real-time imaging ranged between 45 ms and 72 ms, dependent on heart rate. Image quality was rated by a 5-point Likert scale and ventricular volumes were quantified in both sequences. Univariate comparisons were performed.
Results: Among 15 patients, 12 subjects completed the imaging protocol (8 male, 4 female, TOF 50%, d-TGA 25%, ISTA 10%, DILV 10%). Rated image quality of real-time cine sequences was significantly lower compared with SSFP cines (2.3±0.7 vs. 3.4±0.6, p=0.03). In contrast, agreement of left- and right-ventricular volumes was excellent (LV-EDV: 102±35 vs. 102±35 ml; RV-EDV: 139±51 vs. 136±46 ml). Similarly, a significant agreement between derived functional parameters of real-time and SSFP cine images was observed (LV-EF: 60±10 vs. 60±10%; RV-EF: 53±12 vs. 53±11%). The absolute difference for right-ventricular EDV was -2.3 ml (95%-CI: -20.1 to 23.2).
Conclusion: Real-time imaging in combination with a high acceleration factor permits accurate quantification of ventricular volumes and function and may serve as an alternative approach for this potentially low-compliance population.

B-0393 14:24
Regional myocardial contractility in thalassemia major by magnetic resonance tagging
C. Tudisca[1], A. Meloni[2], E. Grassedonio[1], G. Valeri[3], M. Missere[4], C. Cirotto[5], S. Renne[6], M. Midiri[1], A. Pepe[2]; [1]*Palermo/IT*, [2]*Pisa/IT*, [3]*Ancona/IT*, [4]*Campobasso/IT*, [5]*Sassari/IT*, [6]*Lamezia Terme/IT (chiaratudisca@gmail.com)*

Purpose: Magnetic resonance (MR) tagging analyzed by dedicated tracking algorithms allows precise measurements of myocardial motion and characterization of regional myocardial function. Our aim was to quantitatively assess regional myocardial contractility in thalassemia major (^{TM}) patients and correlate it with heart iron overload and global biventricular function.
Methods and Materials: Seventy-four ^{TM} patients (46 F; 31.8 ± 8.5 yrs) enrolled in the MIOT network underwent MR (1.5 T). Three short-axis tagged MR images were analyzed offline using harmonic phase (HARP) methods (Diagnosoft software) and circumferential shortening (Ecc) was evaluated for all the 16 myocardial segments.The same short-axes were acquired by a T2* GRE-multiecho technique to assess myocardial iron overload (MIO).Biventricular function parameters were quantitatively evaluated by cine-images.
Results: Segmental Ecc values ranged from -9.66±4.17% to 13.36±4.57%.No significant circumferential variability was detected. Compared with previous studied healthy subjects ^{TM} patients showed strain values significantly lower in all circumferential regions (mean difference from 4% to 13%; $P < 0.001$ for all the comparisons). Segmental Ecc values were not significantly correlated with the correspondent T2* values and no correlation was detected considering the global values.We identified three groups on the basis of cardiac iron distribution:no MIO, heterogenous MIO and homogeneous MIO;global Ecc was comparable among them (-11.56±1.60% vs -11.70±2.43% vs -11.14±1.95%; P=0.602). Circumferential shortening was not associated to left ventricular volumes and ejection fraction (with a $P > 0.5$ in all the comparisons).

Conclusion: ™ patients showed a significant lower cardiac contractility compared with healthy subjects, but this altered contractility was not related to cardiac iron,volumes and function.

B-0394 14:32

Time dependent analysis of left ventricular shear wave amplitudes in diastolic dysfunction measured by MR elastography

T. Elgeti, I.G. Steffen, B. Hamm, J. Braun, I. Sack; *Berlin/DE (thomas.elgeti@charite.de)*

Purpose: To investigate the diagnostic potential of a time dependent analysis of left ventricular (LV) shear wave amplitudes (SWA) changes using cardiac magnetic resonance elastography (MRE).
Methods and Materials: ECG-triggered SWA-based cardiac MRE was performed using 24.13 Hz external vibration frequency in 20 asymptomatic subjects (10 young, 10 old) and 30 patients with diastolic dysfunction, which was staged echocardiographically into mild, moderate, or severe. The levels of diastolic SWA were calculated in the LV and normalized against SWA in the chest wall (Unorm (dia)). The elasticity-based cardiac time interval, normalized against heart rate, was calculated for diastole. Analysis of variance with Holm-corrected pairwise comparison was used for statistical evaluation.
Results: The control subjects had Unorm (dia) of 0.95 (SD 0.16; young) and 0.77 (0.19, old), respectively (P=0.07). Compared to young subjects, patients with mild, moderate, and severe diastolic dysfunction displayed significantly reduced Unorm (dia) of 0.66 (0.18), 0.56 (0.13), and 0.50 (0.12) ($P < 0.001$). τRnrom was 94 (17) and 83 (24) in young and old subjects. Statistically significant differences were found between old subjects and patients with diastolic dysfunction with τRnrom of 143 (59), 146 (45) and 137 (39) ($P < 0.05$). The best cutoff values derived for Unorm (dia)/τRnorm were 0.66/107. The AUROC was 0.87/0.84 with 74/74% sensitivity and 85/85% specificity, respectively.
Conclusion: The time dependent analysis of LV-SWA changes reveals distinct changes between healthy subjects and patients with diastolic dysfunction. Both, the normalized level of diastolic SWA and the diastolic cardiac time interval have good diagnostic performance for diastolic dysfunction.

Author Disclosures:
B. Hamm: Research/Grant Support; Grant money from the following companies or non-profit organisations to the department of radiology: 1. Abbott, 2. Actelion Pharmaceuticals, 3. Bayer Schering Pharma, 4. Bayer Vital, 5. BRACCO Group, 6. Bristol-Myers Squibb, 7. Charite research organisation GmbH, 8. Deutsche Krebshilfe, 9. Dt. Stiftung für Herzforschung, 10.Essex Pharma, 11.EU Programmes, 12.Fibrex Medical Inc., 13.Focused, Ultrasound Surgery Foundation 14.Fraunhofer Gesellschaft, 15. Guerbet, 16.INC Research, 17.InSightec Ud., 18.IPSEN Pharma, 19.Kendlel MorphoSys AG, 20. Lilly GmbH, 21. Lundbeck GmbH, 22. MeVis Medical, Solutions AG, 23. Nexus Oncology, 24. Novartis, 25. Parexel CRO Service, 26. Perceptive, 27. Pfizer GmbH, 28. Philipps, 29.sanofis-aventis S.A, 30. Siemens, 31.Spectranetics GmbH, 32.Terumo Medical Co, 33.TNS Healthcare GMbH, 34. Toshiba, 35. UCB Pharma, 36.Wyeth Pharma, 37.Zukunftsfond Berlin (TSB), 38.Amgen, 39.AO Foundation, 40.BARD, 41. Braun 42. Boehring Ingelheimer, 43. Brainsgate, 44. PPD (CR, 45.CELLACT Pharma, 46.Celgene, 47.CeloNova BioSciences, 48.Covance, 49. DC Deviees, Ine. USA 50. Ganymed, 51. Gilead Scienees, 52. Glaxo Smith Kline, 53.ICON (CRO) 54.Jansen, 55. LUX Bioseienees, 56., 57. Merek, 58. Mologen, 59. Nuvisan, 60. Pluristem, 61. Quintiles, 62. Roehe, 63. Sehumaeher GmbH 4. Seattle Geneties, 65. Symphogen, 66. TauRx Therapeuties Ud., 67. Accovion, 68.AIO: Arbeitsgemeinsch, 69.ASR Advanced sleep research, 70. Astellas, 71. Theradex, 72. Galena Biopharma, 73. Chiltern, 74.PRAint, 75.Inspiremd, 76. Medtronic, 77. Respicardia, 78. Silena Therapeutics 79. Spectrum Pharmaceut, 80. St. Jude. **I. Sack:** Research/Grant Support; Deutsche Forschungsgemeinschaft (DFG).

B-0395 14:40

CMR evaluation of diastolic function impairment in Cushing's syndrome and its normalisation with treatment

C. Roux, N. Kachenoura, P. Kamenicky, E. Bollache, E. Mousseaux, P. Chanson, A. Redheuil; *Paris/FR (charles.roux@icloud.com)*

Purpose: While patients with Cushing's syndrome (CS) were shown to have left ventricular (LV) hypertrophy and systolic dysfunction, their diastolic function remains poorly documented. Accordingly, our primary goal was to assess LV diastolic function and the effects of radical treatment in CS, using CMR.
Methods and Materials: Fourteen asymptomatic patients with active CS, matched with fourteen controls for age, underwent CMR exam before radical treatment. Among these patients, 10 were scanned again, after surgery. Mitral inflow and mean longitudinal myocardial velocity curves were estimated, automatically (dedicated CardFlow software) from phase-contrast CMR data and quantitative parameters of diastolic function were extracted: early and late mitral peak flow (E, A) and myocardial longitudinal velocities (e', a'), isovolumetric relaxation time (IVRT), and filling pressure as assessed by E/e' ratio. Of note, for both CMR exams, late gadolinium enhancement (LGE) was performed to evaluate the presence of myocardial scar.
Results: IVRT decreased significantly in CS patients (CS=56.57±11.12 ms, Controls=84.5±12.42 ms, $p < 0.005$). Same decreasing trend was observed for myocardial velocities: e' (CS=4.60±0.97 cm.s1, Controls=6.12±0.75 cm.s-1, p=0.025) and a' (CS=2.39±0.84 cm.s-1, Controls=3.80±0.59 cm.s-1, p=0.009). Filling pressures increased significantly as evidenced by the increase in E/e' (CS=11.01±1.64, Controls=7.02±1.17 p=0.014). After treatment, E/e' decreased from 11.3±2.53 To 8.2±5.69 (p=0.084), a' increased from 2.55±1.42 to 3.29±1.45 cm.s-1 (p=0.002) and IVRT increased from 51.9±19.27 to 67.4±17.43 ms (p=0.035) indicating a normalization of LV passive and active filling functions. None of the patients had LGE.
Conclusion: Phase-contrast CMR was able to show LV diastolic function impairment in CS and more importantly its normalization after radical treatment.

B-0396 14:48

Quality improvement using educational intervention: improving accuracy of cardiac CT function reporting in triple-rule-out patients with acute chest pain

P. Suranyi, L. Hewett; *Charleston, SC/US (suranyi@musc.edu)*

Purpose: To assess the effect of education on the accuracy of post-processing left-ventricular (LV) function from cardiac CT triple-rule-out (TRO).
Methods and Materials: CT datasets from a total of 336 TRO patients were retrospectively re-analysed using a widely accepted post-processing software: first, fully AUTOMATED; next, with MANUAL adjustment of LV delineation. End-systolic-volume, end-diastolic-volume, stroke volume, and ejection-fraction (EF) were obtained. These were compared with REPORTED values from medical records. 168 patients were randomly analysed from 2009 to 2010 (PRE), and 168 random patients were analysed from 2013 (POST) by another blinded investigator. EF[MANUAL] data were considered ground truth. Online and hands-on education took place in 2011-2012.
Results: Statistically significant ($p < 0.01$) correlations were found between EF[REPORTED] and EF[AUTOMATED], both vs. EF[MANUAL] for both datasets. Correlation coefficients pre-education were R=0.75 for EF[REPORTED-PRE] and R=0.71 for EF[AUTOMATED-PRE]. Post-education correlation coefficients were R=0.87 for EF[REPORTED-POST] and R=0.78 for EF[AUTOMATED-POST]. EF[AUTOMATED-PRE] systematically underestimated EF[MANUAL-PRE] by an average of 9.1±9.2% which was significantly more ($p < 0.01$) than the error found in EF[REPORTED-PRE] of 5.8±7.4%. EF[AUTOMATED-POST] underestimated EF by 8.0±4.8%, by significantly ($p < 0.01$) more than EF[REPORTED-POST], of 3.0±7.8%. No significant difference was found between EF[AUTOMATED-PRE] vs. EF[AUTOMATED-POST]. However, EF[REPORTED-POST] was significantly ($p < 0.01$) more accurate than EF[REPORTED-PRE].
Conclusion: Our findings of improved correlation with the true EF and significantly lower errors post-education suggest that educational intervention can lead to practice quality improvement in post-processing functional cardiac CT datasets. The study also highlights the importance of radiologist "supervision" of post-processing. Over-reliance on fully automated softwares may lead to significant errors in function-reporting, and possibly misdiagnosis.

B-0397 14:56

Evaluation of aortic strain with MR imaging in different pathologic conditions: a retrospective study

F. Secchi, M. Scarabello, F. Damiani, M. Petrini, G. Di Leo, F. Sardanelli; *Milan/IT (francescosecchimd@gmail.com)*

Purpose: To evaluate aortic strain (AS) with MR imaging (MRI) in a population with different pathologic conditions, taking into account flow data.
Methods and Materials: Two dimensional (2D) phase-contrast gradient echo sequences (TR 37.12 ms, TE 2.47 ms) with a through-plane velocity encoding gradient ranging from 150 to 350 cm/s were performed on the ascending aorta in 1,363 patients with 39.4±22.4 (mean±standard deviation) years of age. Minimum and maximum aortic cross-sectional areas were measured and forward volume (FV) was acquired; AS was measured and a modified index was generated as a ratio between AS and FV. Patients with different conditions were compared against subjects with normal cardiac MRI. Mann-Whitney U test and Spearman statistics were used.
Results: Average results for the following parameters were: AS 0.30±20; minimum area 6.06±3.5 cm2; maximum area 7.57±3.8 cm2; and FV 75±28 ml. AS decreased with age and was lower in male patients. AS was significantly lower in patients with congenital heart disease (0.29±0.18) and previous myocardial infarction (0.21±0.11) than in normal subjects (0.34±0.17) ($p < 0.01$). Significant differences were also obtained between normal subjects and other pathologic conditions. AS was correlated with FV, mean flow velocity and mean aortic area in all patients; AS/FV was more conservative than AS alone when comparing different groups.

Conclusion: AS is a simple parameter to assess the likelihood of cardiovascular disease in a patient who undergoes a cardiac MRI; AS/FV is a more conservative index whose applications require further study.

B-0398 15:04

Intra- and interobserver agreement of noninvasive pressure difference measurements derived from 4D flow MRI in patients with repaired aortic coarctation and healthy volunteers

F. Rengier[1], M. Delles[2], J. Eichhorn[1], Y.-J. Azad[2], H. von Tengg-Kobligk[3], R. Unterhinninghofen[2], H.-U. Kauczor[1], R. Dillmann[2], S. Ley[1]; [1]*Heidelberg/DE*, [2]*Karlsruhe/DE*, [3]*Berne/CH*

Purpose: To assess inter- and intraobserver agreement of pressure difference amplitude measurements derived from 4D flow MRI in patients with repaired aortic coarctation compared to young healthy volunteers.
Methods and Materials: 4D flow MRI of the thoracic aorta was acquired at 1.5 T in 13 patients after aortic coarctation repair without recoarctation (mean age 18.8 years) and 13 healthy volunteers (mean age 22.9 years). Spatial/temporal resolution was 1.6x1.6x2.1 mm³/28 ms. After computation of 4D pressure difference maps, 8 positions were analyzed: P1, mid ascending aorta; P2, proximal to first branch of aortic arch; P3, mid aortic arch; P4, distal to left subclavian artery; P5-P8, at equal distances in descending aorta. For each position, pressure difference amplitude was assessed by three readers, and by one of them again after 10 months. Inter- and intraobserver agreement was calculated as Shrout and Fleiss intraclass correlation coefficients.
Results: Pressure difference amplitude (in mmHg, averaged over all three readers for clarity purposes) was for patients/volunteers: P1 2.3/1.9, P2 4.3/3.5, P3 8.2/4.8, P4 13.0/6.1, P5 19.5/10.2, P6 21.9/14.3, P7 25.1/19.2, P8 28.3/23.8, with P3 to P7 being significant differences ($p < 0.05$ for all readers). Inter- and intraobserver agreement was excellent ($p < 0.001$ for all correlation coefficients), with inter-/intraobserver agreement being: P1 0.75/0.94, P2 0.81/0.90, P3 0.99/0.998, P4 0.99/0.998, P5 0.998/0.998, P6 0.998/0.999, P7 0.996/0.998, P8 0.997/0.996.
Conclusion: Significant increase of aortic pressure difference amplitudes in patients with repaired aortic coarctation could be detected with excellent intra- and interobserver agreement by noninvasive 4D pressure difference mapping derived from 4D flow MRI.

B-0399 15:12

Magnetic resonance imaging-based diagnosis of pulmonary hypertension: 4D flow versus standard functional indices

G. Reiter, U. Reiter, G. Kovacs, C. Janig, H. Olschewski, M.H. Fuchsjäger; *Graz/AT (gert.reiter@siemens.com)*

Purpose: Duration of vortical blood flow in the main pulmonary artery (MPA) visualised by magnetic resonance (MR) 4D flow imaging is associated with the presence and severity of pulmonary hypertension (PH). Purpose of the present study was to compare the diagnostic performance of 4D flow-derived vortex duration with standard functional MR indices for detection of PH.
Methods and Materials: 127 patients with suspected PH (69/58 without/with PH) underwent right heart catheterization and cardiac MR imaging including cine short-axis imaging, cine phase contrast imaging perpendicular to the MPA and 4D flow imaging of the MPA. Normalised right ventricular muscle mass (nRVMM), right-to-left ventricular mass ratio (VMR), minimal MPA area (Area_MPA), average blood flow velocity in the MPA (Vel_MPA) and alpha-index (Area_MPA/right ventricular ejection fraction) were determined from cine images. 4D flow data were evaluated for duration of vortical blood flow along the MPA (t_vortex in percent of the cardiac interval). Diagnostic performance of the indices for presence of PH was analysed and compared by receiver operating characteristic curve analysis.
Results: Areas under the curve for nRVMM (0.88), VMR (0.83), Area_MPA (0.88), Vel_MPA (0.75) and alpha-index (0.86) were significantly smaller than the one for t_vortex (0.99, $p < 0.001$ for all comparisons). Among the standard functional MR indices best accuracy for PH detection was achieved for nRVMM (cut-off=32 g/m^2: sensitivity/specificity=0.81/0.87 with 95% confidence intervals 0.69-0.89/0.77-0.93). t_vortex revealed higher sensitivity and specificity for PH diagnosis (cut-off=15%: sensitivity/specificity=0.97/0.96 with 95% confidence intervals 0.88-0.99/0.88-0.99).
Conclusion: 4D flow allows significantly more accurate PH detection than standard functional MR parameters.

Author Disclosures:
G. Reiter: Employee; Siemens AG, Healthcare.

B-0400 15:20

Cardiovascular magnetic resonance myocardial feature tracking assessment of myocardial mechanics: inter-vendor agreement and considerations on reproducibility

V. Stahnke[1], C. Unterberg-Buchwald[1], J. Kowallick[1], P. Lamata[2], S. Kutty[3], G. Hasenfuß[1], P. Beerbaum[4], J. Lotz[1], A. Schuster[1]; [1]*Göttingen/DE*, [2]*London/UK*, [3]*Omaha, NE/US*, [4]*Hannover/DE*
(v.stahnke@stud.uni-goettingen.de)

Purpose: To assess inter-vendor agreement of different CMR feature tracking software and to study the impact of repeated measurements on reproducibility.
Methods and Materials: Ten healthy volunteers underwent cine imaging at rest and with dobutamine stimulation (10and20 µg·kg-1·min-1). Images were analyzed three times using either software A ('TomTec') or software B ('Circle') to assess global circumferential (Ecc), radial (Err) left ventricular strains and myocardial torsion. Differences in intra- and inter-observer variability between software and within single software types were assessed based on single and repeated analysis results (two and three repetitions with subsequent averaging,respectively) as determined by Bland-Altman analysis, intraclass correlation coefficients (ICC) and coefficient of variation (CoV).
Results: Whilst the derivation of myocardial strain and torsion was feasible in all subjects at rest and with 10 µg·kg-1·min-1 of dobutamine using either software one single subject had to be excluded with 20 µg·kg-1·min-1 of dobutamine due to insufficient tracking using Circle. Myocardial strains and myocardial torsion significantly increased with dobutamine stimulation ($p < 0.05$). Inter-vendor agreement was excellent for Ecc (ICC0.81 (0.63-0.91),0.87 (0.72-0.94) and CoV12.9%and14.61%,intra- and inter-observer level, respectively) irrespective of the number of analysis repetitions. Myocardial torsion showed reasonable inter-vendor agreement that improved with repeated analyses. Err had little inter-vendor agreement irrespective of repeated analyses. On an intra-vendor level Ecc performed best and Err worst.
Conclusion: Myocardial strain and torsion measurements are subject to considerable inter-vendor variability, irrespective of the number of analysis repetitions. For both vendors, Ecc qualifies as the most robust parameter with the best agreement and warrants further investigation of incremental clinical merit.

14:00 - 15:30 **Room MB 4**

Emergency Radiology

SS 317

Update on imaging approach in trauma patients

Moderators:
J.B. Dormagen; Oslo/NO
L.M. Lenghel; Cluj-Napoca/RO

B-0401 14:00

One-shot volume wrist CT after trauma: fracture detection and therapeutic consequences in a prospective cohort study

A.C.L.F. Steenbakkers, M. Holla, J. de Rooy, J. Hermans, M.J.M. Ploegmakers, M. Edwards, M. Prokop, M. Brink; *Nijmegen/NL*
(arjan_steenbakkers@hotmail.com)

Purpose: To evaluate radiation dose and diagnostic performance of a fast set-up, low-threshold and low-radiation dose one-shot volume computed tomography (CT) of the wrist in daily practice.
Methods and Materials: We performed an institutional review board approved, prospective study on all patients of 18 years or older with suspicion of fractures of the wrist and carpus. Volume CT scanning was preceded by wrist conventional radiography (CR). We prospectively collected information on dose length products (DLP), fractures and treatment plans both before and after CT. We calculated the proportion of patients with fractures and treatment changes based on CT as compared to CR, as well as areas under the receiver operator curves (AUC) including 95% confidence intervals.
Results: 99 Patients participated (37% male, mean age 49 years, range 18-87)with 100 wrist CTs (mean dose length product 35 mGycm). Incidence of fractures was 62% at short follow-up. CR detected fractures in 52 wrists (AUC 0.783 (95% CI 0.686 -0.881). AUC for fracture detection of CT was 0.975 (95% CI 0.936 - 1.00). CT found 36 additional injuries in 24 wrists: 26 carpal fractures, 2 radial fractures, 1 ulna fracture, and 7 intra-articular radial fractures. In 19 patients (20%), treatment regimen changed after CT (2 operative treatment, 17 (different) cast immobilization).
Conclusion: Standard volume CT is feasible after wrist injury with a relatively low radiation dose. This type of low-threshold CT detects more fractures than CR. However, therapeutic implications merely include type of cast immobilization than operative treatment planning.

Author Disclosures:
M. Prokop: Grant Recipient; Toshiba medical systems, Philips Medical systems, Bracco, Bayer, CME Science. **M. Brink:** Speaker; Toshiba Medical systems Europe.

B-0402 14:08

Improvement of evaluation time in detection of acute rib fractures by generating rotatable "unfolded rib" images

G. Homann, C. Kloth, M.N. Bongers, C. Schabel, K. Nikolaou, M. Notohamiprodjo; *Tübingen/DE*

Purpose: The objective of this study was to evaluate whether postprocessing of CT-images into rotatable, unfolded rib images enhances the detection rate of rib fractures and reading time in acute thoracic trauma.
Methods and Materials: We evaluated 51 patients who presented to our emergency room after thoracic trauma and underwent CT on a 64-MDCT-scanner (Siemens Sensation 64) of the thorax. Images with 1 mm slice-thickness were post-processed into rotatable "unfolded rib" images along the centreline of the ribs using a commercially available software application called "Bone Reading" (syngo.via; Siemens Healthcare). Two readers evaluated the detection of rib fractures in comparison to arbitrary 3D-MPR assessment. Missed fractures were noted as well as their location and the needed reading time. A combination of both the unfolded images and 3D-MPR and, if available, follow-up CT were used as standard of reference.
Results: Using both techniques in combination n = 115 rib fractures were detected. Six fractures were missed on the MPR-set and five using the "unfolded rib" images ($p > 0.05$). The "unfolded rib" images especially enhanced the detection of fissural fractures, whilst fractures nearby the costovertrebral joint or the costocartilaginous junction were missed. Both methods yielded a high intra- and inter-observer correlation. The "unfolded rib" images reading time (19.5 ± 4.9 s) was significantly shorter than using the MPR image-set with 105.5 ± 13.9 s ($p = 0.04$).
Conclusion: Detection of fissural fractures and the reading time can be significantly reduced by using post-processed "unfolded rib" images.

B-0403 14:16

Traumatic thoracolumbar fractures: assessment by MDCT using Denis' classification and TLICS scale

L.E. Dinu, A. Vela, M. Marin, E. Garces, A. Garcia, J. Artigas; *Zaragoza/ES (laura_dinu1@yahoo.com)*

Purpose: To evaluate the utility of Denis' classification and TLICS scale (thoracolumbar injury classification and severity score) in the surgical decision of thoracolumbar spine injuries.
Methods and Materials: We retrospectively studied the CT examinations of 104 consecutive acute thoracolumbar vertebral fractures.The cases with pathologic fractures secondary to metastatic disease were excluded. The revision of the CT studies was done by a single observer in a random manner. Each injury was valued as stable or unstable depending on the classification of Denis and was allocated a score from 1 to 10 according to the TLICS scale. Cut-off point to select patients for surgery was located between 4 (not surgery) and 5 (surgery) taking into account local surgical preferences. Analysis of validity (sensitivity (Sn), specificity (Sp)) and feasibility (positive predictive value (PPV), negative predictive value (NPV)), for both classifications was performed using the surgical decision as gold standard. Kappa coefficient was used to establish the agreement between both classifications.
Results: Validity and feasibility results to predict instability obtained for the two were: Denis' classification - Sn= 95 %, Sp= 86 %, PPV= 63% and NPV= 99% and TLICS scale - Sn=62 %, Sp=98 %,PPV=87 % and NPV=91 %.The Kappa coefficient has been 0.550.
Conclusion: Denis' classification has high sensitivity and NPV to assess instability, so it will be used initially to exclude less severe injuries not requiring surgery. TLICS scale, with greater VPP to predict instability, is useful to establish surgical management. In spite of a moderate agreement between two classifications, its combined use allows better triaging of patients.

B-0404 14:24

Validation of the NEXUS-criteria for CT

R.S. Smit, J.B. Egbers, A.F. Hoogerwaard, J.J. van Netten, D. van der Velde, M. Kraai, J.W. op den Akker; *Almelo/NL (ruth.s.smit@gmail.com)*

Purpose: The NEXUS-criteria are validated criteria to identify adult patients who need conventional radiography of the cervical spine after blunt trauma. Despite the fact that CT is internationally seen as the 'golden standard' when cervical spine injury is suspected, the NEXUS-criteria have never been validated for CT. We tested the accuracy of the NEXUS-criteria for CT with simultaneously implementation of the Dutch guidelines for blunt trauma (CBO, 2009) of the cervical spine after high-energy trauma.
Methods and Materials: A retrospective observational study in the period January 1st 2012 to December 3 1st 2013, including all patients aged 15 years and older with a high-energy-trauma (HET). We evaluated the NEXUS-criteria against the outcome of a fracture or no fracture of the cervical spine determined by CT.
Results: A total of 875 patients were included, from which 599 patients had a positive- and 276 patients had a negative NEXUS-screening. In the group with the positive NEXUS-criteria 35 fractures were found. One patient with a negative NEXUS-screening had a fracture. This leads to a sensitivity of 0.972 (95% CI: 0.837-0,998) and a negative predictive value of 0.996 (95% CI: 0.976-0,999) of the NEXUS criteria.
Conclusion: The NEXUS-criteria have a good sensitivity as well as a good negative predictive value for CT of the cervical spine when injury of the cervical spine is suspected in patients with a high-energy-trauma aged 15 years and older.

B-0405 14:32

Whole body computed tomography for trauma patients in the Nordic countries 2014. Survey shows significant differences and a need for guidelines

H. Eklöf[1], E. Wiklund[1], F. Linder[1], S. Koskinen[2]; [1]*Uppsala/SE*, [2]*Stockholm/SE (hampus.eklof@radiol.uu.se)*

Purpose: To identify Nordic differences in radiation-doses and scanning protocols for whole-body computed tomography in trauma (WBCTT). WBCTT is a scanning protocol for standardized, quick examination of trauma-patients with the ability to detect and define a wide range of injuries of head-neck-thorax-abdomen-spine-pelvis. We also compared Nordic routines with those of major trauma centers outside the Nordic region. Is there a need for up-dated Nordic WBCTT guidelines?
Methods and Materials: A survey with 23 questions was sent to 95 hospitals in the Nordic region and 10 trauma-centers outside the Nordic region. The questions were defined and the hospitals were selected in collaboration with board members of "Nordic Forum for Trauma and Emergency Radiology" (www.nordictraumarad.com).
Results: The questionnaire was answered by 56 of 93 Nordic hospitals and 8 of 10 trauma centers outside the Nordic region. Radiation dose for WBCTT varies between mean 1838±535 mGy·cm in Nordic hospitals and 2200±505 mGy·cm in non-Nordic traumacenters. CT-scanner is located within 50 meters of the emergency department in 60% of Nordic hospitals and 100% of non-Nordic trauma centers. Arterial visualization is routine in non-Nordic trauma-centers but only in 50% of the Nordic hospitals. A need for updated guidelines was considered by 89% of the Nordic responders and a majority is willing to adopt new international guidelines.
Conclusion: There is a need and an interest in most Nordic hospitals to up-date their guidelines for WBCTT.

Author Disclosures:
H. Eklöf: Board Member; Nordic trauma and emergency radiology. **S. Koskinen:** Board Member; Nordic trauma and emergency radiology.

B-0406 14:40

Patients subject to high energy trauma without signs of injury do not benefit from whole-body CT imaging

F. Linder, H. Eklöf; *Uppsala/SE (fredrik.linder@surgsci.uu.se)*

Purpose: Is it safe to omit "Whole body CT imaging" in patients exposed to high energy trauma, when there is no sign of injury or influence of drugs?
Methods and Materials: A two center retrospective cohort study was performed on consecutive trauma patients in an urban university hospital (n=273) and a rural county hospital (n=250). Patients were grouped according to clinical findings. Each group was then evaluated for injury severity and radiological findings. Emphasis was on the information gained from "Whole body CT in Trauma" (WBCT-T). Patients were grouped into: 1.High risk - signs of compromise to vital functions, 2.Intermediate risk - moderate injury (AIS ≥ 2), 3.Low risk - minor injuries (AIS ≤ 1) and no intoxication.
Results: No epidemiological difference between patient population or type of trauma at big vs small hospital. Median age was 32 years, average radiation dose 21 mSv. Of all trauma patients 55% underwent WBCT-T, traumatic findings were seen in 43% of WBCTT. The median ISS-score was 1 and 9% of patients had an ISS-score > 15. The high risk group had a mean ISS-score of 16 with positive findings in 74.5% on WBCT-T. The low risk group had a mean ISS-score of 0.8 and no positive findings on WBCT-T. No serious injuries were missed based on 3 year follow-up.
Conclusion: Patients subject to high energy trauma, with clinical findings suggesting only minor injuries, do not benefit from WBCT-T. After observation in the E.D, most of these patients can be discharged without follow-up.

Author Disclosures:
H. Eklöf: Board Member; Nordic trauma and emergency radiology.

B-0407 14:48

Watch and wait or irradiate

M. Kakollu, N. Jones, L.-G. Baca, S. Pillai, S. Kumar; *Cardiff/UK (kmahendra2105@me.com)*

Purpose: Trauma is the leading cause of death for young adults in the UK. An ongoing debate focuses on the utility of Whole Body Computed Tomography (WBCT) as a standard practice in the evaluation of patients. Estimated radiation for the WBCT is approximately 20mSv, which is significantly higher than the average 9.2mSv for conventional workup with plain radiography and selective CT. Although the potential risk to the individual patient may be minimal, the cumulative risk may be substantial.
Methods and Materials: Notes of all patients between August 2012 and April 2014, and registered with trauma were reviewed retrospectively. We examined in detail all patient notes who underwent WBCT in particular.
Results: Out of a total of 340 patients with major trauma, 284 patients met the inclusion criteria. 151 out of the 284 patients had either selective or plain radiology alone, and 133 patients underwent WBCT. In the WBCT group, 90 were GCS 15, 40 had GCS< 15. 38 patients in the GCS 15 group had no physiological disturbances or clinical signs of injury and also had no significant injuries.
Conclusion: Our results demonstrate that it was not always necessary to perform a hasty WBCT in blunt trauma patients based on the mechanism alone. In doubtful cases, patients should be admitted, closely observed and be appropriately investigated if their clinical condition demands exposure to a highly irradiating procedure.

B-0408 14:56

Scanning and war: utility of FAST and CT in the assessment of battlefield abdominal trauma

I.M. Smith, D.N. Naumann, M.E.R. Marsden, M. Ballard, D.M. Bowley; *Birmingham/UK (drm.marsden@yahoo.com)*

Purpose: To determine the diagnostic accuracy of Focused Assessment with Sonography for Trauma (FAST) and Computed Tomography (CT) in relation to battlefield abdominal trauma and to describe their contribution to the initial assessment and management of such casualties within a mature military trauma system.
Methods and Materials: This study examined battlefield casualties with potential abdominal injuries who were admitted directly to the coalition Medical Treatment Facility at Camp Bastion, Afghanistan, between July and November 2012. Casualties were included if they had undergone FAST, abdominal CT or laparotomy. Radiology reports were matched to military trauma registry data and surgical records.
Results: 468 casualties met inclusion criteria. 85.0% underwent FAST and 86.1% abdominal CT. 159/468 (34.0%) had abdominal injuries. For detection of intra-abdominal injury, FAST sensitivity (Sn) was 0.56, specificity (Sp) 0.98, positive predictive value (PPV) 0.87, negative predictive value (NPV) 0.90 and accuracy (Acc) 0.89. For CT, Sn was 0.99, Sp 0.99, PPV 0.96, NPV 1.00 and Acc 0.99. 46 solid organ injuries were identified in 38 patients by CT; 17 were managed non-operatively. A further 61 patients avoided laparotomy after CT confirmed extra-abdominal wounds only. The negative laparotomy rate was 3.9%.
Conclusion: Advanced imaging in the deployed military setting achieves a similar accuracy to civilian studies. Expert interpretation by radiologists contributes to triage, guides surgical management and reduces non-therapeutic laparotomy. These data challenge current doctrine regarding the inadvisability of non-operative management of abdominal injury after combat trauma, especially when sophisticated image capture and analysis is available during initial decision making.

Author Disclosures:
I.M. Smith: Author; All authors are employed by the UK's Defence Medical Services. These data and the views expressed are the authors' own and do not necessarily reflect policy of the UK's Ministry of Defence. **D.N. Naumann:** Author; All authors are employed by the UK's Defence Medical Services. These data and the views expressed are the authors' own and do not necessarily reflect policy of the UK's Ministry of Defence. **M.E.R. Marsden:** Author; All authors are employed by the UK's Defence Medical Services. These data and the views expressed are the authors' own and do not necessarily reflect policy of the UK's Ministry of Defence. **M. Ballard:** Author; All authors are employed by the UK's Defence Medical Services. These data and the views expressed are the authors' own and do not necessarily reflect policy of the UK's Ministry of Defence. **D.M. Bowley:** Author; All authors are employed by the UK's Defence Medical Services. These data and the views expressed are the authors' own and do not necessarily reflect policy of the UK's Ministry of Defence.

B-0409 15:04

CT in trauma patients: automatic dose monitoring for demonstrating the effect of iterative reconstructions

K. Higashigaito, A. Becker, K. Sprengel, G. Wanner, H. Alkadhi; *Zurich/CH (Kai.Higashigaito@usz.ch)*

Purpose: To illustrate how automatic dose-monitoring software can be used in a clinical setting to control and reduce radiation dose of CT in polytrauma patients using advanced iterative reconstruction (IR).
Methods and Materials: 378 consecutive thoraco-abdominal CT examinations in polytrauma patients were identified using automatic dose-monitoring software (DoseWatch,GE). Patients were split into three cohorts depending on the scanner, protocol, and reconstruction algorithm: cohort 1: 64-slice dual-source CT without IR, tube current-time product 200 mAs; cohort 2: 128-slice dual-source CT with IR and identical scan protocol; cohort 3: 128-slice dual-source CT with advanced modeled IR, tube current-time product 150 mAs. Radiation dose parameters (CTDIvol, DLP, and effective dose (ED)) were extracted using the dose-monitoring software; noise and image quality were determined and compared among cohorts.
Results: All CT examinations were of diagnostic quality. There were no significant differences between cohort 1 and 2 regarding CTDIvol (p=0.62), DLP, and ED (both p=0.95), while noise was significantly lower (chest and abdomen, both -38%, $p < 0.017$). Compared to cohort 1, CTDIvol, DLP, and ED in cohort 3 were significantly lower (all -25%, $p < 0.017$), similar to the noise in the chest (-32%) and abdomen (-27%, both $p < 0.017$). Compared to cohort 2, CTDIvol (-28%), DLP, and ED (both -26%) in cohort 3 was significantly lower (all $p < 0.017$), while noise in the chest (+9%) and abdomen (+18%) was significantly higher (all $p < 0.017$).
Conclusion: Automatic-dose monitoring software can be used in a clinical setting including a large cohort of patients for demonstrating and evaluating the effect of radiation dose lowering techniques.

B-0410 15:12

Is whole-body CT accurate in management of brain-dead patients before organ harvesting?

C. Ridereau-Zins, E. Berthier, L. Dube, C. Nedelcu, C. Aube; *Angers/FR (caridereauzins@chu-angers.fr)*

Purpose: To assess feasibility and accuracy of whole body CT of patients as potential organ donors. To evaluate time saving when substituting chest radiograph and abdominal sonography by whole body CT.
Methods and Materials: Fifty-one consecutive brain-dead patients were prospectively included in this monocentric 2-year study. All had a whole body CT study, exploring head for assesement of brain death then chest and abdomen. Forty-five were prelevated. Arterial anatomy, liver steatosis, suspicious tumours, and pulmonary lesions were evaluated and compared to macroscopy or histology of biopsies. First reading was performed by a senior radiologist, a second in all radio-surgical discordances. Clinical brain death and graft proposal times were compared to the previous evaluation.
Results: Ninety-five % of vascular variants, 100% pulmonary embolies, 80% of macroscopic steatosis were correctly identified. CT-guided seven biopsies, excluded four grafts for tumours and cancelled three harvesting procedures. Average evaluation of potential donors management was 10h30, saving 2h30.
Conclusion: Organ harvesting requires a precise and fast evaluation of grafts. Whole body CT allows an accurate selection of potential donors, and decreases harvesting time.

B-0411 15:20

Comparisons of liver CT perfusion of blunt liver injuries between patients treated with intervention and conservative management

Y.-C. Wong, L.-J. Wang, C.-H. Wu; *Taoyuan, Taiwan/TW (ycwong@cgmh.org.tw)*

Purpose: Blunt liver injuries are treated with intervention management for life-threatening hemorrhage. However, intervention may associate with liver perfusion defect and liver-related complications.
Methods and Materials: We performed perfusion CT for 14 patients of major liver injury (10 males, 4 females; mean age 35.1 ± 15.3 years) who met our inclusion criteria. Their charts were reviewed for demographics, injuries grades, management choice and liver-related complications. The liver perfusion parameters of 112 liver segments were compared and a 2-tail p-value < 0.05 was considered significant.

Results: The intervention group (n=9) and conservative group (n=5) did not differ in age, sex and liver injury grades. The whole liver perfusion index (PI) of intervention group was significantly lower than that of control group (45.7% ± 17.6% versus 68.8% ± 17.0%, p=0.034). Of 112 segments, 21 had undergone intervention. The segmental liver arterial flow (AF) was significantly lower in intervention than conservative groups (89.8 ± 56.7 versus 132.8 ± 104.0 mL/min/100 mL, p=0.032). None of the segmental-liver perfusion parameters was associated with segmental liver injuries. Whole liver PI was apparently lower in patients with delayed recovery of liver enzymes (40.2% ± 9.6% versus 56.3% ± 20.9%, p=0.320) and biloma (49.8% ± 16.0% versus 56.3% ± 22.9%, p=0.589).
Conclusion: Whole liver PI and segmental liver AF of major liver injury are lower in intervention than in conservative management groups. Liver PI is lower in patients with liver-related complications, however, a larger sample size is necessary to confirm their significance.

Author Disclosures:
Y. Wong: Research/Grant Support; National Science Council Taiwan. **L. Wang:** Research/Grant Support; National Science Council Taiwan. **C. Wu:** Research/Grant Support; National Science Council Taiwan.

14:00 - 15:30 **Room MB 5**

Neuro

SS 311b
Hypertension and stenosis

Moderators:
F. Barkhof; Amsterdam/NL
D. Gürbüz; Istanbul/TR

B-0412 14:00

Endovascular treatment in idiopathic intracranial hypertension, clinical result and long-term follow-up

M. Aguilar Pérez[1], W. Kurre[1], D. Horvath-Rizea[1], R. Unsöld[2], H. Bäzner[1], H. Henkes[1]; [1]*Stuttgart/DE*, [2]*Düsseldorf/DE (martaaguilarperez@yahoo.es)*

Purpose: Idiopathic intracranial hypertension (IIH) is a disorder of increased intracranial pressure in the absence of any known causative factor. The most important clinic factor is the progression of the visual loss. Recently, stenting of stenotic dural sinuses has gained popularity as treatment, since these stenoses may contribute to an obstruction of the venous return. We evaluated the safety and efficacy of endovascular treatment in these patients.
Methods and Materials: 38 patients with IIH underwent stenting. Most of them were women (73%) and clinically obese. Mean age was 38.5 years. 66% of the patients referred headache as clinical manifestation, 63% any type of visual problems. All patients presented papilledema in the ophthalmologic evaluation. 97% of the patients presented hyperintensity of the optic nerve sheath; 90%, empty sella syndrome; and all of them, venous stenosis. We performed stenting if symptoms persisted under medical treatment, repeated lumbar punctures, shunts procedures, or a combination of them.
Results: Resolution of the venous stenosis was possible in all the patients. There were no periprocedural complications. Improvement of papilledema was observed in 53% of the patients and 87% reported improvement in the headache. In the long-term follow-up (median 31 months), only 6 patients (19%) presented re-stenosis; 2 of them, symptomatic.
Conclusion: Endovascular treatment with sinus stenting is an easy, safe and effective treatment in patients with IIH. The far majority of patients have a persistent clinical benefit.

Author Disclosures:
M. Aguilar Pérez: Consultant; phenox. **W. Kurre:** Consultant; phenox. **H. Henkes:** Consultant; phenox. Founder; phenox. Shareholder; phenox.

B-0413 14:08

Leptomeningeal collateral vessels are a major risk factor for intracranial hemorrhage after carotid stenting in patients with carotid atherosclerotic plaque

K. Lee, H. Kwak, G. Chung, J. Song; *Jeonju/KR (leekangj@nate.com)*

Purpose: The aim of this study was to evaluate the relationship between leptomeningeal collaterals and intracranial hemorrhage (ICH) after carotid stenting (CAS).
Methods and Materials: This retrospective study was approved by the institutional review board with a waiver of patient informed consent. From Jan. 2009 to Dec. 2013, 228 patients (median age: 75 years, range: 44 - 90 years; M:F = 187:41) underwent CAS due to unilateral carotid atherosclerotic plaque. Cerebral angiographic findings were classified into three patterns: type I - normal visualization of ACA and MCA without leptomeningeal collaterals, type II - visualization of MCA only without leptomeningeal collaterals and type III - visualization of leptomeningeal collateral flow.
Results: For all cerebral angiographic findings, 146 (64.0%) were type I, 61 (26.8%) were type II and 21 (9.2%) were type III. Four patients (1.8%) died with fatal ICH after CAS and had type III angiographic findings (19%). The prevalence of ICH in patients with leptomeningeal collateral vessels was significantly higher than in patients without leptomeningeal collateral vessels (19% vs. 0%, $p < 0.0001$). The percentage of carotid stenosis in patients with ICH based on NASCET criteria was significantly higher than in patients without ICH (89.8 ± 3.6 vs. 72.8 ± 12.8, $p = 0.014$).
Conclusion: Leptomeningeal collateral vessels are a major risk factor for ICH after CAS in patients with carotid atherosclerotic plaque.

B-0415 14:16

Phase contrast and arterial spin labelling magnetic resonance imaging shows improved cerebral blood flow after cardioversion of atrial fibrillation

M. Gardarsdottir[1], S. Sigurdsson[2], T. Aspelund[2], V.A. Gardarsdottir[1], V. Gudnason[2], D.O. Arnar[1]; [1]*Reykjavik/IS*, [2]*Kopavogur/IS (marianna@landspitali.is)*

Purpose: Atrial fibrillation (AF) has been associated with cognitive impairment, reduced brain volume, decreased cerebral blood flow (CBF) and brain perfusion (BP). The purpose of this study was to assess BP with arterial spin labeling (ASL) magnetic resonance imaging (MRI) in patients with AF before and after cardioversion (CV).
Methods and Materials: MRI was done prior to CV and repeated 10 weeks later in patients undergoing elective CV. Patients underwent pseudo-continuous ASL for BP and anatomical sequences for BP quantification in brain regions including grey matter (GM) and white matter (WM) were also done. Before the second MRI, heart rhythm was determined by EKG. Patients in SR or remaining in AF did a second MRI but patients with recurrent AF were excluded, as the time from CV to recurrent AF was uncertain.
Results: The study consists of 22 patients, 17 males, mean age 65 years. Significant increases were seen in patients converting to SR, in global CBF ASL from 35.3 ml/min/100 g to 40.8 ml/min/100 g ($p < 0.05$) and global GM CBF ASL from 38.7 ml/min/100 g to 45.7 ml/min/100 g ($p < 0.05$).
Conclusion: Cerebral perfusion improved after CV to SR. The perfusion increased in both GM and in the whole brain when SR was restored as opposed to when patients remained in AF. Altered cerebral blood flow might, in part, play a role in the decline in cognitive function and brain volume seen with AF.

B-0416 14:24

Contribution of susceptibility weighted imaging in differentiating acute from chronic internal carotid occlusion

I. Yoon[1], Y. Kim[1], Y. Kim[1], Y. Won[1], H. Song[2]; [1]*Uijeongbu/KR*, [2]*Jeju/KR (violet2@catholic.ac.kr)*

Purpose: On magnetic resonance angiography (MRA) absent internal carotid artery (ICA) is either due to acute occlusion by thrombus or chronic carotid occlusion. We propose susceptibility weighted imaging (SWI) to differentiate acute from chronic carotid occlusions that could potentially aid clinical management of patient.
Methods and Materials: We retrospectively studied 44 consecutive patients with unilateral extracranial internal carotid occlusion on MRA proven by conventional angiography. Occlusions were classified as acute (imaging < 1 week of presumed occlusion) or chronic (imaging > 4 weeks), based on circumstantial clinical and radiologic evidence. A neuroradiologist blinded to clinical information looked for asymmetry of deep medullary veins (DMVs) and presence of middle cerebral artery (MCA) susceptibility vessel sign (SVS) on SWI.
Results: Of 44 occluded carotids, 7 were excluded because of insufficient circumstantial evidence to determine timing occlusion. Among the remaining 23 acute and 14 chronic occlusion, the asymmetry of DMV had 78.3 % sensitivity and 85.7 % specificity, and the MCA SVS had 47.8 % sensitivity and 100 % specificity to diagnose acute occlusion. Both asymmetry of DMV ($p = .000$) and MCA SVS ($p = .002$) were significantly more frequent in acute internal carotid occlusion.
Conclusion: The asymmetry of DMV and MCA SVS on SWI helps to differentiate acute from chronic extracranial internal carotid occlusion.

B-0417 14:32

Intracranial arterial calcifications as a prognostic factor for the subsequent occurrence of mixed adverse cardiovascular events (MACE)

F.F. Strobl, B. Kuhlin, F. Bamberg, M.F. Reiser, T. Saam; *Munich/DE (frederik.strobl@med.lmu.de)*

Purpose: To evaluate the association of intracranial arterial calcifications as detected in non-contrast-enhanced CT scans of the head with the subsequent occurrence of mixed adverse cardiovascular events (MACE).
Methods and Materials: We included a cohort of consecutive patients with an age > 60 years who underwent a CT scan of the head due to minor trauma or neurological disorders. Only patients without acute pathological findings in the CT were included. A calcified plaque score (CPS) with range 0-4 was determined in each of the following arteries: Both internal carotid, both mid cerebral, both vertebral arteries and basilar artery. To obtain clinical follow-up information, all patients and their general practitioners were contacted with a questionnaire and telephonically. MACE were defined as myocardial infarction, revascularisation, stroke or death due to cardiovascular event.
Results: We included 175 patients (89 male, mean age 78.2 years). Mean follow-up time was 40.4 months, resulting in 7070 patient-years of follow-up. Overall 36 MACE occurred in the cohort during follow-up (12 myocardial infarctions or revascularisations, 6 strokes, 18 cardiovascular deaths). CPS was significantly higher in subjects with compared to subjects without MACE ($p < 0.01$). 15 patients had a CPS of 0; in none of these patients MACE was registered. Patients were divided into two subgroups by the median CPS (CPS=5). Kaplan-Meier-analysis revealed that patients with a CPS< 5 had a significant longer event free survival than patients with a CPS≥5 ($p < 0.01$).
Conclusion: Patients > 60 years and a burden of intracranial artery calcification have an increased risk for the occurrence of MACE.

B-0418 14:40

Normal ranges and test-retest repeatability of velocity parameters in intracranial arteries measured with phase contrast magnetic resonance imaging (PC-MRI)

M. Correia de Verdier, J. Wikström; *Uppsala/SE (mariacdev@hotmail.com)*

Purpose: To investigate the normal ranges and test-retest repeatability of velocity parameters in intracranial arteries measured with phase contrast magnetic resonance imaging (PC-MRI).
Methods and Materials: Thirty healthy volunteers were examined with a 3 T scanner. PC-MRI data from the anterior (ACA), middle (MCA), and posterior (PCA) cerebral arteries were collected at two different dates. Peak systolic velocity (PSV), end diastolic velocity (EDV), resistivity index (RI) and pulsatility index (PI) was calculated for each vessel. For each parameter the least detectable difference was calculated.
Results: Results are presented as mean (range, least detectable difference). In the ACA EDV was 36.8 cm/s (6.5 - 58.7, 23.9), PSV was 69.4 cm/s (25.8 - 160.9, 67.7), RI was 0.45 (0.17 - 0.75, 0.26) and PI was 0.60 (0.18 - 1.57, 0.60). In the MCA EDV was 45.5 cm/s (20.4 - 66.5, 13.1), PSV was 89.2 cm/s (54.6 -183.1, 38.5), RI was 0.48 (0.32 - 0.71, 0.23) and PI was 0.70 (0.38 - 1.64, 0.63). In the PCA EDV was 27.5 cm/s (14.1 - 41.0, 12.0), PSV was 48.9 cm/s (23.5 - 88.4, 32.1), RI was 0.43 (0.15 - 0.62, 0.19) and PI was 0.57 (0.16 - 1.00, 0.33).
Conclusion: Our results indicate that PC-MRI can be used for diagnosis as well as monitoring of treatment response in patients with arteriovenous malformations but also other neurovascular conditions. Repeatability was higher in EDV than in PSV and higher in RI than in PI for all vessels, suggesting EDV and RI as preferable when evaluating hemodynamic changes.

B-0419 14:48

Endovascular reconstruction of extra- and intracranial vessels after subacute or chronic occlusion: indications, techniques, merits and failures

M. Aguilar Pérez, W. Kurre, E. Henkes, A. Lindner, O. Ganslandt, H. Bäzner, H. Henkes; *Stuttgart/DE (martaaguilarperez@yahoo.es)*

Purpose: To evaluate the indications for and results of the endovascular reconstruction of extra- and intracranial arteries after subacute and chronic occlusion.
Methods and Materials: A retrospective analysis of clinical and angiographic data of 35 patients who underwent this treatment was performed. All endovascular procedures were carried out under general anaesthesia with dual platelet inhibition. An individual combination of balloon angioplasty and stent deployment was used.
Results: A total of 35 patients and 36 occlusions treated between 2007 and 2014 were evaluated. Treatment indications were acute clinical symptoms in 21/35 (60%) patients. Target vessels were ICA (n=5), MCA (n=2), VA (n=13), BA (n=7) or a combination thereof (n=9). The attempted vessel reconstruction was achieved in 32/36 (88.8%) procedures. Clinical improvement was confirmed in 30 patients (83.3%), two of them despite failed attempt. At follow-up, permanent neurological deficit was encountered in 16 patients. Four patients died, one as a consequence to the procedure.
Conclusion: Haemodynamic compromise of the dependent circulation is a possible reason for the endovascular reconstruction of extra- and intracranial vessels in the status of subacute or chronic occlusion. The procedure can be quite demanding (e.g., for basilar and MCA reconstruction). Long-term dual antiaggregation, angiographic follow-up and treatment of in-stent restenoses are part of the concept. Clinical results reach from considerable improvement to major morbidity and procedural mortality.

Author Disclosures:
M. Aguilar Pérez: Consultant; phenox. **W. Kurre:** Consultant; phenox. **H. Henkes:** Consultant; phenox. Founder; phenox. Shareholder; phenox.

B-0420 14:56

To compare post contrast 3D T2 FLAIR, T1-SPACE and MP-RAGE sequences to select the ideal sequence for leptomeningeal abnormalities at 3 T MRI

B. Jeevanandham; *Coimbatore/IN (bjradiologist@gmail.com)*

Purpose: To compare Post contrast 3D T2-FLAIR (Fluid attenuation inversion recovery), T1-SPACE (Sampling Perfection with Application optimized Contrast using different flip angle Evolutions) and MP-RAGE (magnetization prepared rapid gradient echo) sequences to select the ideal single sequence for leptomeningeal abnormalities at 3 T MRI.
Methods and Materials: 30 patients presenting with meningeal signs and symptoms were evaluated with pre and post contrast T2-FLAIR,MPRAGE, SPACE sequences. The images were evaluated independently by two radiologists for cortical gyral, sulcal space, basal cisterns and dural enhancement. These were followed up with results of CSF analysis.
Results: SPACE and 3D T2- FLAIR yielded significantly more information than MPRAGE images ($p < 0.05$ for both SPACE and FLAIR images). SPACE best demonstrated abnormalities in dural and sulcal spaces whereas FLAIR was most useful for abnormalities in basal cisterns. Both SPACE and FLAIR performed equally well in detection of gyral enhancement. In all 9 patients where both SPACE and T2-FLAIR images failed to demonstrate any abnormality, the CSF analysis was also negative for infection.
Conclusion: SPACE sequence best demonstrated abnormalities in dural and sulcal spaces whereas FLAIR was most useful for abnormalities in basal cisterns. Both SPACE and FLAIR performed equally well in detection of gyral enhancement. Post contrast SPACE and T2-FLAIR sequences are superior to MPRAGE sequence for evaluation of meningeal abnormalities and when used in combination have maximum sensitivity for leptomeningeal abnormalities. The negative predictive value when compared to CSF analysis is nearly 100% when no leptomeningeal abnormality was detected on these sequences

B-0421 15:04

Impact of image denoising on image quality, quantitative parameters, and sensitivity of ultra-low-dose volume perfusion CT imaging

A. Othman[1], C. Brockmann[1], Z. Yang[2], M.A. Brockmann[1], M. Wiesmann[1], J. Kim[2]; [1]*Aachen/DE*, [2]*Seoul/KR (ahmed.e.othman@googlemail.com)*

Purpose: To examine the impact of denoising on image quality, quantitative parametric map, and sensitivity of Ultra-Low-Dose Volume Perfusion CT (ULD-VPCT) imaging of acute stroke.
Methods and Materials: A simulated low-dose data set at 20% dose rate were generated from 20 patients with symptoms of acute MCA-occlusion (onset < 6h) acquired at 80 kV and 180 mAs by using a realistic low-dose simulation technique based on sinogram synthesis and quantum noise modeling. Four perfusion maps from each ULD-VPCT-dataset were generated using a deconvolution-based commercial software: 1. not denoised (ND), 2. denoised using a spatiotemporal filter (D1), 3. denoised using a quanta-stream diffusion technique (D2) and 4. denoised using a combination of both methods (D1+D2). Signal-to-noise-ratio (SNR) measures were performed. Image quality, presence/absence of ischemic lesions, and CBV and CBF scores according to a modified ASPECTS-score were assessed by two blinded readers.
Results: SNR values and qualitative scores were highest for D1+D2 followed by D2, and D1, and were lowest for ND. In 5 patients, ND perfusion maps were not assessable. Therefore ND datasets were considered insufficient and excluded from further analyses. Compared to original datasets, ULD-VPCT datasets with D1+D2, D2, D1 showed sensitivity values of 0.99, 0.96, and 0.75 with inter-observer-agreements of 0.77, 0.93, and 0.98, respectively.
Conclusion: An appropriate combination of denoising techniques applied in Ultra-Low-Dose Volume Perfusion CT imaging produces diagnostically sufficient perfusion maps for the detection of ischemic brain lesions at substantially reduced dose rate as low as 20%.

B-0422 15:12

Quantitative comparison of Gadoterate and Gadobutrol for the MR-angiographic (MRA) evaluation of neurovascular disease

M. Dietzel[1], P. Hölter[1], S. Lang[1], T. Struffert[1], M. Essig[2], A. Dörfler[1];
[1]*Erlangen/DE*, [2]*Winnipeg, MB/CA*

Purpose: Compared to conventional contrast-agents, Gadobutrol provides improved relaxivity and concentration. Yet there is no evidence, whether these chemical properties translate into optimized neuroradiological image quality. We designed a prospective, randomized trial to intra-individually compare quantitative enhancement characteristics of Gadobutrol with a conventional contrast-agent in the MRA of neurovascular disease.
Methods and Materials: Patient with significant neurovascular disease were eligible (approval of federal-drug inistitute and local ethical-committee, informed-consent). Patients underwent two MRA-examinations with two different contrast-agents in a randomized order at equimolar dose (Gadobutrol/Gadovist®: 1mol/l; 0.05 ml/kgKG; Gadoterate/Dotarem®: 0.5mol/l; 0.1 ml/kgKG). All other parameters of both MRA examinations were identical (same 1.5 Tesla unit, multi-channel head&neck coil, 3D GRE-MRA etc.; no therapy between MRA). Measurements of enhancement characteristics were performed by two experienced MR-radiologists in consensus. Quantitative analysis was based on 2D ROI-statistics as follows: - Noise - Contrast (extracranial), contrast (intracranial) - Vessel-segments (n=19): pre-/postcontrast. Corresponding values of SNR/CNR (signal/contrast to noise-ratio) and enhancement-rate (ER: Signalintensity+Gd/ Signalintensity-Gd [%]) of Gadobutrol and Gadoterate were compared using descriptive statistics (e.g. ratio=VALUEGadobutrol/VALUEGadoterate), box-pots and Wilcoxon signed-rank test (α=5%).
Results: 452 vessel-segments in 26 MRA-examinations were analyzed (scan-rescan delay: 1-5days). Gadobutrol achieved a significantly higher ER (Gadobutrol=745.1, Gadoterate=610.7; ratio=1.22, $P < 0.001$). Higher vessel contrast translated into improved CNR (Gadobutrol=106.4, Gadoterate=80.6; ratio=1.3, $P < 0.001$) and SNR (Gadobutrol=131.9, Gadoterate=103.6; ratio=1.3, $P < 0.001$) all in favor of Gadobutrol.
Conclusion: Gadobutrol achieved a 20% higher enhancement-rate, leading to a significantly higher SNR and CNR. This underlines the potential of Gadubutrol to assess the delicate vasculature of patients with neurovascular disease.

Author Disclosures:
M. Dietzel: Consultant; Consultant; syneed medidata GmbH Max-Stromeyer-Str. 166, 78467 Konstanz. **M. Essig:** Consultant; Consultant; syneed medidata GmbH Max-Stromeyer-Str. 166, 78467 Konstanz.

Thursday, March 5

10:30 - 12:00 **Room B**

Abdominal Viscera

SS 601a

Focal liver lesions

Moderator:
M. Krokidis; Cambridge/UK
B. Marincek; Cleveland, OH/US

B-0423 10:30

Differentiation of intrahepatic mass-forming cholangiocarcinoma from hepatocellular carcinoma on Gadoxetic acid-enhanced liver MR

R. Kim[1], J. Lee[1], C.-I. Shin[1], E. Lee[2], I. Joo[1], I. Hwang[1], S. Kim[1], J. Han[1], B. Choi[1]; [1]*Seoul/KR*, [2]*Goyang-si/KR (jmsh@snu.ac.kr)*

Purpose: Our purpose was to investigate the different imaging features of intrahepatic mass-forming cholangiocarcinoma (IMCC) from hepatocellular carcinoma (HCC) on gadoxetic acid-enhanced magnetic resonance imaging (MRI).
Methods and Materials: Forty-six patients of pathology confirmed IMCC who underwent gadoxetic acid- enhanced MRI were recruited as study group. Fifty-eight HCC cases were recruited as a matching control group. Two radiologists analyzed the MRI images in consensus for morphologic features, relative signal intensity (SI), enhancement patterns, and hepatobiliary phase (HBP) findings. The student t test, Fisher exact test, chi- square test and multivariate logistic regression were carried out to identify the valuable imaging features.
Results: Several morphologic features favored IMCCs over HCC: lobulated contour, heterogeneous T2 SI, intrahepatic duct dilatation and target sign on diffusion image ($p < 0.05$). Moreover, prevalent enhancement pattern of HCCs was wash-in and wash-out pattern and homogeneous hypointensity on HBP, whereas that of IMCCs was rim enhancement, gradual or persistent enhancement and peripheral rim and/or multilayered pattern on HBP ($p < 0.05$). Multivariate analysis revealed heterogeneous T2 SI, rim arterial enhancement and peripheral hypointense rim on HBP were suggestive of IMCC and the wash-in and wash-out pattern was indicative of HCC ($p < 0.05$). Three of above four features except wash-in and wash-out pattern and additionally multilayered SI on HBP were valuable in differentiation of small (< 3 cm) IMCCs and HCCs ($p < 0.05$).
Conclusion: Although a small portion of IMCCs showed wash-in and wash-out enhancement mimicking HCCs, typical morphologic and enhancing characteristics with combined interpretation of HBP was helpful in the differentiation of IMCCs and HCCs.

B-0424 10:38

Discrimination of Hepatic Alveolar Echinococcosis from Intrahepatic Cholangiocarcinoma using CT and MR Imaging

J. Mueller, M. Stojkovic, K.D. Rosenberger, A.K. Berger, C.L. Schlett, T. Junghanss, H.-U. Kauczor, T.F. Weber; *Heidelberg/DE (jan.mueller84@googlemail.com)*

Purpose: Hepatic alveolar echinococcosis (AE) resembles intrahepatic cholangiocarcinoma (CC) on radiological imaging. The purpose of this study was to identify criteria to discriminate AE from CC with CT and MR Imaging.
Methods and Materials: 116 imaging studies of 94 patients (CT n=65; MRI n=51) diagnosed with AE (n= 55) or CC (n=39) were retrospectively reviewed by two independent radiologists for lesion features including enhancement pattern and matrix composition. A consensus read was conducted in cases of disagreement. Uni- and multivariate logistic regression with bootstrapping were used for analysis.
Results: Using CT, no/or septal enhancement and calcification yielded the highest values of sensitivity/specificity (90.9%/90.6% and 81.8%/83.8%) for AE. Using MRI, no/or septal enhancement and the presence of fibrous components achieved the highest sensitivity/specificity (90.9%/100.0% and 54.5%/83.3%) for AE. The frequencies of volume loss and cholestasis showed no significant differences between AE and CC. Multivariate logistic regression identified the following strong independent predictors for AE: for MRI, no/or septal enhancement (odds ratio [OR], 322.42; $p < 0.001$); for CT, both no/or septal enhancement and calcification (OR, 60.8 and 86.0; p=0.001 and 0.002, respectively). The combined presence of no/or septal enhancement and calcification at CT resulted in a sensitivity/specificity of 75.8% and 100% for AE.
Conclusion: Enhancement pattern in CT and MRI is a helpful imaging criterion for differentiating AE and CC with a high sensitivity and specificity. In CT additional calcification further increases the specificity for AE lesions.

B-0425 10:46

MRI features of inflammatory hepatocellular adenomas on hepatocyte phase imaging with liver-specific contrast agents

M.G. Thomeer, F. Willemssen, K. Biermann, R. de Man, J. IJzermans, R.S. Dwarkasing; *Rotterdam/NL (m.thomeer@erasmusmc.nl)*

Purpose: To evaluate the presentation of inflammatory hepatocellular adenomas (HCAs) on hepatocyte phase MRI.
Methods and Materials: We retrospectively reviewed the MRI features of histologically proven HCAs on hepatocyte phase imaging. Twenty-one lesions (17 with inflammatory subtype) were scanned with gadobenate dimeglumine. Signal intensities of the lesions were assessed in the hepatocyte phase and on the T1-weighted sequences before contrast.
Results: After gadobenate dimeglumine injection, 71% (12/17) of the inflammatory HCAs showed areas of iso- or hyperintensity to the surrounding liver in the hepatocyte phase. In 82% (10/12) of the iso- or hyperintense lesions, this was found over more than 75% of the lesion surface. None of the non-inflammatory HCAs showed areas of iso- or hyperintensity to the surrounding liver in the hepatocyte phase. From these 12, 7 were hyperintense on T1-weighting before contrast due to liver steatosis, 2 due to intrinsic hyperintensity (on the in-phase sequence), and 3 were isointense.
Conclusion: In contrast to non-inflammatory HCAs, inflammatory HCAs can show areas of iso- to hyperintensity to the surrounding liver in the hepatocyte phase; therefore, other typical imaging features should also be used to distinguish between HCAs and FNHs.

Author Disclosures:
M.G. Thomeer: Grant Recipient; BRACCO.

B-0426 10:54

Gd-EOB-enhanced MRI: findings of hepatocellular adenomas and subgroup differentiation

C. Grieser, I.G. Steffen, D. Seehofer, I.-B. Kilic, E. Schott, A. Huppertz, B. Hamm, T. Denecke; *Berlin/DE (christian.grieser@charite.de)*

Purpose: Evaluation of morphologic and enhancement characteristics of histopathologically confirmed hepatocellular adenomas (HCA) with gadoxetic acid-enhanced MRI.
Methods and Materials: Eighty-three patients with 50 histopathologically proven HCA examined with gadoxetic acid-enhanced MRI were retrospectively enrolled (standard of reference: surgical resection, n=45; biopsy, n=5). Two radiologists evaluated all MR images regarding morphological features as well as the vascular and hepatocyte specific enhancement in consensus. Histopathological subgroup analysis was based on the Bordeaux Classification (including steatotic (H-CHA), inflammatory (I-HCA), b-Catenin (b-HCA) and unclassified (U-HCA) adenomas).
Results: Overall, 17 H-HCA (34%), 17 I-HCA (34%), 4 b-HCA (8%) and 12 U-HCA (24%) were present. For differentiation of HCA subtypes, presence of fat (H-HCA, n=17;b-HCA, n=1; U-HCA, n=2) and an atoll sign (I-HCA, n=8) were significant ($p < 0.001$); whereas all other morphologic parameters were not significant ($p > 0.05$). For hepatobiliary phase, most HCA were visually found being hypointense (H-HCA, n=15; I-HCA, n=15;b-HCA, n=3, U-HCA, n=7; p=0.015); relative enhancement was not significant between the different HCA subtypes (p=0.454).
Conclusion: Following the Bordeaux classification, typical morphologic appearance of different HCA-subtypes is present. On hepatobiliary phase, most HCA show hypointensity; however, iso- to hyperintensity may be present in all HCA subgroups

B-0427 11:02

Frequency, CT findings, and fate of multiple infarcted regenerative nodules in liver cirrhosis after variceal bleeding or septic shock

S. Lee; *Seoul/KR (sunyoung0126.lee@samsung.com)*

Purpose: To evaluate the frequency, CT findings, and fate of multiple infarcted regenerative nodules in patients with liver cirrhosis after variceal bleeding or septic shock.
Methods and Materials: During a recent 3-year period, 492 patients with hematemesis or melena (n = 445) and septic shock (n = 47) in liver cirrhosis visited our hospital. After applying the exclusion criteria, 136 patients with active variceal bleeding and 29 patients with septic shock were finally included in the study. We diagnosed multiple infarcted regenerative nodules based on the findings of the first follow-up (within 30 days) CT after events. We evaluated the shape, number, size, margin, location, and distribution of the infarcted regenerative nodules.

Results: Thirty-four patients were diagnosed with multiple infarcted regenerative nodules (20.6% [34/165]): 29 among 136 patients with variceal bleeding (21.3% [29/136]) and 5 among 29 patients with septic shock (17.2% [5/29]). Most of the infarcted regenerative nodules were round in shape, more than ten in number (79.4%), measured 1 cm or less (76.3%), had well-defined margins (61.8%), were present in the periphery (67.6%), and had a clustered distribution (67.6%). Almost all of the infarcted regenerative nodules disappeared on the second follow-up CT (88.9% [16/18]).
Conclusion: In cirrhotic patients, multiple infarcted regenerative nodules were not rare on the first follow-up CT after variceal bleeding or septic shock. Majority of the infarcted regenerative nodules were more than ten in number, measured 1 cm or less, were located in the periphery, and had a clustered distribution.

B-0428 11:10

Impact of observer experience on diagnostic performance in reporting CT and MRI examinations of histopathologically proven non-colorectal liver metastases

M.H. Albrecht, L. Umutyan, M. Hart, C. Polkowski, J.L. Wichmann, T. Lehnert, R.W. Bauer, H. Ackermann, T.J. Vogl; *Frankfurt a. Main/DE (MoritzAlbrecht@gmx.net)*

Purpose: To investigate the impact of radiological experience on diagnostic performance and inter-observer reliability regarding CT and MRI reporting of non-colorectal liver metastases (NCRLM).
Methods and Materials: CT and MRI examinations of 55 patients with histopathologically proven NCRLM were included. Images were acquired within 6 weeks showing stable disease according to RECIST 1.1. Analyses were performed by four observers with varying levels of experience regarding imaging of NCRLM (Reviewers A,B,C and D with respectively > 30, > 20, > 3 years and < 1 years of experience). Per-segment sensitivity, specificity and Cohen's Kappa (κ) for diagnosed segments per patient were calculated.
Results: CT sensitivity and specificity was for reviewer A 95.41/90.36%, B 87.79/79.77%, C 79.05/76.71%, D 72.89/79.25% and regarding MRI A 95.62/94.85%, B 82.98/82.05%, C 82.38/78.93%, D 63.01/69.53%. Overall inter-observer agreement was higher for CT (κ=0.432, $p < 0.001$) than MRI (κ=0.409, $p < 0.001$). The experienced reviewers A and B achieved superior agreement for MRI (κ=0.629, $p < 0.001$) than CT (κ=0.580, $p < 0.001$) unlike the less experienced observers C and D (MRI κ=0.340; CT κ=0.480, $p < 0.001$, respectively).
Conclusion: While diagnostic performance in the detection and localisation of NCRLM depends on observer experience for both modalities, this effect is more distinct regarding MRI than CT studies.

Author Disclosures:
R.W. Bauer: Speaker; On the speakers' bureau of Siemens Healthcare, Computed Tomography division.

B-0429 11:18

Application of dual-energy CT in hypervascular neoplstic lesions of liver: subjective and objective analysis in 64 lesions

M.D. Mahajan[1], R. Kakkar[2], S. Soneji[3], S.B. Desai[2]; [1]*Bangalore/IN*, [2]*Mumbai/IN*, [3]*Montreal, QC/CA (dr.muktamahajan@gmail.com)*

Purpose: To compare the attenuation difference and conspicuity of hypervascular liver neoplasia using dual-energy CT (DECT) reconstructed at 80 and 140 kVp. It is hypothesized that lower kVp imaging aids in their detection.
Methods and Materials: Thirty-one consecutive patients of hypervascular lesions (hepatomas and Hepatic metastasis) with arterial phase enhancement were recuited during 6 months. Data set of triple-phase CT was reconstructed at 80 and 140 kVp. A total of 64 hyperenhancing neopastic lesions (solitary and multifocal) were evaluated by two radiologists. HU values were recorded at the center of enhancing tumour and at the adjacent liver parenchyma. The attenuation difference between the two was calculated at both the kVp values and tested for significance.
Results: All lesions were idenitifed in 80 and 140 kVp imaging. Both radiologists noted better conspicuity in arterial phase of 80 kVp. The mean attenuation of liver tumours at 80 and 140 kVp were 81.20±13.98 and 58.93±26.21, respecyively. Mean attenuation of adjacent liver at same kVp values were 57.46±28.19 and 47.48±26.84, respectively. The mean attenuation difference between hypervascular tumour and surrounding liver was 23.75±6.29 at 80 kVp and 11.23±5.01 at 140 kVp in arterial phase of DECT. This difference was statistically significant.
Conclusion: The significantly greater attenuation difference at 80 kVp makes the lesion significantly more conspicuous on subjective analysis, when compared with that at 140 kVp. Arterial phase DECT is beneficial in early detection of small hypervascular liver tumours and thus could have an impact on staging and management of disease.

B-0430 11:26

Intermediate-stage HCC treated with TACE: proposal for a new scoring system

B. Ginanni, A. Scionti, F. Calcagni, P. Scalise, I. Bargellini, C. Bartolozzi; *Pisa/IT (alessandra86sc@gmail.com)*

Purpose: To identify clinical and radiological predictors of survival in patients with intermediate-stage HCC undergoing TACE and to develop an objective point score useful in patients' stratification.
Methods and Materials: We retrospectively reviewed clinical and demographic data of 149 patients (125 males; mean age 65.1years) with naïve intermediate-stage HCC treated with TACE between January 2006 and December 2011. Post- procedural radiological response was defined in according to mRECIST criteria. Univariate and multivariate analysis was carried out to identify predictors of overall survival (OS) and time-to-progression (TTP).
Results: Mean follow-up was 24.5 ± 20.3 months. Median OS and TTP were 22.7 months and 336 days, respectively. At multivariate analysis, strongest independent negative prognostic factors for OS were: age > 65 years (HR 1.77; 95% CI: 1.18-2.67), ascites (HR 2.44; 95% CI 1.32-4.29), maximum total HCC diameter according to mRECIST > 61 mm (HR: 1.96; 95% CI 1.28-3.08) and 1-month overall radiological response (HR 1.70; 95% CI 1.30-2.20). They were used to create a 6-point scale score. Finally, three groups of patients were identified. Patients with scores 0-1 (group A) had a significantly longer OS (57.8 months) and TTP (12.7 months), compared to patients with scores 2-3 (21.1 and 8.2 months, group B) and scores 4-6 (8.0 and 6.3 months, group C) ($p < .0001$).
Conclusion: Combining pre- and post-TACE parameters, our scoring system enables a simple stratification of patients with intermediate-stage HCC and may help in identifying patients who, after the first TACE cycle, may benefit from different treatment approaches.

B-0431 11:34

Significance of gadoxetic acid-enhanced MR imaging signal intensity for predicting the efficacy of hepatic arterial infusion chemotherapy in hepatocellular carcinoma

N. Fujita, A. Nishie, Y. Asayama, K. Ishigami, Y. Ushijima, Y. Takayama, D. Okamoto, K. Morita, H. Honda; *Fukuoka/JP*

Purpose: To clarify the relationship between the signal intensity (SI) in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging and the efficacy of hepatic arterial infusion chemotherapy (HAIC) in hepatocellular carcinomas (HCCs).
Methods and Materials: A total of 14 patients with HCC who underwent gadoxetic acid-enhanced MR imaging prior to HAIC using cisplatin and 5-flurouracil were enrolled. In the hepatobiliary phase, the SI of the HCC and the background liver was calculated. Patients were assigned to the high- or low-intensity group based on the median value of their SI ratio (HCC SI/background liver SI). In 5 surgically resected cases, the expression of organic anion-transporting polypeptide 8 (OATP8, synonymous with OATP1B3) of tumour cells was evaluated. A progression-free survival analysis was performed using the Kaplan-Meier method and the log-rank test. The OATP8 expression of these two groups was analyzed using chi-square test.
Results: The SI ratio was 0.568 ± 0.093 (mean ± standard deviation) in the high-intensity group and 0.252 ± 0.086 in the low-intensity group. The high-intensity group had a higher progression-free survival rate than the low-intensity group ($p < 0.05$). The OATP8 expression of high-intensity group was significantly higher than that of low-intensity group ($p < 0.05$).
Conclusion: HCCs showing high intensity in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging can be more sensitive to HAIC than those showing low intensity.

B-0432 11:42

Gd-EOB-DTPA-enhanced MRI: diagnostic application of the evaluation of the enhancement kinetic curve obtained with MRI of liver tumours

B. Medvedeva, A. Lukyanchenko; *Moscow/RU (m-diagnostica@yandex.ru)*

Purpose: To evaluate liver tumour specific features of the enhancement kinetic curve obtained with Gd-EOB-DTPA-enhanced MRI.
Methods and Materials: 175 patients with different liver lesions underwent dynamic MRI with IV injection of 0.1 ml/kg of gadoxetic acid. The data obtained were combined to create receiver operating characteristic curves. The histopathological confirmation of findings was a reference standard in all cases.

Results: There was a statistically significant correlation between contrast enhancement kinetic curve and histological attributes of tumors ($p < 0.005$). Maximum contrast enhancement peaks were observed: in HCC: the single peak enhancement obtained in AP - 43/93, 46.2% or in PVP - 50/93, 53.8%, in HCA: the single peak enhancement obtained in AP - 3/7, 42.8% or in PVP - 4/7, 57.2%, but less pronounced than in HCC, in FNH: the peak enhancement obtained in AP followed by plato - 50/52, 96.1%), in CCC: the single peak enhancement obtained in HBP- 5/5, 100%, in hemangioma: the single peak enhancement was obtained in EP - 3/3, 100%, in PEComa: the single one was in PVP - 2/2, 100%. In colorectal metastasis: two peak enhancements were obtained (hypervascular in AP and in EP - 6/10, 60%, hypovascular in PVP and in HBP - 4/10, 40%).
Conclusion: The analysis of the contrast enhancement kinetic curves obtained for different types of liver lesions when gadoxetic acid enhanced-MRI performed is a useful tool for the differential diagnosis. The method has a high sensitivity of 98.8%, and specificity of 81.8%.

B-0433 11:50

Comparision of monoexponential and biexponential models of diffusion-weighted MRI in differential diagnosis of VX2 small hepatic tumours

Y. Zhou, M.Y. Wang, J.B. Gao; *Zhengzhou/CN (zhouyue779@163.com)*

Purpose: To investigate the value of monoexponential model with single b-factor and biexponential model withextended b-factor range of diffusion-weighted imaging (DWI) in differential diagnosis of VX2 hepatic tumours in rabbits (≤3 cm).
Methods and Materials: In the 14 day after planting, fifty planted VX2 hepatic tumours in New Zealand white rabbits were underwent DWI based on single b-factor (b values of 0 and 800 s/mm^2) and multi-b-factor (b values of 0, 30, 50, 100, 150, 200, 300, 400, 500, 600,700 and 800 s/mm^2). Paired comparison of Apparent diffusion coefficient (ADC), ADCslow, ADCfast and ffast values were measured in the rim of tumour (TR) and the normal region (NR). The best thresholds of ADC, ADCslow, ADCfast and ffast were calculated by the receiver operating characteristic curve (ROC).
Results: There was significant difference between TR and NR in ADC values [$(0.27\pm0.05)\times10^{-3}$ mm^2/s vs. $(0.34\pm0.07)\times10^{-3}$ mm^2/s] ($P < 0.05$). The ADCslow value of the NR was also higher than that of TR [$0.30\pm0.08\times10^{-3}$ mm^2/s vs. $0.17\pm0.05\times10^{-3}$ mm^2/s] ($P < 0.05$). There was no significant differences in ADC fast and fast values between TR and NR ($P > 0.05$). The areas under ROC curves of ADC, ADCslow, ADCfast and ffast were 0.85, 0.92, 0.69 and 0.44, respectively. The specificities of ADC, ADCslow, ADCfast and ffast were 87.5%, 93.7%, 57.1% and 37.5% and the sensitivities were 76.9%, 84.6%, 46.2% and 84.6%, respectively.
Conclusion: The ADC value of monoexponential model and the ADCslow value of biexponential model provide certain value for differential diagnosis of small hepatic tumours.

10:30 - 12:00 **Room C**

Breast

SS 602

Imaging techniques and interventions

Moderators:
F. Engelken; Berlin/DE
F. Pediconi; Rome/IT

B-0434 10:30

The value of BIRADS classification in paediatric population and radiologic management of lesions

Ö.S. Okcu[1], F. Can[2], I. Bilgen[1], A. Oktay[1]; [1]*Izmir/TR*, [2]*Kutahya/TR (ozsezginok@hotmail.com)*

Purpose: Here, we aim to document the feasibility of BIRADS in paediatric age group and to evaluate common paediatric breast problems according to BIRADS-US lexicon.
Methods and Materials: The medical records and ultrasound database of patients,aged 18 and less were reviewed retrospectively from September 2011 to December 2013.A total of 149 patients underwent breast US. The lesions were classified according to BIRADS-US lexicon.BIRADS scores are compared with histopathology results of the lesions excised.
Results: Of 149 patients, 125 were girls (83.8%) and 24 were boys (16.1%).Average age was 13.5. 44 patients had different types of breast problems which were not included in the lexicon. 38 patients were categorized as BIRADS 1 (36.1 %). Breast lesions in 29 patients were categorized as BIRADS 2 (27.6 %); in 29 patients as BIRADS 3 (27.6 %) and in 9 patients as BIRADS 4 (9.2 %).There wasn't any BIRADS 5. 9 BIRADS 3 lesions and 6 BIRADS 4 lesions were excised. Histopathologic examination revealed only two malignancies, both were classified as BIRADS 4.
Conclusion: As the spectrum of breast lesions in children and adolescents varies markedly from that for adults, almost one-third of our patients could not be classified using BIRADS lexicon.We believe that the lexicon needs further innovations to include more benign diseases in terminology for paediatric patients.Besides, the radiologist should be very cautious to classify BIRADS 3 versus BIRADS 4 lesions to influence the surgeon in the right way to avoid unnecessary biopsies.

B-0435 10:38

Review of invasive cancers not initially identified by automated whole-breast ultrasound screening: an analysis of the rate of tumour growth

K.M. Kelly; *Pasadena, CA/US (drkelly@kkmdinc.com)*

Purpose: To evaluate the percentage of ultrasonically visible, small, invasive breast cancers that grow significantly, and establish rational screening intervals based on these growth rates.
Methods and Materials: From a database of approximately 20,000 automated whole-breast ultrasound screening (AWBUS) examinations, 36 invasive cancers were identified that had 48 sonographic examinations prior to discovery. The volume of each cancer when first missed was < 1 cc. These cancers were divided into those found by subsequent routine screening (20) and those presenting physically (16). Initial and subsequent cancer and diameters and volumes were calculated from consensus measurements of 3 orthogonal measurements on automated or handheld ultrasound studies. Estimated doubling time was calculated based on the time between sonographic imaging of each cancer on the initial and final tumour volumes.
Results: 100% of invasive cancers doubled in volume in less than 1½ years; 93% doubled in less than one year; but 88 % of these cancers would have been expected to be between 5 and 10 mm in diameter (3 doubling times) at least once on annual screening. Cancers presenting physically averaged doubling in 0.47 years, were 19.6 mm average maximum diameter at discovery and averaged 59.5 years of age; and those presenting from imaging doubled in 0.47 years, were 10.5 mm at discovery and averaged 66.8 years of age.
Conclusion: Assertions that a significant portion of sonographically visible, invasive cancers stabilise or disappear are not supported by our data. Most invasive cancers are between 0.5 and 1 cm at least once on annual screening.

Author Disclosures:
K.M. Kelly: Advisory Board; SonoCine,Inc. Board Member; SonoCine,Inc. Founder; SonoCine,Inc. Shareholder; SonoCine,Inc.

B-0436 10:46

Detection of malignant and benign breast lesions in contrast-enhanced spectral mammography (CESM) compared to ultrasound (US): initial results

C.M. Perez-Fernandez, F. Schmitzberger, H. Amer, T. Denecke, E.M. Fallenberg; *Berlin/DE (carmen.perez-fernandez@charite.de)*

Purpose: To compare contrast-enhanced spectral mammography (CESM) and ultrasound (US) in the detection of histologically proven breast cancers using postoperative histology as the reference standard.
Methods and Materials: A total of 98 patients with newly diagnosed invasive breast cancer or ductal carcinoma in situ (DCIS) were enrolled in this ethical approved study. CESM and US were performed and interpreted by breast specialists in clinical routine according to BIRADS (Birads > 3 was set as a cut of for true positive). Results were documented and correlated to define the index cancer, possible secondary cancer deposits and other potentially benign candidate lesions visible on at least one imaging modality.
Results: Among the 206 histologically confirmed lesions, 183 (87%) were malignant and 23 (11%) were benign. The index cancer was depicted in 98/98 (sensitivity 100%) patients by means of both US and CESM. In a lesion-based analysis, sensitivity and specificity of US were 67% (123/183) and 17% (4/23); while CESM reached 89% (155/173) and 30% (7/23). The differences have been significant ($p < 0.001$).
Conclusion: CESM provides a better detection rate than US especially due to detection of additional lesions in patients with newly diagnosed breast cancer.

Author Disclosures:
T. Denecke: Speaker; Bayer Healthcare. **E.M. Fallenberg:** Research/Grant Support; GE, Siemens, Bayer. Speaker; GE, Siemens, Bayer, Guerbet.

B-0437 10:54

Contrast-enhanced spectral mammography in treatment monitoring: an initial comparison to breast MRI

S. Ravaioli[1], R. Sghedoni[1], A. Nitrosi[1], V. Iotti[1], C. Coriani[1], R. Vacondio[1], C. Mori[1], V. Ginocchi[2], P. Pattacini[1]; [1]*Reggio Emilia/IT*, [2]*Guastalla/IT (sara.ravaioli@asmn.re.it)*

Purpose: To compare Contrast-Enhanced Spectral Mammography (CESM) and Contrast-Enhanced MRI (CE-MRI) in breast cancer response to chemotherapy.
Methods and Materials: 43 consenting women with in situ, lobular or ductal carcinoma and with indication of neoadjuvant chemotherapy (NAC) were enrolled into this prospective study between October 2012 and October 2014. The patients underwent CESM and CE-MRI before, after the first NAC cycle and after the end of NAC. 29 patients completed the therapy up to October 2014. Response to therapy was evaluated for each patient using the variation of the largest dimension of malignancies measured on CE-MRI and CESM image sets. A CESM examination consisted in a pair of low and high energy exposures for each mammographic view, combined to visualize lesions with contrast up-take. CESM and CE-MRI size measurements were compared through correlation (Pearson) and agreement (Paired t-test). Clinical outcomes were also compared: patients were considered as responding to therapy when size reduction after NAC was larger than 30%.
Results: Pearson correlation coefficients were 0.982, 0.946 and 0.894 and paired t-test p-values were 0.71, 0.20 and 0.43, respectively before, during and after NAC. P-values show that there was no statistical difference between measurement sets with CESM and MRI at each stage. Clinical outcomes (response or non-response to chemotherapy) with CESM and CE-MRI were identical for 28 over 29 patients.
Conclusion: CESM and MRI lesion size measurements were highly correlated and in strong agreement. CESM may be an alternative to CE-MRI in assessing response to chemotherapy in patients with breast cancer.

B-0438 11:02

Background parenchymal enhancement (BPE) in contrast-enhanced spectral mammography (CESM): classification and evaluation of impact on diagnostic performance

M. Sklair-Levy, A. Shalmon, Y. Servadio, A. Rundstein, O. Halshtok, M. Gotlieb, Y. Yagil; *Ramat Gan/IL (miri.sklairlevy@sheba.health.gov.il)*

Purpose: BPE usually refers to normal enhancement of fibroglandular tissue on breast MRI. Our aim is to describe and classify BPE on contrast mammography and determine the effect on BI-RADS category assessment, biopsy and cancer detection rate.
Methods and Materials: Consecutive screening and diagnostic CESM examinations were reviewed and for each BPE pattern was recorded (no enhancement, mild, moderate, marked). Associations with patient age, menopausal status, BI-RADS category, biopsy rate, and cancer yield were compared using chi-square tests.
Results: Of the 200 CESM examinations, 59% showed no enhancement; 21.5% showed mild enhancement, 12% moderate, and 7.5% marked enhancement. BPE was more frequent among pre-menopausal patients, younger than 50 years. Women with no enhancement had significantly higher number of BI-RADS categories 1 and 2 examinations (60%) than women with moderate (21%) or marked (20%) enhancement. The BI-RADS category 3 rate was 13% overall and was significantly lower for women with no enhancement (12% vs 21% for women with moderate, and 27% for women with marked enhancement). There was a significant difference in biopsy and cancer detection rate among enhancement categories: 22% and 73% for women with no enhancement vs 54% and 46% for moderate; and 47% and 43% for women with marked enhancement.
Conclusion: Background parenchymal enhancement on CESM is associated with younger patient age, pre-menopausal status and a significantly lower rate of BI-RADS categories 1 and 2 assessments. BI-RADS category 3 assessments, biopsy rate and negative cancer yield were significantly more common among moderate and marked enhancement categories.

Author Disclosures:
Y. Yagil: Employee; Eldan.

B-0439 11:10

Comparison of the accuracy of US-guided biopsy of breast masses performed with 18-gauge, 16-gauge and 14-gauge automated cutting needle biopsy devices

M.L. Huang, K. Hess, R.P. Candelaria, M. Eghtedari, B.E. Adrada, N. Sneige, B.D. Fornage; *Houston, TX/US (mlhuang@mdanderson.org)*

Purpose: It is usually believed that the use of larger-gauge needles improves the diagnostic accuracy of ultrasound (US)-guided core needle biopsy (CNB) of breast masses. Because in our Department, some breast imagers use 18-gauge CNB while others use 16-gauge or 14-gauge cutting needles, we aimed to compare the diagnostic accuracy of CNBs performed with each of those three different sizes of needle.
Methods and Materials: We retrospectively reviewed the charts of 1112 patients who underwent US-guided CNB of breast masses utilizing 14-gauge, 16-gauge, and 18-gauge cutting needles. Only cases with histopathological correlation with surgical excision or with a minimum of 2 years of imaging follow-up were included. Rates of CNBs with sample inadequacy, discordance with surgical histopathology or at imaging follow-up were computed for each needle gauge and compared using Fisher's exact test.
Results: 703 CNBs met the inclusion criteria, including 203 CNBs with 14-gauge, 235 with 16-gauge, and 265 with 18-gauge needles. The median size of the target breast masses was 1.5 cm. There was no statistically significant difference between the specimen inadequacy rates with 14-gauge, 16-gauge and 18-gauge needles (0% [0/203], 0.8% [2/235] and 1.1% [3/265], respectively) (p=0.39), between the rates of discordance with surgical histopathology (2%[3/152], 3.5% [6/173], and 3.3% [6/182], respectively) (p=0.76), and between the rates of discordance on imaging follow-up (0% [0/24], 0% [0/28], and 2% [1/45], respectively) (p=1.0).
Conclusion: There was no statistically significant difference in diagnostic accuracy of US-guided CNB of breast masses obtained with 14-gauge, 16-gauge, and 18-gauge cutting needles.

B-0440 11:18

Modern management of acute breast abscesses: radiological interventions replacing surgical incisions?

N.A. Healy, P. Hughes, M. Stenson, S. Harte; *Dublin/IE (nualahealy@hotmail.com)*

Purpose: Traditionally acute breast abscesses were managed with a combination of antibiotics and surgical intervention. Despite advances in imaging techniques and minimally invasive interventions, acute abscesses remain poorly managed with significant treatment delays. The aim of this study was to review management of acute breast abscesses in a symptomatic breast service over 4-years and develop an updated algorithm for effective and minimally invasive abscess management.
Methods and Materials: From Jan 2010 to June 2014 all acute abscesses referred to the radiology service were retrospectively reviewed with attention to patient demographics, US findings, aetiology, radiological or surgical intervention, treatment duration & outcome. Total number of ultrasounds (US), aspirations and US guided catheter placements were recorded.
Results: 203 acute abscesses attended with 160 US guided aspirations and 43 US guided catheter placements over 4 years. Patients required on average 2.3 US and 1.4 aspirations during each acute episode. Puerperal abscesses accounted for 38 (23%) of the aspiration cases and for 29 (67%) of the catheter cases. The mean abscess size managed with drainage catheters and aspiration was 4.4 cm and 2.7 cm respectively. 4 (2.2%) patients ultimately required surgical intervention.
Conclusion: Radiological assessment and minimally invasive intervention is an accessible and effective strategy in the management of acute breast abscesses. This approach limits more aggressive surgical interventions with improved patient acceptability. An updated treatment algorithm should be adopted in all symptomatic breast clinics to ensure timely treatment and optimize outcome.

B-0441 11:26

Clinical and sonographic predictors of complete resection for percutaneous excision of benign symptomatic breast lesions using US-guided vacuum-assisted breast biopsy system

J.P. Salazar, I. Miranda, Y.K. Ng Wong, C. Avella-García, I. Rubio, R. Salvador; *Barcelona/ES (jpsameaj@yahoo.com)*

Purpose: To determine possible clinical and sonographic predictors of complete resection for percutaneous excision of benign symptomatic breast lesions by US-guided vacuum-assisted breast biopsy (VAB).
Methods and Materials: Prospective study of symptomatic benign breast lesions treated by US-VAB by using 10-G SenoRx EnCor device at Vall d'Hebron Hospital between March 2012 and June 2014. All patients were evaluated by a breast radiologist and surgeon. Size, shape, margins, multiple lesions, distance to pectoral and to skin were determined. Clinical and sonographic surveillance were done 24h after treatment and 3-6 months later.
Results: 74 patients were included. Mean age was 37y. Mean size of lesions was 18.5 mm (4 to 35 mm), median distance to pectoral 5.2 mm and to skin 4.7 mm. Complete resection at 24-hours was achieved in 86% of cases. At 6 months 54% of the lesions were completely removed and had no recurrence by US; however, treated lesions were clinically non-palpable and assymptomatic in 85% of women. Women with residual lesions on US were younger (31 vs 39y) and had nodules closer to skin (mean distance 6.14 vs 7.4 mm) and to pectoral (mean distance 6.6 vs 7.6 mm); however none of these differences were statistically significant. Nodules with US residual tissue or symptomatic after 3-6 months were bigger in size (mean 22.1 vs. 17.1 mm) than nodules completely removed p=0.002.
Conclusion: Percutaneous removal of symptomatic benign breast lesions by US-VAB is an effective therapy relieving original symptoms at 3-6 months. There are important clinical and sonographical variables to consider when proposing this treatment

Author Disclosures:
R. Salvador: Advisory Board; BARD Medical. Consultant; Philips Healthcare System.

B-0442 11:34

Papillary lesions of the breast: is ultrasound-guided VAB useful in their management?

V. Bertani[1], P. Clauser[1], A. De Nicolò[1], M. Pizzamiglio[2], C. Zuiani[1], M. Bazzocchi[1], E. Cassano[2]; [1]*Udine/IT*, [2]*Milan/IT (valeriabert@hotmail.it)*

Purpose: To evaluate the role of ultrasound-guided vacuum-assisted biopsy (US-VAB) in the management of asymptomatic intraductal papilloma (IP) of the breast.
Methods and Materials: Between January 2003 and June 2013 we retrospectively included 142 asymptomatic patients (mean age 53 years, range 22-79) who underwent US-VAB with subsequent histological diagnosis of IP. After procedure, lesions underwent surgery or follow-up. During follow-up, IP which exhibited morphological changes (e.g. increased size or vascularity) underwent subsequent surgical excision. Lesions with confirmed IP at histological diagnosis from surgical specimens or with follow-up stability (at least over 24 months) were considered true positive. Forty-seven patients had follow-up inferior than 24 months and were excluded. We calculated negative predictive value (NPV) of US-VAB considering as false negative cases (FN) those with malignant component (MC) at histological diagnosis from surgical specimens.
Results: The final analysis included 95 cases: 17 (17.9%) were submitted to surgical excision after biopsy and 78 (82.1%) underwent imaging follow-up. In this latter group, 10 (12.8%) exhibited morphological changes and underwent surgery. MC was found in 2/17 (11.8%) cases and in 3/10 (30.0%) cases respectively. The remaining 68/78 (87.2%) lesions showed follow-up stability (at least over 24 months). FN and NPV of US-VAB were 5/95 lesions (5.3%) and 94.7% respectively.
Conclusion: US-VAB of asymptomatic IP showed high NPV (94.7/%) and small number of FN. Imaging follow-up associated with US-VAB could be considered as alternative to surgery for management in selected cases of IP.

B-0443 11:42

Non-surgical complete excision of small suspicious breast lesions using the breast lesion excision biopsy system (BLES)

N.M. Abdel Razek; *Giza/EG (naglaabdelrazek@yahoo.com)*

Purpose: To assess the diagnostic efficiency of BLES in comparison to OB in diagnosis of small suspicious breast lesions.
Methods and Materials: The study is a prospective one conduced in a single center during the period from February 2011 to July 2014.The ethical committee approval and patients written consents were obtained.The study included 290 patients with small suspicious non-palpable breast lesions. The procedures were done both under ultrasound and sterotactic guidance. We included lesions categorized as BIRADS 4& BIRADS 3 with positive family history for breast cancer. The histopathology results were analyzed and compared to the results of open surgery in the histopathologically proven malignant cases.
Results: 290 suspicious lesions were successfully removed using the BLES,20 % (58/290) were diagnosed after histopathology as benign including fibrocystic disease,sclerosing adenosis ,radial scars and papillomas without atypia.31%(90/290)were diagnosed as high risk lesions including ,papillomas with atypia, ALH, ADH & 49 %(142/290) were diagnosed as malignant including DCIS, LCIS,IDC&ILC.the maximum size removed was 12 mm diameter.All histopathologically proven malignant lesions were exposed to Re-surgery.there was no underestimation encountered by the BLES.The margin was free in 71.8% of cases (102/142 malignant lesions) and the margin was flushed in 28.2%(40/142)of malignant cases.
Conclusion: BLES is an efficient large needle biopsy procedure for accurate histopathology diagnosis of suspicious small & borderline lesions as well as the unclassified microcalcfications. BLES offers complete lesion removal with available margin evaluation and no underestimation thus much indicated in borderline lesions offering good results similar to that of open surgery.

B-0444 11:50

Can the breast lesion excision system (BLES) under stereotactic guidance be used as a therapeutic tool in the assessment of small areas of microcalcifications of the breast?

R.-I. Milos, M. Bernathova, P.A.T. Baltzer, K. Pinker-Domenig, P. Kapetas, M. Rudas, T.H. Helbich; *Vienna/AT (ruxandra-iulia.milos@meduniwien.ac.at)*

Purpose: BLES is a new, automatic percutaneous breast biopsy device that uses radiofrequency cautery to excise a whole sample in one piece. The aim of this study was to assess if BLES under stereotactic guidance can be used as a therapeutic tool in the assessment of small areas of microcalcifications of the breast by providing samples with clear margins.
Methods and Materials: In this retrospective study 129 patients with a single suspicious (BIRADS® 4 or 5) small area of microcalcifications underwent stereotactic guided BLES (Intact® Medical USA). Of these, 28 patients (21.7%) with small areas of microcalcifications (≤15 mm) underwent both, BLES and subsequent surgery. In all lesions BLES was performed with the largest available 20 mm tissue basket. The size of the basket was chosen to allow a save margin of at least 5 mm. Histopathology findings from BLES and subsequent surgery were compared. Identical, total excision, underestimation, and false-negative findings were assessed.
Results: BLES revealed twelve (42.8%) B3 lesions, eight (28.5%) ductal carcinomas in situ (DCIS), and eight (28.5%) invasive cancers. Identical results between BLES and surgery was seen in 13/28 (46.4%) lesions. Surgery confirmed total excision of BLES in 13/28 (46.4%) lesions. Underestimation was seen in 2/28 (7.1%) lesions. No false negative results were seen.
Conclusion: BLES allows accurate diagnosis of small areas of microcalcifications with few underestimates and no false negatives. BLES is a diagnostic tool but cannot be considered as a therapeutic tool because total excision is only seen in 46.4% of small areas of microcalcifications.

10:30 - 12:00 **Room Z**

Computer Applications

SS 605

Dose tracking: assessment and reduction of artefacts

Moderators:
N. Kachenoura; Paris/FR
J.H. Thrall; Boston, MA/US

B-0445 10:30

Impact of automated attenuation-based tube voltage selection on radiation dose at CT: an observational big data analysis on a global scale

J.V. Spearman[1], J.L. Wichmann[1], F.G. Meinel[1], I. Driesser[2], C. Canstein[2], R.R. Bayer[1], S. Mangold[1], C.N. De Cecco[1], U.J. Schoepf[1]; [1]*Charleston, SC/US*, [2]*Forchheim/DE (docwichmann@gmail.com)*

Purpose: To evaluate the "real world" impact of automated tube voltage selection (ATVS) on radiation dose at computed tomography (CT) on a larger, global scale encompassing all body regions and types of CT examinations.
Methods and Materials: Data from 86 centres across the world were analysed. All CT interactions were automatically collected and transmitted to the CT vendor during 2 six-week periods before and after the implementation of ATVS. 164,323 unique CT acquisitions were analysed. Acquisitions were categorised by body region and type of examination. The tube voltage choice and volume CT dose index (CTDIvol) were compared between examinations performed before and after ATVS implementation.

Results: Across all types of CT examinations and body regions, CTDIvol was 14.5% lower ($p < 0.0005$) when ATVS was used (n=30,313) compared to the period before ATVS was implemented (n=79,275). Relative reductions in CTDIvol were most notable for CT of the temporal bone (-56.1%, $p < 0.0005$), peripheral run-off CT angiography (-48.6%, $p < 0.0005$), CT of the paranasal sinus (-39.7%, $p < 0.0005$), cerebral/carotid CT angiography (-36.3%, $p < 0.0005$), coronary CT angiography (-25.2%, $p < 0.0005$) and head CT (-23.9%, $p < 0.0005$). A significant increase in CTDIvol was observed in renal stone protocols (+26.2%, $p < 0.0005$) and thoracic or lumbar spine examinations (+6.5%, $p < 0.005$).
Conclusion: By automatically selecting the most dose-efficient tube voltage for each individual patient and examination type, ATVS helps to significantly reduce radiation dose across most, but not all, CT applications.

Author Disclosures:
I. Driesser: Employee; Siemens Healthcare AG. **C. Canstein:** Employee; Siemens Healthcare AG. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0446 10:38

Lessons learned from developing and establishing a national web-based MDCT DRL survey program

A.B. Wallace, A. Hayton; *Yallambie/AU (anthony.wallace@arpansa.gov.au)*

Purpose: To review the lessons learned after the establishment of the MDCT web-based survey and data collection by the National Diagnostic Reference Level Service (NDRLS) and assess any impact on patient dosimetry.
Methods and Materials: Over 2700 MDCT patient records were submitted and analysed to ascertain trends in dosimetry, protocol application and participant compliance.
Results: A national dataset of over 1500 compliant vs 2700 submitted surveys has been accrued from which the following may be observed; 1. The web-based package is a suitable method for data surveys and reporting. 2. National MDCT facility participation is voluntary and greater than 30%. 3. Public hospital facilities registered early while private practice facility participation has been consistently growing. 4. Annual dosimetry data across the 6 scanned body regions has been consistent (95% CI) over the 3-year period. 5. The introduction of iterative reconstruction algorithms has had a positive impact on patient dose. 6. Generally, the participation of specialist paediatric facilities has been poor. 7. International dosimetry comparisons have indicated that Australia is 'average' in patient MDCT dose distribution.
Conclusion: Survey dosimetry data over the previous 3 years has been consistent. However, the introduction of iterative reconstruction algorithms has reduced average patient dose per protocol by approximately 20% or greater. This may necessitate a review of Australian published MDCT DRLs in the near future.

B-0447 10:46

Adult CT dose monitoring using web based radiation dose tracking software

M. Twomey, J. Ryan, K. Murphy, M. Sheehy, M.M. Maher, O.J. O' Connor; *Cork/IE (mariatwomey@msn.com)*

Purpose: Dose monitoring, audit and CT optimization are key factors in achieving CT dose reduction. We assess the ease and feasibility of using web based radiation dose tracking software (RDTS) (DoseWatch, GEHC) in assessing radiation dose; dose length product (DLP) and size-specific dose estimate (SSDE) at adult CT and comparing these values to published diagnostic reference levels (DRLs).
Methods and Materials: Following IRB approval, 576 consecutive CT studies were retrospectively assessed (223 thorax, 353 abdomen-pelvis). Information regarding DLP, SSDE, demographics, effective diameter and time of acquisition were automatically obtained via RDTS. Information on radiographer experience and inpatient status was recorded.
Results: The mean thoracic CT DLP was 282±151 mGycm (range 5-1753) and SSDE 9.22±1.82 (range 5-16 mGy). Mean radiation dose from CT abdomen-pelvis was 621±231 mGycm (range 244-1582); SSDE 13.7 mGy (range 3-21 mGy). Both studies had mean levels below published DRLs [thorax: 460 mGycm; abdomen-pelvis 640 mGycm]. 12% had anomalously high doses;higher doses were significantly associated with inexperienced technologists ($p=0.009$), out of hours scanning ($p=0.04$) and multiphase studies ($p < 0.001$). There was a moderate correlation between radiation dose and effective diameter as expected (Thorax: Pearson $r=0.566$, $p < 0.001$; Abdomen-pelvis: Pearson $r=0.466$, $p < 0.001$). No significant difference between inpatients and outpatients was identified.
Conclusion: Our mean thoracic CT dose levels are significantly superior to published DRLs. RTDS results in excellent streamlining of Information collection and manipulation. In our study it quickly identified our mean doses for common examinations, pinpointed outliers and helped identify reasons for high radiation doses.

B-0448 10:54

Accuracy of SSDE calculation using radiation dose tracking software (RDTS)

M. Twomey, K. Murphy, C. Sullivan, K. Carey, N. Moore, O.J. O'Connor, M.M. Maher; *Cork/IE (mariatwomey@msn.com)*

Purpose: Accurate dose tracking is essential for CT protocol optimization and audit. Size-specific dose estimate (SSDE) calculation requires a user dependent time-consuming measurement of the anteroposterior (AP) and lateral diameters of the body part being imaged. We assess the accuracy and convenience of an automated SSDE calculation tool via RDTS (Dosewatch, GE Milwaukee, WI) that utilizes the median image of the CT radiograph.
Methods and Materials: Two readers manually calculated SSDE on 100 thorax (Tx) & 100 abdomen-pelvis (A-P) adult CT exams independently. These results were compared with automated values calculated using RTDS. Statistical analysis was performed using SPSS version 20.0.Pearson's correlation coefficient was used to compare reader obtained measurements; manual and automated measures of SSDE, effective diameter, lateral, AP diameters were compared using t-tests and Bland Altman plots.
Results: There was no significant difference between Manual (12.13±3.06 mGy) and automated (12.28±2.82 mGy) estimations for A-P SSDE values (mean 1%/0.16 mGy difference). A small but significant ($p < 0.01$) difference was seen between manual (8.87±2.20 mGy) and automated (9.35±2.46 mGy) Thorax SSDE values (mean 5%/0.48 mGy difference). For both Thorax and A-P, manual effective diameters were significantly higher ($p < 0.001$) than via automated methods [Tx - 30.31±4.58 V 28.92±4.18 cm] [A-P - 29.27±4.41 V 28.69±4.47 cm].
Conclusion: A time efficient reproducible automated SSDE calculation tool is essential for accurate dose tracking. This automated tool meets these criteria and is particularly accurate in calculating abdominopelvic doses. CT thorax SSDE calculations were comparable with manual calculations.

B-0449 11:02

Automatic cloud-based monitoring and analysis of computed tomography (CT) dose exposure using DICOM-structured report (DICOM-SR)

J. Boos, A. Meineke, R.S. Lanzman, C. Schleich, O.T. Bethge, G. Antoch, P. Kröpil; *Düsseldorf/DE (Johannes.Boos@med.uni-duesseldorf.de)*

Purpose: Automatic monitoring and analysis of dose related CT-data is ever more important regarding quality assurance and dose management in radiology. In this study DICOM-SR was used as a novel standard of monitoring these data independently of the provided CT-scanner.
Methods and Materials: We used a novel software device (Dose-Intelligence®, Pulmokard, Herdecke, Germany) based on DICOM-SR to monitor dose related data from CT examinations. The DICOM-SR of each single examination was automatically anonymised and sent from the institutional CT-scanners (n=5) to a cloud-server. Dose length product (DLP) and volumetric computed tomography dose index (CTDIvol) were automatically analysed in relation to national reference values (NRV) for the different body regions and stored in a database.
Results: Between 09/2011 and 10/2014 n=34941 CT-examinations performed on five different CT-scanners were monitored. Overall mean DLP and CTDIvol were 45%/43% compared to NRV. DLP and CTDIvol were 8.65 mGy/384.0 mGycm (43%/43%) for abdominal CT (n=6122), 41.4 mGy/642.8 mGycm (68%/64%) for cranial CT (n=8531) and 4.43 mGy/173.1 mGycm (44%/47%) for chest CT, respectively. Overall there were 2% exceedings of reference CTDIvol and 3% exceedings of reference DLP.
Conclusion: DICOM-SR is a comprehensive and reliable way to monitor radiation dose exposure from CT. With the presented device large scale analysis according to multiple parameters (e.g. DLP, CTDIvol, CT-protocol, patient age, size and weight) is possible providing great potential in dose management and optimization in radiological departments. The cloud- based approach enables even a multi-center dose monitoring.

B-0450 11:10

Simulation study about the accuracy of advanced airway geometry determination on MDCT using a computer-generated phantom

O. Weinheimer, C.P. Heußel, H.-U. Kauczor, M.O. Wielpütz; *Heidelberg/DE (weinheimer@uni-heidelberg.de)*

Purpose: We developed a computer-generated phantom simulating cross sections of airways with different inner diameters (1.2-18.0 mm) and wall thicknesses (0.3-1.5 mm) for the examination of the accuracy of our input parameter-free integral-based method (IBMpf) for airway geometry determination.
Methods and Materials: We varied the simulated parenchyma density outside the airways (-250/-500 HU) and down-sampled image resolution from original 0.0375 mm to average clinical resolution (0.3/0.6 mm) by pixel binning. Overall point spread function of a MDCT system was simulated by a Gaussian kernel (SD: 0.0-0.6 mm), and noise (SD: 0-40 HU) was added afterwards. We compared results from the full-width-at-half-maximum (FWHM) and the IBMpf methods to the pre-determined true values for lumen area (LA) and wall area (WA), by calculating the absolute relative error (RE).
Results: Mean RE with FWHM for all simulated airways ranged between 3.7% and 36.9% for LA and 8.0% and 136.0% for WA. RE with IBMpf was between 0.4% and 5.7% for LA, and between 0.5% and 17.3% for WA. RE increases for smaller airways, more noise, wider kernels and poorer resolution - which was more pronounced for WA than for LA. Largest RE occurred for WA with FWHM and IBMpf for the smallest simulated airway with 335.8% vs. 60.7%.
Conclusion: The digital phantom is a free and easy to use possibility to check the potential applicability and accuracy of algorithms or software tools for the measurement of airways in MDCT images. Advanced techniques like IBMpf are recommended for the measurement of airways.

B-0451 11:18

Lobewise registration of the lungs in computed tomography improves anatomically correct voxel-to-voxel mapping of inspiration and expiration data

T. Kaireit, S. Dettmer, O. Solyanik, W. Frank, H.-o. Shin; *Hannover/DE (till.kaireit@me.com)*

Purpose: To evaluate whether lobewise registration improves voxel-to-voxel mapping of inspiration and expiration data for assessment of lung function.
Methods and Materials: Twelve lung transplant recipients underwent twenty-eight paired inspiratory and expiratory CT examinations. Segmentation of the lung parenchyma and individual lobes (right upper and middle lobes were combined) was performed using a local, adaptive region-growing algorithm. The whole lung as well as individual lobes were registered applying a non-rigid registration algorithm using a diffeomorphic transformation model and cross-correlation as the similarity function. Registration results of the whole lung compared to registration of the individual lobes were evaluated in 3 different ways: visual assessment of lung boundaries and fissures by two radiologist, measurement of image similarity using cross-correlation, and measurement of overlapping lung volume. Results of the two quantitative measurements were compared with a paired *t* test.
Results: Regarding lung boundaries, registration of the whole lung resulted in more partial misalignments than individual lobe registration (25 vs. 9 cases). Furthermore, partial misalignments of the major fissures were seen in 26 (left) and 25 (right) vs. 6 (left) and 3 (right) cases, respectively. Both, image similarity and the overlapping lung volume were significantly higher using lobewise registration ($p < 0.001$, $p = 0.0015$, respectively).
Conclusion: Although substantial misalignments were not present in both registration approaches, two possible errors may hinder regional functional analysis: incorrect alignment of the fissures and distortions of peripheral regions of the lung particularly. The registration of individual lobes was performed with more accuracy and decreased distortion.

B-0452 11:26

CAD software for assessment of pulmonary nodules with 100 kV/Tin-filtered input data comparing iterative to filtered back projection reconstructions: a third-generation dual-source CT phantom study

S. Sudarski[1], V. Steck[1], M. Meyer[1], H. Haubenreisser[1], S.O. Schönberg[1], R. Vliegenthart[2], T. Henzler[1]; [1]*Mannheim/DE*, [2]*Groningen/NL (sonja.sudarski@medma.uni-heidelberg.de)*

Purpose: To evaluate a 100-kV chest CT protocol acquired with a tin filter (100 kV-SnF) at different tube currents reconstructed with filtered back projection (FBP) and an iterative reconstruction (IR) algorithm for pulmonary nodule assessment with a CAD software regarding sensitivity, rate of false positive nodules (FP) and radiation dose.
Methods and Materials: Different setups of artificial solid nodules (3 to 12 mm diameter) positioned in an anthropomorphic chest phantom were scanned at 120 kV/20 mAs, serving as lung cancer screening low-dose CT-protocol reference standard (RS), and at 100 kV-SnF with tube currents between 20-120 mAs. Scans were performed with a 3rd generation dual-source CT system (Somatom FORCE, Siemens Healthcare Sector). FBP reconstruction was performed, 100 kV-SnF data were additionally reconstructed using a model-based IR technique (ADMIRE, Siemens Healthcare) with different IR-strengths. Dedicated CAD software (LungCAD, Siemens Healthcare) was used.
Results: Sensitivity for the RS-protocol was 75 % and FP rate was 42 % (0.69 mSv mean dose). For the 100 kV-SnF, FBP datasets showed the lowest sensitivity independent from the tube current setting compared to IR 1, 3 and 5 datasets with 67% vs. 68%, 71% and 73% (FP rates of 5% vs. 4%, 5% and 19%, respectively). Highest sensitivity of 79% (14% FP rate) was achieved for 100 kV-SnF/20 mAs at IR 3 (0.03 mSv mean dose).
Conclusion: Compared to RS, a combined use of 100 kV-SnF/20 mAs and IR 3 increased sensitivity and decreased FP rate of CAD along with dose reduction of 96%. Increasing IR strength increased sensitivity but also FP rates.

B-0453 11:34

The visibility of lesions around hip prosthesis in gemstone spectral imaging dual energy CT: with or without metal artifact reduction software

J. Jeong[1], H.-J. Kim[1], J. Cha[2], H. Lim[1], S. Hong[1], J. Hwang[1]; [1]*Seoul/KR*, [2]*Bucheon/KR (nisroeld@naver.com)*

Purpose: To compare the diagnostic performances in patients after hip replacement arthroplasties using metal artifact reduction software (MARs) in gemstone spectral imaging (GSI) dual-energy CT (DECT) or not in different keV values.
Methods and Materials: Thirty hip joints with prosthesis in 20 patients who underwent GSI-DECT were included. The CTs were performed using fast kV-switching between 80 and 140 keV and data sets were reconstructed with monochromatic energies of 70, 90 and 110 keV with and without MARs. The areas were classified as 10 zones according to reference zone of DeLee and Charnley. All images were retrospectively reviewed by two experienced musculoskeletal radiologists in terms of the severity of beam-hardening artifacts, differentiation of the bony cortex and trabeculae and visualization of trabecular patterns by using a three-point scale.
Results: The lesions are least visualized using 70keV without MARs ($p < 0.0001$~0.7687). Zone II lesions are most well visualized when applied 110 keV without MARs ($p < 0.0001$~0.0169). The other zones' diagnostic performances with MARs or 110keV with MARs showed general similarity ($p < 0.0001$~0.8790). Interobserver agreement showed substantial agreement (k 0.64~0.75).
Conclusion: Monochromatic energy image with 110 keV without MARs is best for evaluating the acetabular zone II. Diagnostic performances are similar in the other zones when used MARs regardless of keV and when applied 110 keV without MARs.

B-0454 11:42

Adaptive statistical iterative reconstruction technique to reduce radiation dose of brain CT in children

P. Lupo[1], F.A. Lupo[2], G. De Matteis[1], G. Sticchi[1]; [1]*Foggia/IT*, [2]*Lecce/IT (pielupo@gmail.com)*

Purpose: The use of the algorithm ASIR, together with the specific study protocols (LOW), allows to significantly reduce the irradiated dose in CT scan examination of the paediatric patient.
Methods and Materials: Over 12 months, 25 children were examinated, divided into 3 groups according to age. All children were subjected to two series of scans of the brain, first at the entry then during hospitalization. The images obtained during the first scan were acquired with standard protocols and reconstruction filtered back projection (FBP). He then proceeded to back-reconstruction of the images obtained with the second scan technique with low-dose ASIR with increasing values using the same algorithm. To do this, we developed three scanning protocols, Low A, B and C, divided by age groups and based on a 30% reduction of Kv and mAs compared to standard protocols. To objectively evaluate the image quality, we applied the average standard deviation (MSD) of three different ROI by comparing the images obtained during the first scan, with those obtained with modified protocols and percentages increasing ASIR.
Results: The results obtained concerning the quality of the images produced showed no significant differences between MSD in the three study groups for the same use of the same reconstruction technique.
Conclusion: The study of diagnostic protocols we developed, associated with the use of ASIR to values of 60%, allowed to obtain satisfactory image quality for diagnostic purposes and iconographically comparable with those obtained with the standard protocol, reducing the dose estimated by approximately 25%.

B-0455 11:50

Use of dose tracking software for assessment of patient positioning in CT

M. Twomey, K. Murphy, K. Carey, P. Nicholson, M. Sheehy, O.J. O' Connor, M.M. Maher; *Cork/IE (mariatwomey@msn.com)*

Purpose: Due to bow-tie filter employment at CT, correct Patient centering is of key importance in reducing patient dose, image noise and optimising automated exposure control performance. We used automated dose tracking software (Dosewatch,GEHC) to assess patient positioning and factors associated with malposition during CT acquisition.
Methods and Materials: Following institutional board approval, 569 consecutive CT studies performed on a 128-slice Discovery HD750 in a trauma and tertiary referral cancer center were retrospectively analyzed on a remote workstation. Automated dose tracking software calculated variance from the isocenter using the CT radiograph (delta-x and delta-y) and collected patient demographics. Statistical analysis was performed using SPSS (T-Test, Mann-Whitney test, Pearson correlation, Spearman correlation). Mean distance from the isocenter was 21.97±18.50 mm (range:1.22-83.49 mm). Malpositioning was significantly more likely in the Y-axis (17.10±15.24 mm) than the X-axis (10.22±14.04 mm)($p < 0.001$). Positioning was inferior in prone studies (p=0.025),off-center body parts (p=0.020), 'out of hours' exams (p=0.03) and studies performed by technologists not regularly working in CT (p=0.006).
Results: Patient positioning for CT examinations deviated from the isocenter by 22 mm on average and findings approximate 15% average overexposure. We quickly identified factors associated with suboptimal patient positioning which are useful for continuous Quality assessment.
Conclusion: Dose tracking software can efficiently detect Patient positioning at CT scanning and could potentially be used to optimize Patient radiation exposure. We suggest isocenter information be reviewed by technologists prior to acquisition and creation of an automated centering tool.

10:30 - 12:00 **Room M**

GI Tract

SS 601b

Inflammatory bowel disease

Moderators:
R. Del Vescovo; Rome/IT
C. Hohl; Siegen/DE

K-08 10:30

Keynote lecture

S. Romano; *Naples/IT*

B-0456 10:39

The impact of Gadolinium-based contrast agent in the assessment of Crohn's disease activity: Is it contrast agent injection necessary?

E. Quaia, M. Pontello, R. Angileri, M.A. Cova; *Trieste/IT (quaia@units.it)*

Purpose: To define the best independent predictors for active inflammation in patients with Crohn's disease (CD) examined by contrast - enhanced magnetic resonance (MR) enterography and the actual impact of gadolinium-based agent injection.
Methods and Materials: Ninety-one patients (47 male and 44 female; 39.58 years ± 17.1) with a diagnosis of CD - CD activity index (CDAI) ≥150 (n=19 patients) or < 150 (n=72) underwent MR enterography including T2-weighted HASTE, T2-weighted SPAIR, T1-weighted True-FISP, and T1-weighted breath-hold THRIVE 3D MR imaging sequences before and after administration of gadobenate dimeglumine. Two readers analysed the MR images in consensus. Reference standard was the Crohn's Disease Endoscopic Index of Severity (CDEIS) with deep mucosal biopsy or the histologic analysis of the surgical specimen in those patients (n=30) who underwent elective small-bowel resection. Logistic regression analysis was performed to assess MR imaging findings as potential predictors of inflammatory CD activity.
Results: Patients revealed prevalently active (n=47 patients) or quiescent CD with mural fibrosis (n=44 patients). The bowel wall T2 hyperintensity (Odds Ratio -OR-, 95% Confidence Intervals -CIs-: 9.20, 2.71-31.19) and total length of disease (OR, 95% CIs: 1.29, 1.11-1.49) were found as the best independent predictors of active CD. Enhancement patterns were not as found independent predictors of active CD.
Conclusion: The bowel wall T2 hyperintensity and the length of the involved bowel tract were predictors of active inflammation in patients with CD examined by MR enterography. Gd-based contrast agent injection did not provide further independent predictors of active inflammation.

Author Disclosures:
E. Quaia: Speaker; Bracco Imaging, GE Healthcare.

B-0457 10:47

Diagnostic value of CEUS to detect acute phase of Crohn's disease: systematic review and meta-analysis

M. Białecki, A. Białecka, Z. Serafin; *Bydgoszcz/PL (mbialecki@poczta.fm)*

Purpose: : The recurrent nature of Crohn's disease (CD) implicates necessity for early and non-invasive identification of exacerbations. Reports on imaging of acute CD using CEUS are encouraging. However, most of published papers are based on small groups of patients and therefore statistical power of such reports is limited. The aim of this review was to verify the diagnostic value of CEUS to detect active intestine inflammation in Crohn's disease.
Methods and Materials: A systematic literature search was performed by two independent reviewers for articles published until June 30, 2014 on the sensitivity and specificity of CEUS to identify acute CD.
Results: Eleven articles were included in the final analysis, for a total of 348 patients. Significant heterogeneity was found regarding reference diagnostic methods and sonographic definitions of active inflammation. When estimated with bivariate analysis, CEUS presented a pooled sensitivity of 93% (95% CI, 83-97%) and a pooled specificity of 73% (95% CI, 59-83%). However, both sensitivity and specificity presented significant heterogeneity between primary studies (I2, 53% and 52%, respectively, p=0.03).
Conclusion: CEUS presents good sensitivity and moderate specificity in the detection of acute phase of Crohn's disease. Large scale randomized trials with quantitative evaluation of CEUS images are necessary to promote this technique in the clinical practice.

B-0458 10:55

Comparison of the impact of MRI and colonoscopy on management of Crohn's disease

J. Rimola, S. Rodríguez, I. Ordás, A. Lopez, E. Ricart, J. Panes; *Barcelona/ES (jrimola@clinic.ub.es)*

Purpose: To compare two patient assessment strategies using colonoscopy and MRE alternatively as first or second line examinations for the assessment of Crohn's disease.
Methods and Materials: Clinical data, endoscopy and MRE examinations of 100 patients within a maxium of one week was blindly reviewed by 4 clinical investigators. 2 investigators were provided with anonymized information of MRE followed by colonoscopy for 50 cases and reverse order for other 50 cases, the other 2 investigators were provided with the same anonymized cases switching the order of the examinations. The evaluations included a rating of inflammation, the presence of a stricture, fistula and abscess, and therapeutic recommendations.
Results: Information of the first examination was considered sufficient for management in 80% of cases for MRE and only 33.5% of cases for colonoscopy ($P < 0.001$). Adding MRE to the information of colonoscopy led to a change in the clinicians' confidence grade in a higher proportion of patients than adding colonoscopy to information of MRE for the suspicion of disease activity (10% vs 4%, p=0.03), stenosis (25% vs 9%, $p < 0.001$), fistula (31% vs 0%, $p < 0.001$), and abdominal abscess (27% vs 0%, $p < 0.001$). The information of MRE as a second examination led to a change in therapy in a higher proportion of patients than colonoscopy (29% vs 8%, $p < 0.001$).
Conclusion: Information provided by MRE has a higher impact on patient management than colonoscopy and may be considered as a first line examination for assessment of CD, although examination costs might have an influence in examination preference.

Author Disclosures:
J. Rimola: Advisory Board; Robarts Clinical Research. Grant Recipient; Genentech Inc.

B-0459 11:03

Diffusion-weighted MRI for prediction of long-term outcomes in patients with perianal fistulas in Crohn's disease treated with anti-tumour necrosis factor antibodies

K. Katulska, M. Wykrętowicz, P. Eder, P. Stajgis, K. Linke, M. Stajgis; *Poznan/PL (katarzyna_katulska@op.pl)*

Purpose: To assess the role of DWI in predicting the long-term efficacy of anti-tumour necrosis antibodies (anti-TNF) in perianal fistulas in Crohn's disease.
Methods and Materials: We carried out a retrospective cohort study among 48 CD patients with perianal fistulas who underwent a successful anti-TNF induction therapy and were treated with maintenance doses of anti-TNF agents. No patients did not need surgical treatment during anti-TNF therapy. All patients underwent MRI prior to 52-week therapy. MRI included T2-weighted images and echo-planar DWI with 5 b-values (0 to 1000 sec/mm2); ADC values were measured. Imaging was correlated with CD activity at weeks 0 and 52 which were associated with a secondary loss of response. 0- and 52-week anti-TNF therapy ADC changes with respect to baseline (%ΔADC) with

the group with clinical remission (CR) were compared with those in the non-clinical remission (non-CR).
Results: 35 patients were in remission at week 52; 13 patients were secondary non-clinical remissions. ROC curve showed that ADC values analysed together at week 0 were associated with remission at week 52 (p=0.01; AUC 0.67). At 0-week therapy, the median %ΔADC of CR group (54%) was higher compared to non-CR (32%) (p=.02). Similarly, at 52-week therapy, the median %ΔADC of CR group (92%) was significantly higher than that of non-CR group (-0.74%) (p=025).
Conclusion: A high baseline inflammatory activity assessed in perianal fistulas in Crohn disease predicts a long-term anti-TNF response. In cases of high %ΔADC before anti-TNF therapy also other therapeutic options should be considered.

B-0460 11:11

Multicentre prospective evaluation of software quantified small bowel motility as a biomarker of inflammatory activity in Crohn's disease
E.F.W. Gryspeerdt[1], A. Menys[1], D. Atkinson[1], J. Makanyanga[1], G. Bhatnagar[1], C. Tuteinnolthenius[2], S.A. Taylor[1]; [1]*London/UK*, [2]*Amsterdam/NL*
(evelien.gryspeerdt@hotmail.com)

Purpose: Previous data using non-consecutive retrospective MR enterography (MRE) datasets suggests software quantified bowel motility may be a biomarker of inflammatory activity in Crohn's disease. The purpose was to formally validate this finding in a non-selective prospective patient cohort.
Methods and Materials: 37 patients (23 female, median age 31 [range 18 to 64], median disease duration5 years) with confirmed or suspected Crohn's disease were prospectively recruited to the multicentre VIGOR++ study in which patients undergo MRE and colonoscopy. During MRE, dynamic 'cine' imaging (coronal, 22 second breath hold, BTFE sequence, TR1.97 ms, TE 0.98 ms, slice thickness 10 mm, 1 slice/1.13sec) was performed through the terminal ileum (TI) to capture motility (Using previously validated software). Motility was quantified via a manually placed region of interest within the last 5 cm of the TI, providing automated estimation of the bowel wall displacement, expressed as the standard deviation of Jacobian determinant (motility index- 0 =absent motility,1 high motility). All patients underwent colonoscopy and TI biopsy within median 4 days (range 0 to 19). Two experienced pathologists graded TI inflammation, deriving an endoscopic acute inflammatory score (eAIS) (range 0 to 6). Correlation between motility and eAIS was performed using Spearman's Rank.
Results: Mean eAIS and motility were 1 (range 0-4) and 0.30 (range 0.046-0.60) respectively. There was a significant negative correlation between the eAIS and TI motility index of Rho = -0.4, P = 0.014.
Conclusion: This prospective validation study confirms previous suggestions that bowel motility is negatively correlated with inflammatory activity in Crohn's disease.

Author Disclosures:
S.A. Taylor: Research/Grant Support; Research consultant for robarts.

B-0461 11:19

Is plain MRI feasible to evaluate inflammation and bowel damage in IBD? A prospective comparison with conventional MR enterography
K. Nielsen[1], V. Løgager[1], B. Rezanavaz-Gheshlagh[1], P. Munkholm[2], H.S. Thomsen[1]; [1]*Herlev/DK*, [2]*Rungsted Kyst/DK (lourdes_K_J@hotmail.com)*

Purpose: To compare prospectively the diagnostic accuracy of plain MRI (no contrast medium orally or intravenously) with Magnetic Resonance Follow Through (MRFT) in patients with inflammatory bowel disease.
Methods and Materials: Plain MRI was done in addition to MRFT, to which they were referred. All patients underwent both examinations on the same day. For the evaluation, the bowel was divided into 9 segments. Two radiologists, blinded to clinical findings, evaluated each segment for: bowel wall thickness, changes in diffusion weighted imaging (DWI) and other inflammatory changes. In MRFT bowel enhancement was also evaluated.
Results: 100 patients (40 males and 60 females; median age 38.5; range 19-90) were enrolled. Sensitivity, specificity and accuracy ranged from 50-77, 88-96 and 86-96% for wall thickening and 46-79, 81-95 and 81-93% for DWI, respectively. The kappa value for bowel wall thickening, DWI and mural hyperenhancement showed fair agreement (κ=0.26-0.39). Only bowel wall thickening in MRFT showed moderate agreement (κ= 0.47).
Conclusion: Plain MRI cannot replace MRFT in the work-up of patients with inflammatory bowel disease. Further research improving plain MRI is warranted.

B-0462 11:27

MR enterography including diffusion weighted imaging compared to capsule endoscopy in patients with suscpected or known inflammatory bowel disease
S. Kinner, S. Sirin, S. Kathemann, T.C. Lauenstein, M.L. Hahnemann;
Essen/DE (Sonja.Kinner@uni-due.de)

Purpose: Aim of this study was to compare MR enterography (MRE) and Diffusion Weighted Imaging (DWI) with Video-assisted Capsule Endoscopy (VCE) in the evaluation of small bowel involvement in patients with suspected or known inflammatory bowel disease (IBD).
Methods and Materials: 28 patients (13 female, 15 male; mean age 46 years) underwent VCE as well as MR enterography including DWI. Two readers evaluated i) MRE alone, ii) DWI alone and iii) the combined data sets concerning lesions in the small bowel (present/ absent). Sensitivity and specificity were calculated using VCE as reference standard including a proposed grading index (CEGI: 1=low-grade/mucosal; 3=high-grade/ulcers). Bowel distension was assessed additionally.
Results: In 10 of 28 patients one or more lesions in the small bowel were detected with VCE. MRE alone detected 6 of these patients, DWI alone 5 and the combination also 6 (sensitivity 0.6 for MRE and combined; 0.5 for DWI). False positive (FP) findings occurred in 1 patient with MRE alone and in a different patient with DWI alone (specificity 0.94, respectively). The combination of data sets showed no FP findings (specificity 1.0). Lesions missed were all grade 1 lesions in limited distended bowel parts (especially proximally).
Conclusion: MRE including DWI can be a valuable tool in the assessment of small bowel involvement in patients with suspected or known IBD as it might especially improve specificity. As low-grade lesions can be missed, VCE will remain the diagnostic gold standard in ambiguous cases.

B-0463 11:35

Monitoring response to infliximab monotherapy in Crohn's disease with interval ultrasound: a safe and objective option
A. Wadhwani, P. Patel, K. Novak, R. Wilkens, S. Wilson; *Calgary, AB/CA*
(aman.wadhwani@me.com)

Purpose: To assess the utility of ultrasound (US) in determining therapeutic response to infliximab induction therapy in crohn disease (CD) patients.
Methods and Materials: This retrospective study comprises 55 patients with established CD treated with infliximab monotherapy monitored sonographically and clinically. All patients had baseline US scans with colour Doppler imaging (CDI) prior to infliximab initiation, with subsequent interval US scans between 3 and 48 months. All US scans were classified as showing mild/moderate/severe inflammation or remission, based on bowel wall thickness, hyperemia, and mesenteric inflammatory fat. Sonographic responsiveness following infliximab induction was defined by a decrease in wall thickness, inflammatory fat and/or CDI signal.
Results: All patients had moderate to severe inflammation at the time of infliximab induction. Ultrasound showed favourable response to therapy at 3 months in 40/55 (78%) patients, increasing to 45/55 (82%) by 24 months. Two patients showed initial sonographic responsiveness, with a minimal decrease in wall thickness, inflammatory fat and CDI signal, but despite clinical improvement 8 patients showed complete lack of response on interval US. These 10 patients received surgical resections post-induction. Pathology confirmed active inflammation in all and stricture in 4, corroborating US findings. All surgical patients re-initiated infliximab with no identified recurrent disease after 12 months of follow-up.
Conclusion: US allows for objective and non-invasive classification of response to infliximab, evident as early as 3 months following induction. Therefore, infliximab therapy for CD can be monitored safely and accurately using US, allowing prediction of dose escalation, additional therapy or surgical intervention.

B-0464 11:43

CT-enterography: diagnostic value of 4th generation iterative reconstruction algorithm in low-dose protocol in comparison with standard dose CT protocol for clinical follow-up of patients with Crohn's disease
S. Lombardi, D. Ippolito, A. Casiraghi, C. Talei Franzesi, P. Bonaffini, S. Sironi;
Monza/IT

Purpose: To compare radiation dose, image quality and diagnostic performance of low dose CT-enterography (CTE) combined with iterative reconstruction algorithm (iDose4) with standard dose CTE in follow-up of Crohn's disease (CD) patients.
Methods and Materials: Fifty-one CD patients (32 males; mean BMI 24.9) underwent low-dose CTE scan in a single venous phase on a 256 MDCT (iCT, Philips; slice thickness 2 mm, 120 kV, automated mAs dose modulation, iDose4 iterative reconstruction algorithm). The same patients underwent a

standard dose CTE on a 16-rows scan (Brilliance, Philips; slice thickness 2 mm, 120 kV, 200-400 mAs depending on patient weight). Two radiologists independently evaluated mural HU values and the presence of CD activity features (mural thickening and enhancement pattern, halo sign, mesenteric fat stranding, comb sign, adenopathies and complications). Image noise and quality were evaluated using a 4-point scale. Dose-length product (DLP) was calculated and data from both examinations were compared and statistically analyzed.
Results: Low-dose CTE showed good diagnostic quality for the evaluation of CD pathological findings that were detected in 43/51 (82%) of our series. Total DLP and CTDI were significantly ($p < 0.001$) lower for CTE studies with iDose4 (607 mGy*cm and 12 mGy) compared to standard dose CTE (891 mGy*cm and 19.13 mGy), with an overall dose reduction of 35%. Noise measurements were slightly higher in iDose4 images (DS 12.9) than in standard dose ones (DS 10.37) but without statistically significant differences (p=0.06).
Conclusion: Low-dose CTE with iDose4 allows significant radiation dose reduction, while providing an appropriate image quality for evaluation of CD manifestations.

B-0465 11:51

MR features of anoperineal involvement in hidradenitis suppurativa: comparison with Crohn's disease

L. Monnier[1], A. Dohan[2], N. Amara[1], L. Vandromme[1], A.-M. Zagdanski[2], C. Hoeffel[1]; [1]*Reims/FR*, [2]*Paris/FR (louisemonnier@live.fr)*

Purpose: MR features of anoperineal disease (APD) in patients with hidradenitis suppurativa (HS) have seldom been described. HS may coexist with Crohn's Disease (CD) in a significant number of patients. Our purpose is thus twofold: describe MR features of perineal involvement in HS and compare them to those of anoperineal fistulas in CD.
Methods and Materials: Two senior GI radiologists retrospectively reviewed pelvic MRI examinations performed for evaluation of anoperineal disease (APD) in consecutive patients with established HS between 2007 and 2014. MRIs were performed on 1.5 T or 3 T scanners, including T2, STIR, Fat-suppressed T1- weighted gadolinium-enhanced axial and coronal sequences. Presence of fistulous tracts, abscesses, myositis, osteitis, inflammatory granulomas, fat inflammatory infiltration was assessed as well as their location and characterisation according to Park's classification in patients with HS and in a control population of 40 patients with CD.
Results: 20 MR of patients with HS were reviewed. Inflammatory granulomas (6.6; 3-16 mm) were significantly more present in the 20 patients (47.8; 20-75 mm) with HS (p= 0.000009). Lesions were also more commonly bilateral (p=0.00021) in HS. Myositis (p= 0.013), presacral extension of fistulas (p =0.027) and anterior perineal extension of abcesses (p=0.012) were also more frequent. In CD, rectal wall thickening (p=0.00032) and perianal area involvement (p=0.00079) were more frequently found. Although no significant differences are found for presence of fistulas, they more often communicate with the anal canal (p=0.022) in CD.
Conclusion: 20 MR of patients with HS were reviewed. Inflammatory granulomas (6.6; 3-16 mm) were significantly more present in the 20 patients (47.8; 20-75 mm) with HS (p= 0.000009). Lesions were also more commonly bilateral (p=0.00021) in HS. Myositis (p= 0.013), presacral extension of fistulas (p =0.027) and anterior perineal extension of abcesses (p=0.012) were also more frequent. In CD, rectal wall thickening (p=0.00032) and perianal area involvement (p=0.00079) were more frequently found. Although no significant differences are found for presence of fistulas, they more often communicate with the anal canal (p=0.022) in CD.

10:30 - 12:00 **Room N**

Cardiac

SS 603a

Myocardial infarction and coronary intervention

Moderators:
M. Francone; Rome/IT
M. Gutberlet; Leipzig/DE

K-09 10:30

Keynote lecture

M. Gutberlet; *Leipzig/DE*

B-0466 10:39

An investigation into the underlying rate of silent myocardial infarction in a low-intermediate risk asymptomatic cohort

K. Fitzgerald, J. Weir-McCall, C. Papagiorcopulo, M.A. Lambert, F.M. Sullivan, S.J. Gandy, J.J.F. Belch, A.D. Struthers, J.G. Houston; *Dundee/UK*

Purpose: Unrecognised myocardial infarctions (UMIs) have the same long-term prognostic significance as recognised myocardial infarctions with an incidence of 0.34 - 30% depending on the technique used and population studied. To date, the incidence of UMIs has not been documented in a large, low to intermediate risk population using MRI.
Methods and Materials: 5,000 volunteers > 40 years with no history of cardiovascular disease (CVD) and a 10 year risk of CVD less than 20%, assessed by the ASSIGN CV risk score, were recruited to the Tayside Screening for Cardiac Events (TASCFORCE) study. Those with a B-type natriuretic peptide (BNP) level greater than their gender specific median were invited for a whole-body angiogram and cardiac MR including late gadolinium enhancement (LGE) assessment. The scans were performed on a 3 T MRI scanner following dual-phase injection of Gadoteric acid. 1,510 volunteers completed the imaging study. Infarct location and extent was scored using the American Heart Association 17-segment model.
Results: 39 (2.6%) scans were excluded due to inadequate LGE image quality. 10 (0.7%) of the remaining 1,471 displayed delayed myocardial enhancement, of which 3 (0.2%) were consistent with UMI. Of these, the UMIs involved 1-8 segments. Only 1 patient had significant systolic impairment secondary to this. The remaining 7 were non-specific and included mid-myocardial enhancement, epicardial enhancement and right ventricular insertion enhancement. Those with delayed myocardial enhancement had a significant higher BNP ($P < 0.002$) and a lower diastolic blood pressure ($P < 0.02$).
Conclusion: UMIs occur even in a population considered as low cardiovascular risk, however they are uncommon and when present are typically small.

B-0467 10:47

Long-term prognostic value of dipyridamole stress cardiovascular magnetic resonance in patients with known or suspected coronary artery disease

E. Bertella, D. Andreini, S. Mushtaq, M. Petullà, M. Loguercio, A. Baggiano, V. Beltrama, P. Gripari, G. Pontone; *Milan/IT (gianluca.pontone@ccfm.it)*

Purpose: Dipyridamole stress CMR (DipCMR) provides information on perfusion defect and wall motion abnormalities (WMA). The aim of this study is to determine the prognostic value of DipCMR.
Methods and Materials: 793 patients (63.9±10.9 yo, 657 men) performed DipCMR and were followed-up for 810±665 days. Based on DipCMR findings, the population was classified in group 1 (no reversible ischemia), group 2 (stress perfusion defect) and group 3 (stress perfusion defect+WMA). The endpoints were "all cardiac events" (unstable angina, myocardial infarction, cardiac death and revascularization) and "hard cardiac events" (excluding revascularization).
Results: During follow-up, 162 all cardiac events and 56 hard cardiac events: 26 unstable angina, 22 nonfatal myocardial infarction and 5 cardiac death. The incidence of all cardiac events in group 1, 2 and 3 was 9.9%, 33.3% and 69%, with a significant higher rate in group 2 vs group 1 ($p < 0.0001$) and group 3 vs group 1 and 2 ($p < 0.0001$). The hard cardiac events were 4.9%, 8.5% and 17.8% of patients of group 1, 2 and 3, respectively, with a higher rate in group 3 vs group 1 ($p < 0.0001$) and vs group 2 ($p < 0.05$) while no differences were found between group 2 and 1 (p: 0.10). Multivariate analysis showed stress perfusion defect alone [HR: 1.05 (1.0-1.1), $p < 0.05$] or with WMA [HR: 2.9 (2.3-3.6), $p < 0.0001$] as independent predictors of all cardiac events. Only stress

perfusion defect plus WMA was predictor of hard cardiac events [HR: 1.6 (1.0-2.5), $p < 0.05$].
Conclusion: DipCMR seems to have an added value for predicting cardiac events.

Author Disclosures:
D. Andreini: Consultant; GE Healtcare. **G. Pontone:** Consultant; GE Healthcare, Heartflow, Medtronic, Bayer.

B-0468 10:55

A preliminary study about the use of diffusion-weighted images (DWI) in the evaluation of ST-segment elevation myocardial infarction (STEMI): our experience

G. Benedetti, A. Esposito, A. Damascelli, M. Cava, A. Del Maschio, F. DeCobelli; *Milan/IT (benedetti.giulia@hsr.it)*

Purpose: CMR is an accurate tool to assess STEMI damage. Our aim is to explore the potential role of Diffusion Weighted Imaging (DWI) in the detection of infarction and micro-vascular obstruction (MVO).
Methods and Materials: 42 patients underwent PCI and CMR within 5 days from STEMI, with axial DWI (b= 0, 100, 300, 500), short-axis LGE and first-pass perfusion (FPP). Infarction-site (septal, anterior, lateral, inferior, apical) and evidence of MVO were assessed on DWI by two blinded observers. LGE and FPP were the "gold standard". DWI sensitivity (Se), specificity (Sp) and inter-observer agreement were assessed.
Results: Infarcted areas were hyperintense at DWI (best visualization b=100). DWI vs LGE positivity were: septum 28 vs 29 pts, lateral wall 13 vs 11, apex 26 vs 29. LGE was able to detect inferior and anterior walls hyperintensity respectively in 22 and 26 pts, axial DWI was not. Inter-observer agreement was good for septum (K=0.60), great for apex (K=0.82), intermediate for lateral wall (k=0.48). Normal and infarcted myocardium had different ADC values (2.93 vs 4.77 x 10^{-3} mm^2/sec; $p < 0.001$). 26 pts had FPP-MVO, 22 DWI-MVO, with a good inter-observer agreement (K=0.67, p=0.001). DWI showed Se=0.80 and Sp=0.87 in the detection of MVO. Pts with DWI-MVO had higher LGE-MVO% (5.45 vs 1.58, p=0.011), LGE% (38.59 vs 23.25, $p < 0.001$) and Oedema% (44.45 vs 30.75, $p < 0.001$).
Conclusion: Axial DWI have good sensitivity in case of septal, apical and lateral infarctions and MVO, with the limit of anterior and inferior infarctions. DWI could be useful for a fast STEMI assessment without Gd injection.

B-0469 11:03

Serial native T1- and T2-mapping to quantitatively monitor resorption of myocardial edema following acute myocardial infarction

E. Tahir, M. Sinn, U. Radunski, D. Saering, K. Muellerleile, C. Stehning, G. Adam, L. Gunnar; *Hamburg/DE (e.tahir@uke.de)*

Purpose: Native T1- and T2-mapping are novel MRI techniques to assess myocardial edema. The purpose of the study was to quantitatively evaluate edema resorption following acute myocardial infarction (AMI) by cardiac magnetic resonance (CMR) imaging.
Methods and Materials: CMR (1.5 Tesla) was performed in 11 patients within seven days (BL) after reperfused AMI and at one (follow-up 1, FU1), three (FU2) and six months (FU3). Black-blood T2-weighted STIR, free-breathing, navigator-gated multi-echo (T2-mapping) and modified Look-Locker inversion recovery sequences (T1-mapping) on end-diastolic LV short-axes were performed. Two experienced observers independently evaluated the images using a threshold method. Edema size and prolongation of the native T1- or T2-times was measured using a cutoff > 2SD of remote normal myocardium.
Results: Edema size continuously decreased from BL with 32.8%LV to 24.6%LV at FU1, to 19.1%LV at FU2 and to 16.4%LV at FU3 using T2-weighted-CMR. T2-times only decreased between BL from 79±5 ms to 73±2 ms at FU1 ($P < 0.05$), but no further change was seen at later time points with 70±5 ms at FU2 and 70±6 ms at FU3. The T2-times of remote normal myocardium were 50±2 ms and significantly lower than in the edema zone. Native T1-times within the edema were with 1253±103 ms significantly increased compared to remote myocardium with 1018±43 ms and remained high in the edema zone throughout all follow-ups.
Conclusion: Edema size continuously decreased after AMI, but was still present after 6 months in all patients. Quantitative mapping showed increased T2- and T1-values within the edema zone indicating prolonged edema presence up to 6 months after infarction.

Author Disclosures:
L. Gunnar: Research/Grant Support; This study was partially funded by the Deutsche Forschungsgemeinschaft.

B-0470 11:11

Assessment of intramyocardial haemorrhage in acute reperfused myocardial infarction using 7.oT CMR T2 mapping

W. Chen[1], B. Zhang[1], F. Gao[1], J. Zheng[2], C. Wang[1]; [1]*Chengdu/CN*, [2]*St. Louis, MO/US (chenwin2008@139.com)*

Purpose: The purpose of this study is to validate whether cardiac MR (CMR) T2 mapping has high diagnostic accuracy for intramyocardial haemorrhage (IMH) and if it is able to quantify IMH.
Methods and Materials: 10 rats, by ligating left anterior descending or circumflex coronary arteries for 60 minutes, then followed by reperfusion for 48 hours, underwent 7.0T CMR scan using T2 mapping and LGE. T2 mapping images were created by a custom-made software to detect haemorrhage, and then calculated its size using ImageJ software. All datas were assessed by 2 radiologists. Left ventricular sections, matched with CMR scan, were assessed for haemorrhage and its size, and then pathological stains including hematoxylin-eosin and Prussian blue were assessed for red blood cells exudation and acute haemorrhage respectively by a pathologist.
Results: One rat died. 55 of 72 sections of left ventricles (LV) pathologically showed myocardial infarction matched with the hyperintense area in LGE. IMH pathologically occurred in 44 sections of LV, and corresponded with hypointense area in 41 slices on T2 mapping. 4 slices of hypointense area on T2 mapping pathologically showed no haemorrhage. The sensitivity and specificity for haemorrhage on T2 mapping were 93% and 85% respectively, and the positive and negative predictive values were 91% and 89% respectively. The size of haemorrhage calculated on T2 mapping corresponded with that on pathological macroscopy. (6.1%±0.02 vs 6.3%±0.02,p=0.46).
Conclusion: CMR T2 mapping not only has high diagnostic accuracy for IMH in reperfused AMI (even in 48h), but also is capable of quantifying its size.

B-0471 11:19

Incidence and role of intramyocardial haemorrage (IMH) in the assessment of STEMI pts through the use of T2 STAR (T2*) and T2 STIR sequences

G. Benedetti, F. De Cobelli, A. Damascelli, M. Cava, A. Esposito, A. Del Maschio; *Milan/IT (benedetti.giulia@hsr.it)*

Purpose: Microvascular obstruction (MVO) is a negative prognostic factor for STEMI patients, sometimes linked to intramyocardial haemorrhage (IMH). Our aim was to investigate IMH and the ability of T2 STIR and T2* to detect it.
Methods and Materials: All STEMI pts underwent PCI, and CMR with Late Gadolinium Enhancement (LGE), T2STIR and T2* sequences. CMR criteria for both MVO and IMH was the presence of an hypointense region within the infarcted area.
Results: We enrolled 28 pts: 19 had MVO at LGE, 11 showed IMH at T2STIR and 14 IMH at T2*. All pts with IMH both at T2STIR and T2* had MVO at LGE. All pts with haemorrhage at T2STIR had haemorrhage at T2*, 3 pts had IMH only at T2*. IMH% was higher in T2* sequences than in T2STIR (T2*: 3.00%±2.04; T2STIR: 2.09%±2.12). Pts with IMH had higher MVO% at LGE (p=0.004). In STEMI general assessment, pts with IMH at T2* had higher cardiac enzymes peaks at the arrival (TNT:13.46 vs 3.34, p= 0.001; CK: 4967.38 vs 1326.29, $p < 0.001$; CKMB: 396.98 vs 110.08, $p < 0.001$). Those pts also had worse functional parameters in the acute phase (LV-EF $p < 0.001$; LV-CO p=0.010; LV-SV p=0.002), higher LGE% ($p < 0.001$) and higher oedema% ($p < 0.001$). Pts with IMH at T2* had also higher occurrence of MACE during follow-up (7 pts with MACE, p=0.0443).
Conclusion: T2STIR and T2* sequences are reliable to detect IMH. T2 * shows higher sensitivity. IMH is strictly linked to MVO, is associated with worse infarctions and higher MACE at follow-up.

B-0472 11:27

Infarct evolution patterns following a revascularised acute myocardial infarction: a multilayer model for LGE analysis

L. Zhang, F. Odille, O. Huttin, N. Girerd, J. Felblinger, P.-Y. Marie, C. De Chillou, D. Mandry; *Nancy/FR (l.zhang@chu-nancy.fr)*

Purpose: Myocardial necrosis progresses from subendocardium to subepicardium, as outlined by the "wavefront" phenomenon. Yet, information on infarct healing in these distinct regions remains unclear. This study aimed at revealing the infarct evolution pattern using a multilayer model.
Methods and Materials: As part of a thorough cardiac MR study, late gadolinium-enhanced (LGE) images were obtained in 93 patients, at 2-4days (baseline) and at 6months (follow-up) after successful reperfusion for acute myocardial infarction. All gave informed consent. LGE images were acquired 10-20 minutes after contrast injection (0.1 mmol/Kg; Dotarem®, GUERBET) on a 3-T scanner (Signa HDxt, GE). Typical voxel size was 1.36×1.36×8 mm. Left ventricular borders and infarct contours were manually drawn on contiguous short-axis slices. Using a homemade post-processing tool, we generated a three-dimensional color-coded endocardial shell, based on LGE location and

depth. Infarct was categorized as subendocardial/subepicardial (hyperenhancement of 1% to 99.9% of LV wall thickness), transmural (100%) or intramural. Wilcoxon signed-rank test was used for paired data comparison.
Results: Subendocardial infarct surface increased significantly over 6 months (median: 4.86 cm2 vs. 11.68 cm2, $p < 0.0001$), whereas transmural infarct (30.78 cm2 vs. 20.03 cm2, $p < 0.0001$) and subepicardial infarct surface (0.55 cm2 vs.0.26 cm2, p=0.11) tended to reduce. Intramural infarct surface remained unchanged (1.93 cm2). Additionally, total infarct volume decreased by 10 mL during follow-up (median: 34.26 mL vs. 23.98 mL, $p < 0.0001$). Similarly to surface data, subendocardial infarct increased significantly (3.16 mL vs. 6.26 mL, $p < 0.0001$), whereas other components (transmural and intramural) declined in volumes.
Conclusion: As depicted on our multilayer model, the healing pattern of myocardial infarct varies according to infarct location and depth.

Author Disclosures:
L. Zhang: Research/Grant Support; Guerbet Company, France

B-0473 11:35

Delayed dual-energy CT (DECT) and conventional cardiac CT angiography (CCTA) in detection of chronic myocardial scar tissue: do we need delayed acquisition? Comparison with MRI

E. Pershina, V. Sinitsyn, E.A. Mershina; *Moscow/RU (pershina86@mail.ru)*

Purpose: To compare delayed enhancement DECT with CCTA and LGE MRI for detection of ischemic myocardial scars. To analyze the possible additive value of delayed DECT as part of CCTA protocol.
Methods and Materials: 19 patients (m/f-16/3, mean age 59.6±2.0 yrs) with chronic myocardial infarction were prospectively enrolled in the study. The CCTA protocol consisted of prospectively gated CTA and DECT. DECT was performed with single-tube 64-row CT in GSI mode with 8 min delay after contrast media injection. CCTA images were visually assessed for first-pass arterial enhancement deficit and late enhancement in DECT images using iodine distribution maps. Per-segment analysis was performed by 2 observers in comparison with LGE MRI. Test characteristics (sensitivity and specificity, contrast ratio (CR) between normal myocardium and scar tissue) for detection of myocardial scar were calculated both for CCTA and DECT. Per segment agreement between modalities was investigated with Spearman rank correlation coefficient.
Results: At segmental level delayed DECT had accuracy, sensitivity and specificity 90%,99%,78%, resp. CCTA protocol without integration of delayed DECT - 92%, 88%, 95%, resp. Addition of delayed DECT results did not improve CCTA performance (94%, 88%, 99%, resp). CR of scar tissue was higher for CTA 274%±29% vs. 123±6% for DECT, p=0.008.
Conclusion: Detection of ischemic scars with delayed enhancement DECT and CCTA showed a good correlation with MRI. Delayed DECT detects myocardial scars with good accuracy but does not improve performance of CCTA and could be omitted from cardiac CT protocols in order to reduce radiation exposure to patient.

B-0474 11:43

CT evaluation of small-diameter coronary artery stents: impact of an integrated circuit detector with iterative reconstruction using 3rd generation dual-source CT

P.M. Cannaò, G. Muscogiuri, C.N. De Cecco, J. Wichmann, A. Varga-Szemes, C. Canstein, U.J. Schoepf; *Charleston, SC/US (paola.m.cannao@gmail.com)*

Purpose: To evaluate the influence of the combination of an integrated circuit computed tomography detector (ICD) and iterative reconstruction (IR) algorithms using different kernels and kilo-voltage settings to assess small coronary stents in a phantom in terms of lumen visibility using third-generation dual-source CT (DSCT).
Methods and Materials: A moving heart phantom with three coronary artery stents of different diameters was examined using third-generation DSCT with a retrospectively ECG-gated protocol with varying tube voltages (70, 90, 120 kV) and heart rates (60, 70, 80, 90 bpm). For each stent images were reconstructed with filtered back-projection (FBP) and advanced modeled iterative reconstruction (ADMIRE) and a medium-soft (Bv40) and medium-sharp (Bv49) convolution kernel. Lumen narrowing (ALN), lumen attenuation, contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were assessed.
Results: Mean ALN was 58.6% using ADMIRE and 55.3% with FBP ($P < 0.05$), and 63.9% using the Bv49 kernel versus 50.5% with Bv36 ($P < 0.0001$) independent of tube voltage and heart rate ($P > 0.05$). For small stents the ALN was 55.6% using Bv49 and 45.1% using Bv36, and 54.2% for ADMIRE versus 46.5% for FBP ($P < 0.0001$). Mean lumen attenuation for Bv36 was 14.38 HU vs. 39.02 HU for Bv49 ($P < 0.001$). SNR was 10.44±5.9 using ADMIRE vs 7.65±5.0 using FBP ($P < 0.0001$) and 4.5±1.4 for Bv49 versus 13.5± 4.6 for Bv36 ($P < 0.0001$). CNR was 1.4±9.4 with ADMIRE versus 0.6±1.68 with FBP ($P > 0.05$).
Conclusion: For evaluation of small-diameter stents on third-generation DSCT with ICD, ADMIRE in combination with a Bv49 kernel resulted in the best image quality.

Author Disclosures:
C. Canstein: Employee; Siemens Medical Solution. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0475 11:51

Diagnostic accuracy of dual-source computed tomography in evaluation of coronary in-stent restenosis: a meta-analysis

L.-Y. Wen, Z.-G. Yang, H.-Y. Xu; *Chengdu/CN (lizzievane@126.com)*

Purpose: To determine the diagnostic accuracy of dual -ource computed tomography (DSCT) in evaluation of coronary in-stent restenosis.
Methods and Materials: A search of PUBMED/MEDLINE, Embase and the Cochrane Central register of Controlled Trials for English literature was performed up to September 2, 2014. Diagnostic accuracy studies using DSCT for the detection of coronary in-stent restenosis (≥50% luminal narrowing) referred for conventional coronary angiography were included for analysis. Quality of included studies was assessed by QUADAS-2 (Quality Assessment of Diagnostic Accuracy Studies). Data were extracted to calculated sensitivity, specificity, summary receiver operating characteristic curve and area under curve (AUC) as well as testing study of heterogeneity and threshold effect.
Results: Six studies with 10 subsets of data which included. Overall, 537 patients and 834 stents met the inclusion criteria and were analyzed. Prevalence of in-stent restenosis was 19.2% (160/834). The pooled data based on per-stent basis showed a sensitivity of 94% (95% CI, 0.89 -0.97), specificity of 89% (95% CI, 0.87 -0.91) and AUC of 0.97. The pooled sensitivity, specificity and AUC based on per-patients basis were 97% (95% CI, 0.92 - 0.99), 77% (95% CI, 0.70 -0.84) and 0.93, respectively. Subgroup analyses showed no significant difference between the subgroups.
Conclusion: DSCT has a high-diagnostic value for detection of coronary in-stent restenosis.

10:30 - 12:00 **Room L 1**

Vascular

SS 615

Vascular imaging in systemic diseases

Moderators:
D. Karnabatidis; Patras/GR
D. Tomais; Athens/GR

B-0476 10:30

Systemic venous anomalies in patients with pulmonary atresia: a CT angiographic study

R. Aslani Menareh Bazari, S. Sabouri, M.A. Karimi, H. Mahdavirad; *Tehran/IR*

Purpose: Associated anomalies in pulmonary atresia result in poor prognosis and more complicated surgeries.The aim of this study was to determine the types and prevalence of systemic venous anomalies in patients with PA by CT angiography.
Methods and Materials: CT angiography images of 90 patients with PA were reviewed by a cardiovascular radiologist and types and frequencies of SVAs were determined.
Results: Types of PA were isolated (2.2%), associated with VSD (42.2%), large VSD or single ventricle (12.2%), complex cardiac anomalies (43.3%). The frequencies of SVC, IVC, innominate vein, azygos and hepatic veins anomalies were 73.3%, 47.8%, 40%, 17.8%, and 16.7%, respectively. The most common type (34.4%) of SVC anomalies was bilateral SVC with drainage of RSVC to right-sided atrium and LSVC to coronary sinus. The most common type (16.7%) of IVC anomalies was left IVC (LIVC) to left atrium. Innominate vein was absent in 39%. IVC continuation with azygos and left azygos to LSVC were seen in 16.7%, and 15.6%, respectively. All 15 cases of anomalous hepatic veins, including separate entry to right or left-sided atrium, were in association with IVC anomalies. In patients with PA and complex cardiac anomalies, IVC anomalies were significantly higher than other types of PA (p=0.001).
Conclusion: SVAs are common in pulmonary atresia; SVC anomalies are seen in more than two-third and IVC anomalies are seen in about half of these patients. Familiarity with SVAs associated with PA is important for detailed interpretation of CT angiographies of these patients and surgery planning.

B-0477 10:38

CT angiographic features of large and medium size arterial vasculopathy of the upper limbs in systemic sclerosis using 320 mutidetector row scanners

Y. Ragab, Y. Emad; *Cairo/EG (yragab61@hotmail.com)*

Purpose: To describe the Computerized tomography (CT) angiographic features of arterial vasculopathy in the major as well as medium-sized arteries of the upper limbs in patients with systemic sclerosis (SSc).
Methods and Materials: Twenty-two cases with established systemic sclerosis were recruited for the study. Laboratory investigations were performed including complete lipid profile. Computed tomography angiography (CTA) studies for the whole upper limbs arterial trees were performed for both sides. That was followed by and volume-rendering reconstruction for creation of an overview of the vasculature and to localize areas of disease for focused investigation. Also multi-planar reconstruction (MPR) and curved planar reconstruction (CPR) were performed allowing for assessment of the vascular lumen. It is important to stress that any analysis always requires review of the axial source images to confirm findings on the reconstructions and to rule out presence of artifacts simulating disease.
Results: CTA showed involvement of subclavian arteries in three cases and axillary artery was involved in five cases. Brachial artery was affected in five cases. At the forearm level, radial artery was affected in four cases with bilateral involvement in two cases, while ulnar artery was affected in five cases. Unilateral non-visualization of the superficial palmar arch was observed in two cases with limited disease, while attenuation of the vascular calibers with poor distal run off in 18 cases.
Conclusion: Large and medium-sized upper limb arteries could be the seat of significant vasculaopthy in cases of systemic sclerosis.

B-0478 10:46

Characterisation of aortic distensibility in a rat model of atherosclerosis using high-resolution black blood cine sequences at 9.4 T

P. Fries, J. Stroeder, A. Müller, F. Mahfoud, M. Hohl, D. Linz, A. Massmann, G.K. Schneider, A. Buecker; *Homburg/DE (drpeterfries@googlemail.com)*

Purpose: The aim of this study was the in-vivo characterization of aortic distensibility in rats with atherosclerosis using black blood CINE sequences at 9.4T.
Methods and Materials: 10 ApoE-/- knock-out rats, representing a model of atherosclerosis, were examined with a 9.4T animal scanner (Bruker, Germany) acquiring black blood self-gated CINE sequences with high temporal and spatial resolution perpendicular to the ascending aorta (TR/TE=8.9/2.1 ms, FA=10°, voxel size: 0.12x0.12x1 mm3, 25 cine frames, temporal resolution: 10 ms/frame). 10 Sprague-Dawley rats (SprDaw) served as controls and were imaged with the same sequence parameters. Based on ROI measurements the cross-sectional vessel areas of the ascending aorta were evaluated at endsystole (AES) and enddiastole (AED). Aortic distensibility was calculated as (AD=(AES-AED)/AEDx100). Statistical analyses included paired t-tests, and Wilcoxon signed-rank tests ($p < 0.05$).
Results: Mean cross-sectional vessel areas were significantly larger in ApoE rats as compared to healthy controls (mean±SD: AED (ApoE): 11.7±3.0 mm2 / AED (SprDaw): 5.4±1.3 mm2, $p < 0.0001$); AES (ApoE): 14.0±2.8 mm2 / AES (SprDaw): 7.4±1.8 mm2, $p < 0.0001$)). This might correspond to a dilative form of atherosclerosis. Aortic distensibility was significantly lower in ApoE rats (AD (ApoE): 20.9 ± 10.1%) as compared to controls (AD (SprDaw): 36.8 ±4.3%, $p < 0.001$) reflecting an increased vascular stiffness and fibrosis (confirmed by histopathology). Both groups did not differ in regard to the animal weight (ApoE: 297±81 g / SprDaw: 303±76 g, p=0.198).
Conclusion: High-resolution black blood cine sequences acquired at 9.4T depict in-vivo the impact of atherosclerosis on aortic distensibility and morphology. This technique enables intraindividual longitudinal studies of therapeutic approaches in the field of atherosclerosis and vascular remodeling.

Author Disclosures:
F. Mahfoud: Research/Grant Support; Deutsche Hochdruckliga / Deutsche Gesellschaft für Kardiologie. **M. Hohl:** Research/Grant Support; Deutsche Hochdruckliga / Deutsche Gesellschaft für Kardiologie. **D. Linz:** Research/Grant Support; Deutsche Hochdruckliga / Deutsche Gesellschaft für Kardiologie.

B-0479 10:54

Follow-up of atheroma burden with sequential whole body contrast enhanced MR angiography: a longitudinal cohort study

J.R. Weir-McCall[1], R.D. White[2], P. Gutur Ramkumar[1], J.J.F. Belch[1], A.D. Struthers[1], G. Houston[1]; [1]*Dundee/UK*, [2]*Cardiff/UK (jweirmccall@doctors.net.uk)*

Purpose: To assess the progression rates of atheroma burden in a population with peripheral arterial disease (PAD) using whole body magnetic resonance angiography (WB-MRA).
Methods and Materials: 50 consecutive patients with symptomatic PAD referred for MRA were recruited. WB-MRA was performed using 4 volume acquisitions with a divided dose of intravenous gadoteric acid. Scans were performed at baseline, 6 months and 3 years. WB-MRA data was analysed by dividing the vasculature into 31 anatomical arterial segments. Each segment was scored according to degree of luminal narrowing: 0=normal, 1=< 50%, 2=50-70%, 3=71-99%, 4=vessel occlusion. From this a standardised atheroma score (SAS) was calculated. Progression was assessed with repeat measure ANOVA.
Results: 46 patients were scanned at 0 and 6 months, with 26 patients scanned at the three year follow-up. Only the final 26 were included in the analysis. The atherosclerotic burden in the assessed population was high with a mean SAS of 15.7±10.3 at baseline. No significant progression was present at 6 months when the mean SAS was 16.4±10.5 (p=0.67), however there was significant disease progression at 3 years compared with baseline with a mean SAS of 17.7±11.5 (p=0.01). On multiple linear regression baseline systolic blood pressure (β -0.40 p=0.048) and ankle-brachial blood pressure index (β -0.54 p=0.01) were the strongest determinants of the rate of progression.
Conclusion: Whole body MRA can quantify and monitor atherosclerosis progression at 3 year follow-up even in a small cohort, while 6 months is insufficient to witness significant change in disease burden.

Author Disclosures:
J.R. Weir-McCall: Research/Grant Support; Wellcome Trust research fellow. **G. Houston:** Grant Recipient; Guerbet.

B-0480 11:02

Prediction of recurrent adverse events and organ specific risk in diabetic patients by contrast-enhanced whole body MRI

R.C. Bertheau[1], C.L. Schlett[1], F. Bamberg[2], K. Parhofer[3], H. Findeisen[4], H.-U. Kauczor[1], S.O. Schönberg[5], M.F. Reiser[3], S. Weckbach[1]; [1]*Heidelberg/DE*, [2]*Tübingen/DE*, [3]*Munich/DE*, [4]*Aachen/DE*, [5]*Mannheim/DE*

Purpose: A prospective cohort study investigated prediction of recurrent adverse events by contrast-enhanced whole-body (WB) MRI and its anatomic relatedness to imaging findings in diabetics.
Methods and Materials: 61 patients with long-standing type-1 or -2 diabetes were assessed by WB-MRI for extent of arteriosclerosis, cerebral and

myocardial changes including late-gadolinium-enhancement (LGE). Data was collected on occurrence of severe, diabetes-related events by phone-interview and chart-review. Patients were stratified into occurrence of no, one or recurrent events; and events of cardiac, cerebral and non-cardiocerebral origin.
Results: During a median of 70 months, 26 (43%) diabetics developed a total of 39 events (6 cardiovascular death, 4 stroke, 3 myocardial infarction, 6 arrhythmia, 5 congestive heart failure, 4 coronary/3 carotid revascularization, 3 nephropathy, 3 peripheral-artery-disease, 2 retinopathy). 18 (30%) patients developed one, 8 (13%) recurrent events. A stepwise higher burden of WB-MR findings was observed between diabetics with no, one and recurrent events for LGE (17/33/63%); for LV hypo-/akinesia (3/28/75%); for carotid stenosis (11/17/63%); for vessel-score (1.0/1.3/1.8), all p≤0.001 for the trend. After adjusting for demographics and past medical history, LV hypo-/akinesia (HR=6.57, $p < 0.0001$) and vessel score (HR=12.29, $p < 0.0001$) remained independently associated with an increased rate of recurrent events. Assessing the organ system specific risk, cardiac and cerebral WB-MRI findings were more strongly associated with events in their own organ system while no significant WB-MRI predictor was found for non-cardiocerebral events.
Conclusion: Specific WB-MRI findings predict recurrent events in diabetics independently from demographics or past medical history and may provide an organ specific risk.

Author Disclosures:
F. Bamberg: Research/Grant Support; Bayer AG, Siemens AG. Speaker; Bayer AG, Siemens AG. **K. Parhofer:** Consultant; Merck & Co, Inc. Research/Grant Support; Bayer AG, Merck & Co, Inc. Speaker; Merck & Co, Inc, Takeda Pharmaceutical Company Limited, Bayer AG, Sanofi-Aventis Group. **H.-U. Kauczor:** Research/Grant Support; Boehringer Ingelheim GmbH, Siemens AG, Bayer AG. Speaker; Boehringer Ingelheim GmbH, Siemens AG, Novartis AG. **S.O. Schönberg:** Research/Grant Support; Siemens AG.

B-0481 11:10

Screening for asymptomatic cardiovascular disease with contrast enhanced MRI: association of left ventricular mass with whole body atheroma burden, cardiovascular risk and B type natriuretic peptide
M.A. Lambert[1], J.J.F. Belch[1], J. Weir-McCall[1], S.J. Gandy[1], R. Littleford[1], A.D. Struthers[1], F. Sullivan[2], G. Houston[1]; [1]*Dundee/UK*, [2]*Toronto, ON/CA (m.lambert@dundee.ac.uk)*

Purpose: The Tayside Screening for Cardiac Events (TASCFORCE) study is assessing the ability of a screening programme using a combination of B-type natriuretic peptide (BNP) and whole body contrast enhanced magnetic resonance imaging (WBCE-MRI) to predict cardiovascular (CV) events.
Methods and Materials: Men and women aged 40 years or older with no CV disease and an estimated 10-year CV disease risk < 20% were recruited. Those with a BNP greater than the median for their gender underwent a WBCE-MRI scan comprising cardiac imaging and whole body angiography (WBA). Left ventricular mass corrected for body surface area (LVMI) was measured. The WBA images were scored to quantify body wide luminal narrowing.
Results: 1515 participants had images suitable for analysis. Mean LVMI was 64.3 and 49.6 g/m2 for men and women respectively. In men and women LVMI was associated with systolic blood pressure (BP) ($r=0.13$ $p=0.003$, $r=0.21$ $p < 0.001$ respectively). In women, LVMI was associated with diastolic BP ($r=0.21$ $p < 0.001$) and estimated CV risk ($r=0.21$ $p < 0.001$). There was no significant correlation with these variables in men. LVMI was not associated with BNP level nor arterial stenotic burden as measured by WBA.
Conclusion: LVM corrected for BSA is associated with estimated CV risk in women. This suggests WBCE-MRI derived LVM may be associated with future CV disease. Follow-up, including those with lower BNP levels who were not offered a scan, will determine whether a combination of BNP and WBCE-MRI is able to improve prediction of CV events to facilitate targeted preventive medication.

B-0482 11:18

Reproducibility of manual measurement of intima-media thickness at distal common carotid artery under a strict measurement protocol by carotid ultrasound in 242 subjects
J. Plasencia Martínez, J. García Santos; *Murcia/ES (plasen79@gmail.com)*

Purpose: To assess the reproducibility of intima-media thickness (IMT) manual measurements at distal common carotid artery (CCA) under a strict protocol.
Methods and Materials: After Institutional ethics approval and informed consent, two experienced observers independently performed prospective carotid ultrasounds in 242 patients. Three different angles were employed to assess the IMT within the distal centimeter of CCAs: at the anterior (A) and posterior (P) edges of sternocleidomastoid muscle (SCM), and over (O) the SCM. Right (R) and left (L) mean (IMTmean) and maximum (IMTmax) IMT were calculated.
Interobserver and intraobserver concordances among A, O and P measurements, IMTmean and IMTmax of each side were assessed by Intraclass Correlation Coefficient (ICC) with 95% confidence interval (95%CI).
Results: Among the different angles, only the intraobserver agreement with the R-P approach was poor: ICC< 0.01 (Observer-1: ICC 0.052, 95%CI -1.073-0.465.Observer-2: ICC 0.013, 95%CI -0.951-0.501) for both observers. All interobserver agreement were good (ICC range, 0.742-0.912). Concerning mean and maximum measurements, only intraobserver agreement of R-IMTmean (Observer-1: ICC 0.134, 95%CI -0.68-0.556. Observer-2: ICC 0.303, 95%CI -0.378-0.646) and R-IMTmax (Observer-1: ICC 0.026, 95%IC -0.903-0.503. Observer-2: ICC -0.012, 95%CI -0.99-0.485) were fair or poor. The remaining inter and intraobserver right and left IMTmean and IMTmax agreements were variable, ranging the ICC from 0.524 to 0.913. IMTmean agreement was always better than IMTmax.
Conclusion: Agreements of distal CCA IMT measurements are variable ranging from moderate to excellent. Right distal CCA IMT has low reproducibility with a SCM posterior edge approach. Distal CCA-IMTmean is more reproducible than IMTmax.

B-0483 11:26

Classification of coronary and carotid atherosclerotic plaque by grating-based phase-contrast computed tomography
H. Hetterich[1], N. Webber[1], M. Willner[2], J. Herzen[2], L. Birnbacher[2], A. Hipp[2], F. Bamberg[1], F. Pfeiffer[2], T. Saam[1]; [1]*Munich/DE*, [2]*Garching/DE (holger.hetterich@med.uni-muenchen.de)*

Purpose: X-ray phase-contrast computed tomography (PCCT) is an innovative imaging technique relying on X-ray refraction providing improved contrast in low absorbing materials like biological soft tissue. The purpose of this experimental ex-vivo study was to determine whether PCCT can accurately classify human carotid and coronary atherosclerotic plaques according to modified American Heart Association (AHA) criteria.
Methods and Materials: Seventeen human carotid and coronary artery specimens were examined at an experimental set-up consisting of X-ray tube (40 kV), grating-interferometer and detector. Histopathology served as standard of reference. In PCT important plaque components including fibrous (FIB), lipid-rich (LIP) and calcified (CAL) tissue were identified and plaques were classified as AHA type I/II, III, IV/V, VI, VII or VIII by reviewers blinded to histopathology data. Diagnostic accuracies for the detection and differentiation of plaque components and types were evaluated.
Results: In total 129 corresponding PCT/histopathology sections were evaluated. FIB, LIP and CAL were detected with sensitivity, specificity and accuracy of ≥0.91. In histopathology type I/II was present in 12 (9.3%), type III in 16 (12.4%), type IV/V in 42 (32.6%), VI in 23 (7.8%), type VII in 30 (23.3%) and type VIII in 6 (4.7%) of all cross-sections. Sensitivity, specificity and accuracy were high for all analyzed plaque types (all > 0.88) with a good level of agreement (Cohen's $\kappa=0.81$). Inter-observer variability was high with Cohen's $\kappa=0.85$.
Conclusion: Carotid and coronary atherosclerotic plaque composition can accurately be evaluated by PCT in an ex-vivo setting. Future studies will have to evaluate its potential in-vivo.

B-0484 11:34

Simultaneous PET-MR imaging with FDG for the evaluation of symptomatic patients with non-stenotic carotid atherosclerotic plaques
A. Schindler, F. Hyafil, D. Sepp, T. Obenhuber, A. Bayer-Karpinska, M. Schwaiger, H. Poppert, S. Tobias; *Munich/DE (Andreas.Schindler@med.lmu.de)*

Purpose: To evaluate the relationship between atherosclerotic plaque morphology and the intensity of 18fluoro-deoxyglucose (FDG) uptake using simultaneous positron emission tomography - magnetic resonance imaging (PET-MRI) provided by the recently introduced multimodality instrumentation.
Methods and Materials: Carotid arteries of 18 consecutive patients with ischemic stroke and non-stenosing (< 50%) atherosclerotic plaques were imaged 150 minutes after injection of 4 MBq /kg of FDG with a combined PET/MRI system. American Heart Association (AHA) lesion type and plaque composition were determined on consecutive MR axial sections (n = 460) in both carotid arteries. Intensity of FDG uptake in carotid arteries was quantified using tissue-to-background ratio (TBR) on corresponding PET sections.
Results: Higher FDG uptake was detected with PET in plaques classified by MRI as high-risk (AHA lesion type IV/V-VI) as compared to other lesion types ($TBR = 3.09 \pm 1.14$ vs. 2.42 ± 0.82, respectively; $p < 0.05$). In addition, plaques containing a lipid-rich / necrotic core, intra-plaque hemorrhage or rupture of the fibrous cap accumulated more FDG in comparison to plaques lacking these morphological features ($TBR= 3.55 \pm 1.21$ vs. 2.38 ± 0.83; 3.14 ± 1.14 vs. 2.36 ± 0.80; 3.48 ± 1.1. vs. 2.40 ± 0.84, respectively; $p < 0.05$ for all).

Conclusion: Morphological features of high-risk plaques by MRI are associated with high FDG uptake. Combined PET-MRI systems provide unique diagnostic means to noninvasively co-register morphological and molecular signals for the more specific identification of high-risk plaques.

Author Disclosures:
M. Schwaiger: Research/Grant Support; Siemens Healthcare AG. **H. Poppert:** Research/Grant Support; Bundesministerium für Wirtschaft und Technologie, Deutsche Stiftung Neurologie.

B-0485 11:42

Super micro-vascular imaging: a new technique detecting neovascularisation in carotid plaque

Q. Yong, L. Zhang, J. Yuan, J. Mu; *Beijing/CN (yongqianganzhen@163.com)*

Purpose: To evaluate the value of Superb Micro-Vascular Imaging (SMI) in the detection of neovascularisation in carotid plaques, and this study prospectively compares the agreement between SMI and contrast-enhanced ultrasound (CEUS).
Methods and Materials: In this single-institution trial, we randomly assigned 32 patients (mean age 63.59±9.52) with ischemic cerebrovascular disease, to take both SMI and CEUS to observe inside plaques. Record if there were neovascularisation in the plaques, the results were compared with CEUS. All patients provided written informed consent.
Results: Totally 100 plaques including 59 hypoechoic plaques and 41 hypoecho-dominant mixed-echoic plaques, 39 plaques of them were found neovascularization by SMI, the detection rate is 39% (39 of 100 plaques), the average thickness of the plaques is 0.39 + / - 0.08 cm, the average length is 2.21 + / - 0.84 cm. In CEUS, 44 plaques were found neovascularisation, the detection rate is 44% (44 of 100 plaques). Results Identification of neovascularisation by SMI was: sensitivity of 89%, specificity 100% and accuracy 95%.
Conclusion: This study shows that SMI, as a new technique, has high detection rate of neovascularisation in carotid plaques.

B-0486 11:50

3D-black-blood 3 T-MRI of the vessel wall and beyond: a clinical perspective

T. Saam[1], K.M. Treitl[1], N.N. Kammer[1], H. Kooijman[2], M.F. Reiser[1], E. Coppenrath[1]; [1]*Munich/DE*, [2]*Hamburg/DE (tobias.saam@med.uni-muenchen.de)*

Purpose: Fat suppressed 2-dimensional T1w-black-blood sequences are commonly used to diagnose arterial dissections and vasculitis in various vascular beds. However, they are time extensive and thus offer limited coverage. We implemented a commercially not available isotropic 3D-black-blood T1w-TSE sequence with variable flip angles (3D-T1-BB-VISTA) for various anatomical regions and sought to evaluate this sequence in patients with CNS vasculitis, large vessel vasculitis, atherosclerotic disease and in tumour patients.
Methods and Materials: We performed > 500 MR exams on a 3 T-MRI using pre- and post contrast 3D-T1-BB-VISTA in the brain, neck, thorax and abdomen. Scan time was 4:43 minutes for brain and neck MRI, 5-6 minutes for the PPU-gated and navigated thoracic sequence and 5-6 minutes for the navigated abdominal sequence (isotropic resolution 0.8-1.2 mm). Overall we scanned > 100 patients with known or suspected vasculitis, > 50 patients with atherosclerotic disease and > 350 patients with known or suspected tumours.
Results: Image quality and blood suppression was good to excellent in > 95% of exams. Black-blood MRI was found extremely useful to identify and monitor vasculitis in all vascular beds, to identify atherosclerotic plaques and to identify even small brain tumours and small lymph nodes in various anatomical regions. In addition meningeal contrast enhancement was much easier identified on T1w-VISTA compared to T1w-3D-MPRAGE sequences.
Conclusion: We have successfully implemented a pre- and post-contrast isotropic 3D-T1-BB-VISTA sequence in many of our routine clinical protocols for various body regions and find it extremely helpful for diagnosing and monitoring tumour patients and patients with vasculitis and atherosclerotic disease.

Author Disclosures:
T. Saam: Research/Grant Support; Pfizer Inc, Diamed Medizintechnik. Speaker; Philips Healthcare. **H. Kooijman:** Employee; Philips.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 610a

Shoulder, brachial plexus

Moderators:
K.-F. Kreitner; Mainz/DE
D. Maric; Banja Luka/BA

B-0487 10:30

Biceps pulley and rotator interval of the shoulder in athletes: MR-arthrography dynamic evaluation

S. Mariani, A. La Marra, F. Arrigoni, L.M. Gregori, L. Patriarca, A. Barile, C. Masciocchi; *L'Aquila/IT (mari.silvia@hotmail.it)*

Purpose: To evaluate the value of the internal/external rotation and abduction-external rotation (ABER) during arthro-MRI in identifying biceps pulley and rotator interval lesions and association with antero-superior impingment (ASI) in athletes.
Methods and Materials: We retrospectively analysed 70 patients using arthro-MRI (1.5 T) exam and arthroscopy, clinically positive for biceps pulley and rotator interval lesions.The shoulder was always studied in neutral and ABER position, in internal-external rotation.
Results: Patients were divided in 4 groups (Habermayer classification) and evaluated for an unstable LHBT:10 patients had superior gleno-humeral ligament (SGHL) tear (Type I),16 patients SGHL and supraspinatus (SSP) tendon tears (Type II),21 patients SGHL and subscapularis (SSC) tendon tears (Type III) and 23 patients SGHL, SSP and SSC tears (Type IV). At arthroscopy 2 patients were negative,8 patients had Type I,16 patients Type II,19 patients Type III and 25 patients Type IV lesions. MRI internal-external rotation showed an initial anteromedial subluxation of the LHBT in 8 patients with Type II lesion and an anteromedial subluxation of the LHBT in all patients with Type III and Type IV lesions. ABER position showed antero-superior gleno-humeral (ASGH) malalignment in 14 cases. The dynamic tests, at arthroscopy, confirmed unstable LHBT and ASI features in patients with Type III-IV lesions and ASGH malalignment in 9 cases.
Conclusion: Only high grade lesions of the biceps pulley can be associated with unstable LHBT and ASGH malalignment. MRI external-internal rotation led to a better identification of biceps pulley structures and the detection of LHBT instability could suggest the presence of ASI.

B-0488 10:38

Evaluation of rotator cuff tears by MR arthrography using the Snyder's arthroscopic classification and arthroscopy as reference standard

C. Mattiuz, A. Aliprandi, N. Verardi; *San Donato Milanese/IT (chiara.mattiuz@gmail.com)*

Purpose: The goal is to evaluate both diagnostic performance and inter-observer reliability of magnetic resonance arthrography (MRA) of the shoulder evaluating rotator cuff tears (RCTs) using Snyder's classification.
Methods and Materials: Local ethics committee approved this retrospective study. 126 patients (64 males, 62 females; median age 55 years) underwent both MR arthrography and arthroscopy (median delay 137 days). MR arthrography were reviewed by two independent radiologists (with 14 and 5 years of experience) using Snyder's classification, blinded to the arthroscopic reference-standard. Accuracy and reproducibility were estimated as percentages and using quadratically-weighted Cohen-kappa.
Results: Of 71 patients with arthroscopic complete RCTs, 66 (93%) were correctly scored by the most experienced reader (kappa: 0.955). A complet agreement was observed regarding reproducibility in distinguishing partial from complete RCTs. All 55 patients with arthroscopic partial RCTs were correctly diagnosed by the most experienced reader (kappa =0.878 for articular-side and 0.837 for bursal-side). Among the 55 partial RCTs, readers disagreed at maximum 1 degree according with degree scorse of Snyder's classification (kappa 0.969 and 0.947 for articular-side and bursal-side).
Conclusion: The Snyder's classification, originally created for arthroscopy, is a reliable system that could be adopted for reporting MR arthrography in evaluating RCTs.

B-0489 10:46

High-frequency ultrasonography in penetrating tendon and nerve injuries of the upper extremity

M. Haroon, I. Ahmad, I. Ahmad, M. Azfar Siddiqui, S. Narayanasamy; *Aligarh/IN (haroon.radiology@gmail.com)*

Purpose: To describe the high-frequency Ultrasound (US) findings in penetrating injuries of tendons and nerves of the upper extremity and to determine its effectiveness in preoperative diagnosis.

Methods and Materials: This prospective study included 50 patients presenting with penetrating injuries of tendons and nerves of the upper extremity. These patients underwent US examination of the affected part followed by surgical exploration. The US findings were compared with the findings of surgical exploration and the sensitivity, specificity, positive and negative predictive values were calculated.
Results: Out of 199 tendons examined on US, 72 were reported as injured with 2 false positives and 127 were reported as intact with 2 false negatives. A total of 48 nerves were examined on US, of which 19 were reported as injured with 2 false positive results and 29 were reported as intact with 3 false negative results. Sensitivity, Specificity, Positive and Negative Predictive values of US for tendon injuries were 97.22%, 98.42%, 97.22% and 98.42% and for nerve injuries were 85%, 92.85%, 89.47% and 89.65%, respectively. US was also able to locate the proximal end in 40 of the 56 complete tendon tears and in 4 of the 5 complete nerve transections. US also identified foreign bodies in 5 patients and pseudoaneurysm formation in 1 patient.
Conclusion: US proved to be highly effective in detection of tendon and nerve injuries in penetrating trauma. Due to limited reliability of clinical examination in diagnosing such injuries, preoperative US may help to avoid unnecessary surgical exploration.

B-0491 10:54

Quantitative shear wave ultrasound elastography of the supraspinatus muscle in relation to tendon integrity and muscle quality
A.B. Rosskopf, C. Ehrmann, F.M. Buck, C. Gerber, C.W.A. Pfirrmann; *Zurich/CH*

Purpose: To evaluate the reliability of ultrasound elastography in the supraspinatus (SSP) muscle, define normal shear wave velocity (SWV) values, and assess muscle stiffness in symptomatic patients with correlation to tendon integrity and muscle quality.
Methods and Materials: SSP-SWV was prospectively assessed in 22 asymptomatic volunteers (mean age 53.8 years;11 female) by two independent examiners using Virtual Touch Tissue Imaging Quantification (VTIQ; Siemens) for evaluation of test-retest and inter-examiner reliability. Forty-four patients (mean age 51.9 years;22 female) were prospectively included:SWV in the SSP muscle was assessed using VTIQ and compared to tendon integrity, tendon retraction, fatty muscle Infiltration (Goutallier 0-IV), and muscle volume atrophy (positive Tangent sign) on MR images of the same day.
Results: Test-retest-reliability for mean totalshear wave velocity (MTSWV) was good for Examiner 1 (ICC=0.70;0.30-0.87;p=0.003) and 2 (ICC=0.80;0.53-0.92;$p < 0.001$). Inter-examiner-reliability was excellent (ICC=0.89;0.64-0.96;$p < 0.001$). MTSWV in volunteers (3.0m/sec±0.5) was significantly higher than in patients (2.5m/sec±0.5;p=0.001). Tendon integrity: a significant difference in TMSWV was found in muscles with partial tears compared to full thickness tears (p=0.042). Tendon retraction: a significant difference between MTSWV and degree of retraction (p=0.047) was found. Fatty muscle infiltration:Goutallier 0=43.2%(2.7 m/sec±0.4), I=20.5%(2.5 m/sec±0.4), II=13.6%(2.4 m/sec±0.4), III=15.9%(2.2 m/sec±0.5), IV=6.8% (2.4 m/sec±0.3). A negative correlation was found for MTSWV (r=-0.39/p=0.008) and a positive Tangent sign (n=10).
Conclusion: VTIQ is a reproducible technique for assessment of the SSP muscle stiffness. Normal SSP-SWV is 3.0 m/sec. In patients the SWV decreases with increasing fat content of the SSP muscle (Goutallier 0-III) and re-increases in the final stage (Goutallier IV).

B-0492 11:02

The effect of percutaneous ultrasound-guided subacromial bursography using microbubbles in assessment of subacromial impingement syndrome: initial experience
M. Lu; *Chengdu/CN (graceof@163.com)*

Purpose: To detect the feasibility of percutaneous US-guided subacromial bursography (PUSB) with microbubbles for assessment of subacromial impingement syndrome (SIS), and to determine whether it shows more information compared with conventional two-dimensional ultrasound (2-D US) in assessing SIS.
Methods and Materials: 2-D US and PUSB were performed in 76 patients (82 shoulders) with a clinical diagnosis of SIS. The PUSB findings were compared with 2-D US using the Chi-squared test with Magnetic resonance imaging (MRI) as a standard.
Results: The accuracy of PUSB in detecting full-thickness and bursal side partial-thickness rotator cuff tears was 100.0% and 98.8%, while 2-D US was 90.2% and 87.8% ($P < 0.005$, $P < 0.005$). 2D US and PUSB yield a sensitivity for full-thickness tears of 70.6% and 100% with specificity of 95.4% and 100.0%, while for bural side partial-thickness tears, yield a sensitivity of 60.0% and 100.0% with specificity of 91.7% and 98.6%, respectively. PUSB also shows the distribution of the subacromial-subdeltoid (SASD) bursa between acromion/deltoid and rotator cuff, and the adhesions of SASD bursa.
Conclusion: PUSB is a safe and available procedure, which compares better than 2-D US in assessing SASD bursitis and rotator cuff tears, hence it expands the capacity of CEUS in evaluating SIS.

B-0493 11:10

Evaluation of recurrent rotator cuff tendon tears: comparison of MRI, MR arthrography and ultrasound
B. He[1], Q. Dong[2]; [1]*Kunming/CN*, [2]*Ann Arbor, MI/US (henri5437@sina.com)*

Purpose: To retrospectively determine the accuracy of magnetic resonance imaging (MRI), ultrasound (US), and magnetic resonance arthrography (MRA) for evaluating the rotator cuff retears after repair, with surgical findings as the reference standard.
Methods and Materials: Institutional reviewed board approval was obtained for this retrospective chart review study. The study was HIPAA compliant. Informed consent was waived. The records including imaging and surgical reports, and historical notes were reviewed in 104 patients with 107 shoulders (bilateral shoulder in 3 patients) after rotator cuff repair (63 men, 41 women; mean age, 54.5 years) who underwent MRI (66 shoulders), US (52) or/and MRA (24) examinations before repeat surgery between January, 2004 and November, 2013. 24 shoulders were examined with both MRI and US. Imaging and report findings in rotator cuff were classified into full-thickness tear and no full-thickness tear (partial-thickness tear and intact). The sensitivity, specificity, accuracy, positive predictive value and negative predictive value of MRI, US and MRA were determined.
Results: Rotator cuff full-thickness retears after repair were identified by MRI with sensitivity, specificity, accuracy, positive predictive value and negative predictive value of 82.5%, 92.9%, 91.4%, 78.8% and 86.8%, respectively, and by US with values of 90.0%, 87.5%, 90.0%, 87.5% and 94.4%, respectively, and by MRA with all values of 100%. The differences in performance of MRI and US for detecting rotator cuff full-thickness retears were not statistically significant.
Conclusion: MRI, US and MRA were highly accurate for detecting rotator cuff full-thickness retears in patients after prior repair.

B-0494 11:18

Quantification of early fatty infiltration of the rotator cuff muscles: comparison of multi-echo Dixon with single-voxel MR spectroscopy
C.A. Agten, A.B. Rosskopf, C. Gerber, C.W.A. Pfirrmann; *Zurich/CH (christoph.agten@balgrist.ch)*

Purpose: To evaluate quantification of early fatty infiltration in the supraspinatus muscle with magnetic resonance (MR) imaging using a T2*-corrected multi-echo 3D-gradient-echo Dixon-based sequence (multi-echo Dixon) in comparison to a Proton-MR-spectroscopy.
Methods and Materials: This study was approved by our local ethics committee and informed consent was obtained. Fifty patients and 10 healthy volunteers with good supraspinatus muscle quality on 1.5 T MR imaging were included. Fat percentage (FP) in the supraspinatus muscle was quantified using a multi-echo Dixon compared to single-voxel MR-spectroscopy as reference standard. In 18 subjects the multi-echo Dixon was repeated to assess test-retest reliability. Measurements based on multi-echo Dixon were performed by two independent readers by placing region-of-interests in the supraspinatus muscle corresponding to the MR-spectroscopy voxel. Intraclass correlation coefficients (ICC) were used for statistical analysis.
Results: Test-retest mean FP (±standard deviation) were 3.3±1.1 and 3.2±1.1 for reader 1, 3.4±1.6 and 3.3±1.3 for reader 2 (first and second multi-echo Dixon), and 2.9±1.4 for MR-spectroscopy. Test-retest reliability was substantial for reader 1 (ICC=0.757) and almost perfect for reader 2 (ICC=0.873). Inter-reader reliability for multi-echo was almost perfect (ICC=0.893, $P <.0005$). Mean FP in all 60 subjects with multi-echo Dixon was 3.5±1.6 for reader 1, 3.7±1.8 for reader 2, and 2.8±1.4 with MR spectroscopy. Correlation between multi-echo Dixon and MR-spectroscopy was good (ICC=0.645, $P <.0005$).
Conclusion: The multi-echo Dixon sequence is a reliable method and comparable to MR-spectroscopy for quantification of low levels of fatty infiltration in the supraspinatus muscle.

B-0495 11:26

MR imaging after supraspinatus tendon repair with good clinical outcomes: morphology and signal alterations of the supraspinatus tendon
C.A. Agten, F.M. Buck, C.W.A. Pfirrmann; *Zurich/CH (christoph.agten@balgrist.ch)*

Purpose: To describe morphology and signal changes in MR imaging in the supraspinatus tendon after surgical tendon repair during a 2-year period in patients with good clinical outcomes.

Methods and Materials: Thirty-three patients (24 men, mean age 59±7 years, 22 right shoulders) with good clinical outcomes (relative Constant-Score > 90%) 2 years after surgical repair of a full-thickness supraspinatus tendon tear were prospectively included. MR-arthrography was performed 3 months (n=25), 1 year (n=28) and 2 years (n=27) post-operatively. Morphology of the supraspinatus tendon was assessed by 2 readers as normal, thinning, thickening, or defect - signal intensity as normal, increased, fluid-like, or defect on fluid-sensitive sequences. Descriptive statistics were used.
Results: 5-6/25-28 patients had morphologically normal tendons at all times, 1-3/25-28 tendons were thickened, 12-13/25-28 tendons showed thinning, and 7-8/25-28 tendons were defect. Three months postoperatively no supraspinatus tendon showed normal signal intensity on fluid-sensitive sequences. There was an increase in normal tendon signal intensity after 1 year (2/28 and 6/28 for reader 1 and 2, respectively) and after 2 years (8/27 and 17/27). Tendon defects 3 months and 1 year postoperatively were found in 7/25-28 patients (both readers) and 2 more for reader 1 after 2 years. On fluid-sensitive sequences the proportion of fluid-like/increased signal intensity tendons decreased from 3 months to 2 years from 18/25 to 10/27 for reader 1 (18/25 to 2/27 for reader 2).
Conclusion: Postoperatively increased tendon signal intensity decreased over time towards normal signal intensity, while no relevant change to the tendon morphology was found.

B-0496 11:34

Usefulness of IDEAL T2 imaging for homogeneous fat suppression and reducing susceptibility artifacts in brachial plexus MRI at 3 T

B. Bignotti, S. Airaldi, F. Zaottini, G. Tagliafico, C. Martinoli, A. Tagliafico;
Genoa/IT (albertotagliafico@gmail.com)

Purpose: To quantitatively and qualitatively compare fat-suppressed MRI quality using iterative decomposition of water and fat with echo asymmetry and least-squares estimation (IDEAL) with that using frequency selective fat-suppression (FSFS) T2-images of the brachial plexus at 3 T.
Methods and Materials: Prospective MR image analysis was performed in 40 volunteers ans 10 patients at a single center. Oblique-sagittal fat suppressed T2-IDEAL and FSFS were compared. Visual assessment was performed by two independent musculoskeletal radiologit with respect to: 1) susceptibility artifacts around the neck; 2) homogeneousity of fat suppression; 3) image sharpness; 4) tissue resulotion contrast of pathologies. The signal-to-noise ratios (SNR) for each image sequences were assessed.
Results: Compared to FSFS sequences, IDEAL fat suppressed T2-images significantly reduced artifacts around the neck and significantly improved homogeneous fat suppression ($p < 0.05$). IDEAL significantly improved sharpness and lesion-to-tissue contrast ($p < 0.05$). The mean SNRs was significantly improved on T2-weighted IDEAL images ($p < 0.05$).
Conclusion: IDEAL technique improved image quality by reducing artifacts around the neck while maintaining a high SNR and provided superior homogeneous fat suppression than FSFS sequnces.

B-0497 11:42

Comparison of 3 T MR elastography and shear wave US elastography measuring normal skeletal muscle stiffness: a pilot study

D. Na[1], S.-J. Hong[1], C. Kang[1], B. Kim[2], K.-S. Ahn[1], S. Lee[2]; [1]*Seoul/KR*, [2]*Gyeonggi-do/KR (oproom11@hanmail.net)*

Purpose: To determine the feasibility of the 3 T MR elastography (MRE) and shear wave US elastography (USE) in measuring the stiffness of medial gastrocnemius muscle (MGCM) and to compare the stiffness values of each modality.
Methods and Materials: 6 healthy volunteers (M:F=3:3, mean age:30.7years, range:27-37) without any calf pain or abnormality underwent both MRE and USE. MRE was acquired on a Siemens 3 T Skyra scanner using a 2D GRE-based MRE sequence at two different exciatation frequencies. USE (Axilporer, Super sonic, France) was performed by one operator. The mean stiffness values of MGCM were measured at the upper one-third level of left calf on neutral, full dorsiflexion, and full plantar flexion positions. The values were compared between the 2 modalities, and the data were also compared between the 3 different positions in each modality.
Results: The mean stiffness values of MGCM were 1.15/1.08/1.52kPa on neutral, dorsiflexion and plantar flexion at 90 MHz and 1.56kPa on neutral at 120 MHz by MRE. The values of MGCM were 16/189.5/38.2kPa on each positions by USE. The values of MRE were about 10-100 times lower than that of USE. In USE, the values in 3 different calf positions were significantly different (p=0.002), and the stiffness of MGCM was significantly increased in dorsiflexion. In MRE with 90 MHz, whereas, there was no difference in the values between the 3 different calf positions statistically.
Conclusion: The mean stiffness values of normal MGCM using 3 T MRE were around 10-100 times lower than using USE. The stiffness of normal MGCM was increased during ankle dorsiflexion measuring in USE.

B-0498 11:50

Three-dimensional glenohumeral relationship of different surgical glenoid planes: a three-dimensional CT-scan study

T.R.G.M. Verstraeten, L.F. De Wilde; *Gent/BE*
(tom.verstraeten82@gmail.com)

Purpose: There is no consensus on which glenoid plane should be used in total shoulder arthroplasty. Nevertheless, anatomical reconstruction of this plane is imperative for the success of total shoulder arthroplasty.
Methods and Materials: Three-dimensional reconstruction CT-scans were performed on 152 healthy shoulders. Four different glenoid planes, each determined by three surgical accessible bony reference points, are determined. The first two are triangular planes, defined by the most anterior and posterior point of the glenoid and respectively the most inferior point for the Saller's Inferior plane and the most superior point for the Saller's Superior plane. The third plane is formed by best fitting circle of the superior tubercle and the most anterior and posterior point at the distal third of the glenoid (Circular Max). The fourth plane is formed by the best fitting circle of three points at the rim of the inferior quadrants of the glenoid (Circular Inferior). We hypothesized that the plane with normally distributed parameters, narrowest variability and best reproducibility would be the best suitable surgical glenoid plane.
Results: No difference in position of the mean humeral center of rotation is found between the Circular Max and Circular Inferior plane (X=91.71degrees/X=91.66degrees p=0.907 and Y=90.83degrees /Y=91.7degrees p=0.054 respectively), while clear deviations are found for the Saller's Inferior and Saller's Superior plane ($p < 0.001$). The Circular Inferior plane has the lowest variability to the coronal scapular plane ($p < 0.001$).
Conclusion: This study provides arguments to use the Circular Inferior glenoid plane as preferred surgical plane of the glenoid.

B-0499 11:58

Preoperative guiding for the reconstruction of the native glenoid plane: an anatomical three-dimensional CT-scan reconstruction study

T.R.G.M. Verstraeten, L.F. De Wilde; *Gent/BE*
(tom.verstraeten82@gmail.com)

Purpose: Reconstruction of the native plane in eroded glenoids is difficult. Nevertheless, accurate reconstruction of this plane is imperative for successfull total shoulder arthroplasty.
Methods and Materials: Three different circular planes are determined on three-dimensional CT-scan of 152 healthy shoulders. The Circular Max plane (CM) is formed with the superior tubercle and two points, one anterior and one posterior, at the rim of the inferior 3rd of the glenoid. The Circular Inferior plane (CI) is formed by three points at the inferior two quadrants of the glenoid rim. The Circular minima plane (Cm) is formed with three points situated at the non-eroded sector of the anterior glenoid. The angulation of the spinal scapular axis (SSA = line between the most medial point of the scapular spine and the center of the three different glenoid planes) and the correlation coëfficient between the radius of the circle and the length of SSA are calculated.
Results: Angle SSA in the X-axis: 94.46degrees, 93.43degrees, 93.43degrees and in the Y-axis: 95.22degrees, 111.36degrees and 111.27degrees for CM, CI and Cm respectively. Correlation coëfficient between the radius of the circle and the length of SSA: r=0.69 for CM, r=0.753 for CI and r=0.746 for Cm.
Conclusion: Three points situated at the native anterior glenoid can reconstruct, within 2degrees accuracy (95% CI: 1.82degrees; 2.32degrees), the Circular Inferior plane (CI). The relationship between the radius of CI and the width of the scapula (SSA-length) can be used as extra tool to verify the position of this native plane.

10:30 - 12:00 **Room E2**

Neuro

SS 611
Brain tumour (1)

Moderators:
N. Bargalló; Barcelona/ES
S. Blasel; Frankfurt a. Main/DE

K-10 10:30
Keynote lecture
I.M. Björkman-Burtscher; *Lund/SE*

B-0500 10:39
Perfusion and permeability MRI biomarkers for enhancing and nonenhancing components predict patient survival in newly diagnosed glioblastoma
O. Solà[1], J. Puig[1], G. Blasco[1], J. Daunis-i-Estadella[1], M. Essig[2], R. Jain[3], M. Puigdemont[1], S. Pedraza[1]; [1]*Girona/ES*, [2]*Winnipeg, MB/CA*, [3]*New York, NY/US (urisolagimferrer@gmail.com)*

Purpose: Accurate prognosis of newly diagnosed glioblastoma would improve patient management. MRI biomarkers' role in prognosis is unclear. We retrospectively determined the usefulness of dynamic susceptibility contrast (DSC), permeability maps, diffusion parameters, and extensive battery of qualitative findings for contrast-enhancing lesion (CEL) and surrounding non-CEL in predicting survival.
Methods and Materials: Before treatment, 33 consecutive patients (22 men; mean age, 63 years) with histologically proven glioblastoma underwent 1.5 T MRI (anatomical, first-pass DSC, and post-contrast T1-weighted sequences). We obtained volumes of interest for cerebral blood volume ratio, cerebral blood flow ratio, mean transit time (MTT), time-to-maximum, time-to-peak, permeability constant (k2), and apparent diffusion coefficient in CEL, NCEL, and contralateral tissue using Olea Sphere V.2.0 software (Olea Medical, La Ciotat, France). We evaluated 26 VASARI descriptors. Patients were classified by survival: 6months. Surgery, radiotherapy and chemotherapy was considered complete treatment.
Results: Twenty patients (60.6%) survived < 6months. Eleven (33.3%) underwent complete treatment. Survival groups differed in treatment (P=0.037), MTT-CEL (4.6±1.5 vs 5.5±1.2 mL; P=0.043), k2-CEL (-30.22±90.12 vs -113.21±94.69; P=0.018), k2-NCEL (-20.22±34.06 vs -59.74±58.72; P=0.041), for 6months survival, respectively. k2-CEL best predicted survival at 6 months (AUC=0.738, 57.1% sensitivity, 83.3% specificity, 72.7% positive predictive value, 71.4% negative predictive value). k2-CEL and treatment yielded the best combined prediction of survival at 6 months (AUC=0.83, 64.3% sensitivity, 88.9% specificity, 81.8% positive predictive value, 76.8% negative predictive value).
Conclusion: Preliminary data suggest perfusion and permeability parameters might predict survival in newly diagnosed glioblastoma. More specifically, MTT-CEL, k2-CEL, and k2-NCEL seem useful survival biomarkers.

B-0501 10:47
Prognosis prediction of measurable enhancing lesion after completion of standard CCRT and adjuvant temozolomide in glioblastoma patients: application of dynamic susceptibility contrast perfusion and DWI
J. Kim, S. Choi, T. Yun, J.-H. Kim, C.-H. Sohn; *Seoul/KR (yyssaa21@gmail.com)*

Purpose: To assess the prognosis predictability of measurable enhancing lesion using histogram parameters produced by the normalised cerebral blood volume (nCBV) and normalized apparent diffusion coefficient (nADC) after completion of standard concomitant chemoradiotherapy (CCRT) and adjuvant temozolomide (TMZ) medication in glioblastoma multiforme (GBM) patients.
Methods and Materials: A total of 59 patients with newly diagnosed GBM who received standard CCRT with TMZ and adjuvant TMZ for six cycles underwent perfusion-weighted and diffusion-weighted imaging. Twenty-seven patients had a measurable enhancing lesion and 32 patients lacked a measurable enhancing lesion based on the RANO criteria in the follow-up MRI. We measured the nCBV and nADC histogram parameters based on the measurable enhancing lesion. The progression free survival (PFS) was analyzed by the Kaplan-Meier method with the use of the log-rank test.
Results: The median PFS of patients lacking measurable enhancing lesions was longer than for those with measurable enhancing lesions (17.6 vs 3.3 months, P <.0001). There was a positive correlation between the 99th percentile nCBV value of a measurable enhancing lesion and the PFS (P =.044, R2 =.152). Furthermore, the median PFS was longer in patients with a 99th percentile nCBV value ≥ 4.5 than it was in those with a value < 4.5 (4.4 vs 3.1 months, P =.036).
Conclusion: The nCBV value can be used for the prognosis prediction of a measurable enhancing lesion after the completion of standard treatment for GBM, wherein a high 99th percentile nCBV value (≥ 4.5) suggests a better PFS.

B-0502 10:55
The functional language connectome in frontal and temporal gliomas
K.-H. Nenning, A. Müller, D. Prayer, G. Langs, G. Kasprian; *Vienna/AT (karl-heinz.nenning@meduniwien.ac.at)*

Purpose: Primary brain tumours involving the language processing cortex are difficult to treat. Knowledge on alterations of the language connectome (LC) caused by left hemispheric, high or low grade, frontal or temporal gliomas is necessary to develop treatment strategies which preserve or optimise language function.
Methods and Materials: The structure of the functional LC was reconstructured on the basis of preoperatively acquired functional MRI data (3 Tesla, verb-generation task, FreeSurfer, FSL). A reference LC was established based on 14 healthy controls and compared to the connectome of 6 patients with low-grade frontal, 4 patients with high-grade frontal, 4 patients with low-grade temporal and 4 patients with high-grade temporal gliomas. Differences in the functional connectome analysis were quantified using the Network Based Statistics approach.
Results: Reduced functional connectivity for both groups of high-grade brain tumours was found (p=0.009 for frontal and p=0.026 for temporal high-grade tumours). Glioblastomas involving the left frontal lobe showed a more extensive impact on the language network compared to temporal high-grade tumours (47 connections for frontal and 25 connections for temporal high-grade gliomas). Temporal glioblastomas affected ipsilateral language networks, whereas frontal tumours affected also connections to the contralateral cortex and the contralateral cerebellar hemisphere. No significant connectome differences between controls and patients with low-grade gliomas were found.
Conclusion: Left hemispheric frontal and temporal glioblastomas cause a widespread derangement of the functional language connectome extending far beyond the frontotemporal language processing regions. These insights help to better understand and potentially treat language dysfunction in glioma patients.

B-0503 11:03
Prognostic value of dynamic contrast-enhanced MRI for therapeutic evaluation of brain metastases from lung cancer
G. Kuchcinski, C. Delmaire, E. Le Rhun, R. Duhal, M. Lalisse, R. Lópes, J.-P. Pruvo, A. Cortot, X. Leclerc; *Lille/FR (gregory.kuchcinski@univ-lille2.fr)*

Purpose: To assess the prognostic value of dynamic contrast-enhanced MRI (DCE-MRI) for therapeutic evaluation of brain metastases from lung cancer, treated by radiosurgery, whole-brain radiotherapy or chemotherapy alone.
Methods and Materials: Thirty-seven patients with 110 brain metastases underwent a 3 T DCE-MRI evaluation at initial diagnosis of brain metastases (MRI1) and at 2-to-3 months follow-up (MRI2). Initial values of pharmacokinetic parameters Ktrans, kep, ve and vp on MRI1 and their early variation on MRI2 (ΔKtrans, Δkep, Δve and Δvp) were measured in each metastasis. The final therapeutic response status (response/stable disease/progression) was defined by the volume variation of each metastasis at 6 months. Initial Ktrans, kep, ve, vp and their variation on MRI (ΔKtrans, Δkep, Δve, Δvp) were compared according to the final therapeutic response status using the Kruskall-Walis test. A ROC-analysis determined optimal cut-off values for prediction of therapeutic response or progression at 6 months.
Results: Twenty-one patients with 55 brain metastases survived at 6 months. Δve was significantly different in each therapeutic response subgroup (p < 0.001). A Δve< 0% threshold predicted a 6-month therapeutic response with a sensitivity/specificity of 91% [CI95%=79-97] / 70% [CI95%=40-89]. A Δve> 25% threshold predicted a 6-month progressive disease with a sensitivity/specificity of 100% [CI95%=51-100] / 92% [CI95%=82-97]. Δve significantly correlated with the metastatic volume variation at 6 months in each treatment subgroup (radiosurgery/whole-brain radiotherapy/chemotherapy) (p < 0.001). Initial pharmacokinetic parameters were not predictive of the final response status.
Conclusion: DCE-MRI, and particularly the pharmacokinetic parameter ve, is a potential non-invasive biomarker of therapeutic response for brain metastases.

B-0504 11:11

Tumour permeability pattern: a potential for new prognostic factor in immunocompetent patients with primary CNS lymphoma

S. Chung, H. Kim, C. Choi, S. Kim; *Seoul/KR (jserom@naver.com)*

Purpose: The aim of this study is to investigate the utility of the pattern of dynamic contrast-enhanced MR imaging (DCE-MRI) for predicting early treatment response to high dose-methotrexate (HD-MTX) treatment and progression-free survival (PFS) in patients with primary CNS lymphoma (PCNSL).
Methods and Materials: Thirty five patients (21 men and 14 women; mean age, 58.5 years) with PCNSL underwent DCE-MRI before starting first-line treatment with HD-MTX. The pattern of DCE-MRI was categorized as diffuse (centrifugal) and non-diffuse (heterogeneous or poor perfusion) pattern. After four course of HD-MTX, patients underwent follow-up brain MR imaging for the assessment of early treatment response. The early treatment response was classified as complete response (CR) and non-complete response (PR, SD, and PD). The predictors of CR were analyzed using multivariate logistic regression analysis. The potential prognostic factors of progression free survival (PFS) were compared using Cox proportional hazard model.
Results: The diffuse (centrifugal) DCE-MRI pattern showed significant higher rate of CR than non-diffuse pattern (p=0.004, odds ratio of 66.5, confidence interval [CI] of 3.8-1159.1). The univariate analysis showed that the tumour with diffuse DCE-MRI pattern (p=0.04) was significantly associated with a longer PFS, and the multivariate analyses revealed that DCE-MRI pattern was the only independent factor associated with worse PFS after adjustment for age, location, and necrosis (p=0.02).
Conclusion: Pre-treatment DCE-MRI can be used as a potential noninvasive imaging biomarker for predicting initial treatment response to HD-MTX in PCNSL patients, with the diffuse (centrifugal) DCE-MRI pattern related with higher rate of CR and longer PFS.

B-0505 11:19

The value of serial MR imaging in the assessment of brain metastases volume control during stereotactic radiosurgery

G. Sparacia[1], A. Banco[1], F. Bencivinni[1], G. La Tona[1], V. Robusto[2], M. Midiri[1]; [1]*Palermo/IT*, [2]*Messina/IT (sparacia@yahoo.com)*

Purpose: To evaluate early tumour control capabilities of Stereotactic Radiosurgery (SRS) in the treatment of brain metastasis and the role of follow-up MR imaging.
Methods and Materials: MR imaging of 54 metastases in 31 patients treated with SRS who underwent follow-up MR imaging within 12 months were retrospectively reviewed. Tumours were characterized as either enlarged (> 20% volume increase), stable (follow-up volume ±20% of the initial volume), or decreased (> 0% volume decrease).
Results: Within the first 6 weeks following SRS a decrease was observed in 25 (52%) of the tumours in the extent of 63% in size. Tumour reduction varied according to histopathological subtype with 38% of non-small cell lung carcinomas, 41% of breast carcinomas, 14% renal cell carcinoma and 8% of melanomas. At 9 weeks, 7 out of the 25 lesions had a transient tumour volume increase followed by tumour regression at 12 weeks. At 12 months 19 (37%) of lesions increased in volume in the extent of 41% in size. There was a significant higher tumour reduction in those carcinoma types that are considered as radiation sensitive. The best timing for follow-up imaging is at 6, 9 and 12 weeks to provide clinicians useful information.
Conclusion: Stereotactic radiosurgery provide volume reduction in many brain metastases and it may be used alone or before whole brain radiation therapy to early tumour control. Follow-up MR imaging provide clinicians useful patient information aimed to make treatment decisions.

B-0506 11:27

Intracranial multi-echo MR perfusion measurements: reproducibility and differential diagnostic value for intra- and extraaxial tumours

A. Abramyuk, V. Hietschold, K. Sitoci-Ficici, R. von Kummer; *Dresden/DE (andrij.abramyuk@uniklinikum-dresden.de)*

Purpose: Perfusion properties of brain tumours give valuable hints for differential diagnostics and therapy monitoring. Applying dynamic multi echo sequences, contrast medium (CM) in interstitial and capillary compartments can be measured separately. In our study, the potential of this measurement strategy is evaluated.
Methods and Materials: Measurements were performed preoperatively in 27 patients, 18 of them twice (mean time gap: 2 days) at 3 Tesla. A 10 echo FLASH sequence with temporal resolution of 2 s was applied. 0.2 ml/kg body weight of Omniscan were administered. Evaluations were performed using IDL and Excel. A monoexponential function was fitted to signals of 10 echoes in order to calculate R_2^* and separate it from the T_1 only dependent signal S_0. Perfusion parameters were calculated with Tofts and Patlak models using different estimates for arterial input function (AIF).
Results: Best reproducibility was observed for K^{trans} (Tofts) derived from S_0 and for relative regional blood volume (rrBV), both based on AIFs derived from venous R_2^* time course. Meningeomas differ from intraaxial lesions by their higher K^{trans}. Lymphomas show smaller rrBV than primary intraaxial tumours. rrBV of the metastasis widely varies, probably due to different kinds of primary tumours. Metastasis with glucocorticoid pre-medication show remarkable lower K^{trans}.
Conclusion: MR multiecho perfusion measurements allow for stable and plausible access to K^{trans} as well as rrBV of intracranial neoplasms. By separation of T_1 from T_2^* changes based on 10 echoes, the influence of signal nonlinearities in the calculation of rrBV can be avoided with maximum signal.

B-0507 11:35

Peritumoural perfusion and proton spectroscopic MR imaging in the differentiation of gliomas and solitary metastases

G. Sparacia[1], A. Iaia[2], J. Gadde[2], M. Midiri[1]; [1]*Palermo/IT*, [2]*Newark, DE/US (jgadde@christianacare.org)*

Purpose: To asses the value of peritumoural perfusion-weighted and proton spectroscopic MR imaging in preoperative grading of gliomas and in differentiating between primary gliomas and solitary metastases.
Methods and Materials: Ten low-grade gliomas, eight high-grade gliomas, and ten metastases were prospectively evaluated with MR imaging, dynamic susceptibility contrast-enhanced perfusion imaging, and single-voxel proton MR spectroscopy before surgical resection or stereotactic biopsy. Maximal rCBV values and maximal Cho/Cr ratios were calculated from peritumoural region surrounding the tumour. Tumour grade presumed with these values was compared to histopathologic grading. Differences in the study parameters between groups were assessed using the Mann-Whitney test. A Receiver Operating Characteristic analysis was performed to determine cutoff values.
Results: A clear rCBV cutoff value of 1.88 was detected for differentiating low-grade gliomas from high-grade gliomas (sensitivity 100%, specificity 90%, area under the ROC curve.994, $p < 0.0001$). A clear rCBV cutoff value of 1.20 was detected for differentiation of metastases from gliomas (sensitivity 100%, specificity 90%, area under the ROC curve.972, $p < 0.0001$). The differences in the Cho/Cr ratios in the peritumoural regions of high-grade gliomas and of solitary metastasis were statistically significant ($p < .001$) but a clear cutoff value was not found.
Conclusion: Our preliminary data support that peritumoural perfusion-weighted imaging can assist in preoperative differentiation between a glioma and a solitary metastasis, along with separating high-grade gliomas from low-grade gliomas.

B-0508 11:43

DWI and dynamic susceptibility contrast perfusion-weighted imaging of ganglioglioma in adults: comparision study with oligodendroglioma

S. Lee, S. Choi; *Seoul/KR (seunghyun.lee.22@gmail.com)*

Purpose: To evaluate diffusion-weighted imaging (DWI) and dynamic susceptibility contrast perfusion-weighted imaging (DSC-PWI) of ganglioglioma (GG), which were compared with them of oligodendroglioma (ODG).
Methods and Materials: We enrolled 38 patients with histopathologically confirmed 13 GGs and 25 ODGs, who underwent DWI and DSC-PWI MRI before surgery. The volumetric analysis of normalized ADC (nADC) and normalized CBV (nCBV) maps was performed from whole-tumour voxels. In addition, entire tumour extent, cystic volume, enhancing volume, and the ratio of cystic or enhancing portion per entire tumour extent were measured on whole tumour. These parameters were compared by using unpaired Student t test, receiver operating characteristic curve analysis, and multivariate logistic regression models.
Results: The GGs had higher frequency in the temporal lobe than frontal lobe ($P = .043$). The GGs showed smaller cystic volume, lower ratio of cystic volume per tumour extent, and higher ratio of enhancing volume per tumour extent than ODGs ($P = .038$, $P = .004$, and $P = .025$, respectively). Also, the GGs showed lower nADC value (1.077 ± 0.063 Vs 1.214 ± 0.031, $P = .034$) and higher nCBV value (0.839 ± 0.026 vs 0.517 ± 0.024, $P < .001$) than ODGs. The nCBV was the most significant factor to differentiate GG from ODG among these parameters in the multivariate model ($P < .0001$).
Conclusion: Our results suggest that GGs tend to have higher nCBV, and relatively smaller cystic and larger enhancing portion within tumour areas than ODGs. In these parameters, nCBV measurement can be the most useful tool for distinguishing GGs from ODGs.

B-0509 11:51

Recurrence of high-grade glioma and post-treatment effects: differentiation by using perfusion and proton spectroscopic MR imaging

C. Ho; *Singapore/SG (clho_2002@yahoo.com)*

Purpose: To differentiate glioma recurrence (RG) from post-treatment effects (PTE) using 3 T proton spectroscopic imaging (MRS) and perfusion-weighted MRI (PWI) methods during post-treatment assessment of high-grade glioma (HGG) patients. Diagnostic accuracies of 3 T MRS, PWI and a combination of both in a spectroscopic perfusion index (SPI) were assessed.
Methods and Materials: We reviewed all 3 T MRS and PWI studies performed for post-treatment HGG patients between April 2009 and January 2013. Multivoxel Cho/MI, Cho/Cr, Cho/NAA ratios and Lactate and Lipid levels were recorded at short TE 30/40 and intermediate TE 135 ms. Relative cerebral blood volume (rCBV) of the enhancing area of the lesions were compared with the contralateral normal white matter. Histopathology served as the gold reference standard. ROC curves for rCBV, SPI and MRS parameters were compared.
Results: Twenty eight lesions were classified as RG (n = 15) or PTE (n = 13). Diagnostic performance for intratumoural SPI [AUC = 0.917; p= 0.004, 95% CI 0.799 - 1.000] and rCBV [AUC = 0.917; p = 0.005, 95% confidence interval (CI) 0.799 - 1.000] outperformed multivoxel Cho/MI at TE 30/40 (AUC = 0.680; p = 0.01; 95% CI = 0.520 - 0.880) and Cho/Cr at TE 30/40 (AUC = 0.510; p = 0.05; 95% CI = 0.420 - 0.763). Combining MRS and PWI in a new parameter, SPI outperformed individual rCBV and MRS parameters to differentiate RG from PTE.
Conclusion: Combination of PWI and MRS outperformed other parameters in differentiating RG from PTE during post-treatment follow-up of HGG.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 616

Whole-body imaging of systemic tumour spreading

Moderators:
K.N. De Paepe; Leuven/BE
C.J. Johnston; Dublin/IE

K-11 10:30

Keynote lecture

X. Montet; *Geneva/CH*

B-0510 10:39

Whole-body MRI with T1, STIR and DWI: first non-invasive step to rule out bone marrow involvement in aggressive lymphoma - feasibility study

A. Balbo-Mussetto, A. Fornari, C. Lario, M. Petracchini, C. Saviolo, R. Bruna, C. Tarella, S. Cirillo; *Turin/IT (afornari82@hotmail.com)*

Purpose: Standard approach for assessing bone marrow (BM) involvement in aggressive lymphomas still consists on blind BM biopsy, although it is invasive and not representative of focal lesions. Aim of our study was to compare Whole Body MRI (Wb-MRI) and 18 F-FDG PET-CT for a non-invasive evaluation of BM in lymphoma patients.
Methods and Materials: At staging, 41 patients with lymphoma (27 aggressive Non Hodgkin and 14 Hodgkin) underwent BM biopsy, 18 F-FDG PET-CT and Wb-MRI, including T1, STIR and DWI. BM biopsy was considered standard of reference; when a focal BM lesion was suspected on imaging techniques, disappearance after therapy was assumed as a proof of initial involvement.
Results: Six patients had diffuse BM infiltration on biopsy. Among these, 18 F-FDG PET-CT has 3 false negative and 1 false positive results while Wb-MRI demonstrated 100 % agreement. 18 F-FDG PET-CT and Wb-MRI identified focal lesions in 8 additional patients: per-patient analysis demonstrated same accuracy for both imaging techniques but in per-lesion analysis Wb-MRI detected 12% more localizations. Sensibility and specificity for global BM involvement (focal and diffuse) was respectively of 79% and 96% for 18 F-FDG PET-CT and 100% for Wb-MRI.
Conclusion: Assessment of BM involvement is crucial in lymphoma staging because it has both therapeutic and prognostic implications. In this study, imaging techniques changed management in 19.5% patients respect to BM biopsy alone. Our data suggest that Wb-MRI could be used as first non-invasive step to rule out both diffuse and focal BM infiltration, considering biopsy only to determine the severity of infiltration.

B-0511 10:47

Whole-body DW-MRI in staging of indolent lymphomas: comparison with FDG-PET/CT

F. Buemi[1], A. Stecco[1], M. Quagliozzi[1], M. Perchinunno[1], A. Biacca[1], A. Santagostino[2], M. Lombardi[1], A. Carriero[1]; [1]*Novara/IT*, [2]*Vercelli/IT (franbuemi@virgilio.it)*

Purpose: Purpose of this study was to compare the diagnostic accuracy of WB-DW-MRI (whole-body diffusion weighted MRI) with 18 F-FDG-PET/CT in the staging indolent lymphoma patients
Methods and Materials: 21 patients, 11 with small lymphocytic lymphoma and 10 with follicular lymphoma, underwent both 18 F-FDG-PET/CT and WB-DW-MRI before any treatment. According to Ann-Arbor staging system, the staging given by each techniques were compared to the standard of reference by mean of Cohen's K test. Biopsy results, when available, or a clinical and CT follow-ups served as standard of reference. WB-DW-MRI images and PET-CT were respectively interpreted blind by two radiologists and two nuclear medicine specialists. We calculated the intra-rater and inter-rater concordance between the two techniques and compared the diagnostic accuracy of WB-DW-MRI and FDG-PET/CT to the standard of reference, by mean of 2x2 contingency tables and McNemar test.
Results: The k values for the WB-DWI-MRI inter-observer and intra-observer agreement were "good" (k = 0.86 and k=0.83), similar to PET-CT (k=0.83 and k=0.85). In comparison to the standard of reference, WB-DW-MRI has also proven to be more accurate than FDG-PET/CT (95.2 vs 71.4 %) and showed a better negative predictive value (100% vs 45%) than PET-CT.
Conclusion: Whole-body MRI is a promising technique for staging indolent lymphoma.

B-0512 10:55

Surveillance of aggressive lymphoma recurrence after therapy with whole body-MR-DWI: report of a single-centre experience

A. Balbo-Mussetto, A. Fornari, C. Lario, M. Petracchini, C. Saviolo, A. Gueli, A. De Crescenzo, C. Tarella, S. Cirillo; *Turin/IT (annalisa.balbomussetto@gmail.com)*

Purpose: Patients with aggressive lymphoma, both Hodgkin and Non Hodgkin, routinely undergo surveillance CT following first-line therapy in order to identify disease relapse, with consistent radiation exposure. Because of the high curability of lymphomas with current treatment, it is crucial to decrease long-term radiation-associated morbidity related to diagnostic imaging. Aim of this study was to determine effectiveness of whole body MR with DWI (WB-MR-DWI) in the surveillance after therapy compared with standard imaging techniques.
Methods and Materials: From march 2010 to september 2014, 29 patients previously diagnosed and treated for aggressive lymphoma underwent Wb-MR-DWI associated to standard follow-up with CT. Median follow-up duration was 21.8 months. When disease recurrence was suspected, definitive diagnosis was obtained with PET-CT and bone marrow biopsy, considered standard of reference.
Results: During follow-up, 23 patients were disease-free while 6 developed recurrence (respectively 5 nodal and 1 hepatic). CT did not recognise pathological small coeliac nodes and re-activation in a residual fibrous bulky mass. Wb-MR-DWI had excellent agreement (100%) with reference standard, showing both high sensitivity in recurrence detection and high specificity in distinguish between fibrosis, reactive nodes and active disease.
Conclusion: There is an urgent need for radiation-free imaging techniques that can reduce lifetime risk of other cancer in long-term survivor oncological patients. Our data suggest that Wb-MR-DWI offers reliable evaluation of nodal and extranodal lymphoma involvement and is a feasible alternative to CT for routinary lymphoma re-evaluation for short- and long-term follow-up.

B-0513 11:03

Diffusion-weighted MR at 3 T for therapy response assessment in Hodgkin's lymphoma: comparison with FDG PET

I. Platzek, B. Beuthien-Baumann, K. Zoephel, T. Brauer, J. Maus, R. Ordemann, M. Laniado, J. Kotzerke, J. van den Hoff; *Dresden/DE (ivan.platzek@uniklinikum-dresden.de)*

Purpose: To evaluate the agreement of diffusion-weighted magnetic resonance imaging with background signal suppression (DWIBS) and positron emission tomography (PET) with 18 F-fluordeoxyglucose (FDG) in therapy response assessment of Hodgkin`s lymphoma (HL).
Methods and Materials: Nineteen patients with HL, who underwent an FDG PET/MR for staging and had an FDG PET/MR follow-up examination were included in this retrospective study. Besides the FDG PET scan, the PET/MR examination included DWIBS images of the head, neck, thorax, abdomen and pelvis. PET images were independently evaluated by two nuclear medicine physicians, while DWIBS images were evaluated by two radiologists.

Response was classified as complete response (CR), partial response (PR), stable disease (SD), or progressive disease (PD).
Weighted kappa was used to assess method agreement and interrater agreement.
Results: Based on PET findings, response was classified as CR in 13/19 patients, PR in 2/19 patients, SD in 1/19 patients, and PD in 3/19 patients. In contrast, based on DWIBS, response was classified as CR in 11/19 patients, PR in 6/19 patients, and SD in 1/19 patients. PET readers assigned identical scores in 16/19 cases (k = 0.75), while DWIBS had identical results in 17/19 cases (k = 0.83). PET and DWIBS agreed on response assessment in 14/19 cases (k = 0.37).
Conclusion: Our initial results show that DWIBS and PET have a relatively limited level of agreement. As the prognostic value of PET in lymphoma response assessment is well validated, the use of DWIBS cannot be recommended for HL response assessment at the current stage.

B-0514 11:11

Incremental value of diffusion-weighted whole-body imaging with background body signal suppression coupled with multiparametric MR imaging for the detection of skeletal metastasis in prostate cancer

C.J. Das, P. Chakraborty, A.K. Gupta, C.S. Bal; *Dehli/IN (dascj@yahoo.com)*

Purpose: To evaluate incremental role of DWIBS with MRI for detection of skeletal metastasis in prostate cancer. To compare DWIBS with NaF PET/CT for detection of skeletal metastasis in prostate cancer.
Methods and Materials: 36 histopathologicaly proven prostate cancer patients (Age=67.05± 6.09 years) were prospectively enrolled. Coronal DWI sequence was obtained in four different stations in 1.5 T scanner by using b values of 0.400 and 800. Relationship of ADC with distant metastases were assessed by one way ANNOVA. F-18 NaF PET/CT was performed within one week of MRI on a Biograph scanner. Kappa statistic for concordance between NaF and DWIBS was scored.
Results: Mean PSA was 43.78 (±38.44) and Gleason grades ranged from 5 to 9. There was a negative correlation between ADC values and Gleason grade. Mean ADC values of the patient with local invasion 0.51 (±0.10) which was statistically significant (p 0.05). NaF (141) identified more lesions than DWIBS (108). Weighted kappa for concordance between NaF and DWIBS was 0.433 (95% CI=0.144 to 0.723, SE=0.148).
Conclusion: ADC decreases as Gleason grade increases. Locally invasive tumours showed a lower ADC value. ADC did not predict metastatic potential. NaF is superior to DWIBS for the detection of bony metastases.

B-0515 11:19

Comparison between whole-body MRI and PET/CT in staging newly diagnosed FDG-avid lymphomas: our experience

D. Albano, F. Agnello, C. Patti, A. Mulè, L. La Grutta, F. Midiri, G. Franco, M. Midiri, M. Galia; *Palermo/IT (albanodomenico@me.com)*

Purpose: To compare whole body MRI (WB-MRI) and FDG-PET/CT for staging newly diagnosed FDG-avid lymphoma.
Methods and Materials: Fifty-three patients (28 males; mean age, 42 years; range, 15-84) with histologically confirmed malignant lymphoma (27 Classical Hodgkin, 12 Diffuse Large B-cell, 10 Follicular, 4 Mantle Cell) underwent both WB-MRI and FDG-PET/CT before treatment. Ann Arbor stages obtained with WB-MRI (DWI, T1w and STIR sequences, without c.e). and FDG-PET/CT findings were compared using Cohen's k statistics. Moreover WB-MRI and FDG-PET/CT stages were compared with pathological staging obtained using bone marrow and other biopsies if clinically indicated.
Results: Very good agreement between WB-MRI and FDG-PET/CT (k=0.83, $p < 0.05$) was found. WB-MRI stage was equal to those of FDG-PET/CT in 89% (47/53; in particular 25/27 Hodgkin lymphoma, 22/26 Non Hodgkin lymphoma). Very good agreement between WB-MRI stage and pathological stage (k=0.83; sensitivity=90.4%), and between FDG-PET/CT and pathological stage (k=0.89; sensitivity=92.5%) was found. Understaging and overstaging occurred respectively in 9.4% (5/53) and in 1.9% (1/53) with WB-MRI, and in 7.5% (4/53) and in 0% (0/53) with FDG-PET/CT. Differences with pathological stages were caused by missed identification of bone marrow involvement and gastrointestinal lesions identified only with biopsies.
Conclusion: WB-MRI can be considered a good technique for lymphoma staging, without radiation exposure or contrast administration.

B-0516 11:27

Comparison of diagnostic certainty for abdominal incidentalomas in 18 F-FDG PET/MRI and 18 F-FDG PET/CT

B.M. Schaarschmidt[1], J. Grueneisen[2], P. Heusch[1], L. Umutlu[2], V. Ruhlmann[2], S. Rosenbaum-Krumme[2], G. Antoch[1], C. Buchbender[1]; [1]*Düsseldorf/DE*, [2]*Essen/DE*

Purpose: To evaluate if simultaneous 18 F-fluordeoxyglucose positron emission tomography/magnetic resonance imaging (18 F-FDG PET/MRI) can reduce the number of indeterminate abdominal incidentalomas compared to 18 F-fluordeoxyglucose positron emission tomography/computed tomography (18 F-FDG PET/CT).
Methods and Materials: 164 patients underwent both, abdominal 18 F-FDG PET/MRI and 18 F-FDG PET/CT. These examinations were assessed by two readers in random order for abdominal incidentalomas or incidental tracer uptake in the liver, gall bladder, pancreas, spleen, adrenal gland, and kidneys. Each finding was classified as either most likely benign, indeterminate, or most likely malignant. Discrepancies between both readers were resolved in a consensus reading. The total amount of incidental findings and the number of indeterminate findings were compared between 18 F-FDG PET/CT and 18 F-FDG PET/MRI. An organspecific subgroup analysis was performed to detect potential differences regarding lesion location.
Results: In all patients, a total of 663 incidental findings was discovered when regarding all examinations. 18 F-FDG PET/MRI detected more incidental findings than contrast-enhanced 18 F-FDG PET/CT (649 vs. 416 incidentalomas, $p < 0.05$). Still, less findings were classified as indeterminate on 18 F-FDG PET/MRI than on contrast-enhanced 18 F-FDG PET/CT (27 vs. 91 incidentalomas, $p < 0.05$). In an subgroup analysis, significantly less indeterminate findings were observed with 18 F-FDG PET/MRI than with 18 F-FDG PET/CT in the liver ($p < 0.001$), the adrenal glands (p=0.002), and the kidneys (p=0.012). No significant difference was observed in the spleen, pancreas and gall bladder.
Conclusion: 18 F-FDG PET/MRI may go along with more incidental findings than 18 F-FDG PET/CT. However, PET/MRI significantly reduces the number of indeterminate incidental findings of abdominal organs compared with PET/CT.

B-0517 11:35

ADC of normal abdominal organs and bone marrow from whole body DW-MRI at 1.5 T: the effect of sex and age

F. Castelli[1], I. Lavdas[2], A.G. Rockall[2], R.S. Sandhu[2], A. Papadaki[2], L. Honeyfield[2], A.D. Waldman[2], E.O. Aboagye[2]; [1]*Verona/IT*, [2]*London/UK (fedicastelli@gmail.com)*

Purpose: The objectives of this study were to define the range of apparent diffusion coefficients (ADCs), from whole body diffusion-weighted MRI (DW-MRI), in normal abdominal organs and bone marrow, to identify ADC differences between sexes and changes that occur with age and to evaluate the effect of fat fraction (FF) on the ADC of normal liver parenchyma and bone marrow.
Methods and Materials: Fifty-one healthy volunteers (mean age=38, range=23-68 years) underwent whole body DW-MRI using single-shot echo planar imaging (b=0.150,400,750 and 1000 s/mm^2). A two-point DIXON technique was used to evaluate the FF. Perfusion-sensitive (ADC_{ALL}) and perfusion-insensitive (ADC_{HIGH}) ADCs of the liver and renal parenchyma, spleen, pancreatic tail and red/yellow bone marrow were calculated. The relationships between ADC, sex, age and FF were examined.
Results: ADC_{ALL}/ADC_{HIGH} were significantly higher in female volunteers for the pancreatic tail (p=0.046/0.008,respectively), red (p=0.029/0.001, respectively) and yellow bone marrow ($p < 0.001$), but with considerable overlap. There were significant negative correlations between ADC_{ALL}/ADC_{HIGH} and age in the liver parenchyma (p=0.008/0.01,respectively) and in the yellow bone marrow (p=0.013/0.039,respectively) for all subjects. ADC_{ALL}/ADC_{HIGH} were also negatively correlated with FF in the liver parenchyma (p=0.006/0.008, respectively) and in yellow bone marrow ($p \leq 0.001$) in all subjects.
Conclusion: The ADCs of normal liver parenchyma and bone marrow change significantly with age. The ADCs of bone marrow in women are significantly higher than that of men and correlate strongly with FF. These effects should be taken into consideration when using whole body DW-MRI to assess disease burden and treatment response.

B-0518 11:43

Achieving lower radiation dose in follow-up of oncologic patients: comparison of whole-body CT with 4th generation iterative reconstruction algorithm and standard dose examination

A. Casiraghi, D. Ippolito, P. Bonaffini, C. Talei Franzesi, D. Fior, S. Sironi; *Monza/IT*

Purpose: To compare radiation dose and image quality of low dose CT with iterative reconstruction algorithm (iDose4) with standard dose protocol CT examinations for follow-up of oncologic patients.
Methods and Materials: We retrospectively evaluated 51 patients (32 males; mean BMI 24.9+4.1) with malignant diseases which underwent in different times during follow-up both low-dose and standard-dose whole-body CT scans in a single venous phase. Low-dose CT were performed on a 256-row scan (iCT, Philips), with 120 kV, variable mAs (with automated dose modulation), iDose4 modulation and slice thickness 2 mm. Standard-dose CT were performed on 16-rows scan (Brilliance, Philips), with 120 kV, 200-400 mAs (depending on patient weight), slice thickness 2 mm. We evaluated density values by placing ROIs on liver and vessels, along with image noise, sharpness and diagnostic quality with a 4-point scale. DLP and CDTI were also obtained from the scanners.
Results: Density values in liver and vessels were higher in low-dose images (liver 111.7+17.2 vs 101.7+16.6 HU; aorta 164.8+17.8 vs 149.6+22.7 HU, $p < 0.001$). In low-dose examinations we obtained an overall dose reduction of 29% and total DLP was significantly ($p < 0.001$) lower (1010.0+375.1 mGy*cm) as compared to standard-dose studies (1404.9+281.6 mGy*cm). Qualitative analysis did not reveal significant differences in image noise and diagnostic quality of both groups.
Conclusion: iDose4 reconstruction algorithm allows a mean radiation dose reduction of 29%, without significant loss of diagnostic quality and could be useful in reducing dose exposure in oncologic patients.

B-0519 11:51

Image based body surface area evaluation: quantitative radiology vs anthropomorphic evaluation

A. Iannessi[1], H. Beaumont[2], C. Bastiani[1]; [1]*Nice/FR*, [2]*Valbonne/FR (antoine.iannessi@nice.unicancer.fr)*

Purpose: Body surface area (BSA) is the standard for drugs adaptation. BSA index is currently derived from formulae of questionable reliability as their designs was based on no more representative population studies and are based on too basic anthropomorphic measures. In oncology, patients monitoring generally involves imaging, we hypothesize that CT scan would provide more reliable BSA assessment. We proposed to measure BSA based on a body CT scan and test its reliability.
Methods and Materials: We retrospectively enrolled 26 patients who underwent whole body PET- CT scan. We first evaluated software (Mediantechnologies™) performances in drawing precision from thoraco-abdominal test-retest data. Secondly, we assessed inter-method variability between image-based and Du Bois and Du bois assessments. We computed Standard deviation (SD) from a Bland Altman analysis. Finally, based on inter-method variability, we performed monte carlo simulations of the re-classification rates as the rate of dosage change due to the method. We tested two different prescription scheme involving Xelodia alone then Topotecan + Cisplatine where maximum tolerated dose finding was the aim of the protocol.
Results: On test-retest data precision of BSA assessment featured a SD of 0.96%. Inter-method variability of BSA assessment featured a SD of 4.11%. Considering Xelodia prescription, reclassificiation rate was 25%. In the case of Cisplatine and Topotecan, reclassification rate was 7.6 %.
Conclusion: BSA measurement using follow-up CT scan could help the oncologist to adapt the chemotherapy. Moreover, it could be a good alert for any change of nutritional status due to his high precision.

Author Disclosures:
H. Beaumont: Employee; mediantechnologies, lead scientist researcher.

10:30 - 12:00 **Room F2**

Paediatric

SS 612

Foetal and paediatric neuroimaging

Moderators:
P.C. Maly Sundgren; Lund/SE
L.C. Tzarouchi; Ioannina/GR

B-0520 10:30

Correlation between fetal and postmortem MRI and conventional autopsy in the detection of major fetal abnormalities

M. Saldari, S. Bernardo, V. Vinci, A. Giancotti, L. Manganaro, C. Catalano; *Rome/IT (matteo.saldari@gmail.com)*

Purpose: To compare fetal and postmortem MRI and conventional autopsy in cases of major abnormalities.
Methods and Materials: In this prospective study we enrolled 128 fetuses with severe fetal malformations identified during ultrasound examination. Among these, we performed 94 whole body Fetal MRI on 94 fetuses and of these, only 89 women undewent termination of pregnancy. Of the 89 patients, 80 (90%) consented to postmortem MRI alone; 59 (66%) women consented to both postmortem MRI and autopsy and formed our study group. Also during post-mortem MRI we acquired whole body imaging. MR images were reviewed by two radiologists blinded to the autoptic data. Pathologists were blinded to the MR data. Autoptic data were considered the gold standard.
Results: Final autoptic diagnoses were: polycystic kidney disease (n=15), diaphragmatic hernia (n=10), lissencephaly (n=4), type-2 Arnold-Chiari malformation (n=6), Dandy-Walker syndrome (n=13), cloacal malformation (n=1), anencephaly (n=1), holoprosencephaly (n=4), rhombencephalosynapsis (n=2), Walker-Warburg syndrome (n=2), schizencephaly (n=1). Postmortem MRI provided additional information in 10/59 (17%) compared to fetal MRI. In 6 cases (10%) conventional autopsy provided superior diagnostic information compared to MRI-autopsy. On the other hand, in 7 cases (12%) the disruption of the anatomy during autoptic dissection of the fetal body couldn't allow a correct identification of the pathology.
Conclusion: Postmortem MR was accepted by nearly all mothers while conventional autopsy was accepted by two-thirds of mothers and it provided similar information in case of fetal malformations. It allowed the evaluation of the pathology where autopsy failed because of tissue disruption.

B-0521 10:38

Biometric and diffusional changes in apparently normal fetal head MRI scans of fetuses with congenital heart disease

R. Bercovitz[1], G. Yaniv[1], V. Tchekmeister Abitbol[1], C. Hoffmann[1], A. Furer[2], E. Katorza[1], D. Bergman[3], A. Biegon[4]; [1]*Ramat Gan/IL*, [2]*Tel Aviv/IL*, [3]*Jerusalem/IL*, [4]*New York, NY/US (Ronen.Bercovitz@sheba.health.gov.il)*

Purpose: Evaluate the impact of various congenital heart diseases (CHDs) on fetal biometrics and apparent diffusion coefficient (ADC) values in different areas of fetal brains with no neuroimaging abnormality (iCHD group).
Methods and Materials: Twenty-one fetal head magnetic resonance imaging (feMRI) scans of fetuses with CHDs performed between 2011-2014 were analyzed. Inclusion criteria were no other known neuroimaging (MRI and ultrasound [US]) abnormality with CHD (iCHD group). Suitable fetuses were classified either by site of obstruction (SOO) or estimated cerebral blood flow (ECBF) according to established definitions. ADC values were measured in the white matter of the frontal, parietal, temporal and occipital lobes, and in the basal ganglia (BG), thalamus, pons and cerebellum. Results were compared to 26 normal feMRI and US scans matched for 31-36 weeks gestational age (controls).
Results: Fetuses with iCHD compared to control had lower ADC values in the BG (1411±140 vs. 1301±91, respectively, $p < 0.002$) and pons (1356±127 vs. 1233±122, respectively, $p < 0.002$), as well as decreased Abdominal circumference (AC) percentiles (57.3±20.2 vs. 32.9±22.6, respectively, pAorta) had lower ADCs in the pons (1236±109, $p < 0.036$) and lower AC percentiles (25±19, $p < 0.019$). The normal-sized PAs and AOs group also had reduced ADCs in the pons (1116±47, $p < 0.0001$) and AC percentiles (25.4±8.7, $p < 0.008$). Normal and reduced, but not elevated ECBF, groups had significantly decreased pons ADC values (1243±100 $p < 0.015$ and 1201±82 $p < 0.01$, respectively) and in AC percentiles (26.4±22 $p < 0.017$ and 25.1±11, $p < 0.002$, respectively).
Conclusion: Different fetal iCHD groups exhibit distinct patterns of diffusional and biometrical changes specific to each group.

B-0522 10:46

Disrupted developmental organisation of brain connectivity in fetuses with corpus callosum agenesis: an in utero study

A. Jakab[1], G. Kasprian[1], E. Schwartz[1], G.M. Gruber[1], D. Prayer[1], G. Langs[1], V. Schöpf[2]; [1]*Vienna/AT*, [2]*Graz/AT (andras.jakab@meduniwien.ac.at)*

Purpose: Corpus callosum agenesis is characterized by missing interhemispheric connectivity and abnormal intrahemispheric fiber structures. We aimed to describe the altered organization of structural connections and functional activity in the fetal acallosal brain using recently developed in utero brain mapping techniques.
Methods and Materials: Twenty fetuses with corpus callosum agenesis, with or without associated malformations were enrolled and fiber connectivity among 90 brain regions was assessed using in utero diffusion tensor imaging. Macroscopic scale connectomes were compared to 20 gestational age-matched (weeks 21-34) normally developing fetuses by multiple granularity of network analysis. Nine resting functional MRI sessions were collected for a subgroup, and spatially coherent signal fluctuations were interrogated with independent component analysis.
Results: Gradually increasing connectivity strength and diffusion anisotropy during gestation were dominant in antero-posteriorly running paramedian and antero-laterally running aberrant pathways, and in short-range connections in the temporoparietal regions. In fetuses with associated abnormalities, reduction of cortico-cortical and cortico-subcortical connectivity was observed than in cases with isolated callosal agenesis. Fewer neural components of functional MRI signal fluctuations were found in acallosal fetuses, with a tendency to have overrepresented occipital networks and less frontal activation, presumably indicating a lag in development.
Conclusion: Acallosal fetal brains show a globally altered connectivity structure. Besides the previously described Probst and sigmoid bundles, we revealed a prenatally malformed macroconnectome and disrupted functional developmental trajectory. These findings provide evidence that abnormal excessive or exuberant pathways are already present during at early stages of fetal brain development in the majority of cerebral white matter.

B-0523 10:54

Fetal MRI in the evaluation of facial anomalies: is there a role?

M. Saldari, S. Bernardo, V. Vinci, A. Giancotti, L. Manganaro, C. Catalano; *Rome/IT (silviabernardo@live.it)*

Purpose: To evaluate the role of Fetal MRI in the detection and pre- and postnatal management of facial abnormalities.
Methods and Materials: In this prospective study we enrolled 61 pregnant women with ultrasound (US) suspicion of facial fetal anomalies. Among them, 50 underwent MRI and formed our study group. The MR examination was done by a radiologist who was provided with the US data. The MR images were then read by two radiologists who were blinded to the US data. Antenatal US and MRI findings were compared with postnatal diagnosis. Postnatal evaluation included plain radiograph, US, computed tomography, MRI, surgery, physical evaluation and autopsy.
Results: Fetal MRI diagnosed: primary anophthalmia (n = 2), micrognathia (n = 11), cleft lip (n = 12), cleft lip with cleft palate (n = 9), nasolacrimal duct cyst (n = 1), proboscis (n = 1), agnathia (n = 2), maxillary hypoplasia (n = 2), ocular hypoplasia (n = 1), cyclopia (n = 1), coloboma (n = 3). The concordance between the two radiologists in the diagnosis of fetal anomalies was 100%. MRI was able to provide additional information than US in 13 cases (26%), excluded US diagnosis in 5 cases (10%) and simply confirmed US findings in 32 fetuses (64%). Fetal MRI guided pre- and post-natal management in 10 cases.
Conclusion: Fetal MRI is a useful tool to diagnose facial abnormalities and in some cases it is necessary to guide a correct pre- and postnatal management and treatment.

B-0524 11:02

Fractional anisotropy of the fetal midbrain is specifically elevated in Chiari II malformations

R. Woitek, M. Weber, R. Seidl, D. Bettelheim, V. Schöpf, G. Amann, P.C. Brugger, D. Prayer, G. Kasprian; *Vienna/AT (ramona.woitek@meduniwien.ac.at)*

Purpose: Extrinsic compression of neural structures has been shown to increase fractional anisotropy (FA) on Diffusion tensor imaging (DTI) (Chang 2010 J Neurotrauma). We investigated whether DTI is capable of showing changes in FA or apparent diffusion coefficient (ADC) in the midbrain of fetuses with Chiari II malformations compared to age matched fetuses with normal CNS, with hydrocephalus or mild ventriculomegaly.
Methods and Materials: 76 fetuses (normal CNS [n=46], Chiari II malformations [n=15], hydrocephalus [n=8], mild ventriculomegaly [n=12]) were examined on a Philips 1.5 T scanner (SENSE cardiac coil, 5 elements). Axial T2W-FSE sequences and axial single shot echo planar DTI sequences with 32 non-collinear diffusion gradient encoding directions with b-values of 0 and 700 were acquired. After co-registering T2W-FSE images with FA color coded-maps a region of interest was drawn in the midbrain to calculate FA and ADC.
Results: 15 fetuses with Chiari II malformations showed significantly higher FA than age matched fetuses with normal CNS (p=.003) while ADC was not significantly different. In comparisons of all other subgroups ADC and FA were not significantly different.
Conclusion: FA is a parameter intrinsic to the fetal midbrain (contrasting to morphometry of the posterior fossa in Chiari II malformations) and is therefore a potential indicator of (mal-)function. Therefore higher FA in the midbrain of fetuses with Chiari II malformations is specific for midbrain compression in the axial plane. It might potentially aid in the differentiation of closed from open neural tube defects and further evaluation of correlation with brainstem dysfunction appears promising.

B-0525 11:10

Selected regional changes in brain diffusivity in fetal isolated mild ventriculomegaly

R. Bercovitz[1], G. Yaniv[1], E. Katorza[1], D. Bergman[2], C. Hoffmann[1], A. Biegon[3]; [1]*Ramat Gan/IL*, [2]*Jerusalem/IL*, [3]*New York, NY/US (Ronen.Bercovitz@sheba.health.gov.il)*

Purpose: To evaluate the impact of symmetric and asymmetric isolated mild ventriculomegaly (IMVM, atrial width ≥10 ≤15 mm) on apparent diffusion coefficient (ADC) values in fetal brain areas.
Methods and Materials: Sixty-seven sequential fetal head magnetic resonance imaging (feMRI) scans performed between 2009-2014 were compared to 38 normal feMRI scans matched for gestational age (controls). Ultrasound- and MRI-proven IMVM cases were divided into asymmetrical (AVM, ≥2 mm difference in atrial width), symmetrical (SVM, < 2 mm difference in atrial width) and asymmetrical IMVM with one normal-sized ventricle (AV1norm).
Results: ADC values were significantly elevated in the basal ganglia (BG) of the SVM and AV1norm groups compared to controls ($p < 0.004$ and $p < 0.013$, respectively). The BG ADC values were significantly elevated ipsilateral to the enlarged atria relative to the normal-sized atria in the AV1norm group ($p < 0.03$). Frontal lobe ADC values were significantly reduced in the AVM and SVM groups ($p < 0.003$ and $p < 0.003$ vs. controls). Temporal lobe ADC values were significantly reduced in the AVM group ($p < 0.001$ vs controls).
Conclusion: IMVM patterns are associated with distinct ADC value changes in different brain regions. ADC values may reflect the pathophysiology associated with different IMVM patterns and may serve as prognostic factors in fetuses with mild VM.

B-0526 11:18

Automatic white matter tract segmentation in the neonatal brain

C.V. Pul[1], L. Fonseca[2], N. Lori[3], J. Buijs[1], P. Andriessen[1], A. Vilanova[4]; [1]*Veldhoven/NL*, [2]*Eindhoven/NL*, [3]*Coimbra/NL*, [4]*Delft/NL (c.vanpul@mmc.nl)*

Purpose: Develop a method to automatically quantify and visualise white matter (WM) bundles in the neonatal brain based on Diffusion Tensor Imaging (DTI).
Methods and Materials: We developed a pipeline for automatic tract segmentation consisting of: i) MRI brain masking, ii)-Diffusion Tensor Fitting and Fiber tracking, iii) Undersampling fiber tracts through clustering and selecting the cluster centers (i.e., sampled data), iv) Fiber-based registration between Atlas and Sampled Data, v) Labeling registered Sampled Data - each sampled fiber is given the label of its Atlas closest fiber tract, vi) Propagation of the labels in the sampled tracts to all the tracts.
DTI-Data (50 slices, 1.41x1.41x2 mm voxels, acquired at 3.0 T MRI with b=800, 32 directions) was used to test the pipeline. The Atlas was based on data from 3 preterm neonates scanned at term age.
Results: Of 29 available neonatal datasets, 6 contained large MRI artifacts and failed in the first part of the pipeline. In the remaining 23 datasets, automatic segmentation was possible, with only 2 patients classified "bad", containing more than 30% mislabeled fibers. Segmentation results did not depend on WM pathology, it even performed well in a patient with corpus callosum agenesis. Recognised fiber bundles were quantified, e.g. volume and anisotropy, without user interaction.
Conclusion: We show that automatic segmentation, based on a reference atlas, provides good results for recognition of the main structures of interest in the neonatal brain. Thus, a user independent and less time consuming evaluation of white matter structures in the developing brain becomes possible.

B-0527 11:26

Association between retinoblastoma tumour size and tumour extent

M.C. de Jong[1], F. van der Meer[1], S. Göricke[2], H.J. Brisse[3], P. Galluzzi[4], P. Maeder[5], A. Moll[1], J. Castelijns[1], P. de Graaf[1]; [1]*Amsterdam/NL*, [2]*Essen/DE*, [3]*Paris/FR*, [4]*Siena/IT*, [5]*Lausanne/CH (mc.dejong@vumc.nl)*

Purpose: The purpose of this study was to assess the association between retinoblastoma tumour size (volume and maximum axial diameter) and metastatic risk factors (postlaminar optic nerve and massive choroidal tumour invasion) determined by histopathological examination.
Methods and Materials: In this multicentre study, we included 380 consecutive retinoblastoma patients (386 eyes) who were treated with primary enucleation and underwent baseline magnetic resonance imaging. Receiver operator curve (ROC) and logistic regression analysis were used to analyse the data and to evaluate potential confounders.
Results: For postlaminar optic nerve invasion (n=386), ROC analysis yielded areas under the curve (AUC) of 0.77 (95%CI 0.70-0.85) vs. 0.78 (95%CI 0.71-0.85), respectively, for volume and diameter. Massive choroidal tumour invasion (n=226) showed AUCs of 0.65 (95%CI 0.55-0.74) and 0.67 (95%CI 0.57-0.77). Logistic regression analysis showed that tumour size was the main predictor of these metastatic risk factors. Below 1 cm3 or 14.5 mm (lowest size category), the risk of post laminar optic nerve invasion is minimal (< 3%); whereas above 2 cm3 or 17.5 mm (highest size category), the risk is substantial (> 25%). As reflected by the lower AUC, all tumour size categories showed a more evenly distributed risk of massive choroidal invasion (ranging from 9% to 33%).
Conclusion: Tumour size is a predictor of postlaminar optic nerve tumour invasion and to a lesser extent also a predictor of massive choroidal tumour invasion; especially, the negative predictive value of tumours in the smallest size category is high for postlaminar invasion.

B-0528 11:34

DTI and MR spectroscopy study in the auditory neural pathway of paediatric congenital sensorineural hearing loss patients

C.X. Wu, W.B. Zheng; *Shantou/CN (hwenb@21cn.com)*

Purpose: To evaluate possible changes in microstructure and metabolism in the auditory neural pathway, in children with sensorineural hearing loss (SNHL), by using diffusion tensor imaging and MR spectroscopy.
Methods and Materials: Eighty-eight SNHL children (41 females, 47 males, 1-14 years of age; mean age 5 years) and thirty-one normal hearing subjects (17 females, 14 males, 1-10 years of age; mean age 3.7 years) were studied by conventional MR imaging, DTI and MRS. SNHL patients were divided into two groups: group A > 3-years old (n=43) and group B ≦3-years old (n=45). Two DTI parameters, FA and ADC, were measured in the superior temporal gyrus (STG) and auditory radiation. Regions of interest for metabolic changes measurements were located inside the STG.
Results: Compared with healthy individuals, SNHL individuals displayed decreased FA values in the auditory radiation and STG. A statistically significant reduction ($p < 0.05$) in FA of auditory radiation was observed in group A and group B. And in group A, NAA/CR ratio and FA values in the STG were also significantly decreased ($p < 0.05$).
Conclusion: DTI and MRS can evaluate microstructural alterations and metabolite concentration changes in the auditory neural pathway that are not detectable by conventional MR imaging. Due to the lack of sound stimulus, children with SNHL might undergo myelin developmental delay in the auditory neural pathway and have metabolite concentrations changes in the auditory cortex, which might be associated with the effect of cochlear implantation.

Author Disclosures:
C.X. Wu: Grant Recipient; This study was supported by the Natural Science Foundation of Guangdong Province, China (grant No. S2012010008974), and was sponsored by Shantou University Medical College Clinical Research Enhancemen. **W.B. Zheng:** Grant Recipient; This study was supported by the Natural Science Foundation of Guangdong Province, China (grant No. S2012010008974), and was sponsored by Shantou University Medical College Clinical Research Enhancemen.

B-0529 11:42

Neonatal lumbar puncture: are traditional clinical landmarks of lumbar anatomy accurate when compared with ultrasound assessment?

B. Baxter, J. Evans, R. Morris, U. Ghafoor, M.P. Nana, T. Weldon, T. Hildebrandt, G. Tudor; *Bridgend/UK (melanienana28@hotmail.com)*

Purpose: The intercristal line, defined as the superior aspect of the iliac crest is used to clinically identify the L5/S1 spinal level and guide the correct position for LP in neonates. Accepted practice is to perform LP at the L3/4 or L4/5 intervertebral space. We hypothesise that due to anatomical variation in term babies Ultrasound more accurately identifies an appropriate level for LP.
Methods and Materials: Following ethical approval, 30 term neonates were recruited. The neonate was placed in the left lateral position and two points marked - the intercristal line and intervertebral space immediately above this line. The exact anatomical position of both points and the end of the conus medullaris were then confirmed using ultrasonography (Toshiba, 8 MHz linear probe).
Results: The variation in clinical anatomical position of the intercristal line was between L2/3 and L5/S1. In 25 (83%), the intercristal line was identified between L3/4 and L4/5. The intervertebral space above this line was marked between L1/2 and L4/5. The potential site for LP was identified too high in 11 cases (36%).The conus medullaris ranged from L1 to L3 terminating at L2 or lower in 11 cases (36%).
Conclusion: There is variation in the position of the intercristal line in relation to lumbar level on clinical examination. Using the intercristal line to guide LP does not appear to be accurate raising the possibility of spinal cord injury. Visualisation of the conus medullaris with ultrasound is therefore a potential advantage in identifying a safe intervertebral level for LP.

B-0530 11:50

Comparison of 3 T MRI, PET and Ictal SPECT in presurgical localization of the seizure-onset zone in paediatric patients with refractory temporal lobe epilepsy

H.M. Kassem[1], A. Wafaie[2], N. Al Adwani[1], N. Al Khuraish[1], Z. Azmat[1], S. Al Jubran[1], H. Farghaly[3], L. Affifi[2], M. El Mahdy[1]; [1]*Riyadh/SA*, [2]*Cairo/EG*, [3]*Assiut/EG (kassem_hassan60@yahoo.com)*

Purpose: To compare the sensitivities of 3 T MRI, FDG-PET and Ictal/SPECT in presurgical localization of the seizure-onset zone in paediatric patients with refractory temporal lobe epilepsy.
Methods and Materials: This study included 128 paediatric patients who received surgical treatment for intractable temporal lobe epilepsy whether unilateral or bilateral and whether involving the mesial or lateral temporal lobe structures. 3 T MRI, FDG-PET and Ictal 99mTc-HMPAO SPECT were retrospectively reviewed in all cases regarding their sensitivity in detection of the seizure-onset zone compared to video/EEG, pathological results and surgical outcome as a 3 standards of references.
Results: From the total 128 paediatric patients included in this study, 102 patients showed positive findings (MR-positive group) and 26 cases showed no definite lesions on 3 T MRI (MR-negative group). In the MR-positive group, MRI, PET and ictal/SPECT were concordant to video/EEG in 81%, 83% and 72%, respectively. When compared to pathological diagnosis, they correctly lateralized the seizure-onset zone in 85%, 87%, and 73%, respectively. In patients with good surgical outcome, they correctly localized the zone in 87%, 88%, and 78% of cases, respectively. In the MR-negative group, PET and ictal/SPECT were concordant with video/EEG in 82% and 58%, respectively and matching with pathological diagnosis in 85% and 56%, respectively.
Conclusion: PET is the most sensitive method in lateralization of the seizure-onset zone closely followed by 3 T MRI. The use of 3 T MRI, PET and Ictal/SPECT as a multimodality approach improves lateralization of the seizure-onset zone and distinguishes paediatric patients who will benefit from surgery.

10:30 - 12:00 **Room D1**

Chest

SS 604

Pulmonary nodule

Moderators:
C. Mueller-Mang; Vienna/AT
M. Sánchez; Barcelona/ES

K-12 10:30

Keynote lecture

A. Devaraj; *London/UK*

B-0531 10:39

Ultralow-dose CT with tin-filtration for detection of solid and sub-solid pulmonary nodules: a phantom study

K. Martini, K. Higashigaito, B.K. Barth, S. Baumüller, T. Frauenfelder; *Zurich/CH (katharina.martini@usz.ch)*

Purpose: The purpose of this study was to determine the lowest radiation dose level with maintained diagnostic image quality and high sensitivity for pulmonary nodule detection.
Methods and Materials: Single-energy CT was performed using third-generation dual-source CT at 100 kVp and tin-filtration with varying tube currents. An anthropomorphic chest phantom with solid and sub-solid pulmonary nodules (2-10 mm, attenuation, 20 HU to -800 HU at 120 kVp) was used. The mean volume CT dose index $CTDI_{vol}$ of the standard chest protocol

was of 2.2 mGy. The subsequent measurements resulted in 1/10th,1/20th and 1/70th dose levels. Images were reconstructed with iterative reconstruction algorithms (ADMIRE). One blinded reader measured image noise, and two blinded readers determined overall image quality and nodule localization with confidence rates on a modified 5-point Likert scale.
Results: The image quality was diagnostic for all images scanned with 1/20th of standard dose using iterative reconstruction techniques. Inter-observer agreement for image quality was excellent (k = 0.88). Objective noise has been significantly reduced using IR (ADMIRE5:70.41% for 1/20th;71.6% for 1/10th, p=0.05) compared to FBP. Sensitivity of nodule detection was 97.14% (100% for solid, 93.75% for sub-solid nodules) at 1/20thdose level and 100% for both nodule entities at 1/10th dose level using ADMIRE5. Images obtained with 1/70th dose level had moderate sensitivity (overall 85.71%; solid 94%; sub-solid 73.33%).
Conclusion: Our work suggests that with tin-filtration in combination with IR the effective radiation dose can be lowered to 0.042mSv while maintaining diagnostic image quality and high sensitivity for detection of solid and sub-solid nodules.

B-0532 10:47

Comparison of model-based iterative reconstruction with iDose^4 and filtered back projection for the analysis of ground-glass opacity nodule in the chest phantom

J. Nam, S. Choi, S. Shim, J. Lee, K. Bae, J. Park, W. Kwon; *Ulsan/KR (0732607@uuh.ulsan.kr)*

Purpose: To evaluate usefulness of iterative model reconstruction (IMR) for analysis of ground-glass opacity (GGO) nodules using chest phantom with various CT parameters; comparison with iDose^4 and filtered back projection (FBP).
Methods and Materials: CT scan was performed on chest phantom containing 26 GGO nodules at various CT parameters (kVp; 120, 100, and 80: mAs; 30, 20, and 10). Each CT scan was simultaneously reconstructed by FBP, iDose^4, and IMR. For quantitative analysis, noise, contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR), and nodule size were measured. Detection rate of GGO nodules by each reconstruction algorithms in given various CT parameters was compared. For qualitative image analysis, diagnostic confidence, noise scale, and subjective image quality were assessed by two radiologists in consensus using semi-quantitative grading scale.
Results: Noise, CNR, SNR were significantly greater in IMR than iDose^4 and FBP in all CT parameters ($p > 0.05$). IMR was also superior to iDose^4 and FBP on nodule detection (73.1-100% vs 46.2-88.5% and 34.6-88.5%). However, nodule size was not statistically different among reconstruction algorithms. Diagnostic confidence, noise scale, and subjective image quality also favored IMR than iDose^4 and FBP. With IMR, detection rate, diagnostic confidence, noise scale, and subjective image quality were not significantly different in all CT parameters except 80 kVp/10 mAs. Therefore, 80 kVp/20 mAs was sufficient to evaluate most of GGO nodules, needless to perform higher dose of radiation.
Conclusion: IMR might be useful for assessment of GGO nodule with very low radiation, relatively high CNR, lower noise, and acceptable image quality.

B-0533 10:55

Agreement of pulmonary nodule management based on diameter- and volume measurements in CT lung cancer screening

M.A. Heuvelmans[1], R. Vliegenthart[1], P.M.A. Van Ooijen[1], W.P.T.M. Mali[2], H.J. De Koning[3], M. Oudkerk[1]; [1]*Groningen/NL*, [2]*Utrecht/NL*, [3]*Rotterdam/NL (m.a.heuvelmans@umcg.nl)*

Purpose: To determine agreement of manual and semi-automated (SA) diameter and volume measurements of indeterminate nodules found in CT lung cancer screening, and to compare nodule classification based on a diameter and volume nodule management protocol.
Methods and Materials: Baseline data of 2,240 solid indeterminate nodules (volume50-500 mm^3) in 1,498 NELSON participants was used. Extrapolated volume based on semi-automatic (SA) volume-deducted maximum and mean diameter were compared to SA volume measurements by Bland-Altman-plots. Analyses were repeated by margin (smooth, lobulated, spiculated, irregular). In 100 randomly selected nodules diameters were measured manually by two independent radiologists, and compared to the SA volume-deducted diameters. Nodule reclassification based on a diameter-based protocol was evaluated.
Results: Median participant age was 59 years (interquartile range:8), 85.8% were men. Compared to SA volume, volume extrapolated from volume-deducted mean or maximum diameter led to mean overestimation of 47.2%(95%-confidence interval (CI):44.7-49.7%) and 85.1%(95%-CI:81.2-89.0%), respectively. For irregular nodules, mean overestimation was the highest; 161.7%(95%-CI:131.7%-191.8%). Manual diameter measurement overestimated and underestimated SA volume-deducted maximum diameter by ≥10% in 44% and 18% of nodules, respectively. Using a 10-mm diameter criterion for referral, volume-deducted maximum diameter measurements of NELSON indeterminate nodules would have led to direct referral in 7.9% (177/2240). Manual measurements would have led to 31% (31/100) referrals.
Conclusion: The agreement between manual and SA diameter, and between volume extrapolated from SA volume-deducted diameter and SA volume is poor. The use of volumetry shifts stratification compared to diameter measurements, and markedly diminishes the number of false-positive results.

B-0534 11:03

CT screening for lung cancer: part-solid nodules in baseline and annual repeat rounds on behalf of the I-ELCAP investigators

C.I. Henschke, R. Yip, A. Wolf, R. Flores, M. Salvatore, D. Yankelevitz; *New York, NY/US (cihenschke@gmail.com)*

Purpose: To address the natural course and frequency of diagnosed lung cancer manifesting as part-solid nodules.
Methods and Materials: All participants with at least one part-solid nodule in baseline and annual repeat rounds of screening were identified and were followed to determine whether the nodule resolved, decreased, remained stable, or grew and the resulting diagnoses.
Results: Of 57,496 baseline screenings, a part-solid nodule was identified in 2,893 (5.0%) resulting in 80 diagnoses of Stage I and 1 with Stage II+ adenocarcinoma; median diameter was 15 mm and of the solid component 7 mm. Of 64,677 annual repeat screenings, a new part-solid nodule was identified in 542 resulting in 9 Stage I adenocarcinomas, none in nodules 31+ mm or larger; all started as a nonsolid nodule; median diameter was 10 mm and of the solid component 6 mm. Treatment of 81+9 = 90 patients was by surgical resection in 86 (lobectomy in 64, sublobar resection in 22), radio- and/or chemotherapy in 3 and no treatment other than 4 year follow-up for 1. Lung-cancer-specific survival for all 81+9 was 100% with median follow-up from diagnosis of 84 months (6-158). All with solid components of 10 mm or less were pathologic Stage I.
Conclusion: Lung cancer manifesting as a part-solid nodule starts as a nonsolid nodule. The solid component is the best predictor of tumour invasion. A part-solid nodule should be classified according to the size of its solid component and worked up accordingly.

B-0535 11:11

ACR lung-RADS guidelines for pure ground-glass nodules: is a threshold of 20 mm adequate?

S.J. van Riel[1], K. Chung[1], E.T. Scholten[1], P.A. de Jong[2], C.M. Schaefer-Prokop[3], B. van Ginneken[1]; [1]*Nijmegen/NL*, [2]*Utrecht/NL*, [3]*Amersfoort/NL (Sarah.vanRiel@radboudumc.nl)*

Purpose: The ACR Lung-RADS for management of pulmonary nodules categorizes pure ground-glass nodules (GGN) into a 1 year (category 2) or 6 months (category 3) follow-up CT scan, using a cutoff value of 20 mm as threshold. An analysis of GGNs categorized according to the Lung-RADS is presented.
Methods and Materials: All pure GGNs from two sites of the NELSON screening trial were selected. Morphology was determined in the first CT scan they were annotated. Each nodule was considered only once. Diameter measurements were taken from the NELSON database. Nodules were categorized according to the ACR Lung-RADS, using the proposed threshold of 20 mm. Changes in categorization were calculated when lowering the threshold to 15 and 10 mm.
Results: 86 GGNs were included, with 16 malignant GGNs (19%) including 9 invasive adenocarcinomas. For a 20 mm threshold, only 2% of GGNs were assigned to Lung-RADS 3. For a 15 mm threshold this increased to 16%; for a 10 mm threshold to 53%. Of the 16 cancers, only 1 was assigned to Lung-RADS 3 using a 20 mm threshold. This increased to 4 and 12 for thresholds of 15 and 10 mm, respectively.
Conclusion: Using a threshold of 20 mm to select pure GGNs that warrant shorter follow-up will miss almost all cancers. A less conservative threshold of 10 mm - as has been suggested by the Fleischner Society - will select three-quarters of the cancers at the expense of an overall increased number of follow-up CTs.

B-0536 11:19

Automated CT densitometry in characterizing solitary pulmonary nodule enhancement

Y. Choi, M. Chung, H. Kim; *Bucheon/KR (phillipchoi007@gmail.com)*

Purpose: To determine whether automated CT measurement of solitary pulmonary lesion enhancement is an accurate approach to distinguishing malignant nodules from benign nodules.
Methods and Materials: CT scans of 98 patients with pulmonary nodules from 2012 to 2014 were acquired. Nodules were diagnosed clinically (46) or pathologically (52). Nodules less than 5 cm were selected and attenuation before and after contrast injection was measured using automated CT densitometry (GE AW area histogram & Siemens lung parenchyma analysis). The range of density was set as 15 - 110 HU to exclude water, air, vessel and

calcific densities. The measurement (region of interest) included the entire nodule.
Results: The prevalence of malignancy was 45.9% (45/98). The 53 benign nodules had various diagnoses (17 tuberculoma, 7 fungus, 9 organizing pneumonia, 3 abscess, 17 benign tumours). The mean values of preenhancement, enhancement, and net enhancement of malignant nodules were 42.9, 68.4 and 25.8 HU respectively while those of benign nodules were 43.5, 56.7 and 14.0 HU. Enhancement and net enhancement of malignant nodules were significantly higher than those of the benign group (enhancement t=4.00 P=< 0.001; net enhancement t=4.43 P=< 0.001). The malignant nodule enhancement ranged from 28.6 ~ 98 HU. The median enhancement of benign nodules was 48.2 HU for tuberculoma & fungus, 52.7 HU for FOP & abscess, and 61.9 HU for benign tumour.
Conclusion: The present study suggests that this new automated measurement with preset range of density could lead to more convenient and accurate attenuation results thereby better distinguishing indeterminate pulmonary nodules.

B-0537 11:27

Differentiation of persistent and transient subsolid nodules: does morphology help?

K. Chung[1], E.T. Scholten[1], S.J. van Riel[1], F. Ciompi[1], P.A. de Jong[2], M.M. Wille[3], M. Prokop[1], B. van Ginneken[1], C.M. Schaefer-Prokop[1]; [1]*Nijmegen/NL*, [2]*Utrecht/NL*, [3]*Hellerup/DK (kaman.chung@radboudumc.nl)*

Purpose: Current recommendations propose a three month follow-up CT scan to differentiate between persistent and transient subsolid lesions leading to a substantial number of short term follow-ups. Purpose of the study was to look for morphological features to differentiate persistent from transient lesions.
Methods and Materials: Transient and persistent subsolid nodules were randomly selected from the NELSON and DLCST screening trial. An experienced chest radiologist assessed a number of predefined morphological features. Likelihood of persistence was assessed using a continuous scale between 0-100. MANOVA statistics were used to assess the discriminating power of morphological features ($p < 0.05$ was considered significant), ROC analysis was applied to assess ability to differentiate persistent from transient lesions.
Results: A total of 122 nodules were assessed (median 9.7 mm). Size distribution was equivalent for the two groups. The ROC area under the curve (AUC) for differentiating was 0.68 for all lesions and 0.82 for lesions > 10 mm. MANOVA revealed no significant discriminative features for all lesions, but yielded significance (p=0.02) for lesions > 5 mm. Multiplicity (p=0.046) and margin characteristics (p=0.006) had significant discriminative power. Demarcation by interlobular septum was predictive for transient nodules (74% vs. 26%) while spiculation was predictive for persistence (100% vs. 0%).
Conclusion: There are morphological features with significant predictive power to differentiate persistent from transient subsolid nodules. They may be used in risk stratification models for subsolid nodules and serve as input for computerized classification systems.

B-0538 11:35

Differentiating pre- and minimally invasive from invasive adenocarcinoma using CT features in persistent pulmonary part-solid nodules

J.G. Cohen[1], E. Reymond[1], M. Lederlin[2], M. Medici[1], S. Lantuejoul[1], F. Laurent[2], F. Arbib[1], A. Jankowski[1], G.R. Ferretti[1]; [1]*Grenoble/FR*, [2]*Bordeaux/FR (Rudra38@gmail.com)*

Purpose: To retrospectively investigate the diagnostic value of pre-operative CT-features between pre/minimally invasive and invasive lesions in part-solid persistent pulmonary ground glass nodules in a Caucasian population.
Methods and Materials: Retrospective review of two pre-operative CTs for 31 nodules in 30 patients. There were 10 adenocarcinomas in situ (AIS), 1 minimally invasive adenocarcinoma (MIA), 20 invasive adenocarcinomas (IVA). We analyzed the correlation between histopathology and the following CT-features: maximal axial diameter, maximal orthogonal axial diameter, height, density, size of solid component, air bronchogram, pleural retraction, nodule mass, disappearance rate and their evolution during follow-up.
Results: On univariate analysis, IVA had a higher maximal height, density, solid component size, mass, a lower disappearance rate and presented more often with pleural retraction ($p < 0.05$). After logistic regression performed with the uncorrelated parameters using a method of selection of variables, only the size of solid component remained significant, with 100% sensitivity for IVA when superior to 5 mm.
Conclusion: Preoperative CT-features can help differentiating AIS/MIA from IVA. A solid component superior to 5 mm had 100% sensitivity for the diagnosis of invasive adenocarcinoma.

B-0539 11:43

Pulmonary nodules: a comparative evaluation of unenhanced CAIPIRINHA- volumetric interpolated breath-hold examination (VIBE)- 3-TMRI and multislice computed tomography

P. Dewes, C. Frellesen, F. Al-Butmeh, J.L. Wichmann, M. Albrecht, T.J. Vogl; *Frankfurt/DE (patricia.dewes@kgu.de)*

Purpose: To elucidate diagnostic accuracy regarding detection of pulmonary lesions by 3-Tesla magnetic resonance imaging (MRI) using controlled aliasing in parallel imaging results in higher acceleration (CAIPIRINHA) under sampling technique with volumetric interpolated breath-hold examination (VIBE) sequences in comparison with computed tomography (CT).
Methods and Materials: Three observers retrospectively evaluated 54 patients (27 male, 27 female; mean age: 60.8 years) who underwent thoracic MRI using CAIPIRINHA-VIBE sequences. Subjective image quality was rated by three independent reviewers using a 5-point grading scale. Interobserver agreement was calculated using intraclass correlation coefficient (ICC). Sensitivity and specifity for detection of lung nodules was evaluated to reference standard CT.
Results: Average observer ratings regarding subjective image quality were good to excellent for MRI (1.54) and CT (1.14). Interobserver agreement was almost perfect for evaluation of MRI (ICC, 0.83; 95% [CI]: 0.78-0.89) and CT (ICC, 0.91; 95% [CI]: 0.85-0.94). In 30 patients we detected 122 pulmonary lesions by MRI (out of 137 lesions by CT). Sensitivity of MRI using CAIPIRINHA-VIBE sequences for detection of pulmonary lesions was 89.05%; 95% confidence intervals [CI]: 0.82-0.93 and specifity was 78.57%; 95% [CI]: 0.49-0.95. Sensitivity for Lesions smaller than 5 mm was 75.86%; 95% [CI]: 0.56-0.89 and for Lesions from 5 to 10 mm was 85.71%; 95% [CI]: 0.74-0.93. Sensitivity for Lesions over 10 mm was 100%.
Conclusion: 3 T-MRI using CAIPIRINHA-VIBE sequences with short-breath-hold technique allows reliable detection of pulmonary lesions in comparison to CT with good to excellent sensitivty and specifity with almost perfect interobserver agreement.

B-0540 11:51

Detection and quantification of the solid component in pulmonary subsolid nodules by semiautomatic segmentation

E. Scholten[1], C. Jacobs[2], B. van Ginneken[2], S. van Riel[2], R. Vliegenthart[3], M. Oudkerk[3], M. Prokop[2], H.A. Gietema[1], P.A. de Jong[1]; [1]*Utrecht/NL*, [2]*Nijmegen/NL*, [3]*Groningen/NL (ethscholten@quicknet.nl)*

Purpose: To determine whether semiautomatic volumetric software can differentiate partsolid from nonsolid pulmonary nodules and aid quantification of the solid component.
Methods and Materials: As the reference standard 115 nodules were differentiated into nonsolid and partsolid by two radiologists, disagreements were adjudicated by a third radiologist. The diameters of solid components were measured manually. Semiautomatic volumetric measurements were used to identify and quantify a possible solid component, using different Hounsfield Unit (HU) thresholds. The measurements were compared with the reference standard and manual measurements.
Results: The reference standard detected a solid component in 86 nodules. Diagnosis of a solid component by semiautomatic software depended on the threshold chosen. A threshold of -300 HU resulted in the detection of a solid component in 75 nodules with good sensitivity (90%) and specificity (88%). At a threshold of -130 HU semiautomatic measurements of the diameter of the solid component (mean 2.4 mm, SD 2.7 mm) were comparable to manual measurements at mediastinal window setting (mean 2.3 mm, SD 2.5 mm [p=0.63]).
Conclusion: Semiautomatic segmentation of subsolid nodules could diagnose partsolid nodules and quantify the solid component similar to human observers. Its performance depends on the attenuation segmentation thresholds This method may prove useful in managing subsolid nodules.

Author Disclosures:
C. Jacobs: Employee; Employee of both RadboudUMC and Fraunhover Mevis. **B. van Ginneken:** Employee; Employee of both RadboudUMC and FraunhoferMEVIS.

10:30 - 12:00 **Room D2**

Interventional Radiology

SS 609
Neuro interventions

Moderators:
N. Amoretti; Nice/FR
A. Ringelstein; Essen/DE

B-0541 10:30

Novel x-ray shielding device for reducing the lens exposure during endovascular treatment for brain diseases

L. Sun[1], T. Totsuka[2], K. Akahane[3], M. Hayakawa[4], Y. Matsumaru[5], K. Tsuboi[1], T. Moritake[6]; [1]*Tsukuba/JP*, [2]*Higashi Ibaraki Chiou/JP*, [3]*Chiba/JP*, [4]*Osaka/JP*, [5]*Tokyo/JP*, [6]*Kitakyushu/JP (tmoritake@mac.com)*

Purpose: Endovascular treatments for brain diseases provide a great benefit to a large number of patients, but they carry the risk of radiation-induced skin injury (RSI) or lens opacification. The International Commission on Radiological Protection (ICRP) reviewed recent epidemiological evidence and issued a statement on April 21, 2011. Based on this statement, the threshold dose for the lens of the eye is 0.5 Gy. However, we previously found that the lens receives a dose over 0.5 Gy in more than 10% of patients who undergo endovascular treatments for brain diseases. Therefore, we tried to develop a novel X-ray shielding device for reducing the lens dose during procedures.
Methods and Materials: The X-ray shielding device has two parts: (1) a control unit and (2) an X-ray shielding device unit. The image signal is split just before it reaches the fluoroscopy monitor. The signal is thereafter sent to the main control unit. The X-ray operator can control the position of two shielding plates by using a remote controller. Two X-ray-shielding plates are moored by two radiolucent strings independently, which are attached to two motors for controlling the position of plates.
Results: We analyzed the protection efficiencies using RPLD chips embedded into a phantom head. This device could reduce roughly 30% of the lens dose from X-rays coming from the posterior and reduce nearly 70% of the lens dose from direct X-rays.
Conclusion: This device may be useful for reducing the patients' lens dose during endovascular treatments for brain diseases.

B-0542 10:38

Radiation dose reduction in CT fluoroscopy-guided cervical transforaminal epidural steroid injection by minimising preliminary planning step

N. Paik; *Ulsan/KR (exfreechal@gmail.com)*

Purpose: In CT fluoroscopy (CTF)-guided interventions, the majority of radiation dose is contributed by the preliminary planning CT scan rather than the CTF procedure itself. The aim of this study was to test whether radiation dose reduction in CTF-guided cervical transforaminal epidural steroid injection (TFESI) would be achieved by replacing the preliminary planning CT with a spot CTF while still maintaining technical performance.
Methods and Materials: The study included 338 consecutive procedures performed before (control group: n=163) and after (study group: n=175) instituting the above-mentioned protocol modification. The patient characteristics (age, sex, neck diameter, and level injected) and technical performance (technical success rate, dose-length product [DLP], number of CTF acquisitions, and procedural time) were compared between the two groups.
Results: Technically successful cervical TFESIs were performed at every level from C3-C4 to C7-T1 without serious complications in both groups. The median DLP of the study group (7.92 mGy•cm) was significantly reduced compared to that of the control group (39.05 mGy•cm, $P < 0.001$). There were no significant differences between the two groups regarding the number of CTF acquisitions (median 5 vs. 4, P=0.123) and the procedural time (median 6.62 vs. 6.90 minutes, P=0.100).
Conclusion: When conducting CTF-guided cervical TFESIs, a significant radiation dose reduction (median 79.7 % in DLP) can be achieved by modifying the preliminary planning step, without compromising the technical performance.

B-0543 10:46

Reducing the dose in CT-fluroscopy-guided epidural/perineural injections-how low remains safe?

S.M. Niehues, M. Haas, J. Vahldiek, K. Erb-Eigner, B. Hamm; *Berlin/DE (stefan.niehues@charite.de)*

Purpose: CT-guided epidural/perineural injections remain commonly requested interventions, which increasingly affect younger patients. This study evaluated how much the dose for fluoroscopy can be lowered using step-and-shoot technique with reduced tube current and voltage while providing adequate safety.
Methods and Materials: This study included 362 interventions in 158 patients. Parameters evaluated were: kV, mAs, number of used images and the DLP of the complete procedure as well as needed dose-related changes during intervention. Additionally, patient characteristics (gender, BMI) were noted. The global aim of all parameter settings was sufficient visibility of the needle tip and neuroforamina (landing zone) in order to ensure a safe intervention.
Results: In 99% of all procedures, a protocol with 100 kV is suitable. The default setting during fluoroscopy was 5 mAs. In 35% of the patients cases the mAs had to be initially increased and in 1.7% during intervention to achieve sufficient image quality. 3.6% of all patients had to be scanned with more than 20 mAs. For each intervention a median number of 9 images (median: 9.73, SD±3.68) was required, which resulted in a median DLP of 2 (3.24 MW, SD±2.92). The average BMI was 27, there was a significance between BMI and number of images ($p < 0.001$) as well as BMI vs. DLP ($p < 0.001$).
Conclusion: Using of protocols with 100 kV and less than 20 mAs provide a safe CT-guided epidural/perineural injection in 96.4% with a median DLP of 2.1 mGy*cm. Dose adjustments are required for only a limited number patients with a high BMI.

Author Disclosures:
B. Hamm: Board Member; ECR 2015 president. Consultant; Toshiba Medical Systems.

B-0544 10:54

Preoperative embolisation of meningiomas: analysis of a single-centre experience

A. Pedicelli, L. Danieli, M. Iacobucci, E. Visconti, F. D' Argento, C. Colosimo; *Rome/IT (marta.iacobucci@gmail.com)*

Purpose: Meningiomas are the most common benign intracranial neoplasm. Surgical excision is the mainstay of treatment. They are mostly hypervascular and preoperative endovascular embolization is aimed at reducing blood supply via dural arteries, but there is no consensus on indications and this procedure is a controversial topic. Aim of this study is to review our single-centre experience to assess the efficacy of the endovascular technique.
Methods and Materials: We retrospectively compared patients with intracranial meningiomas who underwent preoperative embolization (with particles of polyvinyl alcohol) followed by radical resection (group 1), with a control group of patients operated without preliminary embolization (group 2) at our institution (January 2006 - June 2014). Comparisons were made on the basis of histology, operation time, operative blood loss, angiographic characteristics and complication rate. According to the percentage of tumour devascularisation we identified 4 subgroups in group 1 (0-24%, 25-49%, 50-74%, 75-100%).
Results: 80 patients underwent preoperative embolization whereas exclusive surgical resection was performed in 111 patients. Overall, no significant differences in operative blood loss, surgical time and complication rate were showed between the 2 groups. Nevertheless a subgroup analysis showed a significant reduction in the operative time in subgroup 4 of group 1 ($p < 0.001$). The complication rate of embolization was 3.8% (2 cases of tumour swelling and 1 case of transient facial nerve palsy).
Conclusion: Preoperative embolization in patients with intracranial meningiomas is safe and effective in reducing operation time in selected cases where > 75% of devascularization is achieved after accurate assessment of tumour vascularization.

B-0545 11:02

New single-layer WEBs intrasaccular flow disrupters for intracranial aneurysm treatment: preliminary results of a European multicenter study

J. Caroff[1], C. Strasilla[2], A. Berlis[3], T. Patankar[4], D. Behme[5], E. Jacobsen[6], T. Liebig[7], S. Prothmann[8], L. Spelle[1]; [1]*Clichy/FR*, [2]*Erfurt/DE*, [3]*Augsburg/DE*, [4]*Leeds/UK*, [5]*Bochum/DE*, [6]*Oslo/NO*, [7]*Cologne/DE*, [8]*Munich/DE (jildaz.caroff@gmail.com)*

Purpose: The safety and efficiency of the dual-layer WEB device has already been published. However, this international multicenter study sought to evaluate the safety of single-layer WEB devices, which are the newest generation of the WEB intrasaccular flow-disrupter family. They have been designed to offer smaller size devices with a lower profile in order to optimize navigability (through smaller catheters) and delivery, which may in turn broaden their range of use.
Methods and Materials: Data from all patients treated with a single-layer WEB device, in 10 centers, across 4 different countries, from June 2013 to May 2014 were included in this study. Clinical presentations, technical details, pre and perioperative complications, and outcomes at discharge were recorded. Clinical and angiographic data at last follow-up were also analyzed when available.

Results: A total of 90 patients with 98 WEB-treated aneurysms were included in this study. In 93 cases (95%), WEB placement was possible. Complete occlusion at the end of the procedure was obtained in 26 instances (26%). Additional treatment during the procedure (coiling and/or stent placement) was necessary in 12 (12.7%) cases. Procedure related complications occurred in 13 cases, leading to permanent neurologic deficits in 4 patients. Early vascular imaging follow-up data were available for 44 patients (57%). Treatment -elated morbidity and mortality rates at last follow-up were 2.2% and 1.1%, respectively.
Conclusion: In this study, the feasibility and safety of the single-layer WEB was comparable to that of the double-layer device. However, further studies are needed to evaluate long-term efficacies.

B-0546 11:10

Endovascular treatment of ruptured blister-like aneursyms with special reference to the flow-diverting strategies

M. Gök[1], C. Çinar[2], H. Bozkaya[2], I. Oran[2]; [1]*Kars/TR*, [2]*Izmir/TR*
(mustafagok@yahoo.com)

Purpose: Blister-like aneurysms (BAs) are rare type of intracranial aneurysm that is difficult to treat with high morbidity and mortality rates. The current literature knowledge describing the treatment of this type of aneurysm offers no clear consensus on the optimal treatment. The aim of this study was to present clinical and angiographic results of BAs treated endovascularly by using predominantly flow diverting strategies.
Methods and Materials: Sixteen ruptured BAs in 16 patients were treated using endovascular methods during the last 9-year period. Endovascular treatment consited of creating flow diversion with intracranial stents in all but one patient (no coils). Initial clinical and radiological findings, treatment results, clinical and angiographic outcomes, and follow-up were retrospectively evaluated.
Results: The flow-diverting treatment could be accomplished in all but one patient (treated by parent artery occlusion due to access problem). The flow diversion was done by using standart intracranial stents and original flow-diverting stents. Long-term control angiography was available in 15 of 16 patients. Clinical outcome was good in 10, fair in 4, bad in 1 patient and 1 exitus. (According to mRS "Modified Rankin Scale").
Conclusion: Management of ruptured BA is challenging, because of high rate of early regrowth and rebleeding. Our series showed that endovascular reconstructive treatment of ruptured BAs by using flow-diverting strategies (ideally with original flow-divertors) is technically challenging but can be done with acceptable clinical and good radiological midterm results.

B-0548 11:18

Complete recanalization after mechanical thrombectomy with stent retrievers: comparison between balloon guide catheter (BCG) and distal access catheter (DAC) in acute ischemic stroke

A. Velasco[1], T. Zoubi[1], W. Kurre[2], M. Aguilar Perez[2], S. Berkemeyer[1], T. Niederstadt[1], H. Henkes[2], R. Chapot[3], W. Heindel[4]; [1]*Muenster/DE*, [2]*Stuttgart/DE*, [3]*Essen/DE*, [4]*Münster/DE (avelgon@gmail.com)*

Purpose: The faster recanalization is achieved, the better the clinical outcome in patients with acute stroke and large vessel occlusion. Multicenter retrospective data collection and comparative analysis of mechanical thrombectomies with stent retriever (SR) for carotid terminus and MCA occlusions were employed to assess the efficacy of mechanical thrombectomies carried out using the Balloon Guide Catheter (BGC) and the Distal Access Catheter (DAC).
Methods and Materials: 205 patients with MCA or carotid-T occlusions treated by SR with the BGC (n=102) and DAC (n=103) at three stroke centers were analyzed retrospectively. Patients with ipsilateral stenosis or acute carotid occlusions were excluded. Procedure duration and number of passes performed to achieve TICI3 or 2b were recorded.
Results: The rate of complete recanalization (mTICI 3 and 2b) regardless of number of attempts was higher in the BCG-group [MCA: 93.9 % (77/82); ACI: 95% (19/20)] compared with DAC [MCA: 81.0% (60/74); ACI: 82.7% (24/29)]. For the BCG and DAC groups, the mean number of passes for MCA-occlusions was 1.5 ± 1.0 Vs 2.1 ± 1, 4 ($p < 0.006$) and for carotid-T occlusions 1.6 ± 1.0 Vs 3.6 ± 2.5, respectively, ($p < 0.001$). Procedure time was significant shorter in the BCG-group (ACM: 23.8 ± 14 min; ICA: 21.3 ± 11.6 min) compared with DAC-Group (ACM: 51.0 ± 38.7 min; 76.8 ± 50.9 min), $p < 0.0001$.
Conclusion: The combination of mechanical thrombectomy with SR for acute ischemic stroke in the anterior circulation with a BGC has better angiographic results and improves procedure time as well as number of passes needed.

B-0549 11:26

Detection of residual clots after endovascular stroke therapy with dual energy CT

A.E. Grams, M. Knoflach, J. Willeit, M. Sojer, E.R. Gizewski, B. Glodny;
Innsbruck/AT (astrid.grams@gmail.com)

Purpose: Dual energy (DE)CT and the application ‚brain hemorrhage" is a reliable tool in distinguishing intracerebral blood and contrast staining, for example after endovascular stroke therapy. As so far it has only applied extravasally, the aim of this study was to investigate DECT as a possible tool to differentiate between residual clots and intraarterial contrast staining after endovascular stroke therapy.
Methods and Materials: Ten patients (six women and three men; mean age 66 years from 50 to 79 years) who received a DECT within one hour after endovascular stroke therapy and displayed angiographically residual clots were examined retrospectively. Region of interest (ROI) density measurements were performed in clotted and not-clotted arteries on the different series: weighted ‚brain window" similar (DEw), virtual non contrast (VNC) and iodine map (IM) series.
Results: In DEw and IM no significant difference was found between clotted and not-clotted vessels, whereas in VNC significantly higher densities were found in residual clots than in not-clotted arteries ($p = 0.0039$). In addition a significant density drop of not-clotted arteries was found from DEw to VNC ($p = 0.0039$), which was not found in clotted arteries.
Conclusion: Besides confirmation of clot persistence DECT could be apllied to detect early re-thrombosis after endovascular therapy. In addition it could be used to detect intracranial thrombembolic complications after other i.e. cardiac endovascular therapies or to rule out suspected intracranial thrombosis after prior intravenous contrast application. This knowledge could lead to faster clinical decisions and avoid further time-consuming diagnostic studies.

B-0550 11:34

Does the therapist's attitude affect the clinical outcome of lumbar facet joint intra-articular injections?

A. Maataoui[1], K. Kollias[2], A. Splettstößer[3], T.J. Vogl[1], M. Khan[1], M. Middendorp[1]; [1]*Frankfurt/DE*, [2]*Düsseldorf/DE*, [3]*Hilden/DE*
(asplettstoesser@radprax.de)

Purpose: To investigate if the therapist's attitude affects the clinical outcome of lumbar facet joint intra-articular injections.
Methods and Materials: A total of 40 patients with facet joint associated chronic low back were randomized into two groups. All patients received computed-tomography guided, monosegmental facet joint intra-articular injections. After the therapeutic procedure the patients of the experimental group (EG) were demonstrated 4 representative CT-images of the intervention by the radiologist, while the patients of the control group (CG) left the clinic without any further contact with the radiologist. Outcome was assessed using a pain-based Verbal Numeric Rating Scale at baseline and at 1, 3 and 6 months after first treatment.
Results: In both groups the pain scores decreased significantly over the entire observation period. Compared to the CG the EG showed a statistically significant reduction of pain at 1 week and 1 month post-treatment while at 3 and 6 months after treatment there were no significant differences between both groups.
Conclusion: Our results show a significant effect on pain relief during the early postinterventional period in the EG as compared to the CG. The basic principle behind the higher efficacy might be the phenomena of hetero-suggestion.

B-0551 11:42

Technical success and complication of fluoroscopy-guided lumbar drainage of CSF

C. Chee, G. Lee, J. Lee, E. Lee, H. Kang; *Seongnam-si/KR*
(mdccg82@gmail.com)

Purpose: To evaluate the technical success rate and complication rate of fluoroscopy-guided lumbar drainage in technically difficult patient group.
Methods and Materials: This retrospective study was approved by the institutional review board of our hospital. From 2008 July to 2013 December, total 96 procedures of 60 consecutive patients were evaluated. Failed initial attempt at bedside approach, history of lumbar surgery, or difficulty in cooperation, or severe obesity were the reasons for fluoroscopy guided lumbar drainage procedure. All procedures were performed in lateral decubitus position with midline puncture via L3/4 interspinous space and the catheter tip was positioned in T12/L1 level. Technical success was defined as: (1) confirmation of CSF fluid, (2) diffuse spread of contrast media into the subarachnoid space, (3) advancement of the catheter without kinking or hairpin loop formation, and (4) no intra-procedural complication. Clinical success was defined as no clinical need for re-insertion of lumbar drainage within 24 hours with the exception of patient self-removal. Complication was also evaluated based on medical record.

Results: Mean external lumbar drain stay was 4.84 days. Technical success rate and clinical success rate were measured 99.0%, 89.6%, respectively. There were 17 complications in which 9 cases (5 cases of oozing; 2 cases of itching; 2 cases of nerve root irritation) were deemed minor complication. There were 7 cases of meningitis, and one with retained catheter.
Conclusion: Fluoroscopy-guided external lumbar drainage is a technically reliable procedure in technically difficult patients groups.

10:30 - 12:00 **Room G**

Genitourinary

SS 607a

DWI in prostate cancer

Moderators:
T. Durmus; Berlin/DE
G. Villeirs; Gent/BE

B-0552 10:30

The role of ultra-high b-value diffusion-weighted MRI for detection of the index tumour in patients with prostate cancer
E. Rud, E. Baco, H.B. Eggesbø; *Oslo/NO (p.e.rud@medisin.uio.no)*

Purpose: The aim of the study was to evaluate the sensitivity of ultra-high b-value (b2000) diffusion-weighted imaging (DWI) for detecting the index tumour (IT) in prostate cancer prior to radical prostatectomy (RP).
Methods and Materials: We included 199 patients with biopsy proven prostate cancer referred to RP. All patients underwent MRI before RP. The initial MRI reading considered all sequences, which included high-resolution 3D T2-weighted images, T2-corrected b1000, and the apparent diffusion coefficient (ADC) map. The ADC map was calculated from b50 and b1000. In addition, b2000 images were obtained. The IT was registered in a 30-sector prostate map. Whole-mounted histology served as the reference standard. We analysed retrospectively all b2000 images to see whether the index tumour expressed high signal relative to the surrounding tissue or not. High signal in the same sector as the main location of the index tumour was defined as positive. Both Gleason score (GS) and histological tumour volume (HTV) was registered in the undetected tumours.
Results: In 187 out of 199 (94%) patients, the IT expressed high signal on b2000. The initial MRI reading detected 183/199 (92%) IT. Eight of the 16 initially undetected IT's were retrospectively seen on b2000, yielding a retrospective detection rate of 191/199 (96%).The GS of the undetected index tumours where, GS 6 (4), GS 7a (3) and GS 7b (1) and the median HTV was 0.6±1.3 ml (range: 0.03-2.7).
Conclusion: Ultra-high b-value DWI is sensitive for detecting the IT, and has the potential to improve the detection rate.

B-0553 10:38

Role of DWI at prostatic lesions at 3 T-MRI in the discrimination of grading: correlation of imaging, quantitative analysis and pathology at 189 MR-guided prostate biopsies
A. Malich; *Nordhausen/DE (ansgar.malich@shk-ndh.de)*

Purpose: The detection of high grade prostatic cancer with a high Gleason-score is of major importance and still a diagnostic challenge especially in case of an inconclusive ultrasound guided biopsy and still high PSA value. Study aimed to analyse the diagnostic potential of DWI and ADC-mapping at lesions which were histologically proven by 3 T-based MR-guided biopsy.
Methods and Materials: 189 prostatic lesions were histologicaly verified by MR-guided biopsy (3 T MRI Philips Ingenia) after inconclusive ultrasound guided biopsy and after multiparametric MRI incl. T2w, dynamic analysis (> 5 min, single dynamic scan < 13s, calculation using DynaCAD and Confirma-CAD) and DWI-analysis (b-value up to 1000) and a PI-RADS score of 4 or 5. ADC-mapping was performed using CAD (Sentinel, Hologic).
Results: 71/189 lesions were proven invasive-malignant and 14/189 lesions as ASAP. 39/189 lesions were verified as prostatitis, 31/189 as hyperplasia, 29/189 as atrophic prostatic tissue or other benign prostatic pathology. In 5/189 biopsies paraglandular tissue was found. Mean ADC-values were obtained as: 905 (invasive malignant lesions); 1403 (ASAP); 1151 (prostatitis); 1282 (Hyperplasia and other benign entities).
Gleason-score 5 malignancies had a mean ADC-value of 1032; Gleason 6: 947; Gleason 7: 826; Gleason 8: 898; Gleason 9: 724, whereas ASAP-lesions had a value of 1403 in mean.
Conclusion: Semiquantitative ADC-mapping is of outstanding relevance to detect malignant prostatic lesions and especially to discriminate aggressive from less aggressive malignancies. A comparison score of the lesion vs. the entire gland might be helpful to overcome MRI-related technical influences.

B-0554 10:46

Small field-of-view single-shot EPI-DWI of the prostate: evaluation of spatially-tailored two-dimensional radiofrequency excitation pulses
D. Hausmann[1], N. Rathmann[1], M. Sertdemir[1], P. Riffel[1], A. Weidner[1], S. Kannengiesser[2], J.N. Morelli[3], S.O. Schönberg[1], U.I. Attenberger[1]; [1]*Mannheim/DE*, [2]*Erlangen/DE*, [3]*Tulsa, OK/US (danielhausmann@hotmail.com)*

Purpose: Parallel transmit allows for spatially-tailored, two-dimensional radiofrequency (RF) excitation pulses in single-shot EPI. The purpose was to evaluate the image quality of a zoomed EPI (z-EPI) sequence in diffusion-weighted imaging (DWI) of the prostate.
Methods and Materials: 33 patients who underwent a multiparametric MRI (mMRI) of the prostate were analyzed. In 26 of 33 patients the initial mMRI was performed on a 3 T whole-body (wb) scanner (Magnetom Trio, Siemens) using an endorectal coil (c-EPI1). Z-EPI examinations of these patients and a complete mMRI protocol including c-EPI2 of 7 additional patients were carried out on another 3 T wb scanner (Magnetom Skyra, Siemens) with a two-channel dynamic parallel transmit array (TimTX TrueShape, Siemens). For z-EPI, the one-dimensional spatially selective RF excitation pulse was replaced by a two-dimensional spatially-tailored RF pulse. Images were evaluated in terms of presence and degree of image blur and susceptibility artifacts, maximum image distortion in mm, apparent diffusion coefficient (ADC) as well as overall scan preference. SNR maps were generated to compare c-EPI2 and z-EPI.
Results: Overall image quality of z-EPI was preferred by both readers. Susceptibility artifacts were rated significantly lower on z-EPI compared to both other methods (z-EPI vs c-EPI1: $p < 0.001$; z-EPI vs c-EPI2: $p < 0.001$)). Image distortion was not statistically significantly reduced with z-EPI (z-EPI vs c-EPI1: p=0.12; z-EPI vs cs-EPI2: p=0.42)). Interobserver agreement was excellent. SNR was higher for z-EPI than for c-EPI2 (n=1).
Conclusion: Z-EPI leads to significant improvements in image quality and artifacts as well as image blur reduction improving prostate DWI.

Author Disclosures:
S. Kannengiesser: Employee; Siemens.

B-0555 10:54

Assessment of prostate cancer aggressiveness using the combination of quantitative diffusion-weighted and dynamic contrast-enhanced MRI
A.M. Hötker, Y. Mazaheri, Ö. Aras, J. Zheng, C.S. Moskowitz, T. Gondo, K. Matsumoto, H. Hricak, O. Akin; *New York, NY/US (Andreas.Hoetker@uni-mainz.de)*

Purpose: To assess prostate cancer aggressiveness using a quantitative multi-parametric MRI approach.
Methods and Materials: This IRB-approved, HIPAA-compliant study included 158 men with histopathologically confirmed prostate cancer, who underwent 3 T MRI before prostatectomy in 2011. Whole-mount step-section pathology identified 195 prostate cancer foci > 0.5 ml, which were then assessed volumetrically to calculate per-tumour apparent diffusion coefficient (ADC) and transfer constant (Ktrans) values. Associations between MRI parameters and histopathological parameters were assessed using Spearman correlation coefficients, uni- and multivariable logistic regression and areas under receiver-operating characteristics curves (AUC).
Results: No overall correlation between tumour ADC and Ktrans was seen, except for the subgroup of tumours with a Gleason score (GS) ≥4+4. Tumour ADC differed significantly between all Gleason groups ($p < 0.001$) and contributed significantly to the differentiation between all Gleason scores ($p \leq 0.002$, AUC: 0.662-0.701), including the differentiation between GS 3+3 and ≥3+4 (p=0.001, AUC: 0.693). Tumour Ktrans only differed significantly between tumours with a GS ≥4+3 and lower-grade tumours ($p < 0.015$) and contributed significantly only to the characterization of tumours of Gleason score ≥4+3 ($p < 0.001$, AUC: 0.711) and ≥4+4 ($p < 0.001$, AUC: 0.788). The combination of ADC and Ktrans further improved diagnostic performance in characterizing GS ≥4+3 (AUC: 0.739) and ≥4+4 (AUC: 0.856).
Conclusion: While ADC contributed to the differentiation between all Gleason scores, including low-grade tumours, Ktrans was of greater value in more aggressive tumours. Combining ADC and Ktrans into a quantitative approach offers improved diagnostic performance in identifying patients with more aggressive tumours (GS ≥4+3) for whom more radical treatment approaches should be considered.

Author Disclosures:
A.M. Hötker: Grant Recipient; Peter Michael Foundation. **J. Zheng:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748). **C.S. Moskowitz:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748).

B-0556 11:02

Advantages of zoomed EPI with parallel-transmit-accelerated 2D-selective excitation imaging in diffusion-weighted MRI of the prostate

K.M. Thierfelder[1], M. Notohamiprodjo[2], J. Weiß[2], O. Dietrich[1], U.G. Mueller-Lisse[1], M.F. Reiser[1], K. Nikolaou[2], D. Theisen[1]; [1]*Munich/DE*, [2]*Tübingen/DE (kolja.thierfelder@med.uni-muenchen.de)*

Purpose: To evaluate the use of 2D-selective parallel-transmit excitation MRI for diffusion-weighted EPI (pTX-EPI) of the prostate and to compare it to conventional single-shot EPI (c-EPI).
Methods and Materials: The MRI examinations of 35 patients were evaluated in this prospective study. PTX-EPI was performed with a TX-acceleration factor of 1.7 and a FOV of 150×90 mm, whereas c-EPI used a full-FOV of 380×297 mm. Two readers evaluated 3 different aspects of image quality on 5-point Likert scales.To quantify distortion artifacts, maximum diameters and prostate volume were determined for both techniques and compared to T2-weighted imaging.
Results: The zoomed pTX-EPI was superior to c-EPI with respect to overall image quality (3.39±0.62 vs 2.45±0.67) and anatomic differentiability (3.29±0.65 vs 2.41±0.65), each with $p < 0.0001$. Artifacts were significantly less severe in pTX-EPI (0.93±0.73 vs 1.49±1.08), $p < 0.001$. The quantitative analysis yielded a higher agreement of pTX-EPI with T2-weighted imaging than c-EPI with respect to coronal (ICCs: 0.95 vs 0.93) and sagittal (0.86 vs 0.73) diameters as well as prostate volume (0.94 vs 0.92). ADC values did not differ significantly between the two techniques ($p < 0.05$).
Conclusion: Zoomed pTX-EPI leads to substantial improvements in DWI of the prostate with respect to different aspects of image quality and severity of artifacts.

B-0557 11:10

Comparison of field-of-view (FOV) optimised and constrained undistorted single-shot (FOCUS) with conventional DWI for the evaluation of prostate cancer

Z. Feng; *Wuhan/CN (fzm198822@126.com)*

Purpose: Diffusion-weighted imaging (DWI) is one of the essential methods in detecting prostate cancer (PCa). Single-shot echo-planar imaging (ss-EPI) is a widely used technique to acquire clinical DWI images. However, ss-EPI is highly prone to a susceptibility artifact and image blurring. Field-of-view (FOV) optimized and constrained undistorted single-shot (FOCUS) is a new sequence that can reducing image distortion, showing better anatomical details and obtaining better DWI images.The purpose of our study was to qualitatively and quantitatively compare the application value of FOCUS DWI with ss-EPI DWI in patients with prostate cancer.
Methods and Materials: Sixteen patients with 18 prostate cancers underwent ss-EPI and FOCUS DWI. Two independent readers visually assessed image studies in terms of lesion conspicuity, image artifacts, image blurring and the overall image quality using a 5-point Likert scale. Regions of interest were drawn in all lesions to investigate differences in apparent diffusion coefficient (ADC).
Results: The readers were in moderate to good agreement in their scores. The mean scores of all terms of the two readers for FOCUS DWI were rated superior to those of single-shot echo-planar imaging ($P < 0.001$).The mean ADC value of 18 cancers was $986.722\times10^{-3}\,mm^2/s$ by FOCUS DWI and $946.778\times10^{-3}\,mm^2/s$ by ss-EPI DWI, and the difference was statistically significant (t=2.484, P=0.024).
Conclusion: FOCUS DWI provided higher image quality and lesion conspicuity than ss-EPI DWI by reducing geometric distortions, image blurring, and artifact level with a high-field-strength MR imager. It is expected that FOCUS DWI as a high-resolution diffusion weighted imaging technique has potential clinical utility.

Author Disclosures:
Z. Feng: Author; Xiangde Min, Liang Wang, Basen Li, Jie Cai, Ming Deng. Grant Recipient; Zhaoyan Feng. Speaker; Zhaoyan Feng.

B-0559 11:18

Diffusion-weighted imaging of the prostate: comparison of readout-segmented DWI and parallel-transmit-accelerated selective excitation DWI regarding image quality and distortion

B.K. Barth[1], A. Cornelius[2], D. Nanz[1], D. Eberli[1], O.F. Donati[1]; [1]*Zurich/CH*, [2]*Aarau/CH*

Purpose: To compare image quality and geometric distortion between readout-segmented DWI (rs-DWI) and parallel-transmit-accelerated selective excitation DWI (PTX-DWI) of the prostate.
Methods and Materials: Forty-five patients underwent 3 T-MRI of the prostate including rs-DWI and PTX-DWI (b-values, 0, 50, 1000 s/mm2; FOV, 150 x 150 mm2 and 77 x 150 mm2 for rs-DWI and PTX-DWI; ST, 3 mm; in-plane resolution, 1.3 x 1.3 mm2; acquisition time, 8:18 min and 1:37 min for rs-DWI and PTX-DWI). Overall image quality (IQ), resolution, depiction of zonal anatomy and geometric distortion were assessed subjectively on a 5-point Likert scale. Quantitative analysis of geometric distortion was assessed by measurements of sagittal and coronal diameters on both DWI-sequences and compared to T2w-sequences using the intraclass correlation coefficient (ICC). Following image analysis, the preferred sequence was chosen on a side-by-side presentation.
Results: There were no significant differences in overall IQ (4.15±.10 vs. 4.04±.12; $p > 0.05$), resolution (3.98±.09 vs. 3.91±.11; $p > 0.05$) and depiction of zonal anatomy (3.76±0.12 vs. 3.83±0.14; $p > 0.05$) between rs-DWI and PTX-DWI, respectively. Geometric distortion was rated lower on rs-DWI than on PTX-DWI (0.74±.10 vs. 1.35±0.12; $p < 0.001$). Sagittal and coronal diameters measured on rs-DWI (ICC, 0.976 and 0.969) correlated better with T2w-images than PTX-DWI (ICC, 0.960 and 0.882). On side-by-side analysis, rs-DWI was preferred in 60.9% of cases.
Conclusion: Despite a more than 5-fold shorter acquisition time of PTX-DWI, there was no significant difference in subjective IQ when compared to rs-DWI. However geometric distortion was significantly higher on PTX-DWI than on rs-DWI.

B-0560 11:26

Added value of multiparametric MRI to clinical parameters for characterising prostate cancer: a histology validated study

P. Pricolo, S. Alessi, O. De Cobelli, G. Renne, B. Jereczek-Fossa, S. Raimondi, P. Summers, G. Petralia; *Milan/IT*

Purpose: To evaluate whether the addition of a prostate imaging reporting and data system (PI-RADS) score to clinical parameters improves risk stratification in patients with prostate cancer (PCa).
Methods and Materials: 301 PCa patients, classified as low, intermediate or high-risk based on clinical parameters (PSA, Gleason score [GS], digital rectal examination [DRE]), underwent pre-surgical multiparametric magnetic resonance imaging (mpMRI), based on which they were assigned a PI-RADS score for each lesion. mpMRI findings were correlated with final histology. We calculated Odds Ratios (ORs) for significant cancer (stage≥ pT3a and/or GS≥ 7 at final histology) between the risk classes based on clinical parameters and risk classes with the addition of PI-RADS score.
Results: 214 patients had significant PCa and 87 patients non-significant PCa at final histology. Patient classification as intermediate/high-risk based on clinical parameters had sensitivity (SE) 68.2%, specificity (SP) 79.3%, positive predictive value (PPV) 89% and negative predictive value (NPV) 50.3% for predicting significant PCa; and about 8 times greater risk of significant PCa than low-risk patients (OR= 8.23, AUC= 0.74). Patient classification as PI-RADS scores 4/5 had SE 97%, SP 37%, PPV 79% and NPV 82% for predicting significant PCa; and about 17 times greater risk of significant PCa than PI-RADS 1/2/3 (OR= 17.2, AUC= 0.67). The addition of PI-RADS score to clinical risk classification improved prediction of significant PCa (AUC 0.83 vs 0.74, $p < 0.0001$).
Conclusion: The improved risk stratification of PI-RADS scores over clinical parameters encourages routine use of mpMRI in patients who are candidates for prostatectomy.

B-0561 11:34

MR-guided biopsy for prostate cancer: the role of DWI at 3 Tesla in the decision making of index lesion

V. Panebianco, F. Vasselli, V. Forte, G. Manenti, G. Simonetti, C. Catalano; *Rome/IT (federica.vasselli@gmail.com)*

Purpose: To assess the role of 3 Tesla diffusion-weighted imaging (DWI) in identifying the index lesion to target MR-guided biopsy in patients with suspiciuos prostate cancer (PCa).
Methods and Materials: 67 patients (< 65 years-old) with a rising PSA serum levels who underwent a 3 tesla multiparametric-MRI and who had 2 or more suspicious foci of PCa in the peripheral zone with a PI-RADS of 5/5 were scheduled for MR-guided biopsy. The protocol included: high-resolution T2-weighted sequences, T1-weightedGRE sequences acquired after intravenous administration of contrast and a DWI study with 0, 500, 1000, 3000 b-values. The area with lower ADC values was chosen as the index lesion to target the MR-guided biopsy.
Results: In 64 patients PCa was detected and they were subjected to radical prostatectomy. In 39 cases the biopsied lesions corresponded to PCa with a Gleason score higher than the non biopsied foci, in 17 patients the non biopsied lesions had a Gleason score equal than the biospied lesions, in 8 patients the non biopsied lesions corresponded to inflammatory changings. A correlation with ADC values and PCa aggressiveness was performed: low-grade tumours showed ADC values of 1 mm2/sec, intermediate-grade tumours of 0.8 mm2/sec and high-grade tumours of 0.6 mm2/sec.
Conclusion: DWI findings play an important role in identifying the index lesion to which target the biopsy in patients scheduled for MRI-guided biopsy with two or more foci of suspicious PCa with the same PIRADS score.

B-0562 11:42

Diffusion parameters (DTI and DWI) are superior to DCE-MRI in differentiation of BPH nodule from prostate cancer: quantitative comparison

M. Kekelidze, G. Müller, M. Weigel, T. Haas, M. Pradella, G. Bongartz; *Basle/CH (mkeke2001@yahoo.com)*

Purpose: To analyze the DTI-, DWI- and DCE-MRI parameters in differentiation of BPH nodule from prostate cancer (PCa).
Methods and Materials: 37 foci of PCa and 39 BPH nodules were prospectively analyzed in 26 patients who underwent MRI examination prior to radical prostatectomy. 3 T multiparametric-MRI included T1W-, T2W-, DW-, (b-values=0, 50, 800 sec/mm2), DTI-, (b-values=0 and 700, single-shot EPI technique and 20 gradient directions) and DCE-MRI (after bolus injection of 15 mL Gd-DOTA) using multi-channel pelvic phase-array coil. Quantitative parameters of ADC, fractional anisotropy (FA) and Ktrans derived from DW-, DTI-, and DCE-MRI respectively, were calculated in BPH nodule and PCa. Mann-Whitney analysis was applied for comparison.
Results: The averaged FA was significantly higher in PCa compared to BPH nodule (0.2±0.04 µm2/ms vs 0.1±0.02, $p < 0.001$), while ADC was lower in PCa vs BPH nodule (0.8±0.2 µm2/ms vs 0.9±0.1 µm2/ms, $p < 0.02$). Mean Ktrans was similar in BPH nodules and PCa (0.26±0.2 min-1 vs 0.27±0.03 min-1, $p < 0.2$ respectively). 86% of BPH nodules showed abnormal enhancement kinetics in DCE-MRI mimicking PCa. Correlation between T2W hypointense lesion and diffusion restriction in ADC was positive in BPH and PCa, while FA showed a negative correlation in PCa. Adding FA parameters to ADC in ROC analysis to differentiate BPH nodule from PCa increased the sensitivity from 65% to 87%.
Conclusion: FA and ADC differ significantly between BPH nodule and PCa while Ktrans shows no significant difference. Combining DWI with DTI can potentially improve the detection of transition zone cancer were DCE-MRI shows no incremental value.

B-0558 11:50

Intravoxel incoherent motion (IVIM) MRI for the interpretation of pelvic lymph nodes in prostate cancer: can we discriminate benign from malignant nodes?

M. Regier, C. Schmitt, C. Seiwerts, C. Behzadi, F.O.O. Henes, M. Kaul, G. Adam, L. Budaeus; *Hamburg/DE (mregier@uke.de)*

Purpose: To determine the accuracy of intravoxel incoherent motion (IVIM) MRI for pelvic lymph node staging in prostate cancer.
Methods and Materials: 43 consecutive patients classified as high risk following D´Amico criteria underwent pelvic MRI prior to radical prostatectomy. The imaging protocol consisted of an axial T2w STIR, DWI (b-values: 0.25.75,100,200,500 and 900) and contrast-enhanced T1w 3D-GRE sequence. The ImageJ-based software IVIMit© was applied to generate IVIM maps and performs a non-linear regression fit. By placing a region of interest encompassing the entire node, Dmean, Dmin, ADC and f were recorded. At prostatectomy, 924 nodes were removed and referred to histopathologic workup. Sensitivity, specificity, positive and negative predictive values for the discrimination of nodes were calculated using Wilcoxon and chi-square test.
Results: The mean short and long axis diameter of malignant lymph nodes was 8.1 mm (range, 3-16 mm) and 11.8 mm (range, 5-25 mm), respectively. Applying diameter measurements as the exclusive discriminator resulted in false-negative rates of > 60%. The calculation of Dmean allowed for the discrimination of benign and malignant nodes with high accuracy. The Dmean was 1.10x10-3 mm2/sec in benign and 0.54x10-3 mm2/sec in malignant nodes ($p < 0.001$). Further, Dmin (0.27x 10-3 mm2/sec vs. 0.81x10-3 mm2/sec; $p < 0.001$) and ADC (0.88x10-3 mm2/sec vs. 1.67x10-3 mm2/sec; p=0.02) were significantly lower in malignant nodes. A higher perfusion fraction f was found in malignant lymph nodes (33.43% vs. 27.13%; p,0.07).
Conclusion: IVIM MRI can be used to assess lymph node metastases prior to prostatectomy. Dmean and Dmin values of 0.54x10-3 mm2/s and 0.27x10-3 mm2/s allow for discrimination of benign and malignant nodes with high accuracy.

10:30 - 12:00 **Room K**

Musculoskeletal

SS 610b

Lower extremity (1)

Moderators:
K. Kapuscinska; Krakow/PL
M. Tzalonikou; Athens/GR

B-0565 10:30

MRI of muscle strains of the thigh in professional soccer players: correlation of imaging findings with the duration of convalescence and presentation at return to play

M. Regier, C. Behzadi, F.O.O. Henes, G. Adam, P. Catala-Lehnen; *Hamburg/DE (mregier@uke.de)*

Purpose: To determine the prognostic value of MRI for the estimation of the rehabilitation period after thigh muscle injury in professional soccer players and to evaluate imaging findings at return to play (RTP).
Methods and Materials: 87 thigh muscle injuries were examined at 3 T in 47 players of the highest professional level. The imaging protocol included coronal and transversal T2w STIR, T2w TSE, DWI and T1w TSE sequences. Identical scans were performed the day after injury and at RTP. All MRI data were independently read by two blinded radiologists applying Peetrons classification system. Transversal area measurements were performed and the percentage of the affected portion was recorded. The grade of muscle injury and the affected transversal muscle area were correlated with the duration of rehabilitation. Statistical analysis included Wilcoxon matched-pairs and Chi-square test.
Results: Muscle injuries were assigned grade 0 in 4.6% (4/87), grade 1 in 64.3% (56/87), grade 2 in 27.6% (24/87) and grade 3 in 3.4% (3/87). The mean duration of rehabilitation correlated well with the severity of injury in all grades (grade 0, 6days; grade 1, 12days; grade 2, 20days; grade 3, 46days; $p < 0.001$). The transversal area of signal abnormalities at the time of injury showed a robust correlation with the time to RTP (p=0.02). At RTP, persistent signal abnormalities were found in 75.8% (66/87).
Conclusion: MRI can be referred to as a valuable tool in the prognostication of thigh muscle injuries in professional soccer players; however, normalisation of imaging findings is not mandatory for RTP.

B-0563 10:38

Delayed gadolinium enhanced MRI of cartilage of the hip at 7 Tesla

A. Lazik, J.M. Theysohn, S. Orzada, H.H. Quick, O. Kraff; *Essen/DE*

Purpose: To evaluate the feasibility of delayed gadolinium enhanced MRI of cartilage (dGEMRIC) of the hip at 7T.
Methods and Materials: Hips of 11 healthy volunteers (5 female, 6 male, 21 - 46 years, BMI 22.5 ± 3.1 kg/m²) were examined with 7T MRI using a dual-flip angle technique for T1-mapping. Parametric T1-maps were obtained in a native scan and repeated after contrast agent administration due to dGEMRIC-protocol (0.2 mmol/kg body weight Gd-DTPA^{2-} intravenously, ½ hour of walking, ½ hour of rest). Accurate and reproducible scan-rescan conditions were monitored with a fast B1-mapping technique (DREAM). A qualitative analysis evaluated the delineation of acetabular and femoral cartilage. T1-relaxation times were measured in 5 acetabular and 5 femoral regions prior to ($T1_0$) and after ($T1_{Gd}$) contrast agent administration by manually placing ROIs in the automatically calculated T1-maps (Syngo MapIt, Siemens Healthcare, Germany). The concentration of Gd-DTPA^{2-} was calculated (T_{delta}= $1/T1_{Gd}$ - $1/T1_0$) and compared to $T1_{Gd}$ using Pearson´s correlation.
Results: A high resolution of 0.4 x 0.4 x 2.0 mm^3 yielded a clear delineation of acetabular and femoral cartilage. There was a high correlation between T_{delta} and $T1_{Gd}$ ($p < 0.001$). T1-relaxation times after contrast agent administrations were 911 ± 449 ms for acetabular, and 950 ± 455 ms for femoral cartilage.
Conclusion: dGEMRIC of hip cartilage is feasible at 7T with excellent delineation of acetabular and femoral cartilage. Because of the high correlation between T_{delta} and $T1_{Gd}$, unenhanced scans might be dispensable at 7T, as known from 3 T studies.

B-0564 10:46

Analysis of remodeling processes in patients with avascular necrosis of the femoral head after advanced core decompression using 3 T MRI

A. Lazik, O. Kraff, T. Claßen, S. Landgraeber, T.C. Lauenstein, J.M. Theysohn; *Essen/DE*

Purpose: By means of 3 T MRI, we describe time-dependent signal changes of remodeling tissue after Advanced Core Decompression (ACD), including the previously described "rail sign" as a histologically-proven marker of remodeling tissue.

Methods and Materials: 23 patients were examined 1 - 34 months (mean 12.7) after ACD, 5 of them more than once (2 - 3 times). 3 T MRI sequences (TIRM, PD/T2w, DESS, T1w without and with contrast enhancement) were evaluated regarding signal intensity of the bone graft and appearance of border phenomenons between bone graft and adjacent tissue.
Results: The rail sign, representing two layers of growth zones with a lining of granulation tissue in between, appeared up to 1.5 years after ACD between the bone graft and osseus tissue close to the necrosis in 14, and along the drilling bore in 11 examinations. Further border phenomenons included a double line sign, a hyperintense and a hypointense seam. The latter appeared at the earliest 4 months after ACD, and was visible up to 34 months. Signal intensity of the bone graft increased in contrast enhanced T1w and TIRM sequences over the time.
Conclusion: Signs of active remodeling (rail sign) could be found in a specific time frame up to 18 months after ACD using 3 T MRI. A single hypointense seam, supposed to represent sclerosis, could at the earliest be detected 4 months after ACD. The increasing signal intensity of the bone graft in the TIRM and contrast enhanced T1w sequence might represent proceeding vascularisation of this initially avital material.

B-0566 10:54

T2- and T2*-mapping of hip cartilage at 7 Tesla: initial results in healthy volunteers

A. Lazik, J.M. Theysohn, S. Orzada, H.H. Quick, O. Kraff; *Essen/DE*

Purpose: To evaluate the feasibility of T2- and T2*-mapping of hip cartilage at 7 Tesla in healthy volunteers.
Methods and Materials: Hips of 11 healthy volunteers (5 female, 6 male, 21 - 46 years, mean 27 years, BMI 22.5 ± 3.1 kg/m²) were examined with 7T MRI using multi-contrast sequences with 5 echoes each for T2- and T2*-mapping. In a qualitative analysis the delineation of acetabular and femoral cartilage was evaluated. Relaxation times were measured in 5 acetabular and 5 femoral regions by manually placing regions of interests in the automatically calculated maps (Syngo MapIt, Siemens Healthcare, Germany). The relaxation times of T2 and T2* were compared using Pearson´s correlation.
Results: With a high in-plane resolution of 0.5 x 0.5 mm^2 and 2.5 mm slice thickness a clear delineation of acetabular and femoral cartilage was achieved with both techniques. T2 relaxation times were 44.4 ± 8.2 ms for acetabular, and 40.7 ± 7.9 ms for femoral cartilage. T2* relaxation times were 15.2 ± 4.1 ms for acetabular, and 15.3 ± 3.8 ms for femoral cartilage. There was a high correlation between T2- and T2*-relaxation times (acetabular: p = 0.009, femoral: p = 0.0002).
Conclusion: T2- and T2*-mapping of hip cartilage is feasible at 7T with excellent delineation of acetabular and femoral cartilage. The high correlation between T2- and T2*-relaxation times, as well as comparable values in literature regarding the knee, indicate the accuracy of the applied methods.

B-0567 11:02

CT-imaging of a hip prosthesis using model-based iterative reconstruction and its influence on metal artefact reduction: a quantitative analysis

R.H.H. Wellenberg[1], M.F. Boomsma[1], J.A.C. van Osch[1], A. Vlassenbroek[2], J. Milles[3], D. Mueller[4], M. Maas[5]; [1]*Zwolle/NL*, [2]*Best/NL*, [3]*Eindhoven/NL*, [4]*Hamburg/DE*, [5]*Amsterdam/NL (ruud_wellenberg@hotmail.com)*

Purpose: To determine the effect of MBIR combined with orthopaedic metal artefact reduction (O-MAR™) in the suppression of metal-artefacts using a large Metal-on-Metal prosthesis at different dose levels.
Methods and Materials: A water-filled phantom was used made of PMMA containing a metal-on-metal prosthesis surrounded by 18 hydroxyapatite pellets representing bone. Scans were acquired using low, normal and high dose (CTDI: 10, 20 and 30 mGy) at 100, 120 and 140 kVp. Images were reconstructed with Filtered Back Projection (FBP), iterative reconstruction (IR, iDose4™) and MBIR (IMR™), with and without O-MAR. Mean Hounsfield Unit [HU], noise and CNR of all pellets with and without the insertion of a prosthesis were calculated and compared.
Results: At identical dose-levels, mean CNR of 6.41, 10.09, 25.82 ($p < 0.001$) and noise levels [HU] of 50.00, 29.87, and 10.66 ($p < 0.001$) were obtained for FBP, IR and MBIR respectively. Even at half-dose CNR is higher and noise is reduced with MBIR when compared with FBP and IR at normal and high dose in a clinical setting. For severe metal artefacts O-MAR works best. O-MAR in combination with MBIR, IR and FBP results in an artefact reduction of respectively 63.30%, 59.95% and 50.24% ($p < 0.005$).
Conclusion: MBIR combined with O-MAR significantly improves CNR and reduces noise and metal artefacts for imaging of MoM-prosthesis. O-MAR is most effective when combined with MBIR. Image quality with MBIR is superior compared to FBP and iDose4 at all dose levels. MBIR in combination O-MAR allows for significant dose reduction while maintaining sufficient image quality.

Author Disclosures:
A. Vlassenbroek: Employee; Philips Healthcare. **J. Milles:** Employee; Philips Healthcare. **D. Mueller:** Employee; Philips Healthcare.

B-0568 11:10

Various factors contribute to graft extrusion in lateral meniscus allograft transplantation: MRI evaluation of 87 knees

J. Yoon, S. Lee, Y. Cho, R. Son, S. Kim, S. Ahn, H.-K. Lee; *Sungnam/KR*

Purpose: Lateral meniscus allograft transplantation (LMAT) is a feasible surgical option for meniscus-deficient young patients. There are a few reports dealt with factors contribute to graft extrusion. However, the factors affecting graft extrusion were not fully explained. The aim of this study was to find various factors that contribute graft extrusion.
Methods and Materials: We reviewed 87 knees those were received LMAT using keyhole technique. The mean age of the patients was 26.9 years (range, 19-54) and mean follow-up interval was 13 days (range, 1-136 days). 12 MRI measurement parameters which could affect the graft extrusion were evaluated with absolute graft extrusion and relative percentage of extrusion (RPE).
Results: 10 of 12 MRI measurement parameters showed correlation with absolute extrusion and RPE ($r = .241$ to $.438$, $p < 0.05$). Absolute middle distance and depth of the bone block were independent predictors of absolute extrusion ($b = .394$ and $.213$, $p < 0.05$). And relative middle distance and relative bone block elevation were found to be predictors of RPE ($b = .409$ and $.211$, $p < 0.05$).
Conclusion: Appropriate location of the bone block and exposure of the tibial tunnel roof are crucial factors that contributed to minimize the graft extrusion in LMAT.

B-0569 11:18

Oedema of the cartilage in the lateral facet of the patella: does it predict patellar instability?

A. Falkowski[1], C. Camathias[1], J.A. Jacobson[2], O. Magerkurth[1]; [1]*Basle/CH*, [2]*Ann Arbor, MI/US*

Purpose: To characterise findings of signal intensity of the cartilage of the lateral facet of the patella in patients with known patellar instability before and after trochleoplasty.
Methods and Materials: IRB approval was obtained. Patients with known instability of the patella with pre- and postoperative MR imaging were included. The following measurements and observations were obtained: if present the existence of oedema in the cartilage of the lateral facet of the patella; Insall-Salvati-Index, TTTG, Patella shape (Wiberg) and Trochlea Shape (Hepp). Results before and after surgery, and intra- and interreader agreement were tested by using the paired-t-test and Wilcoxon-signed-rank test.
Results: 22 patients were included in the study. Oedema was present in 20 patients before and in 4 after trocheoplasty. Insall-Salvati Index was >= 1.2 (patella alta) in 20. Patella shape (classification of Wiberg) was greater than 2 in 18. Trochlear Shape (Classification of Hepp) greater than 2 was present in 21 before and 7 after trocheoplasty. Mean TTTG before surgery was 14 mm and post surgery 10 mm. We found statistical significance comparing results before and after surgery for oedema ($p=0.0132$), TTTG ($p=0.0002$) and trochlear shape ($p=0.0001$). Regarding intra- and interreader agreement there were no significant differences ($p= 0.1130$ to > 0.9990).
Conclusion: In this study oedema of the cartilage in the lateral facet of the patella seems to be a a predictor of patellar instability. Even with postoperative artefacts in the trochlea it is possible to assess the patellar cartilage and describe improvement of the femoropatellar articulation after trocheoplasty.

B-0570 11:26

Characterisation of achilles tendons in familial hypercholesterolemia patients using ultrasound imaging and shear wave elastography: a pilot study

L. Zhang, J. Lin, S. Zhang, Q. Yong; *Beijing/CN (doctor_zhl@163.com)*

Purpose: To assess the echo-anatomy and stiffness changes of achilles tendon in familial hypercholesterolemia patients using ultrasound imaging and quantitative shear wave elastography, in comparison with normal controls.
Methods and Materials: 28 normal and 22 familial hypercholesterolemia achilles tendons were examined both by B-mode and shear wave elastography. Each examination was respectively performed in a longitudinal view at 3 different sites (proximal, middle, and distal sites). The thickness, grey scale image feature and elasticity value of each sites of achilles tendon were measured.
Results: In normal achilles tendons, the thickness in each sites was proximal 4.51±0.63 mm, middle 4.51±0.63 mm, and distal 4.32±0.39 mm. In gray scale images, the tendons were mostly in hypoecho with parallel linear hyperecho in. The mean elasticity value (Emean) in proximal, middle, and distal sites was 404.94±37.37 kPa, 412.78±36.65 kPa, and 400.53±35.17 kPa. Whereas in familial hypercholesterolemia cases, the thickness was proximal

5.45±1.92 mm, middle 8.46±4.55 mm, and distal 6.44±1.90 mm. In grey scale images, the tendon was hypoecho with irregular linear hyperecho in 3 of 22 had calcification in the achilles tendons. Emean of proximal, middle, and distal sites was 287.43±39.77 kPa, 280.75±59.78 kPa, and 260.37±39.09 kPa. Statistically significant differences were found in the thickness ($P < 0.05$), and Emeas ($P < 0.01$) at each site between the health control and familial hypercholesterolemia Achilles tendons.
Conclusion: The results suggest that shear wave elastography as well as grey scale imaging are valuable tools for quantitative assessment of complementary biomechanical information in familial hypercholesterolemia achilles tendons.

B-0571 11:34

Neurogenic myositis ossificans of the hip : correlation between enhanced CT and surgical findings

C. Hangard, R. Carlier; *Garches/FR (hangardchloe@gmail.com)*

Purpose: Perform an exhaustive description of Myositis Neurogenic Ossificans (MNO) from preoperative CT and evaluate correlation between CT and surgical findings. Try to find risk factors associated to recurrence after surgical treatment.
Methods and Materials: All patients who had a CT for MNO during January 2006 and December 2012 were included. We retrospectively rewieved radiological, clinical and surgical data Helical CT with biphasic injection were performed to have good differenciation between bone, arterial and venous densities. We made two and three dimensional surface reconstructions.
Results: 101 patients were included, mean age was 43 years (Min-Max), 48 patients had cerebral trauma (46,%), 8 spinal cord trauma (8 %), 21 vascular diseases (20%) and 25 complications of intensive care (21%). Among the cohort (n=133 hips), 86 MNO required surgical treatment, correlation between preoperative CT and intraoperative findings were excellent. (Kappa= 0.82 for vessels relashionship, 0.62 for nervous relationship and 0.68 for capsular contact) We also describe bone demineralisation, which provided to reduce fracture of femoral head to 0. In univariate analysis, three risk factors were associated to recurrence : relationship with joint capsule ($p=0.005$), joint space narrowing ($p=0.007$), demineralisation bone ($p < 0.001$).
Conclusion: The helical CT with biphasique injection is a an excellent method in preoperative assessment to describe the aspect and complications of NMO. It correlates well with surgical findings and can also allow to anticipate hemorragic complications and fracture. Three risk factors were associated to recurrence : relationship with joint capsule joint space narrowing, demineralisation bone.

B-0572 11:42

Navicular bone position determined by weight bearing MRI: interobserver and between day reliability

P. Hansen, S. Hangaard, F.E. Johannsen, S. Stallknecht, M. Henriksen, R. Bouert, J.D. Nybing, B.B. Hansen, M. Boesen; *Copenhagen/DK (hansen_philip@hotmail.com)*

Purpose: Weight bearing (WB) MRI is a novel technique that allows for dynamic assessment of foot posture. Navicular bone position is an anatomical descriptor of the plantar arch. Tools for precise measurement of navicular position are important to aid current understanding of the association between foot posture and lower extremity disorders. This study evaluated inter-observer reliability and between day agreement in WB MRI measurements of navicular height in a radiology setting.
Methods and Materials: WB MRI of the foot was performed in ten healthy subjects (0.25T WB MRI scanner, 3D gradient echo sequence). Scanning positions were supine, upright and upright plus 10% body weight added. Scanning of each subject was repeated on two separate days. Two independent radiologists blinded for the measurements of the counterpart and the chronology of the examination evaluated all images. Inter-observer reliability and between day agreement were assessed by intraclass correlation coefficient (ICC) and limits of agreement (LOA%).
Results: Mean navicular height decreased with loading (supine 3.46 cm, WB 2.69 cm; $p < 0.001$) with additional decrease by added weight (2.69 cm vs. 2.61 cm; $p < 0.05$). In all scanning positions inter-observer (ICC 0.88-0.99, $p < 0.001$; LOA% 6.0-15.1%; MDC 0.16-0.57 cm) and between-day (ICC 0.90-0.98, $p < 0.001$; LOA% 11.2-21.4%; MDC 0.26-0.53 cm) reliability ranged from "good" to "excellent".
Conclusion: Navicular bone height can be determined in a reliable manner between observers and over time by the presented WB MRI method when applied in a radiology setting. The method allows small changes in navicular height to be detected.

Author Disclosures:
P. Hansen: Research/Grant Support; Unrestricted grant from Oak Foundation Denmark and the Danish Research Council. **M. Henriksen:** Research/Grant Support; Grant from Oak Foundation. **B.B. Hansen:** Other; Has received travel support by ESAOTE, Genoa, Italy. **M. Boesen:** Other; Has received travel support to ESSR and ECR and has given invited lectures sponsored by ESAOTE, Genoa, Italy, Acknowledgement: Unrestricted grant from OAK foundation used to buy the WB MRI scanner.

B-0573 11:50

Role of the weight-bearing MRI in the evaluation of traumatic and overload pathologies of the midtalar and subtalar joints

S. Mariani, A. La Marra, F. Arrigoni, L.M. Gregori, L. Patriarca, A. Barile, C. Masciocchi; *L'Aquila/IT (mari.silvia@hotmail.it)*

Purpose: To evaluate the possible biomechanical modifications of the ankle and foot during upright-MRI in traumatic and overload pathologies of the MT and ST joints.
Methods and Materials: We selected 52 patients clinically suspected of MT and ST syndromes. MRI exams were done with a dedicated machine 0.25 T, in supine and WB position. We used axial, sagittal and coronal SE T1-W and we measured talo-calcaneal angle, lateral talocalcaneal angle and Costa-Bertani angle.
Results: Standard MRI showed 78 pathological findings in 52 patients: in 3 cases a spring ligament (SL)involvement, in 9 a sinus tarsi ligaments (STL) involvement, in 23 a posterior tibialis tendon (PTT) involment, in 43 cases a condropathy (talonavicular in 7, calcaneus-cuboid in 4 and sinus tarsi in 32). Talo-calcaneal angle was abnormal in 32% of the cases, lateral talocalcaneal angle in 38% and Costa-Bertani angle in 30%. In upright-MRI we found modifications of the talo-calcaneal angle (55%), of the Costa-Bertani angle (47%) and of the lateral talocalcaneal angle (58%) with a tendency to an hindfoot valgus with a condition of "pes planus"; as direct consequence of these modifications we noted also an increase of the involvement of the SL (9 cases) and of the STL (12 cases). Tendinophaties and condrophaties didn't have significant modifications.
Conclusion: MRI is the gold-standard to identify ligamentous structures of the ankle and WB-MRI, under physiological load, gives us additional and correct information on possible modifications of these structures and of the midtalar and subtlar joints.

10:30 - 12:00 **Room MB 1**

Head and Neck

SS 608

Oncologic imaging: CT, MRI and PET

Moderators:
S. Bisdas; Tübingen/DE
C. Czerny; Vienna/AT

K-13 10:30

Keynote lecture

C. Czerny; *Vienna/AT*

B-0574 10:39

Detection of locoregional tumour recurrence in post treatment head and neck malignancies: a comparative evaluation of dynamic perfusion CT with F-18 FDG PET/CT

N.M. Mulimani, N. Khandelwal, P. Ssingh, V. Gupta, S. Ghoshal, B.R. Mittal; *Chandigargh/IN (navinmulimani@gmail.com)*

Purpose: Despite aggressive multimodality management, locoregional recurrence in HNSCC remains high at 30-50%. FDG PET/CT and perfusion CT (PCT) to an extent have helped in differentiating recurrent tumour tissue from post-therapy structural alterations. The purpose of this study was to separately perform dual assessment of recurrent tumour and to examine the relationship between PCT and PET/CT parameters.
Methods and Materials: We prospectively evaluated 25 histopathologically confirmed recurrent HNSCCAs using F-18 FDG PET/CT and PCT. SUV (mean & max), blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability surface (PS) values were calculated with ROIs over lesions and healthy muscle tissue. Means, standard deviations and ranges, paired T-tests, Pearson correlations, regression analysis was performed between PCT & PET-CT variables.

Results: The mean (± SD) of 25 recurrent tumour tissue were SUV (mean) - 9.18 (± 4.09), SUV (max) - 10.336 (± 4.81), BF (ICA/ECA) - 89.16 (± 16.78)/84.15 (±17.86); BV (ICA/ECA) 5.16 (± 1.15)/4.85 (±1.05), MTT (ICA/ECA) - 5.38 (±1.54)/5.49 (±1.27), and PS (ICA/ECA) - 17.07 (±5.96)/15.71 (±4.97), respectively. There were significant correlations between BF & PS (ICA/ECA) with SUV (max) (r = 0.42/0.48; P = 0.038/0.017 and r = 0.40/0.48; P =0.04/0.017,) BF & PS (ICA/ECA) with SUV (mean) (r = 0.47/0.54; P = 0.02/0.007 and r = 0.44/0.52; P =0.03/0.009) in the recurrent tumours. No significant correlation was seen for 52 recurrent necrotic lymphnodes.
Conclusion: PCT imaging can be a low cost viable alternative demonstrating the presence of tissue perfusion (PCT)-metabolic coupling (PET/CT) and having equal sensitivity with PET/CT in detection of recurrent HNSCCA tumour tissue even when performed independently.

B-0575 10:47

FDG PET/CT and DWI of head and neck squamous cell carcinoma: prognostic value of standardised uptake value and apparent diffusion coefficient

G. Conte, F. Ruju, M. Moscatelli, L. Bonello, L.L. Travaini, S. Raimondi, M. Ansarin, L. Preda; *Milan/IT (giorgio.conte@ieo.it)*

Purpose: To evaluate the prognostic significance of primary tumour 18 F-fluorodeoxyglucose (FDG) maximum standardized value (SUV_{max}) and diffusion-weighted imaging (DWI) apparent diffusion coefficient (ADC) in patients with head and neck squamous cell carcinoma (HNSCC).
Methods and Materials: Pre-treatment whole-body 18 F-FDG PET/CT and head and neck MRI were performed in 59 patients with HNSCC. Seventeen (29%) patients received surgery, 31 (53%) surgery and chemo-radiotherapy, 11 (19%) chemo-radiotherapy. The follow-up ranged between 1 and 65 months. Semiquantitative analysis of primary tumours was performed using SUV_{max}, mean ADC (ADC_{mean}) and minimum ADC (ADC_{min}). A ROC analysis was performed to find the optimal SUV_{max}, ADC_{mean} and ADC_{min} cut-off values. Disease-free survival (DFS) was calculated by the Kaplan-Meier method. Prognostic value of SUV_{max}, ADC_{mean} and was assessed by the log-rank test and cox regression models.
Results: Patients with SUV_{max}< 5.75 had a better prognosis than patients with SUV_{max}≥5.75 (p=0.001). ADC_{mean} and ADC_{min} seem not to be significantly associated with DFS at the univariate analysis. However, after adjusting by lymph node status at the multivariate analysis, SUV_{max} and ADC_{min} were both significant predictors of DFS with Hazard Ratio (HR)= 10.83 (95%CI: 1.36-86.05) and 3.03 (95%CI: 1.12-8.19) for SUV_{max}≥5.75 and ADC_{min}≥575, respectively. When the analysis was stratified to subjects with SUV≥5.75, high ADC_{min} significantly predict a worse prognosis, with HR=3.46 (95%CI: 1.28-9.37).
Conclusion: Pretreatment SUV_{max} and ADC_{min} may predict DFS of patients with HNSCC. The prognostic potential is more significant when SUV_{max} and ADC_{min} are combined together, with poorer prognosis for HNSCC with high SUV_{max} and high ADC_{min} values.

B-0576 10:55

Combined PET/CT and DWI by rigid image coregistration increases diagnostic accuracy in head and neck tumours

A. Stecco, M. Perchinunno, S. Ciolfi, I. Divenuto, M. Lombardi, A. Carriero; *Novara/IT (marcoperchinunno@gmail.com)*

Purpose: To assess if multimodal assesment by PET/CT and MRI/DWI rigid image coregistration can increase diagnostic accuracy in staging HNSCC.
Methods and Materials: In the period 2011-2012 we enrolled 25 patients affected by head and neck HNSCC tumour, at first diagnosis. Each patient after clinical and fibroscopic evaluation underwent to 18 FDG-PET-CT and MRI with DWI in an interval of maximum 12 days. MRI and PET/CT were separately (blinded each other) read by an experienced Radiologist and Nuclear Medicine Specialist, on a read form with T and N parameters. A consensus reading was then performen on a dedicated workstation loaded with a co-registration and image fusion software. The Gold Standard was the histological assesment and clinico-radiological follow-up. Interobserver agreement between the two readers has been carried out by Cohen's K test. Diagnostic accuracy together with specificity, sensitivity, PPV and NPV values have been calculated.
Results: Interobserver agreement has been found "discrete". About Nodal involvement: Coregistered PET/CT and MR reading session, showed diagnostic accuracy of 91% (vs 76% of PET/CT and 79%/88% of MRI-DWI/MRI-STIR), PPV 96%(vs 95% of PET /CT and 88%/86% of MRI-DWI/MRI-STIR) (i.c. 78.88%-99.89%) and NPV 80% (vs 53%, 63% and 100% of PET/CT, MRI-DWI and MR-STIR) (i.c. 42.19%-97.89%), sensitivity and specificity respectively of 92% (vs 72%, 94% and 100%) (i.c. 73.97%-99.02%), specificity of 89% (vs 89%, 67% and 56%) (i.c. 51.75%-99.72%).
Conclusion: Multimodal Image coregistration increases Diagnostic Accuracy for HNSCC cancer, both on T and N evaluation.

B-0577 11:03

Oropharyngeal squamous cell carcinoma: morphological and functional MRI differences between human papilloma virus positive and negative tumours. Preliminary results

S. Sdao, G. Calareso, L. Bonello, H. Kule, E. Orlandi, N.A. Iacovelli, E. Casiraghi, P. Panizza; *Milan/IT (silvana.sdao@gmail.com)*

Purpose: The aim of our study was to assess the differences between magnetic resonance imaging (MRI) features in HPV positive and negative oropharyngeal squamous cell carcinoma (OPSCC) comparing the following parameters: mean volume and mean apparent diffusion coefficient (ADC) value of tumours and lymph nodes.
Methods and Materials: We prospectively enrolled 23 patients (15M, 8 F, mean age 56, range 44-74) with newly diagnosed biopsy-proven OPSCC (17 HPV positive, 6 HPV negative) who performed staging MRI. For each tumour and largest lymph node the mean volume was calculated using a semi-automated image segmentation software on 3D-gradient echo sequences. We also calculated mean ADC for each tumour and nodal volume on diffusion weighted imaging. Student T test was used to assess the differences in volumes and ADC values in HPV negative/positive patients.
Results: Mean tumour volume was significantly smaller in HPV-positive OPSCC (HPV-positive 16189 mm^3; HPV-negative 37917 mm^3)(p=0.03). No significant differences were observed for mean lymph node volume (HPV-positive 17047 mm^3; HPV-negative 15817 mm^3). Mean tumour ADC values were significantly lower for HPV-positive OPSCC (HPV-positive 859 x 10^{-6} mm^2/sec; HPV-negative 1099 x 10^{-6} mm^2/sec)(p= 0.02). No significant differences were observed for mean lymph node ADC values (HPV-positive 1096 x 10^{-6} mm^2/sec; HPV-negative 1106 x 10^{-6} mm^2/sec).
Conclusion: Patients with HPV-positive OPSCC showed smaller tumour volume and restricted diffusion compared to HPV-negative OPSCC possibly reflecting different tumour cellularity and micro-environment; this could in part explain the well-known different response to therapy in the two groups.

B-0578 11:11

Evaluation of the feasibility of MRI volumetry in staging of oral carcinoma

R.S.S. Al Umairi, J. Hallinan, K. Al-Macki, E. Ting, T. Loh, N. Leehy, S. Liang; *Singapore/SG (alomairi1@hotmail.com)*

Purpose: To evaluate the feasibility of MRI volumetry in staging of oral carcinoma.
Methods and Materials: A retrospective search between 2003-2014 identified 72 patients who underwent primary surgery for biopsy proven oral squamous cell carcinoma. Twenty six patients with no pre-operative MRI were excluded. Tumours were identified in both axial T2W and post contrast T1W sequences in 37/46 (80%) patients who underwent MRI. Tumour volumetry (TV) was then performed for both sequences. The TV was estimated using ImageJ software. Final staging was determined at pathology examination of resected tumours in 36/37 (97%) patients. The TV was correlated with T and N-stage of the tumour. Receiver operating curve (ROC) analysis was performed to determine accuracy of TV in predicting T and N-stage of the tumours.
Results: There was excellent correlation of TV measured on T2W and T1W+C sequences (Spearman's coefficient 0.981, $p < 0.001$). The median TV of different T- stage showed an incremental trend (T1 1.8 cc, T2= 4.5 cc, T3= 9.6 cc and T4= 12.3 cc) and this trend was significant ($p < 0.001$). ROC analysis showed that TV had good accuracy in predicting the T-stage (≥T2, 0.86; ≥T3, 0.90 and ≥T4, 0.89). Prediction of ≥T3 disease using a cut-off value of 8.8 cc has sensitivity/specificity/PPV/NPV of 72.7%/95.8%/88.9%/88.5% respectively. The median TV of different N stages did not show a statistically significant incremental trend.
Conclusion: MRI volumetry shows good accuracy in predicting T staging of oral carcinomas and may be a useful adjunct for preoperative MRI staging of oral carcinomas.

B-0579 11:19

DWI and T2-W MRI for the evaluation of residual lymph nodes in patients affected by squamous cell carcinoma of the head and neck, treated with chemo-radiotherapy

E. Gangemi, F. Piludu, V. Manciocco, A. Guerrisi, R. Covello, S. Marzi, A. Vidiri; *Rome/IT (emma_gan86@yahoo.it)*

Purpose: To evaluate the feasibility of T2-weighted and diffusion-weighted magnetic resonance imaging (DWI) for the evaluation of residual lymph nodes in patients affected by squamous cell carcinoma (SCC) of the head and neck and treated with chemo-radiotherapy (CRT).
Methods and Materials: In 35 patients with residual lymph nodes, MRI obtained previously and 8-weeks after treatment have been retrospectively analysed. T2-signal intensity and apparent diffusion coefficient (ADC), calculated using two b values (0 and 800 mm2/s), have been evaluated. These data were compared with post-surgical, PET-CT and follow-up results.

Results: Of 35 patients with residual lymph nodes, 17 patients undergone surgical emptying, 18 follow-up, because of a negative PET-CT 12 weeks after the end of CRT. T2 hypointensity was correlated with non pathological residual lymph nodes (sensitivity-88%, specificity-40%, accuracy-65%, PPV-61%, NPV-75%). Analysing ROC curve (Receiver Operating Characteristic), ADC threshold of 1.25 x 10^{-3} mm^2/s has been found (sensitivity-75%, specificity-87 %, accuracy-81%). ADC maps had PPV of 86% and NPV of 77%. Median short axis in patients with pathological residual lymph nodes was 10.5 mm (range 10-13), in those with non pathological residual was 10 mm (range 7.3-16.4). Differences among lymph nodes dimensions in the two groups were not statistically significant (test Mann-Whitney). Combination of T2-signal intensity and ADC values showed sensitivity-93%, specificity-75%, accuracy-86%, PPV-86%, NPV-86%.
Conclusion: Combined use of T2-weighted imaging and DWI could be useful for the evaluation of residual lymph nodes in patients affected by SCC of the head and neck and treated with CRT.

B-0580 11:27

MDCT and MRI evaluation of mandibular invasion by squamous cell carcinoma of the oral cavity
S. Agarwal; *Guwahati/IN (sushantgmc@rediffmail.com)*

Purpose: To compare the diagnostic accuracy of MRI and MDCTin the assessment of the mandibular invasion by squamous cell carcinoma of oral cavity with histopathological exams as Standard.
Methods and Materials: 29 patients of biopsy proven scc of oral cavity with clinical suspicion of mandibular involvement were subjected to both MDCT (16 slice) & MR (1.5 T) evaluation. However 9 patients were excluded as they did not undergo surgery. The results of twenty patients were correlated with HPE findings. Differences in sensitivity, specificity, positive and negative predictive values were calculated at a statistical significance of $p < .05$.
Results: The sensitivity, the specificity, the accuracy, positive predictive value and negative predictive value for mandibular cortical involvement were respectively 84.6%, 71.4%, 80%, 84.6% & 71.4% for MR and 100%, 85.7%, 95%, 92.86 & 100% for CT, while the sensitivity, the specificity, the accuracy, positive predictive value and negative predictive value for mandibular bone marrow involvement were respectively 92.3%, 100%, 95%, 100% & 87.5% for MRI and 84.6%, 85.7%, 85%, 91.67% & 75% for CT respectively. Chemical shift artifact by bone marrow fat was postulated to be the source of most false-positive cases on MR imaging findings for mandibular cortical invasion.
Conclusion: CT is better than MR for assessing mandibular cortical involvement whereas MR is better than CT for assessing mandibular bone marrow involvement though none statistically significant difference was found between CT and MR results ($p > 0.05$). Thus MRI is an overall preferred single modality for evaluation of SCC of the oral cavity.

B-0581 11:35

The evaluation of residual bone marrow signal changes in nasopharyngeal carcinoma patients treated with radiation therapy
S. Parlak, B. Ozgen Mocan, G. Yazici, A. Dolgun Barak; *Ankara/TR (parlaksafak@gmail.com)*

Purpose: Clival bone marrow infiltration is frequently seen in nasopharyngeal carcinoma and this signal abnormality can persist after the radiotherapy. Our goal was to investigate the signal changes of the clivus in NPC patients receiving RT in order to define an expected temporal evolution and to accurately diagnose recurrence in the setting of new BM signal changes.
Methods and Materials: Baseline and follow-up MR imaging of 68 NPC patients that had undergone RT were retrospectively examined. The degree of the clival involvement, the BM signal changes and contrast enhancement were evaluated and correlated with the grade of initial clival involvement and the RT dose.
Results: 46 patients were evaluated with a follow-up of maximum 100 months (mean:46). Signal changes persisted for up to 99 months (mean:23.7, $\pm$ 27.9) with accompanying enhancement for 82 months (mean: 13.3 $\pm$ 21.64). Complete resolution of signal abnormality was eventually seen in 23.5% of cases. On follow-up MRI, new clival BM signal changes were detected in 13 patients but only 4 had recurrence. 3 of these patients were found to have increasing BM signal changes. The resolution time of abnormal BM signal had no correlation with the degree of baseline clival infiltration.The persistence of the signal intensity changes/enhancement was independent from the radiation therapy dose (p=0.310/0.307).
Conclusion: Residual clival signal abnormality is seen even after years of remission in the majority of the patients. Persistent signal changes may not indicate recurrent/residual lesion however new and increasing BM signal change suggests recurrent disease.

B-0582 11:43

CT scan in preservation protocols of laryngeal carcinomas: choice of response criterions and impact of on disease free survival
J. Valcke; *Marseille/FR (julievalcke@hotmail.com)*

Purpose: To evaluate the tumour response to induction chemotherapy with contrast enhanced compute tomography (CECT) in larynx preservation protocols.
Methods and Materials: Between 2009 and 2013, 30 consecutive patients with laryngeal squamous cell carcinoma eligible for induction chemotherapy were retrospectively enrolled. Anonymised datasets consisted in pretherapeutic CECT and early response CECT (after 2 cycles of induction chemotherapy using docetaxel, cisplatin and 5-fluorouracil). Two radiologists blindly assessed datasets using 4 criteria: RECIST 1.1, WHO, radiological tumour volume (RTV) and a subjective evaluation. Lesion response to induction chemotherapy (LRC%) was defined for each criterion. LRC% inter-observer and intra-observer agreements were assessed using intraclass correlation and Bland and Altmann. LRC% impact on disease free survival was was evaluated using Kaplan-Meyer and log-rank test.evaluation before and after treatment with blinded reading by two radiologists using WHO, RECIST 1.1, manual lesion volume and a subjective qualitative evaluation criteria.
Results: Within the 30 patients, 25 had disease free survival at follow-up (3 had residual disease after concomitant radio-chemotherapy and 2 had recurrent disease at follow-up). LRC%-RTV emphases a better overall agreement and better impact on disease free survival compared to LRC% using WHO and RECIST and subjective assessment.
Conclusion: LRC%-RTV is a reproducible CECT criterion for larynx preservation protocols; furthermore it is highly correlated to disease-free survival.

B-0583 11:51

Diagnostic confidence for differentiating benign from malignant orbital masses - added value of multiparametric magnetic resonance imaging
P. Asbach, S.-R. Ro, B. Hamm, K. Erb-Eigner; *Berlin/DE (patrick.asbach@charite.de)*

Purpose: Multiparametric magnetic resonance imaging (mMRI) offers additional information for characterization of tumours with regard to cellular density and vascularization. The purpose of this study was to investigate whether reader confidence for differentiating benign from malignant orbital masses is increased by mMRI compared to standard anatomic imaging.
Methods and Materials: 65 patients were prospectively included in this IRB approved study. 33 patients had malignant orbital masses and 32 patients had benign orbital masses (reference standard histopathology in 35 cases and clinical follow-up in 30 patients). Imaging was performed on a 3 Tesla system includin axial T1- and T2-weighted fast spin-echo sequences and postcontrast T1-weighted 3D-gradient echo sequences as well as diffusion weighted imaging (DWI) and perfusion imaging (DCE). One experienced radiologist evaluated the images on a 5-point scale (definitely benign, probably benign, indeterminate, probably malignant, definitely malignant) in three separate reading sessions [standard anatomic imaging (sAI), sAI +DWI and sAI +DCE].
Results: In the sAI reading session 24 masses were scored indeterminate, whereas 6 masses were scored indeterminate on sAI+DWI and 10 masses on sAI+DCE. In the sAI reading session 2 cases were incorrectly scored malignant and none were incorrectly scored benign. In the sAI+DWI session 4 cases were incorrectly scored malignant and none were incorrectly scored benign. In the sAI+DCE session 2 cases were incorrectly scored malignant but one case was incorrectly scored benign.
Conclusion: mMRI increases diagnostic confidence for differentiating benign from malignant orbital masses and should be included in a comprehensive orbital imaging protocol.

Author Disclosures:
B. Hamm: Consultant; Toshiba Medical Systems.

10:30 - 12:00 **Room MB 2**

Genitourinary

SS 607b

Benign gynaecological pathology

Moderators:
J. Arnáiz; Doha/QA
R.N. Lucas; Lisbon/PT

B-0586 10:30

Uterine fibroids treatment selection using MRI: MR-guided high-intensity focused ultrasound (MRgFUS), uterine artery embolisation (UAE) and surgery: a per group analysis of outcomes

F. Ciolina, C. Palla, F. Zaccagna, F. Sandolo, A. Napoli, C. Catalano; *Rome/IT*
(federica.ciolina@gmail.com)

Purpose: To retrospectively investigate the outcome of patients with uterine leiomyoma treated using either Magnetic Resonance Focused Ultrasound (MRgFUS), Uterine Artery Embolization (UAE) and Surgery.
Methods and Materials: 462 patients (group A) affected by uterine leiomyoma referred to our department for the treatment of uterine fibroids with MRgFUS.Pre-treatment evaluation was done to assess symptoms and fibroids MR characteristics for MRgFUS.Patients not eligible were addressed to UAE (group B) or surgery (group C). Primary endpoints were Symptoms Severity Score (SSS)(48.6±13.4),volume shrinkage (group A and B) and the necessity for further treatment.
Results: 131/462 patients underwent MRgFUS (29%;group A), 320 were excluded (70%) and assigned to group B (27%) and Group C (35%).Remaining patients (8%) were lost at follow-up or refused the proposed treatment.In group A, 112/131 patients (86%) showed a decrease in SSS (19.3±6.8),a NPV of 70±15%(P=0.001),a volume shrinkage of 20±15% and an excellent satisfaction related to treatment. 4 patients had a pregnancy;3 patients experienced minor adverse events.In 12 patients (9%), we obtained NPV< 60% and patients needed surgical treatment. In group B, patients showed a decrease in SSS (15.3±5.6),an average NPV of 98%(P=0.001),a volume shrinkage of up to 70% and a good satisfaction related to treatment.The major dissatisfaction was related to post-procedural pain. No pregnancy was observed. In group C, 80 patients underwent myomectomy, 40 hysterectomy; while the remaining refused other treatment. 3 pregnancies were observed.
Conclusion: MRgFUS treatment of symptomatic fibroids is a non-invasive method; clinical success is related to NPV ratio obtained at the end of treatment. Eligibility is limited to 30% of screened women. All patients not suitable should undergo surgery or UAE both with significant lower patient tolerance.

B-0587 10:38

Transvaginal sonography vs uro-colon-CT in the diagnosis of deep infiltrating endometriosis of the anterior and posterior compartment

D. Papadopoulos, F. Coppola, D. Valerio, C. Balacchi, L. Zannoni,
S. Del Forno, R. Seracchioli, R. Golfieri; *Bologna/IT*

Purpose: To compare diagnostic accuracy of transvaginal sonography (TVS) and Uro-Colon-CT (UC-CT), with dedicated protocol, in preoperative evaluation of deep infiltrating endometriosis (DIE) of the anterior (aDIE) and posterior (pDIE) compartments.
Methods and Materials: We analysed retrospectively 47 patients, selected after gynaecological examination, with clinical suspicion of aDIE and/or pDIE, who underwent TVS and UC-CT before laparoscopic surgery. We compared imaging data with the histopatologic analysis of the resected specimen to obtain sensitivity, specificity and accuracy of both imaging techniques.
Results: Pathologic examination revealed pDIE nodules in 41/47 women and aDIE in 39/47. TVS showed higher accuracy for pDIE (sensitivity, specificity and accuracy respectively 98%, 33% and 89% for TVS, 71%, 50% and 68 % for UC-CT) and aDIE (sensitivity, specificity and accuracy respectively 46%, 96% and 78% for TVS, 38%, 96% and 75% for UC-CT), while UC-CT presented better accuracy in the evaluation of the involvement of rectosigmoid junction (sensitivity, specificity and accuracy respectively 65%, 83% and 74% vs 52%, 79% and 66% of TVS), ureters (sensitivity, specificity and accuracy respectively 63%, 71% and 68% vs 22%, 96% and 74% of TVS) and bladder dome (sensitivity, specificity and accuracy respectively 67%, 96% and 93% vs 43%, 97% and 89% of TVS).
Conclusion: TVS, performed by specialists in endometriosis, remains the gold standard technique for patients with symptoms of DIE, because of its better accuracy compared to UC-CT, reserving CT for selected patients, with nodules more difficultly evaluated with TVS, like those affecting rectosigmoid junction, ureters and the bladder dome.

B-0589 10:46

Role of virtual hysterosalpingography in the diagnosis the causes of infertility

A. Dmitriev, A. Karpenko, E. Bogdanova; *St. Petersburg/RU*
(dmitriev1984@inbox.ru)

Purpose: Virtual hysterosalpingography (VH) is a synthetic method that combines latest technical advances computed tomography and long-term experience of traditional hysterosalpingography. Aim of work was to investigate capability of VH in diagnosis the causes of infertility and miscarriage.
Methods and Materials: VH was performed 163 patients. Indications for study were: infertility, recurrent spontaneous abortion, pre- and postoperative evaluation of congenital malformations of the uterus. MSCT scan performed between 7-10 day of menstrual cycle. Patients were placed in supine position with plastic balloon catheter into the uterine cavity. Scanning was performed in delay 45 sec bolus injection (rate: 0.4-0.5 ml/sec) into the uterine cavity. Iodinated contrast agent was diluted by saline (3 ml of contrast media/5 ml saline). All studies were performed on a 64-slice CT scanner with postprocessing on dedicated workstation for 3D, MPR and VRT images. In 88% of cases identified pathology of uterus and tubes was confirmed by gistero- or laparoscopy.
Results: In 30 cases (18%) complete or partial interruption of tubal patency revealed, 8 patients (5%) had evidence of adhesions in the pelvic cavity, in 17 patients (10%) - abnormalities of the uterus, in 5 cases (3%) intrauterine adhesions were found. 5 cases (3%) demonstrated features of adenomyosis and 3 patients (2%) endometrial polyps.
Conclusion: Multiplanar VH is highly informative, less invasive to compare with conventional hysterosalpingography. It's method for diagnostics causes of infertility, particularly when they are associated with tube factor. VH could be used as standard for patients with infertility and miscarriage.

B-0590 10:54

The diagnostic accuracy of multidetector CT in the evaluation of ovarian torsion: compared with mis-read cases

J. Kim[1], Y.-M. Ku[2], S.-L. Lee[2]; [1]*Seoul/KR*, [2]*Uijeongbu/KR*
(tinyshine@naver.com)

Purpose: Ovarian torsion is gynaecologically surgical emergency, but sometimes preoperative diagnosis is difficult and even delayed. The purpose of this research is to identify more helpful MDCT findings for accurate diagnosis of ovarian torsion and to know the cause of mis-read of ovarian torsion with the cases surgically confirmed as ovarian torsion.
Methods and Materials: During the period from 2004. 1. 1 to 2014. 2. 28, 114 cases of MDCT surgically confirmed as ovarian torsion at our institution were retrospectively reviewed. 114 patients were categorised into group A (n=69, correctly pre-diagnosed as ovarian torsion) and group B (n=45, mis-read). We evaluated these cases with already well-known CT imaging features of ovarian torsion (such as enlarged ovary, associated mass, asymmetrical cystic wall thickening, tubal thickening or twisted torsion knot, ascites, and hemorrhage), and compared their frequencies.
Results: Group A (69 correct pre-diagnosis patients; 60.5%) and group B (45 mis-read patients; 39.5%) are reviewed. The twisted torsion knot found to give high reliability (sensitivity; 60.53 %, specificity; 15.38%, accuracy; 55.91%, positive predictive value (PPV); 86.25%, negative predictive value (NPV); 4.26%). The ruptured ovarian torsion or pelvic hemorrhage are often factors that lead to mis-read.
Conclusion: The MDCT features of ovarian torsion are very helpful tools for diagnosis and the trial of searching the twisted knot throughout the multiplanar image is very critical for the diagnostic accuracy of ovarian torsion.

B-0591 11:02

Diagnostic performance of diffusion-weighted MRI in the diagnosis of ovarian torsion: comparison with conventional MRI and surgical findings

T. Bekci, A.V. Polat, K. Aslan, M. Ceyhan Bilgici, M. Danaci; *Samsun/TR*
(tmybkc@gmail.com)

Purpose: The aim of this study was to evaluate the role of diffusion-weighted magnetic resonance imaging in the diagnosis of ovarian torsion.
Methods and Materials: We retrospectively analyzed 82 patient with surgically confirmed ovarian torsion. 67 of 82 patients were diagnosed with ultrasound and surgically confirmed as ovarian torsion. 15 patients with unclear ultrasound findings underwent MRI examination with two different MR systems and MRI results evaluated for mean value of ADC, T2-weighted and contrast enhanced images. Statistical analysis was used to compare ADC values in the torsed and nonaffected ovaries and to calculate best cut-off value for distinguishing both groups based on receiver operator-curve characteristics (ROC).
Results: In ovarian torsion (n=15) the mean ADC value of the torsed ovary was significantly lower than that of the non-affected ovary in both MR systems. (A (n=8); 0.980±0.627 vs. 1.719±0.560 x 10^{-3} mm^2/sec, P=0.001. B (n=7); 0.924±0.493 vs. 1.500±0.431 x 10^{-3} mm^2/sec, P=0.014) Differentiation of the

affected and non-affected ovaries revealed that the threshold value of the ADC in maximum sensitivity and specificity was 1.380×10^{-3} mm^2/sec for system A and 1.103×10^{-3} mm^2/sec for system B; at this threshold sensitivity was 75%, specificity was 75% for system A and sensitivity was 71%, specificity was 72% for system B. (AUC: 0.805 vs. 0.816, $P < 0.05$)
Conclusion: ADC measurements were useful for detecting ovarian torsion. Especially in children and pregnant patients ADC measurements of the affected and unaffected sides can add useful information in the diagnosis of ovarian torsion without any use of contrast media.

B-0592 11:10

Ultrasound guided therapeutic aspiration of simple ovarian cysts with tetracycline sclerotherapy
V. Patre, V. Dutt, S.B. Netam, R. Gahine, A. Singh, T. Nagaria; *Raipur/IN (vivek_patre@yahoo.com)*

Purpose: To assess the utility of sclerotherapy with tetracyline in the management of simple ovarian cysts.
Methods and Materials: Seventy simple ovarian cysts were subjected to cyst / fluid aspiration and sclerotherapy with 5 % tetracycline injection transabdominally under ultrasonography guidance using 18 - gauge spinal needle, from August 2004 to July 2014. Procedure were performed under local anaesthesia taking all aseptic precaution and in an out patient setting. Cytological examination was carried out in all cases. The patient were followed up twice weekly until the tetracycline is absorbed and then every three months by colour doppler sonographically and clinically for detection of recurrence up to twelve months.
Results: The size of ovarian cysts range from 5.5 to 13.0 cm, volume of aspirated fluid was 75 cc to 640 cc. and cyst wall thickness range from 1.5 to 5 mm. Cyst fluid was serous in 66 cases and dark chocolate coloured in four cases. Cytological evaluation of serous fluid obtained in 66 cysts were compatible with benign cystic lesion. Chocolate coloured fluid obtained in four cysts were compatible with endometriosis. During 12 months follow-up six cyst recurrence were detected. Recurrence was greater in larger cyst with greater amount of fluid and cysts from which hemorrhagic fluid obtained.
Conclusion: The procedure of aspiration and tetracycline sclerotherapy was easy, safe and acceptable with minimal recurrences. It is valid alternative to explorative laparotomy in the management of simple ovarian cysts.

B-0593 11:18

Benign enhancing solid component of mature ovarian teratoma: MR imaging features
H. Shin, K. Kim, C. Lee, J. Choi, J. Lee, Y. Park, C. Park; *Seoul/KR (hoonjung32@daum.net)*

Purpose: Mature teratoma (MT) is one of the most common benign ovarian neoplasm, but the tumour undergoes malignant transformation in 1-2% of cases. Squamous cell carcinoma is the most commonly associated malignancy. Enhancing portion of MT is known as possibility of malignant transformation on contrast enhanced MR. We recently experienced the cases of benign MT with enhancing solid component on pelvis MR. The purpose of this work is to evaluate the enhancing solid component within MT of ovary on pelvis MR always means malignant transformation.
Methods and Materials: We retrospectively reviewed pathologic reports and MR findings of the 35 patients who were suggestive of MT in radiologic reports. MR images were reviewed for the following characteristics: the presence or absence of enhancing solid component, the size of enhancing portion, the growth pattern (smooth or irregular) of enhancing solid component, and the presence or absence of extramural extension on pelvis MR.
Results: Eight patients had enhancing solid component within MT of ovary. They were one squamous cell carcinoma arising from MT, two mixed germ cell tumours and five MTs. MTs have smooth and small enhancing portion whereas malignant masses have irregular and larger enhancing portion on pelvis MR. No cases had extensive transmural extension or direct invasion of neighboring pelvic organ.
Conclusion: Enhancing solid component associated with MT of ovary is not infrequent. Enhancing solid portion of MT is not only in malignant transformation but also in some of benign MTs. Therefore, enhancing solid component does not always mean malignant transformation.

B-0594 11:26

Clinical utility of pelvic magnetic resonance imaging (MRI) in patients with suspected ectopic pregnancy
Y. Ragab[1], M. Edris[2]; [1]*Cairo/EG*, [2]*Jeddal/SA (yragab61@hotmail.com)*

Purpose: To assess the utility of magnetic resonance imaging (MRI) in patients with suspected ectopic pregnancy.
Methods and Materials: It is a prospective study of 30 consecutive patients who were clinically and sonographically suspected of having ectopic pregnancies (EP)between January 2010 to march 2014. The diagnostic utility of MRI features of EP was analyzed regarding : (1) Direct detection of ectopic gestational sac (GS); (2) Indirect signs which are tubal dilatation with adnexal hematoma, hemorrhagic ascites and hemosalpinx. The diagnostic accuracy of each sign and their combination was compared to operative results. The MRI findings of an ectopic GS were reviewed as follows: size, shape, and signal intensity changes, No contrast was given. Written concents were obtained.
Results: Of 30 patients, 28 had a tubal pregnancy; (96%) had a direct sign (sensitivity: 92 %; specificity: 100%; positive predictive value: 100%). The diagnostic accuracy of the direct sign was 93.4 %; this was more accurate than that of any single indirect sign (42%, 65%, and 32%, respectively). However, the diagnostic accuracy of EP increased to 100% when diagnostic criteria required the presence of a direct sign or at least two indirect signs.
Conclusion: MRI is an effective modality for diagnosing EP with a high detection rate of extrauterine GSs. The combination of direct and indirect signs is useful for establishing the correct diagnosis.

10:30 - 12:00 **Room MB 3**

Cardiac

SS 603b

Valvular disease

Moderators:
G. Feuchtner; Innsbruck/AT
M. Gardarsdottir; Reykjavik/IS

K-14 10:30

Keynote lecture
F. De Cobelli; *Milan/IT*

B-0595 10:39

Phase contrast 4D flow in bicuspid aortic valves in a porcine model
M. Grothoff[1], C. Etz[1], B. Brenneis[1], F. Reinhold[1], B. Preim[2], M. Gutberlet[1]; [1]*Leipzig/DE*, [2]*Magdeburg/DE (grothoff@gmx.de)*

Purpose: Bicuspid aortic valves (BAV) are associated with aneurysms of the ascending aorta (AAA). We analyzed the 4D-flow characteristics in tricuspid aortic valves in a porcine model and compared them to the flow-patterns after surgical bicuspidalization.
Methods and Materials: 4D-flow-measurements were performed in 3 swine. After the first MRI scan surgical bicuspidalization of the aortic valve was performed with a fusion of the right and left-coronary (R-L) leaflet in swine 1 and the right and the non-coronary (R-N) leaflet in swine 2. In swine 3 a congenital BAV of the R-L type was found intraoperatively. After surgery swine 1 and 2 underwent a second 4D scan. The scans were analysed for helical and vortical flow and for eccentric flow at the level of the sinotubular junction.
Results: Preoperative analysis in swine 1 and 2 revealed a predominantly laminar flow in the thoracic aorta />without vortices. Swine 3 demonstrated a marked right-handed helical flow. Postoperative analysis in swine 1 (R-L) showed a right-handed helical flow with a pronounced vortex in the aortic arch. In swine 2 (R-N) an eccentric flow with a jet towards the left-posterior quadrant at the level of the sinotubular junction was visible and vortices could be detected in the AA.
Conclusion: We showed that bicuspidalization of the aortic valve results in substantial changes of blood flow in the AA dependending on the type of leaflet fusion. This porcine model could be used to analyze the contribution of flow alterations in the development of AAA in BAV patients.

B-0596 10:47

Intraindividual validation of 4D flow measurement against 2D flow measurements in aortas with bicuspid or tricuspid valves by cardiovascular magnetic resonance (CMR)
A.E. Kharabish[1], K. Belker[2], C. Meierhofer[2], P. Ewert[2], S. Fratz[2], S. Fratz[2]; [1]*Cairo/EG*, [2]*Munich/DE (ahmedkharabish@hotmail.com)*

Purpose: Theoretically, blood flow in the ascending aorta of patients with helical flow patterns, as in patients with bicuspid aortic valves (BAV), are underestimated by routine two dimensional (2D) phase contrast velocity encoding (PC-VENC). Four dimensional (4D) PC-VENC is theoretically not influenced by flow patterns. Hence, both, 2D PC-VENC and 4D PC VENC should result in similar blood flow measurements in the ascending aorta of subjects without helical flow patterns, as in subjects with tricuspid aortic valves (TAV).
Methods and Materials: To test this hypothesis, we determined blood flow in the ascending aorta of sixteen patients with BAV and helical flow and eighteen healthy subjects with TAV and non-helical flow by 2D PC-VENC and 4D PC-VENC. Each data set was analyzed by two observers blinded to the other results.

Results: In patients with BAV and helical flow, 4D PC-VENC resulted in systematically higher blood flow volumes than 2D PC-VENC. In subjects with TAV and non-helical flow, there was no systematical difference between 4D and 2D PC-VENC.
Conclusion: Helical flow patterns as in the ascending aorta of patients with BAV may be more correctly quantified by 4D-VENC compared to 2D PC-VENC.

B-0597 10:55

Assessment of the regurgitant orifice area in aortic regurgitation with dual-source CT: comparison with cardiovascular MR

T. Kim, S. Ko, J. Park, J. Shin, J. Kim; *Seoul/KR (20120314@kuh.ac.kr)*

Purpose: To compare ROA using dual-source CT (DSCT) with the grade of AR using PC-CMR for obtaining the cutoff values of the ROA allowing for grading of AR severity.
Methods and Materials: We retrospectively enrolled 208 patients (81 women, mean age 53.3 ± 14.4 years) with AR who underwent DSCT and CMR. DSCT datasets were reconstructed in 10% steps from 0% to 90% of the R-R interval to measure ROA. Grades of AR were determined by regurgitant fraction using PC-CMR. Receiver operating characteristic (ROC) curves were calculated to differentiate between grades of AR and ROA.
Results: Sixty-three patients with mild AR, 80 with moderate AR, and 65 with severe AR by PC-CMR were enrolled. Quantification of the ROA by DSCT (mean, 27±21 mm^2) was significantly correlated with the grade of AR by PC-CMR (r= 0.83). In the ROC analysis, discrimination (mild vs. moderate-to-severe and mild-to-moderate vs. severe) among grades of AR with DSCT was highly accurate when cutoff ROAs of 16 mm^2 and 29 mm^2 in comparison with PC-CMR were used.
Conclusion: The cutoff values of the ROA by DSCT allows for grading of AR severity determined by PC-CMR but are lower than previously published those using transthoracic echocardiography as reference standard.

B-0598 11:03

CT planning of aortic valve replacement: evaluation of virtually reconstructed ultra low keV monoenergetic reconstructions based on 3rd generation dual-energy CT

H. Haubenreisser, M. Meyer, S.O. Schönberg, T. Henzler; *Mannheim/DE (Holger.Haubenreisser@medma.uni-heidelberg.de)*

Purpose: To evaluate the impact of virtual monoenergetic dual-energy (DE) CTA datasets on vessel attenuation and CNR, using a 3rd generation Dual Source CT (DSCT), paired with a recently introduced refined monoenergetic post-processing algorithm with an improved noise reduction filter for low mean energies.
Methods and Materials: 30 Patients (19 men, mean age 75±16 years) that underwent ECG gated DECTA on a 3rd generation DSCT were prospectively included in this study. The patients received a low dose contrast material protocol with 40 ml of iomeprol 400. Tube Voltage was set to 80 kVp/150 kVp with Spectral Filter for improved spectral separation. Virtual monoenergetic image (MEI) datasets were reconstructed at 40keV. Vessel and soft-tissue attenuation and image noise were measured in various regions of interest and the CNR was subsequently calculated. Differences in attenuation and CNR were compared between MEI as well as the conventional polyenergetic image (PEI).
Results: All 40keV reconstructions were considered diagnostically acceptable. Vessel attenuation and CNR of MEI were superior to PEI (all $p < 0.05$). 40keV MEI provided a statistically significant increase in mean vessel attenuation compared to standard 120 kVp PEI (934±380 HU vs. 268±99 HU; $p < 0.01$) and a statistically significant increase in mean CNR (90.2±40.2 vs. 26.8±10.9; $p < 0.01$).
Conclusion: Low contrast material dose in combination with virtual 40 keV MEI significantly increase vessel attenuation and CNR of DE-CTA studies. Our findings indicate that routine clinical application MEI reconstructions allow a significant decrease of iodinated contrast material for the pre-interventional cardiovascular assessment in patients with impaired renal function.

B-0599 11:11

Multimodality imaging evaluation before TAVI: incidence of CI-AKI in relation to known risk factors

C. Schneider, A. Brumberg, F.C. Roller, J. Rixe, P. Roth, G.A. Krombach; *Giessen/DE (christian.schneider@uniklinikum-giessen.de)*

Purpose: Transcatheter Aortic Valve Implantation (TAVI) requires prior assessment with Conventional Coronary Angiography (CCA) and Multidetector Computed Tomography (MDCT), both including parenteral iodinated contrast media (CM). Contrast-Induced Acute Kidney Injury (CI-AKI) is accompanied by increased mortality and may emerge already within the evaluation period. The aim of our study was to evaluate the incidence of CI-AKI in patients undergoing TAVI evaluation and to identify risk factors.
Methods and Materials: Datasets from consecutive patients referred for MDCT for TAVI evaluation were retrospectively analysed. Incidence of CI-AKI (KDIGO 2012) was correlated with potential risk factors: kidney function (eGFR), heart failure (LVEF < 50%, HF), diabetes (DM), amount of CM and duration of evaluation period (EP). Multiple logistic regression was used for statistical analysis.
Results: Datasets of 98 patients (mean age 81 years, 49 male, mean eGFR 59 ml/min, HF=35, DM=37, mean CM amount 274 ml, mean EP 6d) out of 207 were eligible for evaluation. CI-AKI occurred in 67 patients (68%) and was inversely correlated with eGFR ($p < 0.01$) as the only independent risk factor. CM amount, HF and DM were positively correlated with CI-AKI as a function of eGFR ($p < 0.01$), CM amount ($p=0.05$) and EP ($p=0.05$), respectively. In 36 (54%) patients, CI-AKI occurred before TAVI and 13 (19%) patients with CI-AKI finally had no TAVI.
Conclusion: Incidence of CI-AKI in TAVI candidates is high and occurs mostly already before implantation. Moreover, 19% of patients with CI-AKI finally have no benefit because TAVI is not performed. Considering risk factors may prevent useless and harmful TAVI evaluation.

B-0600 11:19

Pre-TAVI evaluation: dynamic assessment of circumference-derived diameter and its influence on prosthesis selection

J. Turek, M. Kok, C. Mihl, B.L.J.H. Kietselaer, V.V.A. van Ommen, E.C. Nijssen, J.E. Wildberger, M. Das; *Maastricht/NL (jakub.turek@gmail.com)*

Purpose: Circumference based prosthesis sizing is becoming the standard for prosthesis size selection in TAVI candidates. The aim was to compare circumference derived dimensions, their dynamical changes and their impact on prosthesis selection.
Methods and Materials: 124 patients were evaluated who were referred for pre-TAVI assessment. All patients underwent retrospective ECG-gated multidetector-row CT (MDCT) of the aortic root. For each patient standard aortic annulus dimensions were measured. Furthermore, circumference derived diameter (CDD=circumference/π), effective diameter (ED - derived from annular area) and mean diameter (MD - average of the longest and the shortest diameter) were calculated. Annular dimensions were measured and calculated at ten different time points (10 - 100 %) of the cardiac cycle. Each time point was compared to the time point with maximal measurement using paired sample t-test. For CDD measurements differences in prosthesis selection were assessed by comparing maximal, minimal and mean values.
Results: Maximal measurements of CDD (25.1 mm±2.0), ED (24.3 mm±1.9) and MD (24.9 mm±1.9) were found at 20% of the RR interval. CDD was significantly bigger (at maximal time point) compared to ED and MD ($p < 0.05$). Prosthesis selection did differ in 76% if maximal CDD was compared with minimal values and in 47% if compared to mean values.
Conclusion: Based on the assumption that optimal prosthesis size should be chosen according the biggest annular measurements of CDD, only 20% of cardiac cycle should be used. If CDD is measured in the wrong cardiac phase, significant mismatch of prosthesis sizing may occur.

B-0601 11:27

Valve-in-valve transcatheter implantation work-up: CT can accurately determine the implanted bioprosthesis size

D. Suchá[1], C.G. Daans[1], P. Symersky[2], R.N. Planken[2], W.P.T.M. Mali[1], L.A. van Herwerden[1], R.P.J. Budde[3]; [1]*Utrecht/NL*, [2]*Amsterdam/NL*, [3]*Rotterdam/NL (D.sucha@umcutrecht.nl)*

Purpose: Valve-in-valve transcatheter implantation procedures have emerged for high-risk patients with dysfunctional bioprostheses. A stented valve is implanted in the dysfunctional bioprosthesis. Knowing the size of the in-situ bioprosthesis is paramount for procedure planning and predicting treatment gain. However, the labeled size does not reflect true internal dimensions. We evaluated whether computed tomography (CT) can determine the bioprosthetic dimensions and discriminate between consecutive labeled sizes.
Methods and Materials: We searched our hospital database and included all patients with bioprostheses and available CT imaging. The bioprosthetic internal area and area-derived diameter were measured by two observers using predefined window level settings. Intraclass-correlation coefficients (ICC) and Bland-Altman plots were obtained and differentiation of consecutive manufacturer labeled sizes was studied. Data on implanted prosthesis type and size were used as reference standard.
Results: We included 82 patients with 83 bioprostheses, comprising mainly the Carpentier-Edwards Perimount (n=46), Sorin Mitroflow (n=16) and Edwards Sapien transcatheter (n=10) valves. Intra-rater and inter-rater reliability for both prosthesis area (ICC 0.988 and 0.910, respectively) and diameter (ICC 0.988 and 0.903) were excellent. Agreement was good, showing mean area differences of 1.6±12.1 mm2 (intra-rater) and 0.1±23.4 mm2 (inter-rater) and prosthesis diameter differences of 0±0.3 mm (intra-rater) and 0±0.7 mm (inter-rater). For all aortic valves, the manufacturer labeled size

could be retrieved and consecutive sizes differentiated based on measured area and/or diameter.
Conclusion: CT can reliably and non-invasively determine the implanted bioprosthesic heart valve size and discriminate between different bioprosthesis manufacturer labeled sizes. This provides crucial information for accurate sizing and transcatheter valve-in-valve procedure work-up.

Author Disclosures:
D. Suchá: Research/Grant Support; This study was supported by a grant from the Dutch Heart Foundation [2009B014].

B-0602 11:35

Medium-term biventricular heart remodeling after percutaneous and surgical pulmonary valve implantation evaluated with cardiac magnetic resonance

F. Secchi, F.R. Pluchinotta, E. Resta, P.M. Cannaò, M. Carminati, F. Sardanelli; *Milan/IT (francescosecchimd@gmail.com)*

Purpose: to evaluate the medium-term impact of percutaneous (PVVI) and surgical (SPVR) pulmonary valve implantation on biventricular function as assessed by cardiac magnetic resonance (CMR).
Methods and Materials: from 2008 to 2013, 33 patients (median 20 years) underwent PPVI while 16 patients (median 30 years) underwent SPVR. CMR (1.5 T) acquired before and after an average of 10 months (range 3-15) were analyzed. Cine true-FISP sequence was performed (TR/TE=45/1.5 ms, thickness 8 mm) to study the right (RV) and left ventricles (LV) function. Wilcoxon and Pearson test.
Results: the right ventricular end-diastolic volume index (RVEDVI, ml/m2) decreases significantly for PPVI and SPVR: from 81±37 to 68±16 (p=0.030) and from 142±34 to 88±21 (p=0.001) respectively. RV ejection fraction (RVEF, %) increased significantly in the SPVR group compared to the PPVI patients: from 46±11 to 53±9 (p=0.038) and from 49 ±14 to 53±12 (p=0.109) respectively. The left ventricular end-diastolic volume index (LVEDVI, ml/m2) increased more significantly after the procedure in the PPVI group, while changes were less evident and delayed in the SPVR patients: from 66±16 to 74±17 ($p < 0.001$) and from 61±7 to 66±12 (p=0.055) respectively. Left ventricular stroke volume index (LVSVI, ml/m2) increased in both groups after PPVI and SPVR: from 38±12 to 41±11 (p=0.004) and from 35±10 to 40±8 (p=0.058) respectively. Finally there is an inverse correlation between the RV and LVEDVI (r=-0.014): as the RVEDVI decreased in the follow-up, the LVEDVI increased.
Conclusion: medium-term follow-up showed permanent beneficial effect of pulmonary valve replacement in both groups.

B-0603 11:43

Assessment of pulmonary insufficiency by cardiac magnetic resonance using regurgitation fraction or absolute value of reverse volume

M. Petrini, F. Secchi, F.R. Pluchinotta, M. Carminati, M. Chessa, F. Sardanelli; *San Donato Milanese/IT (petrini.marcello@gmail.com)*

Purpose: To compare the use of pulmonary regurgitation fraction (PRF) or absolute value of pulmonary reverse volume (PRV) in the evaluation of pulmonary insufficiency with cardiac magnetic resonance (CMR).
Methods and Materials: We retrospectively studied 44 patients (mean age 23±11 mean value±standard deviation, 17 females and 27 males) with pulmonary/conduit insufficiency due to various congenital heart diseases who underwent CMR (1.5 T) before and after surgical valve implantation (14 patients) or percutaneous Melody valve implantation (30 patients). We performed short axis ECG triggered cine true-FISP (fast imaging with steady state precession) and phase contrast sequences. A reader with four years of experience in CMR segmented endocardial contours of right ventricle (RV) to obtain end diastolic volume index (EDVi), stroke volume index (SVi) and analyzed the flow. We obtained both PRF (%, retrograde flow divided by anterograde) and PRV (ml/beat) and we correlated them with RVEDVi, SVi and differences (Δ) of RVEDVi before and after procedures. Spearman test was used.
Results: Overall PRF (%), PRV (ml/beat), RVEDVi (ml/m²) and SVi (ml/m²) were 29±22, 23±25, 99±43 and 45±16 respectively. RVEDVI was significantly correlated with PRF (r=0.480; p=0.001) and PRV (r=0.549; $p < 0.001$). RVSVi was significantly correlated with PRF (r=0.605; $p < 0.001$) and PRV (r=0.701; $p < 0.001$). ΔRVEDVi was significantly correlated with PRF (r=0.427;p=0.004) and PRV (r=0.489; p=0.001).
Conclusion: PRV is stronger correlated with RVEDVi, RVSVi and ΔRVEDVi than PRF.

B-0604 11:51

Percutaneous pulmonary valve implantation (PPVI): four years follow-up by cardiac magnetic resonance

E. Resta, F. Secchi, G. Di Leo, M. Carminati, F. Sardanelli; *San Donato Milanese/IT (eldachiara.resta@gmail.com)*

Purpose: To show medium term follow-up of patients treated with percutaneous pulmonary valve (Melody™, Medtronic) implantation (PPVI) by cardiac magnetic resonance (CMR).
Methods and Materials: Patients with pulmonary conduit dysfunction were prospectively scheduled for 1.5-T CMR before and 12, 36 and 48 months from PPVI. We used a cine true-FISP sequence (TR/TE=45/1.5 ms, thickness 8 mm) to study the right (RV) and left ventricles (LV) function and a turbo-FLASH phase-velocity mapping sequence (41/3.2 ms, 5 mm, respectively; velocity encoding from 150 to 300 ms) to evaluate pulmonary flow. End-diastolic (EDVI), end-systolic volumes (ESVI), stroke volumes (SVI) and ejection fraction (EF) were calculated. Pressure gradient (PG) was estimated from peak flow velocity using Bernoulli's equation. Regurgitation fraction (RF) was calculated. Friedman test was used.
Results: 40 patients were enrolled. 48 months after PPVI, a significant reduction of RV volumes (EDVI from 82±38 to 58±12 mL/m^2, $p < 0.001$ and ESVI from 44±12 to 30±13 mL/m^2, $p < 0.001$), as well as a significant increase of RV EF (from 49±13 to 58±12%, $p < 0.001$) and SVI (from 38±14 to 40±8 mL/m^2, $p < 0.001$) were observed. RF and PG were significantly reduced, respectively ($p < 0.001$). LV showed a significant increase in EDVI (from 67±17 to 73±18 mL/m^2, p=0.034) and SVI (from 37±11 to 43±10 mL/m^2, $p < 0.001$), while no significant changes were observed for ESVI and EF respectively (p=0.508 and p=0.147).
Conclusion: After 48 months from PPVI a good reduction of RV volumes and increase of RV function were observed confirming the positive effect of this less invasive procedure than surgical approach.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 701a

Liver steatosis and fibrosis

Moderators:
K.J. Beiderwellen; Essen/DE
L. Martí-Bonmatí; Valencia/ES

K-15 14:00

Keynote lecture

L. Martí-Bonmatí; *Valencia/ES*

B-0605 14:09

Semi-automated quantification of abdominal fat in non-alcoholic fatty liver disease: a non-invasive assessment in general population

A. Radmard, A. Abrishami, M. Rahmanian, S. Kooraki, A. Hashemi Taheri, M. Gerami Seresht, H. Poustchi, R. Malekzadeh, S. Merat; *Tehran/IR (abr.alireza@yahoo.com)*

Purpose: To investigate the association between non-alcoholic fatty liver disease (NAFLD) and quantitative measures of central adiposity in general population using a semiautomated method on magnetic resonance imaging (MRI) data.
Methods and Materials: Subjects were recruited from Golestan Cohort Study. Two groups of 120 individuals with and without fatty liver were randomly selected based on findings of ultrasound. Non-invasive diagnosis of NAFLD was made by combination of ultrasound and MRI. Various anthropometric indices including body mass index (BMI), waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) were measured. Segmentation and calculation of visceral (VFA) and subcutaneous fat area (SFA) were performed on three levels of MRI slices using a semi-automated software.
Results: A total of 109 individuals fulfilled NAFLD criteria, while 92 subjects were selected as control group. All obesity measures, except for SFA, were significantly higher in subjects with NAFLD compared to controls. Significant associations were found between NAFLD and adiposity indices, except for SFA, with the highest odds ratio observed in WHR (OR: 3.37, CI: 1.40-3.70, $p < 0.001$). The maximum area under the curve was found in VFA (AUC: 0.722, $p < 0.001$) followed by WHR (AUC: 0.715, $p < 0.001$). VFA also had greatest correlation with ultrasound (r=0.523, $p < 0.001$) and MRI (r=0.546, $p < 0.001$) indicators of NAFLD.

Conclusion: Semi-automated quantitative measures of visceral adiposity are associated with NAFLD, while subcutaneous fat measures are the poor indicator for identifying NAFLD subjects. Compared to conventional anthropometric indices, VFA best correlates with ultrasound and MRI criteria of fatty liver, with the highest sensitivity to predict NAFLD.

B-0606 14:17

Use of dual-energy virtual non-contrast CT for quantitative assessment of hepatic steatosis with dual-source CT scanner: a preliminary study

X. Wang, S.-t. Wang, H.-d. Xue, Z.-Y. Jin; *Beijng/CN (wxpumc@163.com)*

Purpose: To investigate the value of dual-energy (DE) virtual non-contrast CT (VNC) image in the diagnosis of hepatic steatosis.
Methods and Materials: This retrospective study was based on 351 abdominal CECT with image diagnosis of hepatic steatosis.The final analysis included 77 patients. The VNC images were reconstructed from two sets (100 kV and 140 kV) of portal phase dual-energy images.CT value and noise of liver (both left and right lobe), spleen and IVC were compared between VNC group and true non-contrast (TNC, 120 kV) group. Two criteria: 1)a hepatic-to-splenic attenuation ratio of less than 0.8 and 2)a hepatic-to-vessel attenuation ratio of less than 1.0 were applied independently for the diagnosis of moderate to severe hepatic steatosis. The diagnosis consistency of TNC and VNC images using these criteria was evaluated, respectively.
Results: The mean CT value of liver and spleen in VNC images were higher than that in TNC images ($P < 0.01$), and the absolute differences were under 10 HU. Lower noises were found for VNC images than that for TNC images ($P < 0.01$). The noise of liver (right lobe) of TNC images had moderate correlations (r=0.562 to 0.608, all $P < 0.01$) with the diameter parameters. In VNC images, the correlations were weak. The hepatic-to-splenic attenuation ratio criterion has a better consistency (kappa value=0.591). The hepatic-to-vessel attenuation ratio criterion had a kappa value of 0.458. The average dose reduction achieved by omitting the TNC acquisition was 24.2%.
Conclusion: VNC and TNC images had moderate consistency in diagnosis intermediate to severe hepatic steatosis, and a hepatic-to-splenic attenuation ratio of less than 0.8 is recommended as the diagnostic criterion.

B-0607 14:25

Heritability of abdominal adipose tissue compartments and hepatic lipid accumulation: a classical twin study

Z.D. Drobni[1], A.L. Jermendy[1], T. Horvath[1], A. Bartykowszki[1], A.D. Tarnoki[1], S. Voros[2], B. Merkely[1], P. Maurovich-Horvat[1], G. Jermendy[1]; [1]*Budapest/HU*, [2]*Richmond, VA/US (zsofi.drobni@gmail.com)*

Purpose: In obese and/or diabetic patients accumulation of abdominal adipose tissue and the presence of non-alcoholic fatty liver disease (NAFLD) are markers of the risk of developing comorbidities. Our goal was to approximate the weight of genetic impact on different abdominal fat compartments and the presence of hepatic lipid accumulation within a cohort of healthy twin pairs.
Methods and Materials: We have investigated 210 twin subjects with a 256-slice CT-scanner, of whom 63 were monozygotic (MZ) pairs (mean age: 55.7±9.7 years) and 42 were dizygotic (DZ) pairs (mean age: 58.1±8.7 years). We have assessed the CT-based waist circumference, subcutaneous (SAT) and visceral abdominal adipose tissue (VAT) areas at the level of L3/L4. Liver attenuation (L) was determined by calculating the average of three ROIs with an area of 300 mm^2. The presence of hepatic lipid accumulation was defined as L≤40 HU. To quantify phenotypic similarity, intra-pair correlations were calculated. These correlations were broken down to additive genetic (A), common (C) and unique (E) environmental correlation components using structural equation models.
Results: Hepatic lipid accumulation was detected in 30 cases. Strong heritability was found regarding SAT (A=74%) and VAT (A=67%), whereas the genetic influence (A=34%) was lower regarding the average liver attenuation (L) values.
Conclusion: In this classical twin study we have demonstrated a weaker genetic dependency of hepatic lipid accumulation, which underscores the importance of the environment and lifestyle in the development of NAFLD. The distribution of abdominal fat compartments showed strong genetic determination.

B-0608 14:33

The role of MR in the diagnosis of non-alcoholic fatty liver disease: correlation with liver biopsy and insulin resistance

C. Berzovini, R. Faletti, C. Arese, F. Barisone, D. Righi, P. Fonio, G. Gandini; *Turin/IT (claudioberzovini@yahoo.it)*

Purpose: To compare liver biopsy and magnetic resonance (MR) in the diagnosis of non-alcoholic fatty liver disease (NAFLD); to calculate visceral fat quantity using MR and correlate liver and visceral fat with glucose metabolism.
Methods and Materials: In- and out-of-phase dual GRE T1W MR images were used to quantify hepatic steatosis in 24 patients. We calculated the fat signal fraction (FSF) in the sixth segment using Fishbein and Hussain's equations to assess the grade of steatosis and correlation with biopsy. We calculated visceral fat (VF) using 3D GRE T1-weighted MR images and processed them by the software Osirix 3.8 (Pixmeo). In 12 patients, we evaluated OGTT (oral glucose tolerance test), HOMA index (Homeostasis Model Assessment) and OGIS index (Oral Glucose Insuline Sensitivity) to determine glucose metabolism. Statistical significance was interpreted with Pearson's and Spearman's correlation coefficients and Bonferroni method.
Results: We found a great statistically significant correlation between FSF (fat signal fraction) and liver biopsy fat (r=0.77; $p < 0.0001$). MR can correctly distinguish the first grade of steatosis from second and third, but can not distinguish with certainty second grade of steatosis from third ($p < 0.05$). The correlations among FSF, LBF and VF with glucose metabolism are not statistically significant ($p < 0.05$) because of too few patients available.
Conclusion: MR can distinguish properly between the first and third grade of steatosis and between first and second. It is also accurate in assessing VF. Hepatic steatosis and VF are moderately correlated with reduced insulin sensitivity.

B-0609 14:41

Association between T2, T2* and indicators of hepatic inflammation as an early sign of non-alcoholic fatty liver disease in asymptomatic high-risk subjects

M.N. Bongers, C. Schabel, F. Bamberg, A. Fritsche, H.-U. Häring, K. Nikolaou, F. Schick, J. Machann; *Tübingen/DE (malte.bongers@med.uni-tuebingen.de)*

Purpose: To determine the association between T2 and T2* relaxation times and early pathogenetic features of non-alcoholic fatty liver disease (NAFLD) in subjects at high risk.
Methods and Materials: The study was designed as a prospective cohort study enrolling subjects at high risk for NAFLD either due to obesity, or high risk for type 2 diabetes mellitus. In all subjects, hepatic T2 and T2* relaxation times were determined using multi-echo spin-echo/gradient-echo sequences and intrahepatic lipid content (IHL) was quantified by proton magnetic resonance spectroscopy (1H-MRS). Serum levels of iron, ferritin, C-reactive protein (CRP) liver enzymes and platelet count were measured and established risk scores (NAFLD, APRI, and De Ritis) were derived. Gender stratified univariate and multivariate correlation analysis was carried out.
Results: A total of 140 subjects (90 females [60 pre-, 30 postmenopausal], 50 males, mean age: 45±12 years, mean BMI: 32±4 kg/m2) completed the study protocol. Men showed strong correlations between ferritin levels and relaxation times (T2 r=-0.45; T2* r=-0.64) while a negative correlation between IHL and T2 (premenopausal women r=-0.51; postmenopausal women r=-0.62; men r=-0.4) was observed in all subjects. Multivariate analysis demonstrated T2-prolonging effect of CRP in premenopausal women and men (β=1.20, 95%-CI: 0.56-1.84 and 1.47, 95%-CI: 0.64-2.29; respectively).
Conclusion: In subjects at risk for NAFLD, T2 and T2* relaxation times were independently associated with ferritin and IHL as well as CRP levels and might thus help in identifying hepatic inflammation.

B-0610 14:49

Grading of steatosis and liver-fibrosis using phase contrast imaging

M. Armbruster[1], B. Zupanc[1], E. Brun[2], A. Bravin[2], W.H. Sommer[1], R. Reimar[1], W. Thasler[1], M.F. Reiser[1], P. Coan[2]; [1]*Munich/DE*, [2]*Grenoble/FR (marco.armbruster@med.uni-muenchen.de)*

Purpose: To evaluate the feasibility of grading steatosis and liver-fibrosis by using high resolution X-ray Phase-Contrast-Imaging (PCI) in computed tomography (CT) mode and a visual grading score of microstructural changes.
Methods and Materials: PCI-CT volumetric imaging was performed for human tissue samples from 22 patients who underwent liver transplantation due to fibrosis or cirrhosis at the European-Synchrotron-Radiation-Facility. Images were acquired at a resolution of 8 µm. Each dataset was graded for the presence of portal, periportal or septal fibrosis as well as for the amount of fatty vacuoles by two observers blinded both for the diagnosis and the histopathological report. Interobserver effects were assessed. Histopathological workup was assessed prior to PCI-CT including METAVIR grading of fibrosis (Grade F1-F4). PCI-CT- and histopathological grading was correlated using pearson's correlation-coefficient.
Results: Both fatty vacuoles, portal deposite of extracellular matrix, and septal fibrougenous deposites were identifiable in PCI-CT datasets. Visual grading of fibrosis and steatosis in PCI correlated significantly with the histopathological assessment (r=0.628; $p < 0.05$ for fibrosis; r=0.726; $p < 0.05$ for steatosis). Interobserver agreement in the grading of fibrosis was 59% for fibrosis and 46% for steatosis. The two observers differed by one grade in 41% for fibrosis and in 46% for steatosis. They differed by two grades in 9% for steatosis (k=0.68; k=0.63 respectively).

Conclusion: X-ray Phase-Contrast-CT allows the identification of microstructural changes within the liver tissue of patients suffering from fibrosis or steatosis. Detailed graduation of diffuse liver diseases is feasible using PCI-CT and is highly correlated to the histopathological assessment.

B-0611 14:57

Diagnostic accuracy of real-time ShearWave elastography for the noninvasive assessment of liver fibrosis

N. Huet, I. Bricault, A. Martino, M. Medici, E. Chipon, N. Sturm, J.-P. Zarski, A. Moreau-Gaudry, V. Leroy; *Grenoble/FR (nhuet@chu-grenoble.fr)*

Purpose: To assess the diagnostic accuracy of ShearWave elastography (SWE) for staging liver fibrosis in chronic hepatitis B or C, and to compare its performance to transient elastography (TE), using liver biopsy as the reference.
Methods and Materials: Prospective study in our University Hospital center, approved by an ethic committee and registered in Clinical Trials (NCT01537965). For each patient, we performed in the right liver 10 TE elasticity measurements using Fibroscan® (M or XL probe) and 3 SWE measurements using the ultrasound system Aixplorer®, followed by biopsy.
Results: 90 patients with chronic hepatitis B or C were included. Fibrosis was staged using the METAVIR scoring system; there were 6 patients F0, 46 F1, 25 F2, 10 F3 and 3 F4. The failure ratio was similar with SWE (11/90) and TE (13/90), but failure occurred with SWE and TE simultaneously in only 5 patients. Higher body mass index and higher subcutaneous tissue thickness were significantly associated to measurement failures. Analysis was performed for the 71 patients with valid measurements for both techniques. For the diagnosis of significant fibrosis and severe fibrosis, areas under the ROC curves were respectively: 0.79 [95% confidence interval: 0.68-0.90] for SWE and 0.76 [0.65-0.87] for TE (p=0.68), and 0.88 [0.73-1] for SWE and 0.79 [0.59-1] for TE (p=0.08).
Conclusion: SWE accuracy was comparable to TE for the diagnosis of significant fibrosis and severe fibrosis. SWE is fast and easy to use and this technique could allow screening for liver fibrosis during routine ultrasound examinations.

B-0612 15:05

Diagnostic value of Real-Time elastography (RTE) compared to biopsy in the assessment of liver stiffness in patients with chronic viral hepatitis

M. Schiavone, D. Ippolito, P.A. Bonaffini, C.R.G.L. Talei Franzesi, D. Fior, S. Sironi; *Monza/IT (mvalentinaschiavone@gmail.com)*

Purpose: To determine the value of real-Time elastography (RTE) in assessment of liver stiffness in patients with chronic viral hepatitis, correlating RTE data with the extent of fibrosis based on biopsy findings (Ishak score).
Methods and Materials: Twenty-four patients (45-75 years) with chronic viral hepatitis (16 HCV, 8 HBV) were evaluated with ultrasonography (US) study that included RTE analysis. In the RTE images relative tissue stiffness is expressed according to color scale with soft areas represented in green/red colors and hard areas in blue. All patients were divided in two groups based on fibrosis degree: soft (D1, corresponding to F1-F3 Ishak score) and hard degree (D2, corresponding to F4-F6). Before the RTE, all patients also underwent a US-guided percutaneous liver biopsy (right lobe) for assessment of fibrosis degree.
Results: Quantitative RTE data were compared with liver biopsy by using the Spearman correlation coefficient in order to assess the correlation between the RTE (D) and fibrosis, according to Ishak score (F) at histology. At RTE 13/24 patients had degree D1 and 11/24 patients had degree D2; at histological analysis we found: 2 patients with F1, 3 with F2, 5 with F3, 5 with F4, 3 with F5, 6 with F6. The Spearman coefficient showed significant correlation between D and F degree, obtaining Rho=0.573, p=0.003.
Conclusion: RTE analysis showed high diagnostic accuracy in assessment of fibrosis, being a potentially useful diagnostic tool for non-invasive quantification of fibrosis itself in patients with chronic viral hepatitis.

B-0613 15:13

Estimation of extracellular volume fraction using routine four-phase liver CT for grading hepatic fibrosis

J.-H. Yoon[1], J. Lee[1], E. Klotz[2], J. Han[1], B. Choi[1]; [1]*Seoul/KR*, [2]*Forchheim/DE (jhjhry@gmail.com)*

Purpose: To determine whether hepatic extracellular volume fractions (fECVs) measured using multiphasic liver computed tomography (CT) can be used to quantify the severity of hepatic fibrosis (HF).
Methods and Materials: A total of 141 patients (M:F=109:32; mean age, 59.4±11.4 years) histologically diagnosed with HF (F0-1=33 and F2-4 =108) underwent multiphasic liver CT. Absolute enhancements (HU) of the liver parenchyma (Eliver) and aorta (Eaorta) three minutes after contrast administration were measured on subtraction images of precontrast and equilibrium phase scans using non-rigid registration software. fECV was calculated using the following equation: fECV (%) = Eliver/Eaorta x (100-Hematocrit [%]). Correlation between fECV and HF stage was evaluated using Spearman's correlation coefficient. fECVs were compared between F0-1 and ≥ F2, and between Child A and Child B or C. Diagnostic performance of fECV in predicting significant HF (≥F2) was assessed using receiver operating curve (ROC) analysis.
Results: fECVs showed a significant correlation with pathologic HF staging ($r=0.493$, $P < 0.001$). F2-4 showed significantly higher fECVs than F0-1 (33.6±4.7% vs. 27.7±4.4%, $P < 0.001$). fECVs were significantly higher in patients with Child B or C than with Child A (35.2±7.0% vs. 31.3±4.2%). fECV larger than 28.76% provided 87.5% sensitivity and 71.0% specificity in detecting significant HF (area under the curve (AUC); 0.832, $P < 0.0001$).
Conclusion: As fECV was shown to increase along with HF progression, estimation of fECV using routine multiphasic liver CT may have the potential to detect significant HF.

Author Disclosures:
J. Lee: Advisory Board; Bayer Schering Pharma., Siemens Healthcare. Research/Grant Support; Guerbet. **E. Klotz:** Employee; Siemens AG, Medical solutions.

B-0614 15:21

Assessment of fibrotic tissue and microvascular architecture by in-line phase-contrast imaging in mouse model of liver fibrosis

Y. Fu, W.-j. Peng, X. Zhang; *Shanghai/CN (fuyi0028@163.com)*

Purpose: To investigate the diagnostic performance of in-line phase-contrast imaging using CT (ILPCI-CT) by synchrotron radiation (SR) in different stages of liver fibrosis.
Methods and Materials: Twenty six BALB/c mice models of liver fibrosis were underwent, on the excised liver, ILPCI-CT by SR. Histologic staging of liver fibrosis served as the reference and categorized the livers in 2 main groups, corresponding to mild and advanced fibrosis. Both qualitative description and quantitative evaluation of vessel features, such as microvessel density (MVD), the ratio of junction point to volume (J/V), and distance map (DM) were performed.
Results: Thirteen specimens were successfully scanned by ILPCI-CT. The CT images without edge enhancement gave a clear view of inner structures showing ground-glass opacity around the portal tracts even in the mild fibrosis group. Vascular in diameter of 10 μm and nodular changes on fibrosis liver surface were detected by CT and reconstruction. The mean MVD was significantly higher in fibrotic mice ($P=0.024$) compared with the control ($p < 0.05$), consistent with fibrosis-related angiogenesis progress. The DM, used as an auxiliary parameter, showed abnormal supply of oxygen compared to normal liver.
Conclusion: Fibrous material can be detected in the liver by ILPCI-CT even in the early stage of fibrosis. Higher MVD likely reflects the fibrosis-related angiogenesis, and 3D reconstruction could be an auxiliary method to visualize morphological changes of the fibrotic liver.

Author Disclosures:
Y. Fu: Research/Grant Support; the National Natural Science Foundation of China (Nos. 81271574, 81371550.11235007), the National Program on Key Basic Research Project (973 Program, No.2010CB834305).

14:00 - 15:30 **Room C**

Breast

SS 702

Breast: diffusion-weighted MR imaging (DWI)

Moderators:
G. Forrai; Budapest/HU
C. Iacconi; Carrara/IT

B-0615 14:00

Is there a systematic bias of apparent diffusion coefficient (ADC) measurements of the breast if measured on different workstations? An inter- and intra-reader agreement study

P. Clauser[1], M. Maieron[1], M. Marcon[1], C. Zuiani[1], M. Bazzocchi[1], P.A.T. Baltzer[2]; [1]*Udine/IT*, [2]*Vienna/AT (clauser.p@hotmail.it)*

Purpose: Apparent Diffusion Coefficient (ADC) values obtained by Diffusion Weighted Imaging (DWI) are increasingly used for breast lesion differentiation and monitoring of neoadjuvant therapy response in breast cancer. The purpose of our study was to evaluate ADC measurements of breast lesions on different computer platforms workstations by different readers in order to address subjective reader and objective post-processing influences on ADC measurement reproducibility.
Methods and Materials: Forty-one patients with 41 biopsy-proven breast lesions were included in this prospective IRB approved study. MRI examination was performed at 1.5 T using an Echo Planar Imaging DWI sequence (TR 7100 ms, TE 84 ms) with b-values of 0 and 1000 s/mm2. Two radiologists (R1, R2) with experience in breast imaging reviewed the images in separate sessions and measured the ADC for each lesion using 3 different softwares: MRI workstation (MRI-WS), PACS workstation (P-WS) and a commercially available DICOM viewer (O-WS). Agreement between WS and readers was evaluated using Intraclass Correlation Coefficient (ICC) and Bland-Altman plots.
Results: Thirty malignant, 2 high-risk and 9 benign mass-like lesions were analyzed. Agreement between WS and readers was very good (ICC R1=0.926; ICC R2=0.976). Inter-reader agreement was high for all three WS (ICC MRI-WS=0.738; ICC P-WS=0.659; ICC O-WS=0.702). Using Bland-Altman plots, no systematic differences were identified between readers and workstations. Limits of agreement ranged between a minimum of 33.9%/-38.9% and a maximum of 38.1%/-46.2%.
Conclusion: ADC measurements show a high reproducibility as measured by inter- and intraobserver agreement and are independent from the software platform used.

B-0616 14:08

Diffusion-weighted imaging with background body signal suppression (DWIBS) imaging of breast lesions before and after gadolinium injection

M. Telegrafo, M. Moschetta, A. Stabile Ianora, G. Angelelli; *Bari/IT (mikitele@hotmail.it)*

Purpose: To assess whether contrast material injection (CMI) significantly affects DWIBS imaging.
Methods and Materials: 200 patients were prospectively evaluated by MRI with STIR, TSE-T2, pre-CMI DWIBS, contrast enhanced THRIVE-T1 and post-CMI DWIBS sequences. Pre and post-CMI DWIBS were analyzed searching for the presence of breast lesions and calculating the ADC value. ADC values of $\leq 1.44 \times 10^{-3}$ mm^2/s were considered suspicious for malignancy. This analysis was then compared with the histological findings. Sensitivity, specificity, diagnostic accuracy (DA), positive predictive value (PPV) and negative (NPV) were calculated for both sequences and represented by ROC analysis. Pre and post-CMI ADC values were compared by using the paired t test.
Results: In 150/200 (59%) patients, pre and post-CMI DWIBS indicated the presence of breast lesions, 53 (35%) with ADC values of > 1.44 and 97 (65%) with ADC ≤ 1.44. Both pre-CMI and post-DWIBS sequences obtained sensitivity, specificity, DA, PPV and NPV values of 97%, 83%, 89%, 79% and 98%, respectively. The mean ADC value of benign lesions was $1.831 \pm 0.18 \times 10^{-3}$ mm^2/s before and $1.828 \pm 0.18 \times 10^{-3}$ mm^2/s after CMI. The mean ADC value of the malignant lesions was $1.146 \pm 0.16 \times 10^{-3}$ mm^2/s before and $1.144 \pm 0.16 \times 10^{-3}$ mm^2/s after CMI. No significant difference was found between pre and post CMI ADC values ($p > 0.05$).
Conclusion: DWIBS is not influenced by CMI. Breast MR protocol could be modified by placing DWIBS after dynamic contrast enhanced sequences in order to maximize patient cooperation and preserve the diagnostic accuracy.

B-0617 14:16

The influence of size and position of the region of interest on the apparent diffusion coefficient values in discriminating between benign and malignant breast lesions in diffusion weighted imaging

M. Wielema, M.D. Dorrius, H. Dijkstra, M. Oudkerk, P.E. Sijens; *Groningen/NL (mirjamwielema@hotmail.com)*

Purpose: To determine the influence of size and position of the region of interest (ROI)in DWI of breast lesions on the ADC values in discriminating benign from malignant lesions.
Methods and Materials: Sixty-four patients with 72 breast lesions (52 malignant; 20 benign) underwent breast DWI. ADCs were calculated for b-value pairs: 0-1000, 0-800, 0-500, 0-200 and 0-50s/mm2. In each lesion 4 oval ROIs were drawn. ROI1 encompassed as much of the lesion as possible, ROI2 (0.5 cm2) was located in the middle of the lesion and ROI3 (0.5 cm2) and ROI4 (1.0 cm2) were selections within the lesion yielding the lowest ADC. ROC analysis was used to quantify the diagnostic accuracy of the ROI methods with the different b-value pairs. An independent sample t-test was used for malignant lesions and Mann-Whitney U test for all and benign lesions to determine statistical significance.
Results: Benign and malignant lesions significantly differed for b-value pair≥ 0-200s/mm2 ($p < 0.001$). A significant difference between ROI3 and ROI4 for malignant lesions ($p=0.005$) was observed with higher accuracy for ROI3 (0.943 versus 0.932, respectively). The ADC outcomes of b-values 0-1000 and 0-800s/mm2 met higher specificity than the lower b-value pairs: 70-75% for ROI1 and ROI3 when choosing a sensitivity and negative predictive value of 100%. The AUC was highest for ROI3 using b-values 0-1000 and 0-800s/mm2 (0.965 and 0.964, respectively).
Conclusion: The highest accuracy in discriminating between benign and malignant breast lesions is for a small ROI yielding the lowest ADC with b-values 0-1000 and 0-800s/mm².

B-0618 14:24

Sensitivity of dynamic contrast-enhanced and diffusion-weighted MRI in the detection of ductal carcinoma in situ and correlation with nuclear grade

C. Borelli, G.K. Parapatt, R. Fubelli, C. Buccheri, M. Giuliani, P. Rinaldi, P. Belli, L. Bonomo; *Rome/IT (cristinaborelli@hotmail.it)*

Purpose: This study aims to investigate the sensitivity of breast MRI in the detection of ductal carcinoma in situ (DCIS) associated with microcalcifications on the mammogram, and to assess whether the combined evaluation of dynamic contrast-enhanced (DCE) MRI and diffusion-weighted imaging (DWI) can be helpful in predicting DCIS grade.
Methods and Materials: Sixty-eight DCIS lesions (32 high-grade, 24 intermediate-grade, 12 low-grade) in 63 women who underwent preoperative breast MRI with both DCE-MRI and DWI were retrospectively reviewed. DCE imaging was classified as negative or positive on the basis of enhancement absence or presence (including all kinetic patterns). DWI was classified as negative or positive on the basis of both hyperintensity and apparent diffusion coefficient (cut-off value of 1.4x10-3 mm2/sec). Sensitivity of MRI in the detection of DCIS was calculated. DCE-MRI and DWI findings were correlated to the DCIS grade.
Results: Detection sensitivities of DCIS were 75% for DCE-MRI, 58.8% for DWI and 77.9% for combined DCE-MRI and DWI. DCE-MRI and DWI detection of DCIS increased significantly with increasing nuclear grade ($p=0.032$ and $p=0.029$ respectively). The simultaneous positivity or negativity of both DCE-MRI and DWI was significantly correlated with DCIS grading ($p=0.028$): negative findings in both DCE-MRI and DWI (n=15) were associated with low-grade DCIS; positive findings in both DCE-MRI and DWI (n=38) were associated with high-grade DCIS. Discordant DCE-MRI and DWI findings (n=15) were inconclusive.
Conclusion: Breast MRI may help identifying DCIS lesions, particularly high-grade DCIS. Simultaneous negative or positive DCE-MRI and DWI findings are useful to predict DCIS grade.

B-0619 14:32

Traffic light labelling of the apparent diffusion coefficient improves specificity of breast MRI

M. Dietzel[1], A. Baltzer[2], P.A.T. Baltzer[2]; [1]*Erlangen/DE*, [2]*Vienna/AT*

Purpose: To assess whether traffic light labeled Apparent Diffusion Coefficient (ADC) values can be integrated with contrast enhanced MRI (CE-MRI) to improve the specificity of breast MRI in enhancing lesions.
Methods and Materials: Retrospective analysis of a consecutive series of patients referred to breast MRI at 1.5 T for further workup of mammographical/sonographical lesions classified as Breast Imaging Reporting And Data System (BI-RADS) 3-5. Reading results of CE-MRI (according to EUSOMA recommendations) were dichotomized into 1 (BI-RADS 4&5, suspicious) or 0 (BI-RADS 2&3, benign). Lesion´s ADC values (in *10-

3 mm2/s, EPI-DWI, two b-values 0/1000 s/mm2) were measured and assigned a traffic light label: red (score +1, ADC ≤1), yellow (score 0, ADC > 1-≤1.4) and green (score -1, ADC > 1.4). CE-MRI and ADC scores were added and any final score > 0 was considered suspicious for malignancy. Histology and imaging follow-up of > 24 months were defined as the reference standard. Diagnostic parameters were compared using McNemar tests.
Results: A total of 150 lesions (73 malignant) were investigated. Based on reading of CE-MRI, a sensitivity of 100% (95% CI 95.1% to 100.00%) and a specificity of 81.8% (95% CI 71.38% to 89.69%) were observed. The addition of traffic light labeled ADC increased specificity to 92.4% (95% CI 84.20% to 97.16%, P=0.057) without causing false negative results.
Conclusion: DWI can be integrated with CE-MRI of the breast using a simple traffic light labeling of the ADC. This approach improves specificity of lesion diagnosis without decreasing sensitivity.

B-0620 14:40

Are morphologic descriptors of MR BIRADS lexicon applicable to breast DWI?

V. Piccione, L. Martincich, S. Carabalona, M. Eandi, S. Osano, F. Astegiano, D. Regge; *Candiolo/IT (valentinapiccione980@hotmail.it)*

Purpose: To define if morphologic descriptors of MR BIRADS lexicon are applicable to DWI.
Methods and Materials: 556 breast cancer patients underwent DWI and Dynamic-MRI followed by surgery. MR BIRADS morphologic descriptors for mass (ML) and non mass-like enhancing areas (NML) were evaluated for the corresponding DWI areas of hyperintensity. Agreement was assessed by Cohen's k test.
Results: Pathology identified 680 malignancies, all detected at Dynamic-MRI. For the 585 ML: shape was round in 143, oval in 175 and irregular in 267; margins circumscribed in 73, irregular in 360 and spiculated in 152; internal characteristics homogeneous in 24, heterogeneous in 511, rim in 50. For the 95 NML: distribution was focal in 10, linear in 34, segmental in 41, regional in 4 and diffuse in 6; internal pattern clumped in 24 and heterogeneous in 71; asimmetry in 95. DWI detected 551/680 malignancies. For the 472 ML: shape was oval in 56, round in 42 and irregular in 374; margins circumscribed in 27, irregular in 430 and spiculated in 15; internal characteristics homogeneous in 18, heterogeneous in 398 and rim in 56. For the 79 NML: distribution was focal in 11, linear in 26, segmental in 32, regional in 3 and diffuse in 7; internal pattern clumped in 7, heterogeneous in 70 and homogeneous in 2; asymmetry in 79. Margins and internal characteristics for ML and distribution and asymmetry for NML showed highest concordance (k 0.71 and 0.77).
Conclusion: Morphologic MR BIRADS lexicon could be applied to breast DWI.

Author Disclosures:
L. Martincich: Speaker; Bracco Imaging. Other; Blinded reader Bayer Schering.

B-0621 14:48

Diffusion-weighted imaging at 3 T: correlation of the apparent diffusion coefficient value with breast cancer biomarkers

M. Telesca, F. Pediconi, S. Ursu, M. Luciani, C. De Felice, V. Cipolla, C. Catalano; *Rome/IT (marianna.telesca@uniroma1.it)*

Purpose: To evaluate the relationship of the apparent diffusion coefficient (ADC) value with cancer biomarkers in patients with biopsy-diagnosed breast cancer.
Methods and Materials: DWI was performed in 255 patients with biopsy-diagnosed breast cancer undergoing dynamic contrast-enhanced MRI at 3 T for local staging. The MRI protocol comprised precontrast FSE T2w IDEAL sequence, single shot echo planar DWI imaging with b-factor 0 and 800 sec/mm2 and VIBRANT 3D T1w sequence before and after administration of 0.1 mmol/kg gadobenate dimeglumine (MultiHance®). The relationship between ADC and classical histopathological/immunohistochemical tumour features (size, histological type, grade, oestrogen receptor [ER], progesteron (PgR) receptor, Ki-67 expression, HER2 status) was assessed for all index cancers. ADC values were compared between immunohistochemical surrogates of the intrinsic subtypes (Luminal A; Luminal B; HER2-enriched; triple negative) using non parametric tests.
Results: The median ADC value of the 255 index lesions (mean diameter 24 mm) was 1.08×10-3 mm2/s (range 0.45-2.20). No relationship was observed between ADC values and size, histological type, grade, ER, PgR and HER2 status. A significant correlation was found between ADC values and Ki-67 expression (p=0.006) and a significant difference in ADC was found between Ki 67< 14 (1.12±0.24 ×10-3 mm2) and Ki 67 ≥14 (1.05±0.24 ×10-3 mm2) groups (p=0.03). No significant difference of ADC values between different immunohistological type was found. However triple negative cancers demonstrated lower median ADC than other subtypes (1.05±0.27 ×10-3 mm2).
Conclusion: MRI with DWI may be an additional tool to predict tumour malignancy, particularly for more aggressive tumours.

B-0622 14:56

Role of unenhanced breast MRI for detecting and differentiating breast lesions

M. Moschetta, M. Telegrafo, E. Tricarico, L. Rella, A. Stabile Ianora, G. Angelelli; *Bari/IT (marco.moschetta@gmail.com)*

Purpose: To assess the role of STIR, T2-weighted TSE and DWIBS sequences for detecting and characterizing breast lesions and to compare unenhanced (UE)-MRI results with contrast enhanced (CE)-MRI and histological findings, having the latest as the reference standard.
Methods and Materials: 280 consecutive patients (age range, 27-73 years; mean age ± standard deviation (SD), 48.8 ± 9.8 years) underwent MR examination with a diagnostic protocol including STIR, T2-weighted TSE, THRIVE and DWIBS sequences. Two radiologists blinded to both dynamic sequences and histological findings evaluated in consensus STIR, T2-weighted TSE and DWIBS sequences and after two weeks CE-MRI images searching for breast lesions. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy for UE-MRI and CE-MRI were calculated. UE-MRI results were also compared with CE-MRI.
Results: UE-MRI sequences obtained sensitivity, specificity, diagnostic accuracy, PPV and NPV values of 94%, 79%, 86%, 79% and 94 %, respectively. CE-MRI sequences obtained sensitivity, specificity, diagnostic accuracy, PPV and NPV values of 98%, 83%, 90%, 84% and 98%, respectively. No statistically significant difference between UE-MRI and CE-MRI was found.
Conclusion: Breast UE-MRI could represent an accurate diagnostic tool and a valid alternative to CE-MRI for evaluating breast lesions. STIR and DWIBS sequences allow to detect breast lesions while T2-weighted TSE sequences and ADC values could be useful for lesion characterization.

B-0623 15:04

Unenhanced breast magnetic resonance imaging : detection of breast cancer

A. Bonatesta, P. Belli, E. Bufi, M. Tumino, C. Buccheri, L. Bonomo; *Rome/IT (angel.bon@hotmail.it)*

Purpose: The purpose of this study was to assess detectability of both mass and non-mass lesions, evaluating sensitivity and specificity of DWI combined with T2-weighted images, compared with contrast-enhanced MRI (ceMRI).
Methods and Materials: We retrospectively reviewed our institutional database and we selected 117 patients who underwent MRI in our department between June and December 2010, with histopathologically proven lesions or 2-year imaging follow-up. In 3 patients, only one breast was evaluated because of previous monolateral mastectomy. Two blinded observers experienced in breast imaging evaluated unenhanced MRI (ueMRI), assessing lesion size, ADC values and T2-weighted descriptors and then rated the examination according to the BI-RADS scale.
Results: This study examined 231 breasts (89 with lesions, 142 without disease). The sensitivity of ueMRI was 76 % for both observer 1 and 2. The specificity was 96.8 % for observer 1 and 97 % for observer 2. The differences between observers were not significant. UeMRI was less accurate in the detection of lesions smaller than 2 cm (sensibility of 65 % for observer 1 and 69 % for observer 2). ADC value was a fundamental positive predictive factor (94 % for observer 1, 95 % for observer 2).
Conclusion: In our study, the sensitivity and the specificity of ueMRI were comparable to ceMRI. However, the detectability of smaller lesions was worse than ceMRI.

B-0624 15:12

Breast lesion differentiation by 3-parameter IVIM analysis

H. Dijkstra, M.D. Dorrius, M. Wielema, M. Oudkerk, P.E. Sijens; *Groningen/NL (h.dijkstra01@umcg.nl)*

Purpose: Optimise intravoxel incoherent motion (IVIM) modeled diffusion-weighted imaging (DWI) for differentiation of malignant and benign breast mass lesions.
Methods and Materials: Twenty-eight consecutive patients with breast lesions ≥ 1 cm were examined with 1.5 T DWI (b=0.50,200,500,800.1000 s/mm^2) between July 2012 and June 2013. Lesions were classified by histopathology or follow-up and non-mass lesions were excluded. Offline IVIM voxel-by-voxel analysis (ROI was drawn with wide margin around the lesion) yielded molecular diffusion (D_{slow}), microperfusion (D_{fast}) and respective fractions ($f_{slow/fast}$). The parameters were combined in parallel to exclude malignancy based on three thresholds optimised during the analysis.
Results: Twenty-four breast mass lesions were found: 10 benign (fibroadenoma/adenosis) and 14 malignant (12 IDCs; 1 ILC; 1 Plyllodes). Malignancy was correctly identified when using the following decision algorithm and optimised thresholds: $D_{slow} < 1.58x10^{-3}$ mm^2/s AND $D_{fast} < 0.068$ mm^2/s AND $f_{fast} < 66.5\%$; otherwise benign. Optimal discrimination was obtained when

Thursday

respectively 70%, 10% and 2% of the highest voxel values within the ROI were analysed. All lesions were correctly identified as benign or malignant.
Conclusion: This study design demonstrates the potential of 3-parameter IVIM analysis to differentiate benign from malignant breast mass lesions. A prospective study should establish the sensitivity and specificity of this new approach.

B-0625 15:20

Correlation of intravoxel incoherent motion diffusion-weighted imaging with immunohistochemical index in breast ductal carcinoma

L. Cai, Y. Chen, X. Liu, Y. Chen, Y. Xiao; *Fujian/CN (yaluzhangbujiang@163.com)*

Purpose: To investigate the correlation of the parameters derived by IVIM-DWI with immunohistochemical index in breast ductal carcinoma.
Methods and Materials: Sixty Patients with suspicious breast lesions underwent Intravoxel Incoherent Motion Diffusion-Weighted Imaging (IVIM-DWI) at 1.5 T MRI and had pathologic and immunohistochemical diagnosis. All lesions were identified using the parameters:Standard ADC, Slow ADC, Fast ADC and Fraction. Correlations between these parameters and immunohistochemical index, including expression of estrogen receptor (ER), progesterone receptor (PR), Ki-67 and human epidermal growth factor receptor 2 (HER2) were analyzed.with Mann-Whitney U test.
Results: Thirty breast ductal carcinoma cases were found among all the subjects. Comparison of immunohistochemical findings with measurements obtained with IVIM-DWI indicates that there were significant differences between the tumour with ER negativity and with ER positivity in mean Standard ADC (P=0.012), Slow ADC (P=0.002) and Fraction (P=0.048). It was essential difference between the tumour with PR negativity and with PR positivity in mean Slow ADC (P=0.021). There were no significant differences in the parameters between other groups.
Conclusion: The measurements obtained with IVIM-MRI was relative to ER and PR expression in breast ductal carcinoma.

14:00 - 15:30 **Room Z**

Vascular

SS 715

Arteries and veins

Moderators:
A. Capelastegui; Galdakao/ES
L. Mailli; London/UK

B-0626 14:00

Overall evaluability of 80-kV multi-detector CTA of the thoracic aorta using a not-tailored injection protocol with low concentration iso-osmolar iodinated contrast medium

A.D. Annoni, A. Formenti, G. Pontone, S. Mushtaq, M. Petullà, E. Bertella, E. Nobili, M. Pepi, D. Andreini; *Milan/IT (andrea.annoni@ccfm.it)*

Purpose: To assess evaluability and image quality of low-kilovoltage 64-slice multi-detector computed tomography angiography (MDCTA) of the thoracic aorta using a not-tailored injection protocol with 80 mL of low concentration iso-osmolar (iodixanol 270 mg I/mL) iodinated contrast medium in patients with Body Mass Index (BMI) up to 36 kg/m2.
Methods and Materials: Eighty six patients referred to our hospital for MDCTA of the thoracic aorta were enrolled in our study. MDCT were performed with 80 kV, retrospective ECG triggering and adaptive statistical iterative reconstruction algorithm, using 80 ml of Iodixanol 270 mg I/mL (total iodine load 21.6 gI) injected at 4.5 mL/sec. Image quality was assessed using a semi quantitative four-point scale, by two independent readers. For each patient, attenuation, image noise, contrast-to-noise ratio (CNR)and effective dose (ED)were measured.
Results: No exams were classified as not diagnostic. Good correlation between the mean image quality score of the two readers (p=0.6). Mean aortic attenuation for ascending aorta, aortic arch and descending aorta were 590.5±85.4, 545.2±65.4 and 557.7±75.9 HU respectively.Mean image noise and CNR for ascending aorta, aortic arch and descending aorta were 48.9±8.0, 49.6±7.9 and 51.02±9.4 respectively and 10.7±3.1, 9.8±2.0 and 9.8±2.1 respectively. Mean ED was 4.6±2.3 mSv.
Conclusion: 80 kV MDCTA of the thoracic aorta using a not-tailored injection protocol of low concentration iso-osmolar (iodixanol 270 mg I/mL) iodinated contrast medium is feasible also in patients with high BMI with evidence of an overall high intravascular enhancement compensating in terms of image quality an increased image noise.

B-0627 14:08

CTA of the aorta using 80 kVp in combination with iterative reconstruction: evaluation of image quality and dose reduction

J. Boos, J. Aissa, R.S. Lanzman, P. Heusch, L. Schimmöller, G. Antoch, P. Kröpil; *Düsseldorf/DE (Johannes.Boos@med.uni-duesseldorf.de)*

Purpose: To evaluate the impact of a reduced tube potential (80 kVp) in combination with iterative reconstruction on image quality of aortic CTA.
Methods and Materials: N=104 CTAs of the aorta performed in n=76 patients (54 male, 22 female, mean age 69.0±11.7 years) between 2012-2014, were included in this retrospective study. All examinations were performed following injection of 100 ml of contrast material on a 128-row CT-scanner. A standard protocol was used in 28 CTAs (100 kVp, group A), whereas a low-dose protocol was used in 76 CTAs (80 kVp, group B). In 10 patients, both 80 kVp and 100 kVp examinations were available. Advanced iterative reconstruction technique (SAFIRE, Siemens) was used. CNR, SNR and aortic attenuation were assessed using ROI-measurements in the thoracic and abdominal aorta. Subjective image quality (IQ) was assessed by two readers on a five point scale (1: non diagnostic - 5: excellent). Furthermore, DLP and CTDIvol were analysed.
Results: All examinations were of diagnostic IQ. Attenuation of the thoracic and abdominal aorta was significantly higher in group B compared to group A (441.6±90.1 HU vs 295.0±57.1 HU and 425.6±93.7 HU vs 286.8±57.6 HU, respectively; $p < 0.05$). Objective IQ was comparable between both groups (CNR: 12.8±3.7 vs. 12.8±7.0 and SNR14.4±4.0 vs. 14.2±7.7, respectively; $p > 0.05$). CTDIvol and DLP were significantly lower in group B (1.9±0.4 mGy, 138.2±40.58 mGycm) as compared to group A (4.2±1.3 mGy, 289.2±85.6 mGycm) ($p < 0.05$).
Conclusion: Low dose CTA of the aorta using 80 kVp with iterative reconstruction leads to a significant dose reduction of up to 50% while diagnostic image quality is maintained.

B-0628 14:16

CT dose reduction using sequential or fast pitch spiral technique employed in CTA of the aorta: results from the CT dose study

A.M. Bucher[1], M. Renker[2], F.G. Meinel[3], T.J. Vogl[1], K.M. Chinnaiyan[4], G.L. Raff[4], U.J. Schoepf[5], [1]*Frankfurt a. Main/DE*, [2]*Giessen/DE*, [3]*Munich/DE*, [4]*Royal Oak, MI/US*, [5]*Charleston, SC/US*

Purpose: Implementation of dose saving strategies, such as high-pitch spiral scan modes and iterative reconstruction algorithms has shown substantial impact on radiation dose in select study environments. In this substudy of the CT DOSE trial, we assessed the actual ("real world") impact on radiation dose resulting from the installation of scanners with high-pitch capabilities in patients undergoing CT angiography of the aorta.
Methods and Materials: From March 2011 to April 2012 a cohort of consecutive patients undergoing CT angiography of the abdominal aorta was included from each of the 7 participating sites. In the control group radiation dose parameters were analyzed retrospectively from previous CT scanner generations. The study group consisted of prospectively enrolled patients after installing 128-slice dual source scanners with high-pitch capability. The study design purposefully refrained from controlled protocol changes. Continuous variables were examined using the non-parametric Mann-Whitney and unpaired student-t test.
Results: This sub-study included 338 patients across all 7 centers (143 in the control group, 195 in the study group). Overall effective radiation dose showed a significant reduction with a decrease from 26.2mSv (interquartile range [IQR]: 21.6mSv) in the control group to 14.7mSv (IQR: 14.9mSv) in the study group ($p < 0.001$). Other than age (63.4 ± 15.2 years (64.0) vs. 67.8 ± 13.0 years (70.0); p=0.005) there were no statistically significant differences present in patient demographics.
Conclusion: Substitution of former generation scanners by scanners capable of high-pitch acquisition results in a significant dose reduction across aortic CT angiography studies in real-world practice.

Author Disclosures:
A.M. Bucher: Other; This study was funded by Siemens Healthcare, USA, M.A. **G.L. Raff:** Grant Recipient; Siemens Healthcare, USA. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE Healthcare, Medrad, and Siemens Healthcare. Grant Recipient; Bayer, Bracco, GE Healthcare, Medrad, and Siemens Healthcare.

B-0629 14:24

Lower limbs low voltage (80 kV) CTA: lower radiation dose delivered and less contrast medium with preservation of image quality

M. Belgrano, C. Cercato, W. Toscano, A. Rossi, M.A. Cova, M. Cazzagon;
Trieste/IT (belgranom@gmail.com)

Purpose: To compare the intravascular enhancement in low dose (80 kV) CT-angiography of lower limbs performed with a reduced dose of high concentration contrast medium (CM) (75 ml of iopromide 370) in comparison with standard protocol at 100 kV performed injecting a full dose of CM (100 ml).
Methods and Materials: 120 patients (84 males; mean age 71.4 years) were randomly directed in two different protocols of CT-angiography of lower limbs, performed with standard tube parameters (100 kV) and administration of 100 ml of CM at 4 ml/s or with low voltage protocol (80 kV) with injection of 75 ml of CM at 3 ml/s. In each patient density values of 4 region of interest (ROI) at the level of the abdominal aorta, popliteal artery, of a vessel of the leg ad in a psoas muscle were measured. Risk factors, serum creatinine, the signal to noise ratio and x-ray dose (DLP) were also registered.
Results: The density values of aorta were significantly higher in 80 kV protocol in comparison with the standard protocol (P=0.001); no statistically significant differences were noted in the vascular enhancement of popliteal or leg artery. There was no statistically significant difference (P = 0.152) in image quality measured with SNR. The DLP in the 80 kV protocol was significantly lower than the standard approach (P < 0.05).
Conclusion: 80 kV CT angiography of lower limbs allows to significantly reducing the amount of administered contrast medium preserving the image quality and lowering the radiation dose of about 30%.

B-0630 14:32

Low-dose runoff CTA in overweight and obese patients: effect of hybrid iterative reconstruction technique on image quality

V. Aznaurov, E.V. Kondratyev, V. Shirokov, P. Davydenko,
G.G. Karmazanovsky; *Moscow/RU (aznaurov@mail.com)*

Purpose: To investigate the effect of low tube voltage and iterative reconstruction on image quality and the radiation dose of the peripheral CTA in overweight and obese patients.
Methods and Materials: 60 overweight or obese patients were enrolled. First group (n=20) was examined under 120 kV200 mAs, second group (n=20) - 100 kV200 mAs and third group (n=20) - 80 kV200 mAs. We compared quantitative and qualitative parameters among three groups and among four reconstructions (FBP, HIR3.4,5) in second and third group. Student's t-test, Friedman test and Mann-Whitney U-test were performed for statistical analysis.
Results: Mean BMI was 29.7±2.7 kg/m2, 29.2±2.94 kg/m2, 29.3±2.34 kg/m2, respectively (p> 0.05). Effective dose was 26.9±5.94mZv, 16.3±1.4mZv, 8±1.7mZv, respectively (p < 0.0001). Mean arterial attenuation was about 17% higher in second group (120 kV vs 100 kV: 303±61 vs.364±57 HU; p < 0.0001), and 32% in third group (120 kV vs.80 kV: 303±61 HU vs.445±103 HU). Image noise at the level of aortoiliac segment was 33.2±11.3 in 120 kV group vs. 58.5±12.5 in 100 kV, and 66.4±11.3 in 80 kV. Average noise decreased when using 3 levels of HIR up to 25%, 37%, 44%, respectively both in 100 kV and 80 kV group (p=0.00001), but the level of the image noise was relatively high and the subjective Image quality was significantly decreased, especially in 80 kV group despite the use of iterative reconstruction (120 kV vs. 80 kV+HIR p < 0.001; 120 kV vs. 100 kV+HIR p=0.09).
Conclusion: Low dose CT angiography using 100 kV and HIR results in significant decrease of radiation dose, maintaining a sufficient image quality in overweight and obese patients. Application of 80 kV protocol fails to achieve sufficient image quality in this patients, even when using IR.

B-0631 14:40

Location and severity of aortic valve calcium in patients undergoing transcatheter aortic valve implantation

P. Apfaltrer[1], T. Henzler[1], S. Wolke[1], H. Schroefel[2], S. Schoenberg[1],
G. Schymik[2]; [1]*Mannheim/DE*, [2]*Karlsruhe/DE (paul.apfaltrer@umm.de)*

Purpose: Recent studies from the German transcatheter aortic valve registry have revealed that patients with paravalvuar leaks are prone to considerably higher in-hospital mortality. Thus, location and aortic valve calcium scoring prior to Transcatheter-Aortic-Valve-Implantation (TAVI) might be important with regards to outcome and paravalvular leaks.
Methods and Materials: 152 patients (64 men, 82±5 years) with symptomatic aortic stenosis were included in this study. Prior to TAVI all patients underwent a thoracic-pelvine ECG-gated-CT-angiography for therapy planning. The total aortic-valve calcifications, leaflet aortic-valve calcifications, and outflow tract calcifications were assessed.
Results: The mean artic valve calcification score was 1.966 mm3, with a range from 164.3 mm3 to 22.857.4 mm3. No patient had an aortic valve calcium score of 0. The median calcium score was 1212.7 mm3 (718.4-2059.1 mm3). There was no significant difference of the calcium distribution between the leaflets; the mean calcium score of the non-coronary leaflet was 675 mm3 and 516 mm3, and 645 mm3 for the left,-and right-coronary leaflet (p> 0.05). This was also true for the median calcium leaflet scores 514.4 mm3 (258.7-769.6 mm3) vs. 343.6 (164.1-543.2 mm3) vs. 428.0 mm3 (237.9-766.9 mm3), respectively. The outflow tract had a mean calcification score of 509 mm3, with a range from 0-9.320 mm3, while the median score was 127.9 mm3 (37.8 - 576.7 mm3).
Conclusion: Predictions for TAVI regurgitation and persistence of paravalvular leaks are still not explored. Both, the amount of calcium and its exact location on the aortic valve and outflow tract may be important in determining the development of paravalvular aortic regurgitation and post procedural outcome after TAVI.

B-0632 14:48

Accuracy and time-efficiency of multi-path curved planar reformations in the evaluation of low-dose CT angiography of the peripheral arteries

M.M. Schreiner, C. Loewe, S. Unterhumer, M. Weber, G. Mistelbauer,
M. Sramek, E. Gröller, R.E. Schernthaner; *Vienna/AT*
(markus.schreiner@meduniwien.ac.at)

Purpose: CT angiography (CTA) is an accurate modality for the assessment of peripheral arterial occlusive disease (PAOD). However, time-consuming reading of axial images is necessary due to the lower accuracy of available reformations such as maximum intensity projections (MIP). This study aimed to evaluate the accuracy and time-efficiency of multi-path curved planar reformations (MP-CPR) for the detection of significant stenosis (> 70%) in comparison to axial images, using digital subtraction angiography (DSA) as reference.
Methods and Materials: Forty consecutive patients with PAOD referred to CTA prior to endovascular treatment were prospectively included. A dual-source CT scanner with 80 kV tube voltage, tube current modulation (120-150 ref. mAs) and iterative image reconstruction was used. 20 arterial segments were defined in each leg; for each segment, the degree of stenosis was assessed on MP-CPR and axial images independent of each other and compared to DSA.
Results: Regarding detection of significant stenoses, MP-CPRs yielded a lower sensitivity (84% vs. 89%, p = 0.01) and accuracy (93% vs. 92%, p = 0.73) but higher specificity (94% vs. 93%, p = 0.04) than axial images. The largest sensitivity discrepancy between MPCPRs and axial images was in the iliac segments (83% vs. 100%).The evaluation of MPCPRs was significantly faster than that of axial images (mean per patient: 4:41 min vs. 6:57 min, p < 0.01).
Conclusion: While providing similar accuracy, MP-CPR evaluation is significantly faster than evaluation based on axial images. However, for stenosis detection in the iliac segments, additional review of axial images is still recommended.

Author Disclosures:
M.M. Schreiner: Research/Grant Support; This work was supported by Fonds zur Förderung der wissenschaftlichen Forschung (FWF, Austria) under the contract number TRP 67.

B-0633 14:56

3D DCE-MRA in evaluation of blood-flow in diabetic foot

M. Zamyshevskaya, V. Zavadovskaya, M. Zorkaltsev, V. Udodov, E. Grigoriev;
Tomsk/RU (Zamyshevskayamari@mail.ru)

Purpose: To identify and evaluate pedal vascularisation in diabetic patients of using contrast MR-angiography.
Methods and Materials: 31 diabetic foot of 31 patients (14 male (45.2%), 17 female (54.8%); mean age 54.65±15.1) underwent 3D DCE-MRA (Gadovist, 15 ml) at 1.5 T. Imaging analysis included blood-flow's speed, vascular architectonic's condition and character of contrast's accumulation. Osteomyelitis was verified according to operations in 15 cases (48.4%).
Results: All patients were divided in 3 groups: I - ischaemic (n=5, 16.1%), II - neuropathic (n=12, 38.7%), III - neuroischaemic (n=14, 45.2%) forms of DF. First-pass MRA detected significantly (p = 0.03) delay in contrast's arrival in I group by comparison with II group. MR-angiography showed absence of pedal vessels patents in I group: arcus plantaris n=3 (60.0%), a.digitales n=5 (100%); and in III group: arcus plantaris n=2 (14.0%), a.digitales n=5 (35.7%). There was uniform (group III 2/5, 40.0%), increase (group.i. 5/5, 100%; group II 10/12, 83.3%; group III 11/14, 78.6%) and absense (group III 1/14, 7.1%) Gadovist's distribution in soft tissues. It wasn't significant difference in long-term contrast extravascular accumulation in all group of diabetic foot. Osteomyelitis associated with diffuse enhanced contrast accumulation in all cases (n=15, 100%).

Conclusion: MRI blood vessel imaging is a promising and valuable method for examining peripheral arterial changes in patients with diabetic foot problems. Prevailing changes of pedal blood-flow was long-term enhanced contrast extravascular accumulation associated osteomyelitis in 100%. MR-angiography may be usefull for treatment planning in different forms of diabetic foot.

B-0634 15:04

Differential diagnosis of chronic total occlusive and subtotal occlusive disease of the lower extremity arteries using reverse attenuation gradient sign on CTA

H.J. Park; *Seoul/KR (parkhiji@gmail.com)*

Purpose: To evaluate the diagnostic usefulness of the reverse attenuation gradient (RAG) sign in occlusive lower extremity arterial disease through computed tomography angiography (CTA).
Methods and Materials: The study was approved by the institutional ethics review board of our hospital; the requirement for informed consent was waived due to the retrospective study design. This study sample enrolled 45 men and 8 women in the chronic total occlusion (CTO) group and 30 men and 7 women in the subtotal occlusion (STO) group. Luminal CT attenuation (in Hounsfield units [HU]) was measured at 3 points from the end of the occlusion site to the first collateral vessel insertion point. We also used HU to measure the CT attenuation of the opposite side artery at the same level in a similar manner. We compared each value using the Mann-Whitney U test.
Results: The mean HU values of the proximal portion of CTOs were significantly higher than those of STOs. The absolute value of the mean differences in the HU values among the proximal, middle and distal portion of CTOs were higher than those of STOs, and this result was statistically significant. The mean ratio of the HU (HU of the stenosed lumen/HU of the opposite normal lumen) of the proximal portion of CTOs was significantly lower than those of STOs.
Conclusion: The RAG sign can be applied to the lower extremity arteries and can be helpful for differentially diagnosing CTOs from STOs through CTA.

B-0635 15:12

Dynamic assessment of deep vein thrombosis: CE MR venography with a bloodpool agent vs duplex ultrasound and contrast venography

C.W.K.P. Arnoldussen[1], R. Strijkers[2], R. de Graaf[2], C.H.A. Wittens[3], J.E. Wildberger[2]; [1]*Maastricht/NL, Venlo/NL*, [2]*Maastricht/NL*, [3]*Aachen/DE, Maastricht/NL (carsten.arnoldussen@mumc.nl)*

Purpose: To evaluate T1-weighted, three-dimensional-ultrafast-gradient-echo, contrast-enhanced magnetic resonance venography (MRV) with a bloodpool agent in dynamic assessment of (iliofemoral)deep vein thrombosis (DVT) compared to duplex ultrasound (DUS) and contrast venography (venography).
Methods and Materials: 40 patients suspected of iliofemoral DVT, were evaluated with DUS, MRV and venography. The deep vein system from the popliteal vein to the inferior vena cava was analysed. All segments were scored as either diagnostic or non-diagnostic, evaluated qualitatively for vein-visualization and confidence of interpretation for presence or absence of thrombus. For MRV interobserver-variability (double-reader) was calculated. In addition, any identified non-thrombotic-obstruction was reported. All diagnostic findings were compared with venography as standard of reference.
Results: Both sensitivity and specificity of MRV for thrombus were 98%.Vein-visualization and reader confidence were excellent. Interobserver-variability for assessment of the MRV studies, calculated by using the weighted kappa statistic, was 0.98.DUS was non-diagnostic in 21% of the segments. MRV was diagnostic in all-but-1 of the non-diagnostic DUS segments. In 23 cases, an ilio/caval (non-thrombotic)obstruction was identified with MRV and confirmed with venography (100%). DUS was inconclusive with regard to non-thrombotic obstruction in 10 cases (sensitivity 52%).
Conclusion: CE-MRV is highly accurate for the diagnosis of DVT from the popliteal vein to the inferior vena cava. MRV is conclusive in virtually all cases, providing an (non-invasive)alternative for cases where DUS is inconclusive and venography is considered. Additionally, non-thrombotic obstructions are identified with MRV. Combined, MRV allows for accurate segmental description of DVT including underlying non-thrombotic obstruction, providing clinicians with a complete overview of the actual deep vein disease.

B-0636 15:20

Thrombus dissolution using contrast enhanced ultrasound in an in-vitro model of acute deep vein thrombosis

B. Dharmarajah[1], T. McKinnon[1], C. Keravnou[2], M. Averkiou[2], A. Davies[1], E. Leen[1]; [1]*London/UK*, [2]*Nicosia/CY (b.dharmarajah@imperial.ac.uk)*

Purpose: Anticoagulation is being superseded by acute thrombus removal to treat extensive deep vein thrombosis (DVT) and prevent post thrombotic syndrome. However, catheter-directed and pharmacomechanical thrombolysis confer a haemorrhage risk of up to 20%. Sonothrombolysis is a novel method of thrombus dissolution using ultrasound (US) and ultrasound contrast microbubbles (MBs).
Methods and Materials: Using a parallel plate flow chamber coated with tissue factor, an in-vitro clot model of DVT was formed under venous shear stress. Treatment groups included: control, US only and US & MBs (each n=8). US was applied via a Philips iU-22 platform with a C5-1 transducer producing a triggered mechanical index pulse of 1.31 every 1500 milliseconds. SonoVue microbubbles were infused at 0.2% concentration. Video microscopy of fluoroscopically tagged fibrin provided validated blinded offline image quantification of surface area coverage with statistical analysis performed using a one-way ANOVA.
Results: Mean surface area coverage of the clot ± SD after treatment was 85.8±5.6% in the control group, 52.7±7.6% in the US only group and 10.7±12.37% in the US & MBs group. Whilst there was a significant difference of US alone over control ($P < 0.05$), a further significant effect was displayed by US & MBs ($P < 0.0001$). Qualitative video microscopy analysis revealed maintenance of the fibrin scaffold with areas of porosity with US only whilst complete dissolution of the fibrin structure with restoration of flow was observed with US & MBs.
Conclusion: This pilot study identifies sonothrombolysis as a feasible non-invasive, non-irradiating technique for dissolution of DVT.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 710

Lower extremity (2)

Moderators:
A.M. Ierardi; Varese/IT
M. Reijnierse; Leiden/NL

B-0637 14:00

Quantitative MRI evaluation of subchondral sclerosis at the tibial plateau

J.W. MacKay, P. Murray, B. Kasmai, S. Donell, A.P. Toms; *Norwich/UK (jw.mackay@gmail.com)*

Purpose: To determine if MRI texture analysis could be developed as a method for quantifying subchondral sclerosis in knee osteoarthrosis (OA).
Methods and Materials: Asymptomatic subjects aged 20-30 (group 1, n=10), symptomatic patients aged 40-50 without radiographic evidence of OA, focal cartilage defect or bone marrow lesion (group 2, n=10) and patients scheduled for total knee replacement (group 3, n=10) underwent high spatial resolution T1 weighted coronal 3 T MRI of the knee. Regions of interest were created at the medial and lateral tibial subchondral bone, from which multiple texture parameters were calculated. Mean texture parameters were compared between the three groups using ANOVA and post-hoc Tukey tests. Linear discriminant analysis was used to evaluate the ability of texture analysis to classify individual coronal slices and subjects correctly.
Results: A significant difference in subchondral bone marrow texture parameters was demonstrated between groups. The largest difference was seen in horizontal grey level non-uniformity with a mean difference (MD) of 86 units (standard error 18.7 units) between groups 1 and 2 ($p < 0.001$), MD of 154 units (18.7 units) between groups 1 and 3 ($p < 0.001$) and MD of 68 units (18.2 units) between groups 2 and 3 ($p < 0.001$). Linear discriminant analysis showed linear separability of the three groups of 0.76 (scale 0-1, 1=perfect), slice classification accuracy of 81% and subject classification accuracy of 90%.
Conclusion: Texture analysis applied to MRI of tibial subchondral bone may allow detection of different stages of subchondral sclerosis, offering significant potential in the diagnosis and monitoring of OA.

B-0638 14:08

Quality validation in posterior cruciate ligament reconstruction: fluoroscopy, radiography and computed tomography

A. Krawinkel, M. Osti, K. Benedetto, M. Cejna; *Feldkirch/AT (alessa.krawinkel@gmail.com)*

Purpose: Evaluate reliability and validity of fluoroscopy (FS), radiography (XR) and CT for quality assessment, estimate the corresponding radiation dosages and accuracy of an all-inside tibial-inlay technique for anatomic footprint replication.
Methods and Materials: Intraoperative FS, postoperative XR and CT images were compared in 52 patients following PCL reconstruction. Femoral and tibial tunnels were correlated to measurement grid systems. XR and CT measurements were performed by three observers (two cycles).
Results: Intercondylar (IC) depth (d) and height (h) of the femoral tunnel (T) were measured with 42.4% (dT/d IC) and 13.2% hT/hIC). The angle segment averaged 63.8°. The tibial measurement yielded 51.3% mediolateral (tunnelaperture distance/mediolateral diameter), 9.4 mm superoinferior and 0.7 mm from the former physis line. Perfect inter- and intra-observer agreement (0.8-0.97) was found for all CT measurements except tibial distance to previous physis line and for all XR tibial measurements (0.7-0.96). Interobserver-agreement for femoral XR measurements was 0-0.5. Intraobserver-agreement was 0.5-0.9. XR specifity was 76% for superioinferior distance of tibia-aperture and for aperture to physis distance) and 70% for femoral tunnel depth and height. Effective doses for FS, XR and CT averaged 2.6mSv, 1.3mSv and 3.6mSv,respectively. FS, XR and CT yielded no statistically significant difference for the reference tunnel positions.
Conclusion: XR and CT represent complementary imaging modalities. FS, XR and CT yield compareable effectiveness in detecting parameters used for quality validation. Accumulating radiation exposure must be considered. All-inside tibial inlay reconstruction is efficient and precise for replication of anatomical PCL footprints.

B-0639 14:16

Femoral and tibial torsion measurements in children: comparison of MR imaging and 3D models based on low-dose biplanar radiographs

A.B. Rosskopf, L.E. Ramseier, C.W.A. Pfirrmann, F.M. Buck; *Zurich/CH*

Purpose: To evaluate reliability and interchangeability of femoral (FT) and tibial torsion (TT) measurements in children using magnetic resonance (MR) imaging compared to measurements on 3D models based on low-dose biplanar radiographs (3DBPR).
Methods and Materials: FT and TT were measured in 30 children (mean age 10.1years;14 female) using axial MR images of the hip, knee and ankle by two independent readers. They were compared to measurements on 3DBPR of the lower limb by two separate independent readers.Interreader and intermethod agreement was calculated using descriptive statistics, Intraclass correlation coefficient (ICC) and Bland-Altman analysis.
Results: FT/TT was -6°-47°/+1°-44° on MR images and -13°-46°/9°-49° for measurements on 3DBPR. The average difference between the two methods was 4.6°±4.1/6.0°±3.8, respectively. Interreader agreement (ICC) of FT/TT measurements was 0.97/0.96 on MR images and 0.99/0.94 on 3DBPR. Intermethod agreement (ICC) for MR measurements was 0.93 (95% confidence interval [CI], 0.88-0.96) for FT and of 0.87 (CI, 0.39-0.95) for TT. Mean interreader differences for 3DBPR were 2.1°(0.0°-7.0°) for FT and 3.4° (0.0°-12.0°) for TT. Mean interreader differences at MR were 3.2°(0.1°-8.0°) for FT and 3.5°(0.1°-9.5°) for TT. Bland-Altman plots showed a systematic underestimation of TT on MR measurements compared to 3DBPR of 5°. All but 3/4 measurements of FT/TT were within the 95% limit of agreement.
Conclusion: FT and TT measurements in children using MR images are comparable to measurements on 3DBPR models.

B-0640 14:24

Prevalence of bone marrow oedema and its association with structural damage in patients with femoroacetabular impingement syndrome using MRI

Y. Ragab, Y. Emad, A. Anbar; *Cairo/EG (yragab61@hotmail.com)*

Purpose: To evaluate the prevalence of femoral head bone marrow oedema (BME) and its association with signs indicative of structural damage on MRI in patients with femoroacetabular impingement (FAI) syndrome.
Methods and Materials: Forty-four patients presenting with hip (s) pain and MRI proven diagnosis of either cam or pincer FAI were consecutively recruited in a prospective cohort study. For all patients, contrast-enhanced MRI studies were performed for both hips. All MRI studies were analyzed with special attention tobone marrow oedema (BME), cartilage morphology, subchondral cysts, osteophytes, acetabular labrum abnormalities, synovitis, and joint effusion. In all patients, BME was correlated with other detected MRI features.
Results: The prevalence of BME was 51.6% and 38.5% in cam and pincer FAI, respectively. In cam FAI BME positively correlated with VAS (R=0.659, $P < 0.0001$), cartilage denudation (r= 0.569, p=0.001), hip effusion (r= 0.442, p=0.013) and reactive synovitis (r= 0.613, $p < 0.0001$). However, in pincer pattern BME did not correlate with other MRI signs indicative of structural hip damage. BME in both pattern positively correlated with pain severity.
Conclusion: Femoral head BME is prevalent among cases of FAI irrespective of the disease pattern. BME is positively correlating with MRI signs indicative of hip OA in case of cam FAI as compared to pincer pattern. The presence of BME sign on MRI in cases of FAI is associated with structural hip damage indicative of OA which may in turn reflects a disease severity and aggressive course.

B-0641 14:32

Muscle and tendon damage after total hip arthroplasty: MRI evaluation of different surgical approaches

C.A. Agten, R. Sutter, C. Dora, C.W.A. Pfirrmann; *Zurich/CH (christoph.agten@balgrist.ch)*

Purpose: To provide muscle and tendon damage profiles in patients after total hip arthroplasty with a posterior, direct-lateral, antero-lateral, or anterior surgical approach.
Methods and Materials: This retrospective study was approved by the institutional review board and informed consent was waived. 120 patients with MRI of primary total hip arthroplasty (30 patients per approach, 71 females/49 males, mean age 66 years, mean interval after surgery 60 months) were included. Each MRI was assessed by 2 independent readers regarding fatty atrophy of muscles (Goutallier classification) and tendon quality (0=normal, 1=tendinopathy, 2=partial tear, 3= complete avulsion). The transverse area of the tensor fasciae latae muscle (TFL) was measured. TFL was defined as damaged if an area < 3 cm2 or Goutallier grade 3 or 4 was present. Descriptive statistics were applied.
Results: The direct-lateral approach showed highest Goutallier grades and tendon damage for the gluteus minimus muscle (2.07-2.67 and 2.00-2.77 for reader 1 and 2) and tendon (2.30/1.67 for reader 1/2), as well as the lateral portion of the gluteus medius tendon (2.77/2.20 for reader 1/2). The posterior approach showed highest Goutallier grades and tendon damage for the external rotator muscles (1.97-2.67 and 1.57-2.40 for reader 1/2) and tendons (1.41-2.45 and 1.93-2.76 for reader 1/2). The anterior approach showed most damage to the TFL (7/30 and 6/30 for reader 1/2).
Conclusion: Specific muscle and tendon damage profiles are presented for the different THA approaches, as the soft tissue damage around the hip joint strongly depends on the surgical approach.

B-0642 14:40

Ultrasound versus magnetic resonance imaging for Morton neuroma: systematic review and meta-analysis

B. Bignotti, A. Signori, M. Sormani, L. Molfetta, S. Airaldi, F. Zaottini, G. Tagliafico, C. Martinoli, A. Tagliafico; *Genoa/IT (bignottibianca@gmail.com)*

Purpose: To compare ultrasound (US) and magnetic resonance imaging (MRI) to diagnose Morton's neuroma.
Methods and Materials: Studies that assessed the diagnostic accuracy of US and MRI for Morton neuroma were retrieved from major medical libraries independently by two reviewers up to April 1st, 2014. Predefined inclusion and exclusion criteria were adopted.
Results: 277 studies were initially found. The meta-analysis was conducted on 14 studies. US sensitivity were studied in 5 studies, MRI's in 3 studies and both modalities' in 6 studies. All studies used surgery as the reference standard. A high sensitivity of diagnostic test was observed both for US (SE (95% CI) = 0.91 (0.83 - 0.96)) and for MRI (SE (95% CI) = 0.90 (0.82 - 0.96)) with no significant differences between the two modality of diagnosis (Q test p = 0.88). For MRI, specificity of test was 1.00 with a pooled estimation of 1.00 (0.73 - 1.00) while the pooled specificity was 0.854 (95% CI: 0.41 - 1.00) for US. No differences were observed between US and MRI regarding study design (p = 0.76).
Conclusion: Our meta-analysis has shown that the sensitivity (SE) of ultrasound (SE=0.91) is equal to (p=0.88) that of MRI (SE=0.90) for identification of Morton's neuroma.

B-0643 14:48

Fascicular involvement in common peroneal neuropathy: evaluation with ultrasound

S. Airaldi, B. Bignotti, F. Zaottini, G. Tagliafico, A. Tagliafico, C. Martinoli; *Genoa/IT (airaldi.sonia@gmail.com)*

Purpose: To evaluate single fascicular involvement in common peroneal (CP) neuropathy at the fibular head using high-resolution ultrasound (US).
Methods and Materials: We prospectively enrolled 40 adult patients (mean age: 55 years; age range, 36-65 years; BMI range: 21-27) with clinical and electrodiagnostic suspect of CP neuropathy between April 2012 and September 2014. Two musculoskeletal radiologists used high-resolution US

probes to prospectively and independently evaluate the CP nerve in 40 patients. Presence of single fascicular involvement (increased cross-sectional area or loss of fascicular echotexture) at the CP nerve was recorded. US evaluation was repeated after two weeks for intra and inter-observer agreement.
Results: US revealed 7 patients with only one fascicular involvement. In these patients, US showed a single pathologic fascicle of the CP nerve. In all these cases US revealed an involvement of the anterior fascicle (deep peroneal component). Intra-observer agreement was good (K=0.78). Inter-observer agreements were good (k =0.79; 95% confidence interval 0.68 to 0.92).
Conclusion: Single fascicle involvement in patients with CP neuropathy has never been reported. High-resolution US allowed identification of single fascicular involvement in CP neuropathy. Anterior fascicular involvement, corresponding to the deep peroneal nerve, was present in up to 17% of patients with suspect of CP neuropathy.

B-0644 14:56

Ultrasound versus magnetic resonance imaging in common peroneal neuropathy

S. Airaldi, B. Bignotti, F. Zaottini, G. Tagliafico, A. Tagliafico, C. Martinoli;
Genoa/IT (airaldi.sonia@gmail.com)

Purpose: To prospectively compare US and MRI in patients with common peroneal (CP) neuropathy.
Methods and Materials: N=40 adult patients with clinical suspect of CP neuropathy and 40 controls underwent both US and MRI. US and MRI imaging data sets were randomized for prospective reading by three experienced musculoskeletal radiologists and compared to the clinical and neurophysiological gold standard.
Results: The overall sensitivity of US and MRI for diagnosing peroneal nerve neuropathy was 90% (95% CI:79.7% to 97.3%) and 87.5% (95% CI: 71.55% to 93.1%). The overall specificity of US and MRI for diagnosing peroneal nerve neuropathy was 92% (95% CI: 77.45% to 96.1%) and 85% (95% CI: 73.3% to 94.4%). The overall sensitivity and specificity of US combined with MRI were 94% (95% CI:0.80% - 0.99%) and 84% (95% CI = 0.70% - 0.91%) respectively. In 3 patients with negative MRI, US resulted positive. In 2 patients with negative US, MRI resulted positive. Overall intra- and inter-observer agreements among the three readers were 0.76% (95%CI: 0.62%-0.85%) and 0.74% (95%CI: 0.65%-0.81%).
Conclusion: US diagnostic accuracy for diagnosing CP neuropathy was slightly higher than that of MRI. In addition, US combined with MRI in CP neuropathy may increase sensitivity.

B-0645 15:04

The quantitative MRI evaluation of repair tissue after microfracture treatment for ankle osteochondritis dissecans (OCD)

H. Tao, Y. Qiao, S. Chen; *Shanghai/CN (taohongyue@126.com)*

Purpose: To evaluate repair tissue on short-term and middle-term follow-up after microfracture treatment for ankle osteochondritis dissecans (OCD) using quantitative MRI.
Methods and Materials: Twenty patients of ankle OCD who had been performed microfracture treatment from Sports Medicine Department were recruited in this study. The patients were given twice MRI scans and twice evaluations of clinical outcomes for ankle joint on 3-12 months post-op (short-term) and 12-24 months post-op (middle-term), respectively. The MRI sequences mainly included 3D-DESS, T2-mapping, T2-STIR, which were used to respectively measure the thickness index, T2 index of repair tissue (RT) and the volume of bone marrow edema (BME) under RT. The clinical outcomes were evaluated using American Orthopaedic Foot and Ankle Society (AOFAS) scoring system. The paired samples t test was used to compare the differences of quantitative MRI (thickness index, T2 index, BME volume) and AOFAS scores between the two follow-up groups. The difference would be statistically significant if $P < 0.05$.
Results: The thickness index of RT in middle-term after microfracture was higher than that in short-term (0.813 ± 0.104 and 0.687 ± 0.123,$P < 0.05$),T2 index was lower than short-term (1.109 ± 0.171 and 1.392 ± 0.174,$P < 0.05$),BME volume was lower than short-term (0.646 ± 0.70 and 0.992 ± 0.924,$P < 0.05$);and AOFAS score was higher than short-term (85.050 ± 7.660 and 76.750 ± 9.419,$P < 0.05$).
Conclusion: After microfracture, the defect region was filled gradually, the RT got matured gradually, the BME region under the RT decreased, and patients' clinical outcomes were improved. The quantitative MRI 3D-DESS, T2-mapping, T2-STIR could comprehensively evaluate the RT after microfracture treatment for ankle OCD from the respects of repair thickness, biochemical structure of RT and BME under RT.

B-0646 15:12

Knee joint subchondral bone structure is altered in active athletes

F.W. Roemer[1], M. Jarraya[2], J. Niu[2], J. Duryea[2], J. Lynch[3], A. Guermazi[1];
[1]*Doha/QA*, [2]*Boston, MA/US*, [3]*San Francisco, CA/US*
(frank.roemer@aspetar.com)

Purpose: It has been shown that trabecular bone structure parameters extracted from radiographs known as fractal signature analysis (FSA) is able to predict structural outcomes such as radiographic osteoarthritis progression. Little is known about early disease or about differences between subjects exposed to increased joint loading. Aim was to compare horizontal and vertical dimensions of bone texture considering athlete status, gender, previous anterior cruciate ligament surgery.
Methods and Materials: 135 consecutive athletes (82% soccer players) 18 to 36 years old and 550 non-athletes aged-matched controls had knee radiography for assessment of subacute or chronic knee complaints. Regions of interest were placed in the subchondral medial and lateral tibial plateaus. Fractal signatures were calculated in the horizontal and vertical dimensions. Curve fitting algorithms were applied taking into account all four risk factors in the same model adjusting for each other.
Results: Included were 685 patients of which 135 were athletes. For the horizontal dimensions significant differences were observed for gender (estimate (E) 0.098 standard error (SE) 0.004, p <.0001), previous ACL surgery (E -0.031, SE 0.006, p <.0001) and the highest age group (E -0.039, SE 0.005, p <.0001). For vertical dimensions, significant differences were shown for athletes (E -0.012, SE 0.004, p <.0001), gender (E 0.056, SE 0.004, p <.0001), and age range from 28-32 years (E -0.028, SE 0.005, p <.0001).
Conclusion: Trabecular bone structure differs between athletes and non-athletes, in regard to previous ACL surgery, for gender and for higher age. Specific differences observed for horizontal and vertical dimensions of FSA warrant further exploration.

Author Disclosures:
F.W. Roemer: Shareholder; Boston Imaging Core Lab (BICL), LLC. **A. Guermazi:** Consultant; OrthoTrophix, Genzyme, MerckSerono and TissueGene. Shareholder; Boston Imaging Core Lab (BICL), LLC.

B-0647 15:20

Efficacy of computed tomography (CT) guided radiofrequency ablation (RFA) for osteoid osteomas in 31 patients

J. Kim, E. Lee; *Seongnam-si/KR (kimjhoon06@gmail.com)*

Purpose: To present the clinical outcome of computed tomography (CT) guided radiofrequency ablation (RFA) for osteoid osteoma.
Methods and Materials: Thirty-one patients (M:F = 23:8, mean age: 20 years, range: 4-54 years) who underwent RFA for clinically suspected osteoid osteoma from May 2004 to December 2013 were retrospectively reviewed. RFA was done in all cases under CT guidance by one of three radiologists in our department. Electronic medical records and images were retrospectively reviewed in all patients.
Results: Lesions were located in femur (n= 20), tibia (n= 5), fibula (n= 2), humerus (n= 3), talus (n= 2) and calcaneus (n= 1). On discharge, 27 of 33 cases showed complete remission of pain (82%). One major complication (compartment syndrome) and 2 minor complications (reactive synovitis, minimal skin burn at electrode insertion site) were observed. On the last follow-up (0-78 months, mean: 12.6months) 27 of 33 cases were successfully treated (82%) and had no more complaints. 3 cases presented remaining pain (9%). In 3 cases relapse occurred (9%) and RFA was repeated in 1 case. The repeated treatment was successful.
Conclusion: CT-guided RFA is an effective method for the treatment of osteoid osteoma.

14:00 - 15:30 **Room E2**

Neuro

SS 711
Brain tumour (2)

Moderators:
J.S. Bauer; Munich/DE
P. Due-Tonnessen; Oslo/NO

B-0648 14:00

The diagnostic benefit of T1-DCE MRI for navigated glioma biopsies

V.C. Keil, A.M. Vogelgesang, B. Pintea, G. Gielen, J. Gieseke, M. Simon, H.H. Schild, D.R. Hadizadeh; *Bonn/DE (vera.keil@ukb.uni-bonn.de)*

Purpose: Glioma biopsies chosen based on gadolinium-enhanced T1-weighted sequences (standard procedure) do not always lead to accurate diagnoses. We assessed if the diagnostic quality can be raised based on the quantitative information of Ktrans maps derived from T1-weighted dynamic contrast-enhanced (T1-DCE) MRI sequences.
Methods and Materials: 16 glioma patients (12 glioblastoma, 2 astrocytoma WHO III, 1 oligoastrocytoma WHO III, 1 oligoastrocytoma WHO II) received a T1-DCE MRI sequence at 3.0 Tesla (flip angle 8°; 50 dynamic scans; slice thickness 3 mm) as well as a gadobutrol-enhanced 3D T1 navigator map (0.1 mmol/kg BW Gadovist). Target regions for glioma biopsies were defined either by a neurosurgeon's choice based on the T1 navigator map, or by a neuroradiologist based on permeability (Ktrans) and extravascular extracellular volume fraction (ve) maps. A blinded neuropathologist ranked all biopsies for diagnostic quality defined as in concordance with the reference diagnosis.
Results: 42 glioblastoma, 6 WHO III astrocytoma, 3 WHO III oligodendroglioma and 1 WHO II oligodendroglioma biopsies were taken. Ktrans-based biopsies were more often rated diagnostically accurate compared to T1 navigator map-based biopsies (n=16/27 vs. n=7/15; 59.3 vs. 46.7%). Ratiometric analyses of Ktrans and ve revealed substantially higher values for accurate biopsies (Ktrans accurate: 13.87±24.56/min, Ktrans incorrect: 5.44±9.02/min, ve accurate: 5.53±6.62; ve incorrect: 2.87±3.82). Ktrans and ve values greatly differed depending on WHO grade also allowing subdifferentiation of gliomas of mixed WHO grade.
Conclusion: Targeting biopsies based on Ktrans permeability maps may improve the diagnostic quality of glioma biopsies compared to mapping using standard contrast-enhanced protocols.

Author Disclosures:
J. Gieseke: Employee; PHILIPS Healthcare.

B-0649 14:08

Brain tumours: contribution of diffusion MRI, perfusion MRI and spectroscopy in grading primary cerebral gliomas and the differentiation of high-grade gliomas from solitary metastasis

K. Drevelegas, D. Chourmouzi, M. Potsi, A. Moumtzouoglou, A. Drevelegas; *Thessaloniki/GR (kdrev@hotmail.com)*

Purpose: To assess the contribution of diffusion MRI, perfusion MRI and spectroscopy in grading primary cerebral gliomas and the differentiation of high-grade gliomas from solitary metastases.
Methods and Materials: The study included 70 cases: 10 low-grade gliomas, 8 high-grade gliomas (grade III), 38 high-grade gliomas (grade IV) and 14 metastases. Although the sample is unbalanced largely reflect the actual proportion of clinical cases in daily practice, correlated with the epidemiological data.
Results: Statistical analysis demonstrated rCBV critical value of 1,625<cv< 1,735 to provide sensitivity 100%, specificity 98.3% and accuracy 98% in determining high-grade gliomas. Critical value of Cho/Cr metabolite ratio 1,685<cv< 1,885 resulted in accuracy 94% in determining high-grade gliomas. Threshold value for rCBV 2.3 leads to sensitivity 100%, specificity 37.5% and 89.13% accuracy in distinguishing grade III from grade IV gliomas. Critical value of peritumoural Cho/Cr metabolite ratio 1.16<cv< 1.3 leads to sensitivity 75%, specificity 97.2% and 91% accuracy in differentiation of high-grade gliomas from solitary metastases. Peritumoural rCBV value achieves lower accuracy of around 83.3%.
Conclusion: The advanced MR techniques contribute to the accurate separation of brain tumours preoperatively. The integration of advanced techniques should become routine in the protocol study of brain tumours.

B-0650 14:16

Comparing gadolinium-based DSC perfusion MRI in malignant brain tumours with and without leakage correction

J. Prola Netto, B. Hamilton, C. Varallyay, E. Neuwelt; *Portland, OR/US (prolanet@ohsu.edu)*

Purpose: Increased relative cerebral blood volume (rCBV) has shown correlation with pre-treatment grading and prognosis and helps evaluate post-therapy tumour response. Vascular abnormalities in malignant brain tumours promote leakage of gadolinium-based contrast agents (Gd) into the extravascular space that may lead to underestimation of rCBV on dynamic susceptibility contrast (DSC) perfusion with Gd. The aim of this study is to measure the impact of mathematical leakage correction algorithms on rCBV maps in patients with brain tumours.
Methods and Materials: This study was approved by the local institutional review board. This prospective study included patients with primary or metastatic malignant brain tumours with before treatment or with residual enhancing abnormality after surgery and/or chemoradiotherapy. Perfusion imaging was performed using DSC technique, which was post processed using a dedicated software package and CBV maps were created with and without mathematical leakage correction. Resultant rCBV maps were compared.
Results: 37 patients were enrolled. Mean rCBV values in enhancing areas increased from 1.43 (SD=1.67) on non leakage corrected maps to 2.71 (SD=1.75) when leakage correction was applied. 13/37 (35%) patients had clinically relevant increase in rCBV rising above the commonly used threshold of 1.75, indicating active, high grade tumour. The non-enhancing, abnormal T2/FLAIR areas showed no significant rCBV changes. No patient had a decrease in rCBV values after leakage correction.
Conclusion: Gd-based DSC perfusion MRI in patients with malignant brain tumours yields different rCBV values with vs. without mathematical leakage correction. These differences may change diagnostic interpretation, therefore patient management in one third of the cases.

B-0651 14:24

Pseudoprogression or true progression in high-grade gliomas post radiation and chemotherapy: incremental value of functional imaging over conventional MRI

D. Das, S. Arya; *New Delhi/IN (deepakdas.scb@gmail.com)*

Purpose: 1. Various posttreatment appearances in high-grade gliomas and the problems in differentiating between these and true progression. 2. To discuss the role of both conventional MRI as well as functional MRI (perfusion, spectroscopy and diffusion) in differentiating the above. 3. Since clinical evaluation is unreliable and biopsy is limited by the heterogeneity of lesion in postradiotherapy brain, exploring the potential role of functional imaging in clinical decision-making.
Methods and Materials: 50 patients of proven gliomas with posttreatment (chemoradiotherapy) changes show indeterminate features on MRI, fMRI helped to differentiate reliably between progression and pseudoprogression. The findings were confirmed on subsequent imaging where addition of fMRI differentiated between the two in all cases except one.
Results: In true progression, the contrast enhancement and peritumoural oedema increase over time, rCBV > 1.8 times, increased choline and decreased NAA (cho/NAA> 1.8), low ADC values are noted and there is FDG uptake on PET. In pseudoprogression, the findings reversed. Addition of antiangiogenic agents decreased enhancement, so enhancement cannot be a reliable marker for differentiation.
Conclusion: There are short comings in Mac Donald and RANO criteria in assessing response to therapy in posttreatment glioma, functional MRI is the way to go about in differentiating the two as the treatment varies. In pseudoprogression, the same therapy can be continued; whereas in progression salvage surgery or change in chemotherapy is needed.

B-0653 14:32

Dynamic T1 contrast-enhanced MRI of peritumoural white matter in differentiation between glioblastoma multiforme and metastatic tumour

R. Tupý, J. Ferda, J. Kastner, O. Hes, V. Přibáň; *Plzen/CZ (ferda@fnplzen.cz)*

Purpose: The aim of this study was to verify whether the pathophysiologic changes difference in peritumoural white matter near contrast enhanced glioblastomas and metastatic tumours correspond to contrast enhancement kinetics changes measured by dynamic contrast enhanced MRI (DCE-MRI) using GRE-T1.
Methods and Materials: Retrospective study of adult patients (n = 60) with histopathologically confirmed glioblastoma (n = 42) and brain metastases (n = 18). Examination before surgery included conventional MR imaging at 3 T and DCE-MRI using contrast agent gadoterate meglumine and continuous 25 acquisitions with GRE-T1 (VIBE). The iAUC (initial area under the curve) and Ktrans (transfer constant) in peritumoural regions of the white matter were calculated, measured and normalised to iAUC and Ktrans value of the

contralateral white matter using Tissue 4D syngo (Siemens) software. Data were statistically analysed by unpaired t test.
Results: Comparing two tumour groups, there were statistically significantly higher iAUC and Ktrans values observed in peritumoural white matter near glioblastomas 2.36 (SD 1.39) and 2.48 (SD 2.35) vs. 1.02 (SD 0.37) and 1.13 (SD0.3) in metastases ($p < 0.001$ and $p = 0.02$), respectively. Using decisive threshold of 1.2 to assign iAUC and Ktrans in glioblastomas, there was sensitivity of 74% and 86%, specificity of 83% and 55%, positive predictive value of 91% and 82%, negative predictive value of 58% and 63%, respectively.
Conclusion: The iAUC obtained by DCE-MRI is more suitable to assess glioblastoma because it better reflect its neovascularisation than Ktrans. Increased iAUC mostly indicates glioblastoma, however, low level does not exclude it.

B-0655 14:40

DWI and histological parameters in meningioma

A. Surov[1], S. Gottschling[2], A. Wienke[2], C. Mawrin[3], R. Spielmann[2], J. Prell[2], E. Fiedler[2]; [1]*Leipzig/DE*, [2]*Halle/DE*, [3]*Magdeburg/DE*
(Alexey.Surov@medizin.uni-leipzig.de)

Purpose: To analyse DWI findings of meningiomas and to compare them with different histological parameters.
Methods and Materials: 49 meningiomas were included into the analysis. MRI of the head was performed using a 1.5-T device. DWI was done using a multi-slice single-shot echo-planar imaging sequence. All meningiomas were surgically resected and analySed histopathologically. The tumour proliferation index was estimated on Ki 67 antigen-stained specimens. Cell density was calculated in every case as an average cell count per five high power fields. Collected data were evaluated by means of descriptive statistics (absolute and relative frequencies). Analyses of ADC values were performed by means of two-sided t tests. Pearson`s correlation was used additionally.
Results: The estimated ADC values of meningiomas ranged from 0.71 to 1.78×10-3 mm2s-1. The mean ADC value in grade I meningiomas was higher in comparison to grade II/III tumours (0.96 vs 0.80×10-3 mm2s-1, p=0.044). The mean cell count was 1158.20±333.74. The mean level of the proliferation index was 4.78±5.08%. Ki 67 was negatively associated with ADC (r=-0.45, p=0.001) The correlation between ADC and Ki 67 was higher in the atypical/malignant meningiomas (r=-0.76, p=0.044). Cell-rich meningiomas showed lower ADC values in comparison to cell-poor tumours.
Conclusion: Grade II/III tumours had statistically significant lower ADC values than grade I meningiomas. ADC values correlated negatively with the tumour proliferation index. This association is different in several meningioma subtypes. Cell-rich meningiomas showed lower ADC values in comparison to cell-poor tumours.

Author Disclosures:
A. Surov: Author; Gottschling Sebastian, Wienke Andreas, Spielmann Rolf Peter, Prell Julian, Mawrin Christian, Fiedler Eckhard. Speaker; Gottschling, Sebastian.

B-0656 14:48

MRS in differentiating low-grade from high-grade astrocytoma in children

M. Dziubinska-Basiak, M. Konopka, M. Basiak, M. Wicher, M. Machnikowska-Sokolowska, J. Walecki; *Katowice/PL*
(mariabasiak@tlen.pl)

Purpose: The purpose of this study was to investigate whether Magnetic Resonance Spectroscopy (MRS) can differentiate between low-grade (WHO I) pilocytic astrocytoma (PA) and high-grade (WHO III) anaplastic astrocytoma (AA) in children. Data from 14 children with astrocytoma (8 PA and 6 AA) were evaluated retrospectively.
Methods and Materials: 14 paediatric patients with brain tumour had MRI with MRS performed on 1.5 T scanner as preoperative exam. Single Voxel Spectroscopy was performed placing one voxel in the tumour and the second voxel in the same but not-changed area of opposite brain hemisphere.
Results: In patients with PA, relations of main metabolites in MRS using TE of 35 ms were: Cho[Tu]/Cho[Ref]=1.51 (SD 0.41; p=0.02); Cr[Tu]/Cr[Ref]=1.03 (SD 0.25; p=0.18); NAA[Tu]/NAA[Ref]=0.61 (SD 0.22;p=0.01). In patients with AA, relations were: Cho[Tu]/Cho[Ref]=2.43 (SD 0.58;p=0.05); Cr[Tu]/Cr[Ref]=0.78 (SD 0.28;p=0.14); NAA[Tu]/NAA[Ref]=0.52 (SD 0.28;p=0.26). In patients with PA, relations of main metabolites in MRS using TE of 144 ms were: Cho[Tu]/Cho[Ref]=1.44 (SD 0.42; p=0.02); Cr[Tu]/Cr[Ref]=0.96 (SD 0.27; p=0.24); NAA[Tu]/NAA[Ref]=0.51 (SD 0.26;p=0.21). In patients with AA, relations were: Cho[Tu]/Cho[Ref]=1.71 (SD 1.14;p=0.04); Cr[Tu]/Cr[Ref]=0.82 (SD 0.28;p=0.08); NAA[Tu]/NAA[Ref]=0.43 (SD 0.20;p=0.21).
Conclusion: In group of patients with AA, MRS showed much higher concentration of Cho and lower concentrations of Cr and NAA comparing with group of patients with PA. Results of our study showed that it is possible to differentiate low-grade pilocytic astrocytomas from high-grade anaplastic astrocytomas in paediatric patients by analysing MRS but further studies must be held to confirm this.

B-0657 14:56

fMRI signal changes in the central nervous system after 3D based radiotherapy

A. Kovacs[1], M. Emri[2], C. Vandulek[1], C. Glavak[1], Z. Szalai[1], G. Biro[1], G. Bajzik[1], I. Repa[1]; [1]*Kaposvár/HU*, [2]*Debrecen/HU (kovacs.arpad1979@gmail.com)*

Purpose: In this study we report the changes of functional MRI activation areas after the 3D based radiotherapy of glioblastoma multiforme patinets.
Methods and Materials: Seventeen patients with a histologically proven Glioblastoma Multiforme were enrolled in this study. All patients received 3D based radiotherapy combined with temolozamide up to 60 Gy. The follow-up fMRI examinations were performed after completion of the treatment in the sixth week and in 3 months. Changes of the task related activation areas were registered and analysed.
Results: When comparing the pretreatment and 6 week control fMRI activation areas significant changes were registered in the motor activation (left hand, left hemisphere, high dose area and right hand, left hemisphere, high dose area) and listen task related (left hemisphere, high dose area) fMRI activation profiles. Based on the population level statistical parametric images (motor activation tasks) acquired during the 6 week control examination, a significant increase of signal was registered in the precuneus region and in the globus pallidus region.
Conclusion: Our results demonstrate the influence of radiotherapy on functional MRI signals within the human brain. In case of the motor activation tasks following the completion of the radiotherapy, activations of the secondary motor area were observed.

B-0658 15:04

Diffusion Kurtosis imaging in diagnosis of malignancy and proliferative activity of brain gliomas

A.S. Tonoyan[1], I. Pronin[1], F. Grinberg[2], E. Farrher[2], D. Pitskhelauri[1], L. Fadeeva[1], E. Pogosbekyan[1], A. Potapov[1], V. Kornienko[1]; [1]*Moscow/RU*, [2]*Juelich/DE (atonoyan@nsi.ru)*

Purpose: To assess the efficacy of DKI in the diagnosis of glioma malignancy and proliferative activity.
Methods and Materials: 61 patients with cerebral gliomas underwent 3 T-MR-imaging. DKI was performed using b-values of 0, 1000 and 2500 s/mm2 and 60 gradient directions. Absolute and normalised values of mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), fractional anisotropy (FA), relative anisotropy (RA), mean kurtosis (MK), axial kurtosis (AK), radial kurtosis (RK), kurtosis anisotropy (KA) of tumours were compared in the most malignant solid parts of 21 grade-I-II, 20 grade-III and 20 grade-IV gliomas ($P < 0.05$ significance level, Mann-Whitney test). Pearson correlation coefficient was used to correlate between absolute values of DK-parameters and Ki67-LI of gliomas.
Results: Absolute and normalised values of MK, AK, RK, KA, FA, RA were significantly higher in HGG (grade-III-IV) and absolute and normalised values of MD, AD, RD were significantly lower in HGG, compared with LGG (grade-I-II). Absolute and normalised values of MK, AK, RK, were significantly higher in grade-III gliomas and absolute and normalised values of MD, AD, RD were significantly lower in grade-III gliomas, compared with LGG (grade-I-II). Absolute and normalised values of MK, AK, RK, KA, were significantly higher in grade-IV gliomas and absolute and normalised values of MD, AD, RD were significantly lower in grade-IV gliomas, compared with grade-III gliomas. Absolute values of MK, AK, RK of gliomas were in a significant strong positive correlation with tumour Ki-76 LI.
Conclusion: DKI demonstrated a promising potential in the diagnosis of glioma malignancy and proliferative activity.

Author Disclosures:
A.S. Tonoyan: Grant Recipient; grant RSF (РНФ) N 14-15-00197. **I. Pronin:** Grant Recipient; Grant RSF (РНФ) N 14-15-00197. **D. Pitskhelauri:** Grant Recipient; Grant RSF (РНФ) N 14-15-00197. **L. Fadeeva:** Grant Recipient; Grant RSF (РНФ) N 14-15-00197. **E. Pogosbekyan:** Grant Recipient; Grant RSF (РНФ) N 14-15-00197.

14:00 - 15:30 **Room F1**

Oncologic Imaging

SS 716

Urogenital oncology

Moderators:
R.A. Kubik-Huch; Baden/CH
I. Thomassin-Naggara; Paris/FR

B-0659 14:00

Prediction of response of primary tumours to neoadjuvant sunitinib using perfusion (DCE) CT in metastatic renal cell carcinoma (mRCC) patients (PREINSUT trial)

M. Bouaboula, Y. Vano, L. Mauge, H. Pereira, D. Helley, A. Mejean, C.-A Cuenod, S. Oudard, L. Fournier; *Paris/FR (mehdi.bouaboula@etu.parisdescartes.fr)*

Purpose: The multicentric PREINSUT trial was conducted to explore biomarkers for neoadjuvant sunitinib therapy in mRCC patients before nephrectomy. In an ancillary imaging study, we evaluate the performance of Dynamic Contrast Enhanced (DCE)-CT for predicting treatment efficacy.
Methods and Materials: DCE scans were performed at baseline and at the end of the 4 weeks of the 1st cycle of sunitinib. The following perfusion parameters were calculated in the primary renal tumour and correlated to the response in size at the end of neoadjuvant therapy: tissue blood flow (tBF), tissue blood volume (tBV), permeability surface coefficient (PS), area under the enhancement curve at 60s (AUC).
Results: Nineteen patients were eligible for the DCE imaging analysis.There was a negative correlation between baseline values of tBF and response in size (r = -0.54, p = 0.04), PS (r = -0.53, p = 0.04). Responders (N=7) had a larger decrease in AUC between baseline and 4 weeks (-39.2% vs 6.0%, p = 0.04). There was a positive correlation between size response and both PS (r = 0.62, p = 0.02), and AUC changes (r = 0.65, p = 0.02). Blood volume was negatively correlated, to plasmatic VEGF levels (r = -0.36, p = 0.01).
Conclusion: Perfusion CT parameters measured on baseline and early changes after neoadjuvant sunitinib therapy were predictive of the final 3-months response of the renal tumour. The higher the tumour perfusion and permeability, the greater the reduction in size of the primary renal tumour.

B-0661 14:16

Characterising adrenal 18 F-FDG uptake in oncologic patients by dynamic MDCT in combined PET/CT scanner

A. Regnaud, V. Soubeyran, H. Lang, M. Christodoulou, C. Constantin, M.-E. Kamel; *Sion/CH (alice.regnaud@hotmail.fr)*

Purpose: To assess the value of combining a dynamic adrenal CT protocol in characterising adrenal FDG uptake in oncologic patients.
Methods and Materials: Thirty-four oncologic patients who displayed abnormal FDG accumulation in their adrenal glands were prospectively enrolled. Abnormal adrenal FDG uptake was classified into grade I (< liver parenchyma), grade II (equal to liver parenchyma), and grade III (> liver parenchyma). Dynamic adrenal CT protocol included, in addition to the native acquisition of PET CT, portal phase and delayed phase at 10 minutes. Absolute enhancement loss of contrast was calculated, lesions with washout > 52% were considered benign and those with washout ≤52% were considered malignant. The results were correlated with histological analysis and radiological follow-up ≥6months.
Results: Among the studied 34 patients, 40 adrenal lesions were identified, 19 were proven malignant whereas, 21 were benign. Grade I FDG uptake was recorded in 2/21 benign lesions. No malignant lesions presented with grade I uptake. Four out of 6 lesions with grade II uptake were of benign origin and 2 were malignant. In 32 lesions with grade III uptake, 17 were malignant and 15 were benign. The adrenal CT protocol mistook a malignant lesion for a benign one and an adrenal hyperplasia for malignant one yielding a sensitivity, specificity, and accuracy of 94.7%, 95.2%, and 95%, respectively.
Conclusion: The adrenal CT protocol is a useful adjunct in characterising FDG avid adrenal lesions in oncologic patients. This algorithm could have an impact on decision making and patient management.

B-0660 14:08

DWI of the renal cell carcinoma: applicability and limitations of the apparent diffusion coefficient in differential diagnostics of the malignant renal lesions

Y. Mytsyk, Y. Borys, I. Dutka, I. Komnatska, I. Datz, I. Shatynska-Mytsyk; *Lviv/UA (mytsyk.yulian@i.ua)*

Purpose: The objective of the survey was to assess the value of the diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) in differential diagnostics of the malignant renal lesions.
Methods and Materials: The study enrolled 54 adult patients with renal cell carcinoma (RCC) confirmed by pathomorphological examination: 33 patients with clear cell subtype of the renal cell carcinoma (25 patients with solid form and 8 patients with cystic form of the ccRCC), 12 patients with papillary RCC (pRCC) and 9 patients with chromophobe RCC (chRCC). All patients were assessed by renal MR imaging on 1.5-T body scanner involving DWI (b value=0.800) with consequent ADC measurement.
Results: There was a reliable difference in mean ADC values between the subtypes of the RCC: in patients with the solid form of ccRCC, it was 1.81±0.24×10–3 mm2/s (1.89±0.31×10–3 mm2/s in low-grade tumours, 1.73±0.22×10–3 mm2/s in high-grade tumours); in patients with pRCC, it was 1.61±0.19×10–3 mm2/s and 1.53±0.21×10–3 mm2/s in patients with chRCC; the mean ADC value of the cystic form of ccRCC was 2.08±0.25×10–3 mm2/s with insignificant difference in low- and high-grade tumours.
Conclusion: The method of the diffusion-weighted imaging along with ADC measurement gives valuable information for the differential diagnostics of the malignant renal lesions but have limitations in differentiating between the grades of the cystic form of ccRCC.

B-0662 14:24

Pretreatment DCE-MRI estimates of extravascular extracellular volume (ve) predict for survival following therapy for muscle invasive bladder transitional cell carcinoma (TCC)

T.D. Westwood, L.E. Kershaw, S.B. Donaldson, B.M. Carrington, R. Cowan, J. Lyons, T. Elliot, A. Choudhury, S. Bonington; *Manchester/UK (thomas.westwood@christie.nhs.uk)*

Purpose: In bladder TCC, DCE-MRI parameters obtained after treatment have shown utility in detecting tumour recurrence, and can be useful in distinguishing recurrent tumour from inflammatory change. The purpose of this study was to assess whether these parameters are prognostic for disease free survival when measured prior to commencing treatment for muscle invasive bladder TCC.
Methods and Materials: Patients with muscle invasive bladder TCC underwent DCE-MRI scans prior to treatment with neoadjuvant chemotherapy followed by radical radiotherapy, chemoradiotherapy or cystectomy. Whole volume-of-interest (VOI) signal-time curves were analysed with a two-compartment uptake model to estimate tracer kinetic parameters including extravascular extracellular volume (ve). Kaplan-Meier survival curves were generated, with patients grouped according to whether they had above or below median values of the kinetic parameters.
Results: 29 patients underwent DCE-MRI prior to treatment. After a minimum follow up period of 2 years and 5 months, 18 patients were alive and disease free. The remaining 11 were either alive with disease recurrence or had died as a result of recurrent disease. A log rank analysis of survival curves for patients with pretreatment ve above and below the median value for the cohort (median ve 23 ml/100 ml) demonstrated a significant difference in survival between those with low and high ve (p=0.00079).
Conclusion: Patients with above median pretreatment ve had significantly longer survival than those with below median ve. In the future ve estimation prior to treatment may allow more accurate prediction of risk of tumour recurrence and facilitate individualised patient management.

B-0663 14:32

A MRI scoring system for predicting endometrial vs cervical origin in patients with bulky uterine masses of indeterminate histology

C. Bourgioti, K. Chatoupis, E. Panourgias, C. Tzavara, L. Moulopoulos; *Athens/GR (charisbourgioti@yahoo.com)*

Purpose: To develop a MRI scoring system which may predict the origin (cervix or endometrium) of large uterine cancers with indeterminate histology.
Methods and Materials: Dedicated pelvic MRIs of 77 patients with large uterine tumours involving both cervix and uterine corpus were reviewed by two experts in gynaecologic - oncology imaging. Findings characteristic of either cervical or endometrial histology were tested for statistical significance based on final histology. Levels of inter-rater reliability were assessed with Kappa values. Based on the estimation of positive likelihood ratio values a MRI score was assigned.

Results: Seven MRI tumour characteristics showed significant discriminant ability for tumour origin: tumour location, perfusion, rim enhancement, depth of myometrial invasion, parametrial integrity, endometrial mass and retained intracavitary secretions. K-coefficient values proved excellent for most of the MRI features. Based on ROC analysis, a cutoff of 4 had the highest sensitivity (96.6%) and specificity (100%) values. Using a ≥4 cutoff for cervical cancer and < 4 for endometrial cancer diagnosis, almost all patients (97.4%) were correctly classified. The AUC of the MRI scoring system was 0.99 (95% CI: 0.98-1.00). When the MRI scoring system was applied to 20 patients with inconclusive initial biopsy and 5 surgically treated patients with erroneous pre-op histology, all patients were correctly classified.
Conclusion: The proposed MRI-scoring system may accurately identify cervical versus endometrial origin of bulky, histologically indeterminate uterine tumours.

B-0664 14:40

Accuracy of retrospective PET and MRI-DWI (PET/MRI-DWI) image fusion in detection of cervical and endometrial cancer lymph node metastases: comparison with PET/CT and MRI-DWI

F. Buemi, A. Stecco, A. Cassarà, G. Sacchetti, R. Matheoud, M. Brambilla, A. Arnulfo, A. Carriero; *Novara/IT (franbuemi@virgilio.it)*

Purpose: To assess the accuracy of retrospective PET/MRI-DWI image fusion with respect to PET-CT and MRI-DWI alone in detecting lymph node metastases in patients with newly diagnosed cervical and endometrial carcinoma.
Methods and Materials: Twenty-seven patients with biopsy-proven endometrial (n=14) and cervical (n=13) cancer underwent preoperative DWI-MRI and PET/CT for staging. The diagnostic accuracy of PET/CT, MRI-DWI, and retrospective PET/MRI-DWI image fusion in assessing regional lymph node metastases (N stage) was evaluated by two experienced readers. Histopathological and follow-up imaging results were used as the gold standard. The McNemar test was employed for statistical analysis.
Results: Histopathology identified lymph node metastases in 8 of 27 patients (29%), while all investigated techniques identified only 7 of these cases. McNemar's test revealed no statistically significant differences between PET/CT and DWI, PET/MRI-DWI and DWI (p=0.08) or PET/CT and PET/MRI-DWI (p=1). Metastatic lymph nodes were identified by histopathology in 37 of the 216 lymph node regions (17%) examined. In this case, McNemar's test revealed statistically significant differences between MRI-DWI and both PET-CT ($p < 0.01$) and PET/MRI-DWI (p=0.09).
Conclusion: PET/MRI-DWI, by combining the advantages of MRI and PET, is a useful technique for N staging in patients with endometrial and cervical cancer.

B-0665 14:48

Role of DWI in cervical cancer for prediction and monitoring of chemoradiotherapy response

P. Kala, V. BharGavi, R. Avantsa, G. Narayan; *Bangalore/IN (prachi_kala@yahoo.com)*

Purpose: DW-MRI has the potential to provide a standardized imaging measurement in therapeutic response evaluation. We investigate the possibility of DWI as an imaging bio marker and evaluate its ability to measure tumour response in carcinoma cervix.
Methods and Materials: Study was approved by an independent ethics committee. 30 carcinoma cervix patients who underwent chemo radiation therapy were examined with routine pelvic MRI and DWI before initiation of chemo radiation, after completing external beam radiotherapy and following completion of brachytherapy with a 1.5-T MR scanner and a 16 channel torso coil. Treatment response was determined by comparing pre and post treatment conventional MR images. Analysis of variance (ANOVA) and Student t test has been used to compare the ADC, size and volume parameters between the different response groups.
Results: Cervical lesions demonstrated serial increase in the tumour ADC values along with corresponding decrease in the tumour diameters and volumes during the chemo radiation therapy (all p values < 0.001). A significant and moderate positive linear correlation was found between the tumour ADC values and the final size and volume responses. The pretreatment, mid and post treatment mean tumour ADC values showed significant differences between response groups being larger in the complete response and good response groups than that of partial response group (all p values < 0.070).
Conclusion: It was found that DWI and its quantitative parameter, ADC has a potential role in the prediction, assessment and monitoring of cervical cancer treatment response to chemo radiation therapy.

B-0666 14:56

CT performance for the pre-operative quantification of peritoneal carcinomatosis in ovarian cancer

S. Bennani, A.-S. Bats, F. Chamming's, C. Bensaid, C. Bourillon, C. Couvidat, F. Lecuru, L. Fournier; *Paris/FR (souhailbennani27@gmail.com)*

Purpose: CT performance for the pre-operative evaluation of the Peritoneal Cancer Index (PCI) in patients with advanced stage ovarian cancer.
Methods and Materials: A single-center retrospective study included: patients with stage III or IV ovarian cancer, a CT in the PACS less than six weeks before surgical evaluation, a laparotomy with a PCI evaluation (with or without neoadjuvant chemotherapy). A PCI quantifying the peritoneal involvement on CT (performed blinded to surgical data) was performed and compared to the surgical PCI.
Results: 48 patients (39-77 years) were enrolled from September 2011 to January 2014. There was a good correlation between PCI using CT and surgery (r=0.53, P=0.0001), though individual quadrant results differed due to differences in anatomical interpretation between radiologists and surgeons. PCI using CT vs. PCI at laparotomy were similar in the group that had only surgery (respectively 9.9 vs. 8.2,p = 0.15), whereas they were statistically different for patients who underwent neoadjuvant chemotherapy (respectively 12.6 vs. 7.8, p = 0.001).
Conclusion: CT accurately quantifies peritoneal involvement to help prepare surgery, but surgeons and radiologists must work together to agree on anatomical definitions. After chemotherapy post therapeutic changes may lead to an overestimation of lesions.

B-0667 15:04

Accuracy of MDCT in preoperative definition of peritoneal carcinomatosis of bowel loops in patients with advanced ovarian cancer who underwent peritonectomy and hyperthermic intraperitoneal chemotherapy

S. Guerrini, M.A. Mazzei, A. Cirigliano, N. Cioffi Squitieri, G. Bettini, F.G. Mazzei, D. Marrelli, L. Volterrani; *Siena/IT (guerrinisus@gmail.com)*

Purpose: To evaluate the accuracy of MDCT in the preoperative evaluation of peritoneal carcinomatosis (PC) of bowel loops in patients with advanced ovarian cancer who underwent peritonectomy and HIPEC to obtain an optimal cytoreduction surgery.
Methods and Materials: Pre-surgery abdominal CT examinations of 24 patients with advanced ovarian cancer after neoadjuvant chemotherapy were blindly and prospectively analysed by a radiologist with expertise in the oncologic field. The peritoneal cancer index (PCI) was scored according to the Sugarbaker classification, based on lesion size and distribution, with particular attention to the small bowel regions (regions 9-12). In 9 patients the bowel distension was obtained through the administration of neutral oral contrast medium. The results were compared with histologic data after surgery.
Results: Considering the patient-level analysis (the capacity to detect bowel loops PC), the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPP) and accuracy of MDCT, were 75%, 67%, 69%, 73% and 71%, respectively. Considering the regional level analysis (the capacity to localise bowel loops PC), a sensitivity, specificity, PPV, NPV and accuracy of 63%, 87%, 55%, 91%, and 82%, respectively were obtained. Bowel distension with oral contrast medium improved the CT accuracy.
Conclusion: Our results encourage the use of MDCT as the only technique sufficient to select patients with bowel loops PC for cytoreductive surgery and HIPEC on the condition that a CT examination will be performed using a dedicated protocol, optimised to detect minimal peritoneal disease and CT images will be analysed by an experienced reader.

B-0668 15:12

Agreement in identification of tumour recurrence, peritoneal deposits or distant metastasis in patients treated with ovarian cancer using MRI

K. Skrobisz-Balandowska, L. Klasa, M. Liro, D. Wydra, M. Studniarek, A. Bianek-Bodzak; *Gdansk/PL (kskrobisz@gumed.edu.pl)*

Purpose: To assess inter-observer agreement in the evaluation of the presence or absence of tumour recurrence, peritoneal deposits or distant metastases in MRI studies in patients treated with ovarian cancer.
Methods and Materials: From 2002 to 2009, 125 consecutive female patients (min.age 32, max. 83, mean age 57) were studied using MRI and 197 MRI examinations were performed. Each patient had been treated for ovarian cancer by the first cytoreduction surgery-chemotherapy and was scheduled for abdominal-pelvic MRI by patient's oncologist as part of routine follow-up studies. All examinations were performed with Gyroscan T5-NT 0.5-T magnet by using body coil. 197 MR studies were retrospectively interpreted by two radiologists independently.
Results: Of 197 MRI examinations performed, 55 were with no evidence of disease. Ascites was found by observer A in 50 examinations (prevalence 35%), whereas by observer B in 46 examinations (prevalence 32%). Observer A detected liver metastasis in 27 examinations (prevalence 19%), whereas

observer B in 19 examinations (prevalence 13%). Observer A detected tumour recurrent in 60 examinations (prevalence 42%), whereas observer B in 58 examinations (prevalence 40%). Observer A detected lymph nodes in 35 examinations (prevalence 24%), whereas observer B in 28 examinations (prevalence 20%). Observer A detected peritoneal enhancement in 87 examinations (prevalence 61%), whereas observer B in 85 examinations (prevalence 60%).
Conclusion: In study, the results indicate that MRI has high inter-observer agreement in identification of ascites, recurrent tumour in abdomen and peritoneal enhancement; whereas the agreement is suboptimal for identification of metastasis in liver and lymph nodes.

B-0669 15:20

Prediction of 5-year survival with texture analysis in patients with ovarian cancer

I. Radlgruber, M.E. Mayerhoefer, S. Aust, S. Polterauer, M. Weber, S. Polterauer, T. Knogler; *Vienna/AT (ilja.radlgruber@meduniwien.ac.at)*

Purpose: To evaluate CT texture analysis (TA) for a 5-year survival prediction of patients with ovarian cancer.
Methods and Materials: 32 patients with histologically proven ovarian cancer were included. 15 had a survival < 60 months. Unenhanced and contrast-enhanced (CE-)CT images obtained for routine purposes were used. Regions-of-interest (ROI) were manually defined bilaterally on a single cross-sectional image at the level of lumbar vertebra three covering (1) the spinalis thoracis, longissmus thoracis, iliocostalis lumborum, quadratus lumborum, (2) psoas major and (3) obliquus internus/externus, transversus and rectus abdominis muscles. Texture features derived from the grey-level histogram, the co-occurrence matrix, the run-length matrix, the absolute gradient, the autoregressive model, and the wavelet transformation were calculated for the ROIs. Fisher, probability of classification error and average correlation (POE.ACC), and mutual information coefficients were used for selection of optimized texture features. Linear discriminant analysis in conjunction with k-nearest neighbour classification was used for survival classification. Classification accuracy (percentage of correctly classified cases) was used as primary outcome measure.
Results: An accuracy of 90.62% was achieved using a subset of ten CT texture features selected on the basis of POE.ACC coefficients extracted from ROI 1. The single texture feature Perc.90% (90^{th} grey-level percentile) had a sensitivity and specificity of 88.2% and 60%, respectively, using a cut-off value of 94.5 HU; and a sensitivity and specificity of 82.4% and 66.7%, using a cut-off value of 96 HU.
Conclusion: TA of CE-CT images is able to support the 5-year survival prediction of patients with ovarian cancer non-invasively.

14:00 - 15:30 **Room F2**

Physics in Radiology

SS 713

Innovations in CT technology

Moderators:
P.E. Colombo; Milan/IT
I. Sechopoulos; Atlanta, GA/US

B-0670 14:00

Reconstructing interventional C-arm CT rawdata from non-conventional scan trajectories

J. Kuntz[1], L. Ritschl[2], C. Fleischmann[2], M. Knaup[1], M. Kachelrieß[1]; [1]*Heidelberg/DE*, [2]*Nürnberg/DE (j.kuntz@dkfz.de)*

Purpose: To propose an image reconstruction algorithm with exact redundancy weights for unconventional scan trajectories including dynamic collimation.
Methods and Materials: Common CT rawdata acquisition is performed with a circular trajectory covering a rotational range of at least 180° plus fan angle. However, recently published trajectories may be more favourable for example in C-arm CT, where the form factor of the C-arm can be significantly reduced, leaving more room to the interventionalist. In conventional short scans patient dose can be reduced using dynamic collimation techniques, eliminating most of the redundant rays. Reconstructing these non-conventional scans requires new redundancy weights which can be regarded as a generalisation of Parker's weight. We developed an algorithm that is applicable to circular and non-circular scans combined with curvilinear shifts. It is demonstrated with filtered backprojection reconstructions of simulated cone-beam CT projections of the Forbild head phantom with 165°+shift, 175°+shift, 195° and dynamic collimation. Additional phantom measurements acquired with a modern C-arm system, modified to allow for new scan trajectories were reconstructed.
Results: The reconstructions using the new Feldkamp-type reconstruction algorithm show high-image quality and are equivalent to reconstructions of 195° using Parker's weight. The mathematical exactness of the reconstruction of the center slice and numerical equality to Parker's weight for circular scans is proven.
Conclusion: The proposed algorithm allows for exact reconstructions of the center slice and thus enables new, dose-efficient and highly flexible data acquisition strategies for clinical applications, e.g. mobile C-arm CT, where fast reconstructions in intraoperative imaging are required.

Author Disclosures:
L. Ritschl: Employee; Ziehm Imaging GmbH. **C. Fleischmann:** Employee; Ziehm Imaging GmbH.

B-0671 14:08

Imaging blood vessel boundaries in photon counting spectral CT with the nonlinear partial volume effect

M. Persson, H. Bornefalk, F. Grönberg, B. Huber, S. Karlsson, X. Liu, M. Sjölin, M. Danielsson; *Stockholm/SE (mats.persson@mi.physics.kth.se)*

Purpose: Blood vessels in CT images appear to have diffuse boundaries because of the limited spatial resolution. However, the nonlinear partial volume (NLPV) effect means that abrupt and gradual transitions have different spectral responses. The purpose of this work is to investigate whether using a photon-counting energy-resolving CT detector allows determining whether a vessel wall is intact or leaks contrast agent into the surrounding tissue.
Methods and Materials: CT imaging of a blood vessel, 5 mm in diameter and containing an iodinated contrast agent, was computer simulated using a polychromatic forward model. Two cases were studied: one with an abrupt transition at the border and one where the iodine concentration decreases to zero gradually over a distance of 1 mm. Projection-space basis material decomposition was used to form basis images: one for water, one for iodine and one specific to the NLPV effect. In addition, projection x-ray measurements of the border of a 5 mm thick aluminum slab were made in a table-top setup, to demonstrate that the method is experimentally feasible.
Results: Comparison of the NLPV-specific basis images showed that the vessel wall was visible for the abrupt transition but not for the gradual transition. In the experimental study the border of the aluminum slab was visible in the NLPV basis image with an SNR of 9.3.
Conclusion: With a photon-counting energy-resolving detector, the NLPV effect can be used to distinguish a healthy blood vessel from a bleeding one.

Author Disclosures:
M. Persson: Shareholder; Prismatic Sensors AB. **H. Bornefalk:** Shareholder; Prismatic Sensors AB. **B. Huber:** Shareholder; Prismatic Sensors AB. **S. Karlsson:** Shareholder; Prismatic Sensors AB. **X. Liu:** Shareholder; Prismatic Sensors AB. **M. Sjölin:** Shareholder; Prismatic Sensors AB. **M. Danielsson:** Board Member; Prismatic Sensors AB. CEO; Prismatic Sensors AB. Shareholder; Prismatic Sensors AB.

B-0672 14:16

Evaluation of a low iodine concentration contrast media in abdominal multiphasic CT using spectral imaging: a prospective study on 210 patients

C. Roy, F. Severac, M. Ohana, A. Labani, N. Chakfe; *Strasbourg/FR (catherine.roy@chru-strasbourg.fr)*

Purpose: Demonstrate the non-inferiority of a low iodine contrast media for abdominal multiphasic CT acquired with Spectral Imaging.
Methods and Materials: Three groups of 70 patients were prospectively randomized. Examinations were performed on a single-source dual-energy CT (GE Discovery 750HD). Two groups underwent conventional single-energy CT with 1.5 mL/kg of Iomeprol 400 mgI/ml and Iomeprol 350 mgI/ml; one group with Iobitridol 250 mgI/ml using spectral. Quantitative analysis consisted of HU+ SD measurements in aorta, hepatic parenchyma and portal vein, obtained for both arterial and portal phases. Image quality of all phases was assessed. Quantitative statistical analysis was performed using Bayesian method with a 95% credibility interval.
Results: Spectral images revealed an excellent image quality. For quantitative evaluation, at aorta arterial phase 60 KeV differences between 350 and 250 was estimated to 99.99% credibility and between 400 and 250 to 99.06%. At aorta venous phase 60 KeV differences between 350 and 250 was estimated to 99.99% credibility, as well as between 400 and 250. At 60 KeV, 250 was superior for venous phase in hepatic parenchyma and portal vein. At 65 KeV, 250 revealed no significant differences for all sites. At 75 KeV, 250 was inferior for all sites. Increase radiation doses was less than 10% (DLP: 489 mGy.cm vs 513 mGy.cm).
Conclusion: Low iodine concentration offers good image quality and enhancement for arterial and portal phases compared to high-concentration contrast media, when using Spectral Imaging, saving up to 37.5% iodine load, without any significant increase of the radiation dose.

B-0673 14:24

Image quality of liver small lesions with virtual monochromatic spectral CT low-osmolar contrast: preliminary animal experience

Y. Zhou, M.Y. Wang, J.B. Gao; *Zhengzhou/CN (zhouyue779@163.com)*

Purpose: To assess the image quality of virtual monochromatic spectral CT with low iodine concentration contrast medium of liver small lesions.
Methods and Materials: 80 rabbits with VX2 liver tumours underwent spectral contrast-enhanced abdominal CT were randomly divided into study group and control group. On the 7th day after implantation, 40 rabbits in study group with 320 mgI/mL iobitrido injection: 80/140 kVp, reconstructed with FBP (group A) and adaptive statistical terative reconstruction (ASIR) (group B), respectively; 40 rabbits in control group with 270 mgI/mL iodixanol injection: 80/140 kVp, reconstructed with FBP (group C) and ASIR (group D), respectively. The image noise, tumour-to-liver contrast-to-noise ratio (CNR) were calculated at optimal CNR keV in arterial phase (AP). The lesion conspicuity scores (LCS) and Overall image quality scores (OQS) were recorded.
Results: The image noise of group A, B, C, D at optimal CNR keV during AP were (10.53±1.13; 8.10±0.71; 6.10±0.60 and 5.87±0.87) HU ($P < 0.001$). SNR and CNR in group B and group D at optimal CNR keV were higher than that of group A and group C during AP ($P < 0.001$), but group B vs. group D and group A vs. group C showed no significant difference. OQS in group B and group D at optimal CNR keV were higher than that of group A and group C during AP [(4.45±0.28) vs. (3.97±0.28) vs. (3.55±0.21) vs. (3.12 ±0.31) ($P < 0.001$)].
Conclusion: VMS-ASIR images in spectral CT associated with low-osmolar contrast can greatly reduce contrast media dose and improve the image quality.

B-0674 14:32

Does dual energy dual source CT with energy-selective photon counting detectors make sense?

S. Faby[1], S. Kuchenbecker[1], D. Simons[1], H.-P. Schlemmer[1], M. Lell[2], M. Kachelrieß[1]; [1]*Heidelberg/DE*, [2]*Erlangen/DE (sebastian.faby@dkfz.de)*

Purpose: To study different DEDSCT concepts combining traditional energy integrating (EI) detectors and novel photon counting detectors (PC) with respect to their material decomposition performance regarding image quality and patient dose.
Methods and Materials: The anticipated introduction of PC detectors to diagnostic CT may not only be useful for single source CT (SSCT) but also for DSCT concepts. Parasitic effects like charge sharing are currently degrading the performance of PC detectors if used in SSCT: PC detectors with multiple energy bins used in SSCT are not as performant as EI detectors used in DEDSCT. We study possible performance improvements by simulating different DSCT concepts with realistic PC (4 energy bins) and EI detectors. Patient data are used to calculate virtual non-contrast (VNC) images and iodine maps, and to quantify image quality and dose. The material decomposition is carried out using an optimal statistical weighting method [SPIE-Medical-Imaging 903318, 2014] in all cases.
Results: The dose savings when using PC/EI-DEDSCT (PC on the 90 kV and EI on the Sn 150 kV thread) compared to conventional EI/EI-DEDSCT are 10% for the VNC images and 19% for the iodine maps. Interestingly, but not surprisingly, the performance in PC/PC-DEDSCT is worse than in PC/EI-DEDSCT. This is due to the different intrinsic energy weighting of PC and EI detectors.
Conclusion: DSCT concepts employing both conventional EI and novel PC detectors can compensate for the degraded PC detector performance and make these detectors interesting for applications in clinical CT.

Author Disclosures:
M. Lell: Research/Grant Support; Siemens AG. Speaker; Siemens AG.

B-0675 14:40

Empirical dual-energy beam hardening correction in dual-energy CT

S. Schüller[1], S. Sawall[1], M. Lell[2], M. Kachelrieß[1]; [1]*Heidelberg/DE*, [2]*Erlangen/DE (soeren.schueller@dkfz.de)*

Purpose: To improve the contrast-to-noise situations in pseudo-monochromatic imaging using DECT.
Methods and Materials: CT images often suffer from beam-hardening artefacts. DECT provides one pseudo-monochromatic image with a significant reduction of artefacts. Thereby, the contrast-to-noise ratio is diminished. We propose EDEBHC to generate different solutions with further improved artefact reduction and higher CNR without the necessity of rawdata-based material decomposition. EDEBHC computes several basis images which are obtained by running the low- and high-energy rawdata, e.g. acquired using 100 kV and 140 kV, through polynomials that generate new sinograms that depend on the original data in a non-linear way. These reconstructed sinograms are linearly combined by EDEBHC to minimize the beam-hardening artefacts of the resulting image. EDEBHC automatically seeks for artefact-free solutions in which the energy-dependent contrast situation can be chosen. EDEBHC was evaluated using simulations, phantom and patient measurements.
Results: If only the two linear terms are used to compute the basis images EDEBHC reproduces the 100 kV and the 140 kV images (with artefacts). The additional basis images which are specific to EDEBHC allow to obtain beam hardening artefact-reduced images for a wide range of pseudo-monochromatic energies. Due to its empirical nature, scatter artefacts are suppressed as well.
Conclusion: EDEBHC is easy to use and does not require calibration or segmentation. Compared to pseudo-monochromatic imaging not only the artefact correction is improved, although the better contrast and noise situation above a wide energy-range allows more diagnostic applications for DECT.

B-0676 14:48

Dual source dual energy CT for kidney stones: impact of patient motion

B. Krauss, B. Schmidt, T. Allmendinger, T. Flohr; *Forchheim/DE*

Purpose: Evaluate the sensitivity of the differentiation between uric acid and non uric acid stones to patient motion.
Methods and Materials: Based on a cardiac motion phantom, a kidney stone motion phantom was developed with three spherical stones (diameter = 3, 5, 7 mm) per material (hydroxyapatite / uric acid). 3d motion patterns were designed with 20 mm path length along the scan axis and three cycle times (6, 3, 1.7 s). CT scans were performed on a SOMATOM Definition Flash scanner (Siemens AG, Forchheim, Germany) using the default Dual Energy kidney stone protocol (0.5s rotation time) for all cycle times and 0.28s rotation time for the lowest cycle time. For each stone, cycle time and rotation time, 5 scans were done for statistical evaluation of the stone classification using syngo Dual Energy.
Results: The mean CT-value in all stones decreased with decreasing cycle time (typically to less than 50% at 1.7s cycle time), but increased with decreasing rotation time. With motion, some stones dropped below the classification threshold of the algorithm (200 HU) especially if they consisted of uric acid, were small or if motion was fast. Otherwise, the assigned color was correct, except for one scan at rapid breathing motion.
Conclusion: Dual Source Dual Energy CT classification into uric acid and non uric acid stones is highly reliable even for stones which appear strongly elongated because of patient motion.

Author Disclosures:
B. Krauss: Employee; Siemens AG, Healthcare. **B. Schmidt:** Employee; Siemens AG, Healthcare. **T. Allmendinger:** Employee; Siemens AG, Healthcare. **T. Flohr:** Employee; Siemens AG, Healthcare.

B-0677 14:56

A comparison of image quality between fine focal spot and standard focal spot CT of the abdomen and pelvis

Y.P. Goh, K.K.-P. Lau, K.Y. Low, C.W. Oh, M. Huynh, K. Buchan, A. Kuganesan; *Melbourne/AU (yinpeng.goh@gmail.com)*

Purpose: CT tubes usually have two focal-spot sizes, with the finer focal spot providing higher spatial resolution. The use of fine focal spot size (FFSS) was previously limited by the thermal damage to the X-ray tube, which can now be overcome by the advanced cooling system on newer CT scanners. The aim of this prospective study was to compare the image quality of the abdominal viscera between FFSS and standard focal spot size (SFSS).
Methods and Materials: All consecutive contrast-enhanced CT abdomen and pelvis (CTAP) of all adult patients between June and September 2014 were included. Two blinded radiologists assessed the margin clarity and internal noise of the abdominal viscera and the margin clarity of the detected lesions using a 5-point grading scale. The radiation doses of all the CTAPs were prospectively documented.
Results: 52 CTAPs were examined with SFSS of 1 mm x1 mm and 48 CTAPs were examined with FFSS of 1 mm x0.5 mm. Cohen's kappa showed substantial agreement for organ margin clarity (mean κ=0.759, $p < 0.001$) and almost perfect agreement for organ internal noise (mean κ=0.840, $p < 0.001$) among the reviewers. Mann-Whitney U testing indicated that FFSS produces images with clearer organ margin (U=76194.0, $p < 0.001$, r=0.523), lower organ internal noise (U=83856.0, $p < 0.001$, r=0.508) and clearer lesion margin (U=239, p=0.052, r=0.269). Independent t-test revealed that the mean radiation dose was 0.77mSv lower in the FFSS group (95% CI 0.067 - 1.483, p=0.032).
Conclusion: FFSS CTAP improves image quality in terms of improved organ and lesion margin clarity, and reduced organ internal noise, while at the same time reducing radiation dose.

Author Disclosures:
K. Buchan: Employee; Clinical Science Development specialist at Philips Healthcare.

B-0678 15:04

Alpha-image reconstruction: a novel iterative image reconstruction algorithm with well-defined image quality metrics applied to clinical CT data

S. Lebedev, S. Sawall, M. Knaup, M. Kachelrieß; *Heidelberg/DE (sergej.lebedev@dkfz-heidelberg.de)*

Purpose: Iterative reconstruction is promising for CT imaging but conventional approaches suffer from a lack of well-defined quality metrics, e.g. modulation transfer function (MTF), and inadequate noise textures. To overcome these issues we designed the alpha image reconstruction (AIR) algorithm and want to highlight its favorable image quality using an optimized version of the algorithm applied to clinical data.
Methods and Materials: AIR uses multiple basis images, each reconstructed using the original data, preferably with mutually exclusive image properties. We use FBP reconstructions with different reconstruction kernels. AIR performs a voxel-wise blending between the basis images with weighting coefficients (alpha-images) being determined iteratively by maximizing the rawdata agreement of the resulting image. This allows for a combination of desired properties from all basis images, i.e. high spatial resolution and low noise. We improved AIR's performance towards clinical feasibility using an ordered-subset approach and quantified its image quality using classical metrics in simulations and measured patient data.
Results: The images show low noise and simultaneously high spatial resolution. This combines mutually exclusive properties while the MTF is the linear combination of the MTFs found in the basis images. The choice between well-defined basis images provides an intuitive way of control. Dose reduction values of up to 40 % were achieved.
Conclusion: AIR results in images with high diagnostic quality. Using an ordered-subsets approach, a favorable computational performance was achieved. AIR could easily be integrated into clinical systems and can be applied to improve image quality and to significantly reduce patient dose.

B-0679 15:12

Iterative model reconstruction and hybrid iterative reconstruction techniques in liver CT for evaluation of hepatocellular carcinoma: comparison of image quality in the detection of hypervascular hepatocellular carcinoma

H. Park, J. Lee, S. Park, J. Lee, Y.-K. Jeong; *Seoul/KR (seolly1024@gmail.com)*

Purpose: To evaluate image quality of relatively low-dose liver CT (RLCT) with knowledge-based iterative model reconstruction (IMR) algorithm compared to CT using different levels of radiation dose and different reconstruction algorithms in patients with hepatocellular carcinoma (HCC).
Methods and Materials: 29 patients with RLCT and 27 with standard-dose liver CT (SDCT) who had been confirmed as HCCs were enrolled. Images were reconstructed with FBP, hybrid iterative reconstruction, IMR algorithm. Mean noise of various sites were measured, and contrast-to-noise ratios (CNRs) of HCC to liver on arterial phase (AP) and 3-min delay phase (DP), main portal vein (MPV) to liver were measured.
Results: The reduction of CTDIvol in RLCT was 23.6% compared to SDCT ($P < 0.001$). All image qualities in RLCT using IMR were higher than those in RLCT using others. Image noise in RLCT using IMR was significantly lower compared with SDCT using FBP and iDose. RLCT using IMR showed significantly higher CNRs of HCC to the liver on DP and the MPV to the liver, and comparable CNRs of HCC to the liver on AP compared with SDCT using FBP and iDose. Although images with IMR showed plastic appearance, RLCT images with IMR were significantly superior to SDCT images with FBP and comparable or superior to SDCT images with iDose regarding image quality, lesion conspicuity, and image noise.
Conclusion: RLCT reconstructed with IMR yielded improved image quality and comparable or superior CNR to RLCT and SDCT reconstructed with FBP, iDose algorithm for evaluation of HCC with considerable noise reduction.

B-0680 15:20

The influence of the orbital bone density on the eye-lens dose in dental CBCT

A. Stratis, G. Zhang, R. Jacobs, R. Bogaerts, H. Bosmans; *Leuven/BE (andreas.stratis@uzleuven.be)*

Purpose: To investigate the influence of orbital bones on eye-lens dose for two dental Cone Beam CT imaging protocols; an upper jaw protocol where the eyes are outside the Field of View and a facial protocol where the eyes are into it.
Methods and Materials: The jaw protocol was simulated to examine the shielding properties of the orbit against scatter radiation whereas the facial investigated the absorption of stray radiation and the beam hardening effect of the orbit. A fully validated Monte Carlo framework was used to model a Planmeca-Promax-3D-Max CBCT system. Simulations were performed with the Zubal head and the ICRP female voxel phantoms. To account for variations in bone density, thickness or pathology across population, a series of simulations were carried out by using different bone densities.
Results: Facial protocol analysis showed that while density decreases from 2.2 to 1.2 g/cm3, eye-lens dose increases by 10.12% with ICRP (pearson-correlation-coefficient, r= -0.915) and by 9.95% with Zubal phantom (r=-0.933). Jaw protocol analysis highlights the shielding role of orbit against scatter radiation revealing a substantial six-fold dose increase for the same density reduction (r=-0.987 for Zubal, r=-0.991 for ICRP).
Conclusion: The orbit significantly contributes to eye-lens protection against scatter radiation (jaw protocol). When the eyes are within the FOV (facial protocol), the lens-dose is mainly influenced by the primary beam as the tube crosses the solid angle in front of the eyes. An efficient way for dose reduction would be to stop tube exposure at those angles during rotation.

14:00 - 15:30 **Room D1**

Chest

SS 704

Lung cancer: screening and staging

Moderators:
F. Gleeson; Oxford/UK
T. Henzler; Mannheim/DE

K-16 14:00

Keynote lecture

P.A. Grenier; *Paris/FR*

B-0681 14:09

Diagnostic performance of ultra-low-dose computed tomography for detecting asbestos-related pleuropulmonary diseases: prospective study in a screening setting

M. Schaal, F. Severac, A. Labani, M.-Y. Jeung, C. Roy, M. Ohana; *Strasbourg/FR (marysa.jehl@gmail.com)*

Purpose: To evaluate the diagnostic performance of ultra-low-dose chest-CT (ULD-CT) for the detection of lung and pleural asbestos-related lesions (primary endpoint) and specific abnormalities, e.g. pleural plaques, visceral pleura thickening, asbestosis and significant lung nodules (secondary endpoints).
Methods and Materials: Monocentric prospective study on 55 male patients (55.7 ±8.1 years old) with occupational asbestos exposure for at least 5 years. Patients underwent a standard unenhanced chest CT (120 kV, automated tube current modulation), considered as the reference, and an ULD-CT (135 kV, 10 mA), both using iterative reconstruction.Two radiologists independently and blindly read the examinations; discrepant cases were reviewed by a third reader.
Results: Radiation dose was evidently lower (17.9 mGy.cm ±1.2 versus 288.8 mGy.cm ±151; $p \leq 2.2e^{-16}$). Prevalence of abnormalities was 20%. The ULD-CT's diagnostic performance in joint reading was top-notch for the primary endpoint (sensibility = 90.9%, specificity = 100%, positive predictive value = 100%, negative predictive value = 97.8%), with only one false negative. In details, ULD-CT was perfect for lung nodules, visceral pleura thickening and calcified pleural plaques but only fair for asbestosis. Intra-reader accuracy between the ULD-CT and the reference CT for the primary endpoint was 98% for the senior and 100% for the junior radiologist.
Conclusion: ULD-CT accurately depicts asbestos-related diseases and can therefore be proposed as a first-line screening tool, completed by a reference standard dose CT only in doubtful or positive cases. This would allow a reduced radiation dose of nearly 75% for the screening population.

B-0682 14:17

Pleural abnormalities in lung cancer screening trial: prevalence, features, and relation with cancer

M. Silva[1], N. Sverzellati[1], D. Colombi[1], C. La Vecchia[2], C. Galeone[2], A. Marchiano[2], U. Pastorino[2]; [1]*Parma/IT*, [2]*Milan/IT (mariosilvamed@gmail.com)*

Purpose: To describe pleural findings in lung cancer screening participants, to compare asbestos-related pleural findings with self-reported asbestos exposure, and to evaluate relation with lung cancer.
Methods and Materials: Pleural abnormalities were reviewed in 2303 baseline low-dose computed tomography (LDCT) and divided into two categories: "specific" associated to pleural plaques or diffuse pleural thickening, and "unspecific" if otherwise. Pleural abnormalities and concomitant parenchymal findings were visually scored according to LDCT features. Self-disclosure of asbestos exposure was collected from each participant. Frequency of lung cancer was detailed according to presence of pleural findings. Statistical

analyses included comparison of mean or median, contingency tables, and odds ratio (OR) of lung cancer.
Results: 193/2303 (8.4%) participants showed pleural abnormalities, with 27/2303 (1.2%) subjects with specific and 166/2303 (7.2%) with unspecific pleural findings. 42/193 (21.2%) showed parenchymal abnormalities, with positive association to specific pleural findings (p=0.02). 150/2303 (6.5%) subjects disclosed asbestos exposure,with the highest frequency in subjects with specific pleural findings (6/27; 22.2%). Frequency of lung cancer was similar between subjects with or without pleural abnormalities (p=0.39). Lung cancers were 2/27 (7.4%) in subjects with specific and 5/166 (3.0%) with unspecific pleural findings (p=0.31). Parenchymal abnormalities were significantly associated with risk of lung cancer (OR 12.42).
Conclusion: Risk of lung cancer was not related to pleural abnormalities, either specific or unspecific. Parenchymal abnormalities were a risk factor for lung cancer among subjects with pleural abnormalities. The majority of subjects with specific pleural findings were not aware of asbestos exposure. LDCT findings should be integrated in models of lung cancer risk.

B-0683 14:25

Parametric response mapping in lung cancer screening subjects with and without COPD

E. Pompe[1], E.M. van Rikxoort[2], L. Gallardo Estrella[2], M. Oudkerk[3], H.J. de Koning[4], J.-W.J. Lammers[1], B. van Ginneken[2], P.A. de Jong[1], F.A.A. Mohamed Hoesein[1]; [1]*Utrecht/NL*, [2]*Nijmegen/NL*, [3]*Groningen/NL*, [4]*Rotterdam/NL (e.pompe@umcutrecht.nl)*

Purpose: Detailed imaging of smoking related changes on chest computed tomography (CT) of lung cancer screening participants could improve individual treatment and prognostic information. We investigated the value of CT based parametric response mapping (PRM) in quantifying emphysema, airway wall thickening and air trapping.
Methods and Materials: We included current and former smokers who participated in a lung cancer screening trial. They underwent in- and expiratory CT and lung function tests. Emphysema and small airway disease were assessed by PRM (PRMEmph and PRMfSAD, respectively) and results were compared with the 15th percentile (Perc15) as measure for emphysema, airway lumen perimeter (Pi10) to measure airway wall thickening (large airway disease) and the Expiratory/Inspiratory-ratioMeanLungDensity (E/I-ratioMLD) to assess air trapping (small airway disease).
Results: 1,070 male subjects with a mean age of 62.4 (5.1) years were included. Median (25th- 75th percentile) PRMEmph was 0.96% (0.41 - 2.33) of the total lung volume and median PRMfSAD was 12.71% (8.61 - 18.73). Both measures were significantly different between subjects with and without COPD ($p < 0.001$). PRMEmph correlated better with FEV1 than Perc15 ($r = 0.32$ and $r = -0.15$, respectively), while Pi10 and E/I-ratioMLD correlated better with FEV1 than PRMfSAD ($r = -0.55$, $r = -0.38$ and $r=-0.35$, respectively), all $p < 0.001$.
Conclusion: Our study showed that PRM provides information on smoking related changes in lung cancer screening participants. It gives more information on emphysema than current emphysema measurements. It however does not provide more information on small airway disease than currently used measures.

B-0685 14:33

Screening for lung cancer using ultra-low dose computed tomography with Iterative model reconstruction algorithm

M. Zhang, Y. Sun, W. Qi, Y. Jiang, Y. Liu, N. Hong; *Beijing/CN (zhangmiao0801@126.com)*

Purpose: To investigate the ultra-low dose (ULD) protocol in lung cancer screening with knowledge-based iterative reconstruction technique (IMR, Philips Healthcare) compared with routine low dose (LD) chest CT.
Methods and Materials: Low dose chest CT scans were acquired using a 256-slice CT scanner for 102 subjects with BMI less than 30 kg/m2 who were randomly assigned into 2 groups (51 for each). The scan protocol for ULD group was 120 kVp/17 mAs while the LD group was 120 kVp/30 mAs. All images were reconstructed with FBP, iDose4 and IMR algorithms, respectively. Effective dose (ED) was recorded. Image quality assessments were performed by 2 radiologists according to the features of structure demarcation, noise and artifacts using a 5-point scale. Standard deviation (SD) of CT attenuation in the descending aorta was measured as objective image noise. In addition, the detection rate of solid and non-solid nodules of both groups with different reconstruction algorithms were calculated and compared.
Results: The effective dose (ED) of ULD group (0.66±0.04mSv) was about 47% reduced compared with LD-group (1.24±0.07mSv) ($P < 0.01$). IMR improved image quality and reduced image noise significantly than iDose4 and FBP in both ULD and LD groups (all, $p < 0.01$).
There was no difference of detection rate among different algorithms in both groups for nodules with diameters larger than 4 mm, however, IMR enabled a higher detection rate compared to iDose4 and FBP for nodules with diameters less than 4 mm in ULD groups ($p < 0.05$).
Conclusion: IMR may improve the diagnostic accuracy of ultra-low dose CT lung screening with potential detection rate improvement.

B-0686 14:41

Comparison of diagnostic capability for N-stage in non-small cell lung cancer patients with DWI using EPI sequence at 3 T and FDG-PET/CT

Y. Ohno[1], S. Seki[1], H. Koyama[1], Y. Kassai[2], M. Yui[2], T. Yoshikawa[1], S. Matsumoto[1], K. Sugimura[1]; [1]*Kobe/JP*, [2]*Otawara/JP (yosirad@kobe-u.ac.jp)*

Purpose: To compare the diagnostic capability for N-stage among diffusion-weighted MR imaging using fast advanced SE (FASE-DWI) and EPI (EPI-DWI) sequences and PET/CT in non-small cell lung cancer (NSCLC) patients.
Methods and Materials: 66 consecutive operable NSCLC patients prospectively underwent FASE-DWI and EPI-DWI at a 3 T system, integrated PET/CT, surgical treatment and pathological and follow-up examinations. Then, probability of lymph node metastasis at each station was visually assessed by a 5-point visual scoring system. To compare diagnostic capability among all methods, ROC analyses were performed. Then, diagnostic performance was also compared each other by McNemar's test on a per node basis. Finally, diagnostic capabililty of the N-stage was also statistically compared each other by McNemar's test.
Results: Area under the curve (Az) of FSE-DWI ($Az=0.89$) was significantly larger than that of EPI-DWI ($Az=0.77$, $p < 0.0001$) and PET/CT ($Az=0.83$, $p=0.03$). On a per node basis, sensitivity (SE) and accuracy (AC) of FASE-DWI (SE: 80.0 %, AC: 95.3 %) were significantly higher than those of EPI-DWI (SE: 56.0 %, $p < 0.0001$; AC: 91.5 %, $p < 0.0001$) and PET/CT (SE: 72.0 %, $p < 0.0001$; AC: 94.0 %, $p < 0.0001$). While assessing N-stage, sensitivity (96.9 %) and accuracy (95.3 %) of FASE-DWI were significantly higher than those of EPI-DWI (SE: 75.0 %, $p=0.02$; AC: 86.0 %, $p=0.03$) and PET/CT (SE: 75.0 %, $p=0.02$; AC: 86.0 %, $p=0.03$).
Conclusion: DWI using FASE is more sensitive and accurate than DWI using EPI and PET/CT for N-stage assessment in NSCLC patients.

Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems Corporation, Bayer Pharma, Eizai Co., Daiichi Sankyo Co. Ltd. **Y. Kassai:** Employee; Toshiba Medical Systems Corporation. **M. Yui:** Employee; Toshiba Medical Systems Corporation. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **K. Sugimura:** Research/Grant Support; Toshiba Medical Systems Corporation.

B-0687 14:49

Multifunctional assessment of NSCLC using whole-body MRI with DWI and 18 F-FDG-PET/CT: correlation between ADC and metabolic volumetric and non-volumetric parameters

L. Calandriello, A.R. Larici, M. Ciliberto, A. del Ciello, L. Leccisotti, A. Giordano, L. Bonomo; *Rome/IT (lcalan@hotmail.it)*

Purpose: To correlate quantitative parameters obtained by diffusion-weighted imaging (DWI) and 18 F-FDG PET/CT in patients with NSCLC.
Methods and Materials: 34 patients with histologically proven NSCLC underwent whole-body MRI (WBMRI) including DWI (b values= 0-1000 s/mm2) and 18 F-FDG-PET/CT within two weeks. Mean apparent diffusion coefficient (ADCmean) and minimum ADC (ADCmin) of all primary lesions were calculated on DWI sequences. Non-volumetric metabolic parameters, including SUVmax and SUVmean, and volumetric metabolic parameters, including metabolic tumour volume (MTV) and total lesion glycolysis (TLG) obtained with a threshold of 40% of the maximum SUV were calculated for all primary lesions on 18 F-FDG PET/CT exams. Correlation between 18 F-FDG PET/CT and DWI parameters was assessed using Pearson's correlation coefficient.
Results: Mean ADCmean value was 1.26 (range: 0.75 - 1.59). Mean ADCmin value was 0.76 (range: 0.26 - 1.16). Mean SUVmax value was 9.6 (range: 2.8 - 18.4). Mean SUVmean value was 5.63 (range: 1.3 - 11.6). Mean MTV value was 24.8 (range: 4.7 - 73.1). Mean TLG value was 165.5 (range: 6.63 - 562.87). A significant negative correlation was found between SUVmax and ADCmin ($r=-0.48$; $p=0.05$), SUVmean and ADCmin ($r=-0.50$; $p=0.04$) and TLG and ADCmin ($r=-0.52$; $p=0.03$).
Conclusion: We found a significant negative correlation between ADC values derived by WBMRI with DWI and metabolic parameters derived by PET/CT showing a possible relationship between tumour glucose metabolism and tumour cellularity. ADC values could be used for a better lesion characterization and might represent a marker for prognostic stratification and treatment response assessment in patients with NSCLC.

B-0688 14:57

Sequential dynamic PET and dynamic MR imaging in N-staging of lung cancer patients

P. Flechsig, H. Zabeck, C.-P. Heußel, H.-U. Kauczor, U. Haberkorn, F. Giesel; *Heidelberg/DE*

Purpose: For therapy stratifications, staging of lung cancer is typically performed with FDG-PET/CT. In the context of new established integrated PET/MR-scanners, the combination of well established dynamic contrast enhanced (DCE) MRI imaging with dynamic PET might be an upcoming imaging modality. In order to evaluate potential perfusion changes between benign and malignant lymph nodes in lung cancer patients, DCE MRI was correlated to microcirculatory and sub cellular dynamic parameters in FDG-PET/CT.
Methods and Materials: According to the clinical routine, a total number of 14 patients with lung cancer were examined sequentially with FDG-PET/CT (Siemens Biograph 6) and DCE MRI (Gadovist®, Bayer, Germany; Siemens Magnetom Aera, 1.5T) prior to surgery. Findings were correlated to the histological gold standard.
Results: 14 lymph nodes (four malignant, ten benign) could clearly be histological analyzed and were correlated with findings in MRI and PET/CT. In DCE MRI, malignant lymph nodes showed early and generally increased perfusion values compared to benign ones, with typical signs for washout 60 seconds after contrast injection. Benign lymph node reached the typically plateau phase after 60 seconds with steady state during the first 180 seconds. This correlated well with microcirculatory and sub cellular parameters in dynamic PET according to a two compartment model, especially with changes in k3 and k4.
Conclusion: The sub cellular parameters k3 and k4 in dynamic PET are correlating with changes in DCE MRI, indicating k3 and k4 as potential surrogate parameter for malignant lymph node infiltration in lung cancer patients

B-0689 15:05

Dynamic contrast-enhanced perfusion area-detector CT in non-small cell lung cancer patients with chemoradiotherapy: influence of mathematical model to early prediction of recurrence

Y. Ohno[1], S. Seki[1], H. Koyama[1], T. Yoshikawa[1], S. Matsumoto[1], Y. Fujisawa[2], N. Sugihara[2], K. Sugimura[1]; [1]*Kobe/JP*, [2]*Otawara/JP (yosirad@kobe-u.ac.jp)*

Purpose: To determine the influence of mathematical method on dynamic contrast-enhanced (CE-) perfusion area-detector CT (ADCT) to early prediction of recurrence in non-small cell lung cancer (NSCLC) patients with chemoradiotherapy.
Methods and Materials: 66 consecutive stage IIIB NSCLC patients underwent dynamic CE-perfusion ADCT examinations, chemoradiotherapy and follow-up examinations. Dynamic CE-perfusion ADCT examinations were performed at 2 weeks prior to treatment and third course of chemotherapy. According to RECIST criteria, all patients were divided as follows: partial response (PR) group and stable and progressive diseases (SD+PD) group. In this study, three mathematical models were applied to calculate perfusion ADCT indexes. Tumour perfusions were determined by dual- and single-input maximum slope methods, and extraction fraction and distribution volume were assessed by Patlak plot method. For early therapeutic effect assessment in each patient, differences between two time points at all targeted lesions were averaged as final value of each index. To compare each index between two groups, Student's t-test was performed. To determine the utility of each index for early prediction of recurrence, each perfusion index was compared recurrence free survival between responders and non-responders by Kaplan-Meier method.
Results: All indexes except extraction fraction had significant differences between two groups ($p < 0.05$). Recurrence free survivals of tumour perfusion by dual-input maximum slope method and distribution volume showed significant differences between responders and non-responders ($p < 0.05$).
Conclusion: Early recurrence prediction capability on dynamic CE-perfusion ADCT is significantly affected by mathematical models in NSCLC patients with chemoradiotherapy.

Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems, Bayer Pharma, Daiichi Sankyo Co. Ltd., Grants-in-Aid for Scientific Research, Japan Society for the Promotion of Science. **T. Yoshikawa:** Grant Recipient; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **Y. Fujisawa:** Employee; Toshiba Medical Systems Corporation. **N. Sugihara:** Employee; Toshiba Medical Systems Corporation.

B-0690 15:13

Value of computerised 3D shape analysis in differentiating encapsulated from invasive thymomas

J. Lee, C. Park, S. Park, J. Bae, S. Lee, J. Goo; *Seoul/KR (lee87jh@gmail.com)*

Purpose: To retrospectively investigate the additional value of quantitative 3D shape analysis in differentiating encapsulated from invasive thymomas.
Methods and Materials: From February 2002 to October 2013, 53 patients (25 men and 28 women; mean age, 53.94±13.13 years) with 53 pathologically-confirmed thymomas underwent preoperative chest CT scans (slice thicknesses < 2.5 mm). Twenty-three tumours were encapsulated and 30 were invasive thymomas. Their clinical and CT characteristics were evaluated. In addition, each thymoma was manually-segmented from surrounding structures, and their 3D shape features were assessed using an in-house developed software program. To evaluate the additional value of 3D shape features in differentiating encapsulated from invasive thymomas, logistic regression analysis and receiver-operating characteristics curve (ROC) analysis were performed.
Results: Significant differences were observed between encapsulated and invasive thymomas, in terms of cystic changes (p=0.004), sphericity (p=0.016), and discrete compactness (p=0.001). Subsequent multivariate logistic regression analysis revealed that absence of cystic change (adjusted odds ratio (OR) = 7.619; p=0.005) and higher discrete compactness (OR= 1.084; p=0.005) were significant differentiators of encapsulated from invasive thymomas. ROC analyses revealed that the addition of 3D shape analysis to clinical and CT features (AUC, 0.836; 95% CI, 0.729-0.943) provided significantly higher performance in differentiating encapsulated from invasive thymomas than clinical and CT features (AUC, 0.701; 95% CI: 0.560-0.843) (p=0.009).
Conclusion: Addition of 3D shape analysis, particularly discrete compactness, can improve differentiation of encapsulated thymomas from invasive thymomas.

14:00 - 15:30 **Room D2**

Interventional Radiology

SS 709a

TIPS and portal vein intervention

Moderators:
A. Krajina; Hradec Králové/CZ
A. Massmann; Homburg/DE

B-0691 14:00

Comparison of hepatic venous pressure gradient and endoscopic grading of oesophageal varix

E. Lee[1], Y. Kim[1], S. Yang[2], D. Goo[1], J. Hwang[1], S. Hong[1], J. Hwang[1], H.-J. Kim[1]; [1]*Seoul/KR*, [2]*Gumi/KR*

Purpose: To determine correlation between hepatic venous pressure gradient and endoscopic grade of oesophageal varix.
Methods and Materials: This retrospective study was approved by the institutional review board of our institution and performed from September 2009 to March 2013. Total 176 times of measurement of hepatic venous pressure gradient (HVPG) were done for 146 patients. Each HVPG was measured two times with use of end whole catheter (EH-HVPG) and balloon catheter (B-HVPG) technique. HVPG was compared with endoscopic grade of oesophageal varix (according to General rules for recording endoscopic findings of oesophagogastric varices), which were performed within a month before or after measurement of HVPG.
Results: The study included 109 men and 36 female, with a mean age of 56.1 years (range; 43-76y). Mean HVPG was higher in B-HVGP (EH-HVPG, 15.3 mmHg, B-HVGP 16.5 mmHg, $p < 0.000$). Portal hypertension (> 12 mmHg) was found 66% in EH-HVPG and 83% in B-HVGP, respectively. The number of endoscopy was 163, which showed 16 cases of normal findings and endoscopic grade of oesophageal varix appeared as 28 cases of grade 1, 67 cases of grade 2 and 52 cases of grade 3. On comparison of endoscopic oesophageal variceal grade and HVPG with univariate analysis, *P* value appeared as 0.004 in EH-HVPG and 0.002 in B-HVPG.
Conclusion: Both EH-HVPG and B-HVPG show positive correlation with endoscopic grade of oesophageal varix. B-HVPG shows stronger correlation with endoscopic grade of oesophageal varix than EH-HVPG (P=0.002).

B-0692 14:08

Towards a turning point in gastric varices treatment: modified balloon-occluded retrograde transvenous obliteration

M.-Y. Chang, M. Kim, S. Lee, G. Kim, J. Won, S. Park, D. Lee; *Seoul/KR (mysfavorite@yuhs.ac)*

Purpose: To evaluate the feasibility, safety, and clinical outcomes of modified balloon-occluded retrograde transvenous obliteration (mBRTO) to treat gastric variceal (GV) hemorrhage in patients with portal hypertension.
Methods and Materials: From August 2012 to June 2014, 19 patients who underwent mBRTO for GV with a vascular plug and gelfoam pledgets were included. A vascular plug was deployed on the stenotic portion of the gastrorenal shunt and embolization of the GV using gelfoam pledgets was performed. Follow-up computed tomography was performed to confirm GV obliteration. Clinical and laboratory data were examined to evaluate technical success, complications, clinical success, Change of liver function, and worsening of esophageal varices.
Results: Technical success (complete occlusion of the efferent shunt and complete GV thrombosis) was demonstrated in 18 (94.7%) of 19 patients. The clinical success rate (no recurrence of GV bleeding) was also 94.7%, because the technically failed Patient showed recurrent GV bleeding 4 months later. Complete GV obliteration was confirmed in all other patients. Some patients showed acute complication including leukocytosis (n=3, 15.8%), fever and hypotension (n=1.0.05%), which was treated with antibiotics and fluid resuscitation. During the mean follow-up duration of 8 months, eight (42.1%) of 19 patients underwent follow-up endoscopy that revealed GV improvement, but worsening of esophageal varix in some (n=3). Laboratory findings including coagulation profile and Serum albumin, ammonia, and total bilirubin levels were improved after the procedure.
Conclusion: mBRTO is technically feasible, safe, and effective for the treatment of GV.

B-0693 14:16

Fast balloon-occluded retrograde transvenous obliteration using n- butyl cyanoacrylate after foam sclerosants for gastric varices

J. Koizumi, C. Itou, T. Hara, T. Sekiguchi, N. Mori, S. Ono, T. Ichikawa, C. Tanaka, Y. Imai; *Isehara/JP (jkoizumi@is.icc.u-tokai.ac.jp)*

Purpose: To obtain complete thrombosis of gastric varices (GV) and to prevent pulmonary embolism, long balloon occlusion is desirable during balloon-occluded retrograde transvenous obliteration (BRTO). However, long cannulation is a burden for patients and risky for unstable patients. Thus, we applied n- butyl cyanoacrylate (NBCA) plug instead of long balloon occlusion.
Methods and Materials: After temporary balloon occlusion at the gastro- renal shunt (GRS), foam sclerosant (3% polidocanol five times diluted by air) was injected and C-arm CT was performed to confirm the reach of sclerosant into GV in 36 patients. Eighteen of 36 patients, NBCA plug was injected a few centimeters away from the balloon via a microcatheter. After confirming the immobilization of the plug at balloon deflation, the whole system was retrieved. In other eighteen patients, balloon was kept inflated until complete hemostasis was obtained after balloon deflation at least a few hours. The fluoroscopy and whole procedure times were compared in without vs. with plug. Whether GV were thrombosed or not was investigated by postcontrast CT a few days after BRTO.
Results: 47.0±10.8% of 1.5±0.6 mL glue was injected. The fluoroscopy and procedure times were 32.4±18.9 vs. 49.7±41.1 minutes (p=0.271) and 919.6±566.4 vs.112.8±63.0 minutes ($p < 0.01$) in without vs. with plug. In one patient partial migration of glue cast occurred at balloon deflation without any symptom. Each one patient with and without plug required antegrade obliteration (94.4% of success rates in both groups).
Conclusion: NBCA plug allowed fast BRTO maintaining similar success rates.

B-0695 14:24

Long-term outcome of expandable-polytetraethylene (e-PTFE) covered stents for transjugular intrahepatic portosystemic shunts (TIPS)

B. Geeroms, W. Laleman, S. Heye, C. Verslype, F. Nevens, G. Maleux; *Leuven/BE (barbara.geeroms@student.kuleuven.be)*

Purpose: To retrospectively analyse the long-term primary patency and overall survival of cirrhotic patients with severe portal hypertension-related symptoms, treated with TIPS using e-PTFE-covered stents (Viatorr®, W.L. Gore, Flagstaff, AZ, USA). Additionally, prognostic factors for patency and survival were analysed.
Methods and Materials: From August 2000 till December 2013, 285 consecutive cirrhotic patients with severe portal hypertension-related symptoms were included in the study. Follow-up performed by regular clinical evaluation was analysed up to January 2014, the patient's death, liver transplantation or TIPS reduction. Patency rates and transplant-free survival were estimated by the Kaplan-Meier method; potential differences in outcome between subgroups were calculated with the Pepe and Mori test.
Results: The 1-, 2-, and 5-year primary patency were 91.5%, 89.2% and 86.2%, respectively, with no new shunt dysfunctions after 5 years of follow-up. TIPS revision was performed more often in ascites versus bleeding patients (P=0.02). The 1-, 4- and 10-year survival rates were 69.2%, 52.1% and 30.7%, respectively. Survival was higher in Child-Pugh A-B versus C class (P=0.04), in the recurrent bleeding group versus refractory ascites group versus refractory bleeding Group (P=0.008) and in patients with underlying alcoholic cirrhosis versus non-alcoholic cirrhosis (P=0.01).
Conclusion: On the long term, primary patency of e-PTFE-covered TIPS stents remains very high (> 80%); shunt revision was required only during the first 5 years after TIPS procedure and more frequently in ascites patients. Overall survival was better in Child-Pugh A-B patients with recurrent variceal bleeding and alcoholic liver cirrhosis.

B-0696 14:32

Digital subtraction angiography during TIPS creation or revision: data on radiation exposure and image quality obtained using a standard and a low-dose acquisition protocol in a flat-panel detector-based system

M. D'Amico, R. Miraglia, L. Maruzzelli, C. Tafaro, R. Gerasia, A. Luca; *Palermo/IT (Damicoma@gmail.com)*

Purpose: To determine whether the use of a low-dose acquisition protocol (LDP) in digital subtraction angiography during transjugular intrahepatic portosystemic shunt (TIPS) creation/revision results in significant reduction of patient radiation exposure and adequate image quality, as compared to a default reference standard-dose acquisition protocol (SDP).
Methods and Materials: Two angiographic runs were performed during TIPS creation/revision: the first following catheterization of the portal venous system and the second after stent deployment/angioplasty. Constant field of view, object to image-detector distance, and source to image-receptor distance were maintained in each patient during the two angiographic runs. 17 consecutive adult patients who underwent TIPS creation (n=11) or TIPS revision (n=6) from December 2013 to March 2014 were considered eligible for this single centre, prospective study. In each patient, the LDP and the SDP were used in a random order for the two runs, with each patient serving as his/her own control. The dose-area product (DAP) was calculated for each image and compared. Image quality was graded by two interventional radiologists other than the operator.
Results: In all the runs acquired with the LDP, image quality was considered adequate for a successful procedural outcome. The DAP per image of the LDP was numerically inferior as compared to the DAP per image of the SDP in all patients. The mean reduction in DAP per image was 75.24±5.7% ($p < 0.001$).
Conclusion: Radiation exposure during TIPS creation/revision was significantly reduced by selecting a LDP in our flat-panel detector-based system, while maintaining adequate image quality.

B-0697 14:40

A real-time three-dimensional ultrasound user interface for TIPS: preliminary results

C. Klink[1], C.F. Cuijpers[2], E. Varga[2], J. Banerjee[1], P. Stappers[2], A. Moelker[1], T. van Walsum[1], A. Freudenthal[2]; [1]*Rotterdam/NL*, [2]*Delft/NL (s.klink@erasmusmc.nl)*

Purpose: The intrahepatic puncture is the most challenging and critical step in a transjugular intrahepatic portosystemic shunt (TIPS). We introduce a real-time 3D ultrasound user interface to guide the intrahepatic puncture.
Methods and Materials: A phantom was used simulating intra-hepatic vascular anatomy. With the help of the user interface and electromagnetic tracking equipment to track needle position, participants were asked to perform two intra-hepatic puncture in the phantom using a Rösch-Uchida Transjugular Liver Access Set (Cook Medical) which was fitted with electromagnetic sensors. The total number of punctures per attempt was measured. Furthermore a questionnaire was taken along with an interview.
Results: 19 interventional radiologists and 9 trainees, from 14 nationalities and with various TIPS experience levels, participated. All participants punctured in the target vein. In 48 of 56 trials only one puncture was needed to successfully puncture the target vein. Only once, three puncture attempts were required. The mean overall grade given for the user interface by the participants was 7.8 out of 10. All said that they would use this technique during a TIPS if they had the opportunity. Participants appreciated the visual feedback guiding the puncture; instead of making an estimated guess the user interface allowed them to control and adjust movements.

Conclusion: The test showed that the new user interface provides valuable real-time 3D visualization support to perform the intrahepatic puncture during TIPS placement. Design improvements based on the feedback and elaborate testing (e.g., in vivo) are needed to further improve the user interface.

Author Disclosures:
C. Klink: Research/Grant Support; STW project number 10482. **C.F. Cuijpers:** Research/Grant Support; STW project number 10482. **E. Varga:** Research/Grant Support; STW project number 10482. **J. Banerjee:** Research/Grant Support; STW project number 10482. **P. Stappers:** Research/Grant Support; STW project number 10482. **A. Moelker:** Research/Grant Support; STW project number 10482. **T. van Walsum:** Research/Grant Support; STW project number 10482.

B-0698 14:48

Clinical outcomes of selective variceal coil embolisation during PTFE-covered transjugular intrahepatic portosystemic shunt (TIPS) placement for variceal hemorrhage

C.N. Weber, B.H. Ge, T.W.I. Clark, M.C. Soulen, G.J. Nadolski; *Philadelphia, PA/US (charles.weber@uphs.upenn.edu)*

Purpose: To assess outcomes of selective coil embolization of persistently filling varices during TIPS placement despite normalization of the portosystemic gradient (PSG).
Methods and Materials: Retrospective review of patients with variceal bleeding treated with PTFE-covered TIPS (2002-2013) was conducted. Demographics, MELD, procedural data, primary patency, survival, and episodes of rebleeding were collected. Patients were divided into two groups, those treated with TIPS alone and those treated with coil embolization of persistently filling varices despite normalization of PSG (≤12 mmHg) during TIPS placement. Patients with less than four weeks follow-up were excluded. Clinical success was defined as no further episodes of variceal bleeding during follow-up. TIPS dysfunction was defined as stenosis/occlusion or elevated PSG.
Results: 93 patients received TIPS variceal hemorrhage. Of these, 70 were included in the clinical success analysis; 19 received TIPS plus coil embolization while 51 received TIPS alone. Differences in post-TIPS PSG, age, MELD, primary patency and survival between groups were not significant. TIPS with coil embolization was clinically successful in 17/19 (89%) compared to 47/51 (92%) of patients with TIPS alone (p=0.66). The six patients with rebleeding underwent a total of 12 TIPS venograms, of which 6 in 3 patients revealed patent TIPS with normal PSGs, while the other half revealed underlying shunt dysfunction.
Conclusion: Overall, recurrence of bleeding and shunt dysfunction is low in patients with variceal bleeding treated with TIPS. Patients requiring coil embolization of persistently filling varices despite normalization of PSG during TIPS placement have similar outcomes as those treated with TIPS alone.

B-0700 14:56

Benefit and safety of combined partial splenic artery embolisation to transjugular intrahepatic portosystemic shunt for the treatment of portal hypertension: a pilot study

A. Geffray, J. Pucheux, L. d'Alteroche, M. Sainz Barriga, D. Alison, J.-M. Perarnau; *Chambray-Lès-Tours/FR (arnaudgeffray@hotmail.com)*

Purpose: Thrombocytopenia is often observed in PHT patients with splenomegaly. PSAE improves thrombocytopenia but can increase morbidity, probably caused by portal venous congestion. We evaluated the efficacy and morbidity of non-selective PSAE combined with TIPS placement in PHT related thrombocytopenia patients.
Methods and Materials: TIPS was performed using stents calibrated to obtain an hepatic venous pressure gradient (HVPG) inferior to 12 mmHg. PSAE was performed by non-selectively injecting Embospheres® microspheres (900-1200 µm) in the splenic artery hilum in ten patients.
Results: Indications for thrombocytopenia correction were intraarticular infiltration (n=2), shoulder surgery (n=1), chemotherapy (n=1), antiviral therapy (n=2), colonic mucosectomy (n=1) and recurrent bleeding other than varices haemorrhage (n=3). In 3 cases PSAE was performed in patients having a preceding TIPS, in 2 immediately after TIPS placement and in 5 just before. Platelet count was 51.5±19 G/L before the procedure, 206±126 G/L at M2 and 160±25 G/L at M12. Nine patients kept a platelet count above 100.000. In the remaining patient, a repeated combined procedure corrected the thrombocytopenia. After PSAE, the HVPG decreased from 16±6.6 mmHg to 10.2±4.9 mmHg, allowing to limit the TIPS size to 6 mm in 4 patients. Only two minor complications have been observed: a grade 2 encephalopathy arising after medication with hypnotics and morphine and an ascites infection probably preexistent to the combined procedure.
Conclusion: This combination therapy has been effective and safe for the treatment of thrombocytopenia. It can also allow the realization of a smaller caliber TIPS, thus reducing the risk of iatrogenic encephalopathy.

Author Disclosures:
J. Perarnau: Consultant; Gore and associates.

B-0701 15:04

Portal vein embolisation with histoacryl via an ipsilateral approach is safe and effective

C. Loberg, M. Schmeding, C.K. Kuhl, P. Bruners; *Aachen/DE (cloberg@ukaachen.de)*

Purpose: Portal vein embolization (PVE) is a well established technique to introduce hypertrophy of the future liver remnant in patients, scheduled to undergo extended hemihepatectomy. Histoacryl is an inexpensive and reliable embolizing agent, but difficult to control. Therefore, if Histoacryl is used, usually a contralateral approach is chosen to avoid non-target embolization. However, a puncture route through the contralateral lobe, the future liver remnant, has its own downsides. We therefore evaluated the safety of Histoacryl-based PVE from the ipsilateral approach.
Methods and Materials: Between January 2010 and July 2014 a total 107 PVE (male n= 68/ female n=39), age 22-84y (mean n= 60.37y) of the right portal system were performed via percutaneous transhepatic right-sided approach. Right portal branches (S V-VIII) were embolized with a Histoacryl/ Lipiodol mixture. We recorded the success rates and rates of complications following ipsilateral Histoacryl-based PVE.
Results: In 106 patients, PVE was technically successfull. In one patient, no appropiate access to the right portal system could be established. In 2/ 105 patients (1.8%), Histoacryl/ Lipiodol dislocated into the main portal trunk and caused non-target embolization requiring anticoagulation with prolonged hospitalization for 72 hours. A total 103/ 105 (98.2%) right-sided Histoacryl-based PVE procedures were completed successfully without non-taget embolization. Three patients (3/106), 2.8%) developed severe sepsis after the procedure. A total of 77 patients (72.6%) finally underwent successfull extended hemihepatectomy.
Conclusion: PVE with Histoacryl from an ipsilateral approach is a safe and effective technique to prepare liver surgery. In experienced hands, non-target embolization is rare.

14:00 - 15:30 **Room G**

Genitourinary

SS 707

New frontiers and contrast agents in GU imaging

Moderators:
S. Dudea; Cluj-Napoca/RO
M. Onur; Elazig/TR

B-0702 14:00

Magnetisation transfer MR imaging of normal and abnormal testis: initial experience

A. Tsili, A. Ntorkou, D. Baltogiannis, S. Stavrou, V. Maliakas, N. Sofikitis, M. Argyropoulou; *Ioannina/GR (alexdorkou@hotmail.com)*

Purpose: Magnetization transfer (MT) in MRI provides tissue contrast that depends mainly on the concentration of macromolecules. The MT phenomenon is quantified by MT ratio (MTR). The aim was to determine the MTR values of normal testis and possible variations with age and to assess the feasibility of MTR in characterizing intratesticular lesions.
Methods and Materials: Fifty-nine men were included. In addition to the MR standard protocol, a three-dimensional gradient-echo MT sequence was performed, with/without an on-resonance binomial prepulse. MTR was calculated as: (SIo-SIm)/(SIo)x100%, where SIm and SIo refers to signal intensities with and without the saturation pulse, respectively. Subjects were classified according to their age as: group 1, < 20 years; group 2, men 20-39 years; and group 3, aged 40-75 years. Analysis of variance (ANOVA) followed by the least significance difference test was used to assess possible variations of MTR with age. Comparison between the MTR of normal testis, benign and malignant intratesticular lesions was performed using independent-samples t test.
Results: ANOVA revealed differences of testicular MTR between age groups (F=7.3, p=0.001). Significant differences between groups 1, 2 (p =0.003) and 1, 3 (p < 0.001) were found, but not between 2, 3 (p =0.170). The MTR (in percent) of testicular carcinomas was 55.7+2.9, significantly higher when

compared to that of benign intratesticular lesions (50.7+3.2, p=0.010) and to normal testis (46.2+2.2, p < 0.001).
Conclusion: Based on our preliminary results, normal MTR decreases with advancing age. MTR can be used to differentiate testicular carcinomas from benign intratesticular lesions and normal testis.

B-0703 14:08

Added value of multi-parametric ultrasound (mpUS) in magnetic resonance imaging (MRI)/US fusion-guided biopsy of the prostate in patients with suspicion for prostate cancer

T. Fischer, C. Stephan, A. Maxeiner; *Berlin/DE (thom.fischer@charite.de)*

Purpose: To analyse whether magnetic resonance imaging/ultrasound (MRI/US) fusion-guided biopsy detects more and clinical significant prostate cancer (PCa) in comparison to conventional transrectal US (TRUS)-guided prostate biopsy (PBX). Second, to investigate if multi-parametric (mp) US during MRI/US fusion can further characterise mpMRI suspected lesions according to the prostate MRI reporting and data system (PI-RADS).
Methods and Materials: From January 2012 to January 2014, 169 patients with a median of two negative conventional PBX and / or initially or consistently elevated PSA levels were prospectively included and underwent 3 T mpMRI. Real-time-MRI/US fusion was used to biopsy the mpMRI targeted lesions (n=316). MpUS, including B-mode, Power-Doppler, strain elastography and contrast-enhanced-US (CEUS) was performed to further characterise those lesions and to score by US modalities resulting in a mpUS score. Afterwards, a conventional 10-core PBX was performed. PCa detection based on the results of targeted and conventional PBX were estimated. Performances of single US modalities were analysed. The mpUS score was also investigated for PCa and PI-RADS score prediction.
Results: Among 169 patients, 71 PCa (42%) were detected. From these 71 cases clinically significant PCa (≥ Gleason 4+3=7) were detected exclusively by MRI/US fusion in 22 from 25 cases (88%). The highest sensitivity was observed in CEUS (85%) and elastography (80%). The mpUS score predicts PCa and PI-RADS score with an overall accuracy of 86% and 80%, respectively.
Conclusion: MRI/US fusion-guided PBX detects more clinically significant PCa compared with conventional TRUS. MpUS could confirm tumour aggressiveness by prediction of the highest PI-RADS score.

B-0704 14:16

Cognitive target MRI-TRUS fusion biopsies of MRI detected PIRADS 4 and 5 lesions

P.P. van Westerveld, J.L.J. Vriesema, J.H.W. van den Hout, E.B. Cornel, J. Veltman; *Almelo/NL (p.p.vanwesterveld@gmail.com)*

Purpose: Significant lesions detected on prostate-MRI need to be evaluated by histological biopsy. MRI guided biopsies are limitedly available, time consuming, uncomfortable and costly. TRUS guided target biopsies based on MRI findings are a logical first diagnostic step. Our purpose was to evaluate the performance of cognitive target MRI-TRUS fusion biopsies of MRI detected PIRADS 4 and 5 lesions.
Methods and Materials: 52 consecutive patients in the period from 12/2013-06/2014 with increased PSA and a PIRADS 4 or 5 lesion on MRI (3 T Siemens-skyra, protocol according to ESUR guidelines) were included. All patients target biopsies using TRUS were performed by the same urologist and radiologist with MRI images and structured report available. In patients with a negative biopsy MRI-guided biopsy was advised.
Results: A total of 52 patients were included (16 PIRADS 4 and 36 PIRADS 5 lesions). Mean PSA and PSA-density value was respectively 9.88 (SD 6.1) and 0.20 (SD 0.11). Mean lesion size was 13.95 mm (SD 6.26 mm). 9 PIRADS 4 lesions (56%) were found positive for prostate cancer, 26 PIRADS 5 (72%). Overall 67% of the patients were diagnosed with prostate cancer using cognitive target MRI-TRUS fusion biopsies. The additional MRI-guided-biopsies that were performed from the negative cases proved in 50% to be malignant (0/2 biopsies were positive of the Pirads 4 and 3/4 of the Pirads 5 lesions).
Conclusion: Cognitive target MRI-TRUS fusion biopsies are an effective first step in the evaluation of PIRADS 4 and 5 MRI detected lesions. Additional MRI-Guided-Biopsies of negative results are mandatory.

B-0705 14:24

Computer-assistant histoscanning-targeted prostate biopsies in diagnosis of PCa: a pilot study

A. Fedorova, S. Salnikova, A. Pavlovichev, N. Sokolova, G. Varlamov, A. Zubarev; *Moscow/RU (annyfed@mail.ru)*

Purpose: To evaluate diagnostic possibilities of histoscanning - targeted prostate biopsies.
Methods and Materials: In this prospective study we have observed 90 patients (median age 68.3) with suspicion on PCa and raised PSA (median 11.03 ng/ml). All patients underwent B-mode TRUS and histoscanning. After that, systematic standard scheme (SS) transrectal biopsies from 12 cores and additional targeted (AT) biopsies (with TT Histoscanning program), were performed. The number of biopsy cores varied from 12 to 14. The total number of cores was 1181, among them 18 were additionally targeted by histoscanning.
Results: The overall Se of histoscanning was 88.6%; Sp, Ac, PPV and NPV achieved 56.1%, 68.5%, 55.3% and 88.8% respectively. B-mode revealed only 17.77% of all PCa cases. In 21.5 % histology have found PIN. PCa was detected in 172 of 1181 cores (14.6%). Among them, 137 cores (11.6% from all biopsy cores, 79.65 % from all positive PCa cores) were detected by SS biopsy without histoscanning navigation, and in 11 of 18 cores (1.52% from all biopsy cores, 6.39% from all positive PCa cores), which were received by AT biopsy under histoscanning navigation. AT biopsy helped us to detect PCa in 3 cases, while SS biopsy was negative, that improved detection rate of PCa on 9.67 %.
Conclusion: Inclusion of additional targeted biopsies in standard scheme biopsies can improve final biopsy results, but now it is hard to say that they can be used as a single method to detect prostate cancer. More wide groups of patients should be analyzed.

B-0706 14:32

Feasibility of a pneumatically actuated MR-compatible second generation robot for transrectal prostate biopsy guidance by using the PIRADS classification

D. Yakar, J. Bomers, D. Bosboom, J.J. Fütterer; *Nijmegen/NL (derya.yakar@radboudumc.nl)*

Purpose: The purpose of this study was to assess the feasibility of a remote controlled, second generation MR-compatible, robotic device as an aid to perform transrectal biopsy in the prostate by using the Prostate imaging-reporting and data system (PIRADS) classification.
Methods and Materials: This prospective study was approved by the ethics review board of our institution and written informed consent was obtained. Permission was given for inclusion of 20 patients. Inclusion criteria were; history of at least one negative transrectal-ultrasound (TRUS) guided biopsy, no prior treatment of the prostate, and at least one suspicious prostate lesion with a PIRADS score of 3 or higher detected on diagnostic multi-parametric (MP) MRI images. The MP-MRI comprised T2-weighted, diffusion-weighted, and dynamic contrast-enhanced sequences. Thus far 9 consecutive patients were included in this ongoing study.
Results: A total of 9 prostate lesions with a PIRADS score of 3 or higher were detected in 9 patients on the diagnostic MR images. These lesions were targeted for MR-guided robot assisted biopsy. Median patient age, PSA, previous negative TRUS sessions was 69 years, 11 ng/mL, and 2 sessions respectively. All lesions were reachable for biopsy. Six out of 9 lesions were proven to be prostate cancer (detection rate 67%). Two biopsies contained prostatitis, one contained no abnormality. The median procedure time was 37 minutes. Median manipulation time for needle guide movement was 7.8 minutes. No complications occurred.
Conclusion: It is feasible to perform transrectal prostate biopsy using a remote controlled, MR-compatible, robotic device as an aid.

B-0707 14:40

Angio-uro dynamic functional MRI: difference between this new technique and the traditional investigations in patients with pathology of the urinary tract (work in progress)

A. Viviani, L. Moreschi, E. Ricci, C. Guerra; *Pescia/IT (adriano.viviani@tin.it)*

Purpose: Evaluate the effectiveness of angio-uro dynamic functional MRI in patients with urinary problems; evaluating renal perfusion, the renal vasculature anatomy, the urinary tract, the bladder and the urine flow.
Methods and Materials: 10 patients (mean age 45 years, male), 3 with suspected hypofunctionality of a kidney, 4 with suspected pathology of the ureteropelvic junction and 3 healthy subjects underwent Angio Uro-dynamic functional MRI.The examination was performed with a MRI scanner (GE 1.5 T), basal sequences were performed, subsequently was performed an Angio-MRI of the renal arteries and the renal perfusion. Subsequently, after administration of a diuretic (Lasix ®) was performed the study of the morphology of the urinary tract. At the end of the examination patients were asked to urinate to evaluate the kinetics of emptying the bladder and the urethra study.
Results: The 3 healthy patients were use as control. In the 3 patients with suspected kidney hypofunction the renal perfusion were compared with renal scintigraphy and in all cases the data correlated directly (sensitivity 90%, specificity 95%). Two patients had reduced renal function on the right kidney and one with a marked reduction of renal function on the left side with normal creatinine values. In the 4 patients with urethral stricture the results were compared with the Urethrography (sentitivity and specificity 100%).
Conclusion: In conclusion, Angio-Uro dynamic functional MRI study is a protocol that allows to make the diagnosis of diseases of the urinary system without resorting to traditional methods.

B-0708 14:48

Reproducibility and agreement in quantification of renal function using 1.5-T DCE-MRI

E. Eikefjord, E. Andersen, A. Lundervold, E. Hodneland, J. Monssen, E. Hanson, J. Rørvik; *Bergen/NO (eli.eikefjord@hib.no)*

Purpose: To evaluate reproducibility and intra-subject agreement of single-kidney (SK) perfusion and -filtration rate assessed with DCE-MRI and compare the agreement between total kidney MR-GFR and blood sample GFR.
Methods and Materials: Within ten days twenty healthy volunteers underwent two DCE-MRI examinations and blood samplings of estimated GFR (eGFR) and Iohexol-GFR. A multiple breath-hold FLASH sequence with temporal and spatial resolution of 2.3s and 2.2x2.2x3 mm was acquired. A ROI-based two-compartment renal filtration model was applied on motion corrected DCE-series calculating blood volume (V_b), blood transit time (T_b), tubular flow (F_T), tubular transit time (T_T), blood flow (F_b) and GFR. AIF ROI`s were defined manually, SK-volumes were segmented semi-automatically. MR-SK-perfusion and -GFR were analyzed for intra-subject reproducibility using mean coefficients of variations (CV) and agreement using intra-class correlation coefficients (ICC). Agreement between total MR-GFR, eGFR and Iohexol-GFR were analyzed using Bland-Altman plots.
Results: Mean MR-SK-estimates were: V_b=29.5 mL/100 mL, T_b=4.5s, F_T=31 mL/100 mL/min, T_T=2.6s, F_b=430 mL/100 mL/min and SK-GFR=49.5 mL/min. Intra-subject SK-estimates were reproducible (CV) in the range of 4-28%, differences not being statistical significant. High intra-subject agreement were found in all perfusion estimates (ICC=0.5, p=0.06), lower in filtration parameters (ICC=0.3, p=0.1). MR slightly underestimated total-GFR (mean=99 mL/min,SD20) compared to Iohexol-GFR (mean=105 mL/min,SD10) and eGFR (mean=112 mL/min,SD17), mean difference of -5.9 and 7.1 mL/min, respectively.
Conclusion: DCE-MRI provides renal functional parameters in physiological ranges and total-GFR in good agreement to reference methods. We found good intra-subject agreement in perfusion-estimates but lower agreement in filtration estimates (e.g. GFR). Reproducibility issues need to be further explored before introducing MR-renography into clinical practice.

B-0709 14:56

Arterial spin labeling and T1-mapping allow detection of acute kidney injury in patients after lung transplantation

M.J. Peperhove, D. Hartung, S. Tewes, M.-S. Jang, B. Jüttner, R. Lichtinghagen, G. Warnecke, F. Gueler, K. Hueper; *Hannover/DE*

Purpose: Following lung transplantation (lutx) a majority of patients develops acute kidney injury (AKI). Our purpose was to assess whether perfusion imaging by arterial spin labeling (ASL) and T1-mapping allow detection of AKI in lutx patients.
Methods and Materials: 41 patients and 9 age-matched healthy volunteers underwent MRI on a 1.5 T-magnet 14±2 days after lutx. Flow alternating inversion recovery (FAIR) trueFISP ASL-sequences and modified LL inversion recovery (MOLLI) sequences were acquired and parameter maps of renal perfusion and T1-relaxation times were calculated. ROIs were manually placed into the upper, middle and lower third of renal cortex and mean±SD were calculated. Renal function was monitored by daily s-creatinine measurements. Presence of AKI was diagnosed according to AKIN criteria. Statistical analysis comprised t-test and ANOVA.
Results: 63% (26/41) of lutx patients developed AKI. S-creatinine peaked 1-2 days after surgery and was higher in AKI-patients than in patients without AKI (149±61 vs. 83±20 µmol/L, $p < 0.001$). S-creatinine levels before surgery were normal and comparable between both groups. In lutx patients with AKI renal perfusion compared to healthy volunteers was significantly impaired (225±53 vs. 324±70 ml/(min*100 g), $p < 0.001$). Even patients without AKI showed decreased renal perfusion compared to healthy volunteers (254±57 vs. 324±70 ml/(min*100 g), $p < 0.01$). Additionally, cortical T1-values were significantly higher in patients with AKI to healthy volunteers (1071±89 vs. 985±91 ms; $p < 0.05$).
Conclusion: Renal perfusion is impaired and cortical T1-time is increased in patients early after lutx and thus enable early assessment of renal function and pathology to improve patient management and therapy monitoring.

B-0710 15:04

Distribution profile of gadolinium (Gd) in gadolinium chelate-treated renally impaired rats: role of pharmaceutical formulation

N. Fretellier[1], M. Salhi[1], J. Schroeder[2], T. Chevalier[1], G. Jestin-Mayer[1], J.-F. Mayer[1], B. Bonnemain[1], J.-M. Idée[1], C. Corot[1]; [1]*Roissy/FR*, [2]*Regensburg/DE (ideej@guerbet-group.com)*

Purpose: To investigate the consequences of the presence of small amounts of either "free" gadolinium or low-stability chelating impurity in the pharmaceutical solution of the macrocyclic gadolinium chelate (GC), gadoteric acid in renally impaired rats.
Methods and Materials: Renal failure was induced by adding adenine in the diet. The pharmaceutical solution of gadoteric acid was administered (2.5 mmol Gd/kg/day, 5 days) either alone or after being doped with either "free" gadolinium (i.e. 0.04% w/v) or low-stability impurity (i.e. 0.06 w/v). Gadodiamide was given as its pharmaceutical solution (same dose). Gd citrate was tested at two doses (0.005 and 0.01 mmol Gd/kg).
Results: Gadodiamide-induced systemic toxicity (mortality, acanthosis and dermal lesions) and substantial tissue Gd retention. The addition of very low amounts of "free" Gd or low thermodynamic stability impurity to the pharmaceutical solution of gadoteric acid resulted in substantial capture of metal by the liver, similar to what was observed in free Gd salt-treated rats. Relaxometry studies strongly suggested that the presence of Gd revealed the presence of Gd (insoluble form) in the cytoplasm of the hepatocytes and Kupffer cells of rats treated with gadoteric acid solution doped with low-stability impurity, free Gd and a pharmaceutical solution of gadodiamide, but not in rats treated with the pharmaceutical solution of gadoteric acid.
Conclusion: The addition of very low amounts of "free" (i.e. unchelated) Gd or low thermodynamic stability impurity to the pharmaceutical solution of the stable macrocyclic GC gadoteric acid resulted in substantial capture of the metal by the liver.

Author Disclosures:
N. Fretellier: Employee; Guerbet. **M. Salhi:** Employee; Guerbet. **J. Schroeder:** Grant Recipient; Guerbet. **T. Chevalier:** Employee; Guerbet. **G. Jestin-Mayer:** Employee; Guerbet. **J. Mayer:** Employee; Guerbet. **B. Bonnemain:** Employee; Guerbet. **J. Idée:** Employee; Guerbet. **C. Corot:** Employee; Guerbet.

B-0711 15:12

Nonionic iodinated contrast medium (CM) and risk of nephrotoxicity: results of a prospective study

G.M. Giuseppetti, G. Polonara, S. Galassi, G.M. Frascà, F.P. Gentile, L. Ferrante, E. Skrami, S. Amoroso; *Ancona/IT (sarahgalassi13@gmail.com)*

Purpose: This study proposes to evaluate the risk of nephrotoxicity (CIN) associated to intravenous contrast-enhanced computed tomography.
Methods and Materials: A total of 1000 patients were enrolled consecutively. Nephrotoxicity was defined as 25% reduction of Glomerular Filtration Rate (GFR). The percentage variations occurred on GFR (ΔGFR%), between values measured before and 24 hours after CM administration were calculated. A quantile regression analysis was performed to evaluate the effect of CM type and volume, the presence of cardiovascular diseases and the use of drugs and prophylactic strategies on ΔGFR%.
Results: Overall 615 subjects were eligible. CM median volume was 100 ml (CM volume/weight = 1.4 ml/Kg). The distribution of CM type was 87% Iopamidol, 6.2% Iomeprol, 4.1% Iobitridol, 2% Iopramide, 0.8% Iodixanol. With regard to the most frequent pathologies 34.5% of patients had vascular diseases; 43.3% were hypertensive; 15.5% were diabetic; 9.9% had pre-existing renal disease. 37.2% of subjects took drugs (21.3% diuretics; 18.3% AIIRAs; 17.6% NSAIDs; 10.5% ACE inhibitors); 13.3% received prophylactic strategies.CIN was observed in 1 patient (0.62%) and adverse events in 1% of cases. The pathologies and drugs above mentioned, CM type and volume were not found to be risk factors for the GFR decrease, including patients with Chronic Kidney Disease (CKD).
Conclusion: Preliminary results showed that intravenous CM administration, in everyday practice, was not significantly associated with CIN.

B-0712 15:20

NSsaFe study: determining the incidence of nephrogenic systemic fibrosis after administration of Dotarem in patients with renal impairment

R.G. McWilliams; *Liverpool/UK (Richard.McWilliams@rlbuht.nhs.uk)*

Purpose: To prospectively determine the incidence of nephrogenic systemic fibrosis (NSF) after administration of gadoterate meglumine (DOTAREM®) in patients with renal impairment.
Methods and Materials: Safety data are being collected worldwide for 1000 patients with moderate to severe renal impairment undergoing contrast-enhanced magnetic resonance with DOTAREM®. At inclusion, clinical history, indication for MRI and renal function are recorded, and patients are followed up for over 2 years with 3 visits separated by at least 3 months. During follow-up visits, adverse events (AE) are recorded with particular focus on any symptoms related to NSF. If NSF is suspected then biopsy is performed for confirmation.
Results: As of August 27, 2014, the safety data of 426 patients (mean age: 70.2 years (range: 21-92); male: 60.3%) were available for review. The mean eGFR was 36.9 ±16.2 ml/min/1.73m^2 (range: 4.0-74.2) including 67.6% of moderate, 15.5% of severe, 14.1% of end-stage renal insufficiency and 2.8% of kidney transplanted patients. To date, 226 patients attended the first follow-up visit (between 3 and 12 months after MRI), 129 patients attended the second follow-up visit (between 13 and 21 months after MRI) and 64 patients the third follow-up visit (between 22 and 27 months after MRI). No AE related to DOTAREM® were reported. Three patients (0.7%) had serious adverse

events deemed not related to DOTAREM®. No cases of NSF have been observed.
Conclusion: This interim analysis of the NSsaFe study records no cases of NSF in patients with moderate to severe renal impairment after the administration of DOTAREM®.

14:00 - 15:30 **Room K**

Interventional Radiology

SS 709b

Biopsy techniques and solid tumour ablation

Moderators:
O. Akhan; Ankara/TR
M. Reiter; Vienna/AT

B-0713 14:00

Clinical application of robotic system for CT-guided biopsy of lung lesions in comparison to the manual technique
R. Argirò, M. Anzidei, A. Porfiri, M. Bezzi, M. Anile, F. Venuta, C. Catalano; *Rome/IT (renato.argiro@gmail.com)*

Purpose: To evaluate the clinical performance of a robotic system for CT-guided biopsy of lung lesions in comparison to the conventional manual technique.
Methods and Materials: 100 patients (63 males, 37 females, age range 48-88 years, mean age 65 ±4 years) referred for CT-guided lung biopsy of previously diagnosed lung lesions were randomly assigned to group A (robot-assisted procedure with the ROBIO™ EX system, Perfint Healthcare - India) or group B (conventional procedure). Biopsies were performed by two operators with 2 and 8 years of experience. The size, distance from entry point and position in lung of target lesions were evaluated to assess potential homogeneity differences between the two groups. Procedure duration, dose length product (DLP), precision of needle positioning, diagnostic performance of the biopsy, rate of complications and operator preference were evaluated for significant differences between the two groups to assess the clinical performance of the robotic system as compared to the conventional technique.
Results: All biopsies were successfully performed. The size (p=0.41), distance from entry point (p=0.86) and position in lung (p=0.32) of target lesions were similar in both groups (p=0.05). Procedure duration and radiation dose were significantly reduced in group A as compared to group B (p=0.001). Precision of needle positioning, diagnostic performance of the biopsy and rate of complications were similar in both groups (p=0.05).
Conclusion: Robot-assisted CT-guided lung biopsy can be performed safely and with high diagnostic accuracy, reducing procedure duration and radiation dose in comparison to the conventional manual technique.

B-0714 14:08

Robot-assisted navigation system for CT-guided percutaneous lung lesions procedures: our experience in Hong Kong
C. Chu, S.C. Yu; *Shatin/HK (charmantchu@gmail.com)*

Purpose: To evaluate the new Robot-assisted Navigation System for CT-guided percutaneous lung lesion procedures.
Methods and Materials: Imaging-guided lung procedures are usually challenging due to patient breathing, especially during local anaesthesia procedures. This was prospective study in a university-based hospital. This was assessment of efficacy involving total 50 patients with lung lesions underwent CT-guided percutaneous lung interventions utilizing Robot-assisted Navigation system (Maxio, Perfint Healthcare, USA). Targeted needle pathway was planned on Maxio Robotic system based on pre-procedural CT-scans. Primary endpoint was satisfactory instrument position for intended intervention. Lesion size and depth from skin were noted. Performance level was documented on five-point scale (5-1: excellent-poor). Total radiation doses were recorded and compared against 20 patients with conventional CT-guidance and CT-fluoroscopy lung procedures (ratio 1:1).
Results: There were 38 males and 12 females patients in Robotic group. Average age was 67.8 years (range 38-85). 37 patients underwent lung biopsy while rest had thermal ablation, fiducial-marker insertion or drainge. Average lesion size was 3.0 cm (range 1.2-7.8 cm). Average lesion depth was 5.7 cm (range 2.8-9.3 cm). All interventions met primary endpoint of satisfactory instrument positioning. Average performance levels were 4.76. Average radiation dose (Dose Linear Product) was 575.6 mGycm (range 146.4-2012.7) whereas conventional CT-guidance was 645.4 mGycm (range 285.1-1043.5) and CT-fluoroscopy was 460.1 mGycm (range 214.2-1157.0).
Conclusion: Our experience demonstrated effectiveness of Robot-assisted Navigation system for CT-guided lung lesions interventions with lower radiation dose compared with conventional CT-guided procedures. Radiation doses were larger than CT-fluoroscopy without radiation exposure to interventional radiologists. Targeting success rate for satisfactory intervention was 100%.

B-0715 14:16

Value of contrast-enhanced ultrasound guided percutaneous biopsy in peripheral pulmonary lesions
Y. Dong, W.-P. Wang, F. Mao, B. Huang; *Shanghai/CN (dr_mimi@163.com)*

Purpose: To investigate the value of contrast-enhanced ultrasound (CEUS) in characterization and guidance of percutaneous biopsy in peripheral pulmonary lesions.
Methods and Materials: This study focused on 53 patients (male 38, female 15, mean age, 55.7 years±10.7) with 53 single peripheral pulmonary lesions. All lesions were detected on contrast-enhanced CT, and were proved by pathology as benign lesions (n=7), primary malignancies (n=41) or metastasis (n=5). Before biopsy, CEUS were performed with C5-2 broadband curved transducer of HD11 units (Philips, Bothell, WA, USA) in all lesions, with injection of 2.4 ml SonoVue® (Bracco, Italy). The enhancement patterns, including the begin time of enhancement (BTE), time to peak (TTP), active (obviously enhanced) and necrosis (non-enhanced) areas inner-lesions were recorded.
Results: The mean maximum diameter of peripheral pulmonary lesions was 30.4±7.7 mm (mean ± SD), all lesions were hypoechoic on grey-scale ultrasound. After SonoVue® administration, 93.4% (43/46) malignant and 57.1% (4/7) benign lesions displayed rapid and heterogeneous enhancement ($P < 0.05$). The average BTE of malignant lesions (15±6.5 sec) was significantly later than benign ones (10±2.1sec) ($P < 0.05$). No significant difference was found in TTP. Forty (86.9%) malignant lesions showed necrotic areas. After CEUS, 16 Gauge coarse needle percutaneous biopsies were performed successfully in the active areas of all lesions.
Conclusion: CEUS before biopsy provided diagnostic information about peripheral pulmonary lesions, which helped us to avoid unnecessary biopsy of benign lesions. By depicting active and necrotic area inner-lesion, it is a promising technique for guarantee the accuracy and success of coarse needle biopsy.

B-0716 14:24

CT-fluoroscopy guidance for lung biopsies performed by clinical fellows without prior training: radiation dose and workflow
A. Ghali, P. Rogalla, S. Kandel; *Toronto, ON/CA*

Purpose: To analyze the impact of CT fluoroscopy versus conventional CT guidance of lung biopsies, performed by radiologists (clinical fellows) without prior CT-fluoroscopy experience, on radiation dose and navigation time.
Methods and Materials: Retrospective analysis of 102 consecutive patients referred for CT guided chest biopsies between July to December 2013. All biopsies were performed by 3 clinical fellows with previous experience in conventional CT guided biopsies but none with CT fluoroscopy guidance. CT fluoroscopy was used in intermittent mode for verification of needle position, following incremental needle advancement, to prevent hand exposure to the primary beam. Needle navigation was guided by helical CT mode in 50 patients (Group I) and by CT fluoroscopy in 52 patients (Group II). Patient age, gender, lesion size, site of the lesion, lesion size, depth (skin to lesion, pleura to lesion), complications, navigation time and DLP were recorded. Statistical comparison of values was made using t-test.
Results: Mean patient radiation dose (mGy*cm) was 57.15 (SD: 57.72) in Group.i. (~ 0.97mSv) and 45.70 (SD: 28.5) in Group II (~.078 mSv) ($p < 0.014$). Navigation time of 15 min (SD: 0.01) in Group.i. was significantly longer than in Group II were a time of 9 min (SD: 0.01) was required ($p < 0.0005$). Other parameters did not show significant difference between the two groups.
Conclusion: CT fluoroscopy guided lung biopsies have shorter navigation (hence overall procedure) time and less patient radiation dose despite inexperience in using the technique.

Author Disclosures:
S. Kandel: Research/Grant Support; Toshiba Medical Systems. **P. Rogalla:** Research/Grant Support; Toshiba Medical Systems.

Thursday

B-0717 14:32

Cone-beam CT vs CT in lung ablation procedure: which is faster?

R. Cazzato[1], J. Battistuzzi[2], R. Grasso[1], X. Buy[2], J. Palussiere[2]; [1]*Rome/IT*, [2]*Bordeaux/FR (r.cazzato@unicampus.it)*

Purpose: To compare the duration of targeting and positioning of radiofrequency ablation (RFA) electrode on lung tumours using two different modalities [cone-beam CT (CBCT) vs CT].
Methods and Materials: Patients referred for lung RFA due to primary or metastatic lung tumours were prospectively enrolled and randomised to receive CBCT- or CT-guided RFA. Lesions were stratified in 3 groups (< 10 mm vs 10-20 mm vs > 20 mm). Time needed to target and place the RFA electrode within the lesion was registered and compared in both groups. Occurrence of electrode repositioning, time needed for it, RFA complications and local recurrence after RFA were also investigated.
Results: Forty tumours were treated in 27 patients (19 male, 8 female, 67.25 ± 9.13 years). Thirty (16 under CBCT-guidance and 14 under CT-guidance) RFA sessions were performed. Time required to target and place the RFA electrode was significantly shorted when CBCT-guidance was applied despite lesions size ($p < 0.05$). Electrode repositioning occurred while treating 9/22 (40.9%) tumours under CT-guidance and 6/18 (33.3%) tumours under CBCT-guidance; repositioning was more common when applying CT-guidance. Pneumothorax (PNX) occurred in 12/30 (40%) RFA sessions.
Conclusion: Despite lesion size, CBCT allows faster lung RFA than CT.

B-0718 14:40

Percutaneous thermal ablation of breast cancer metastases in oligometastatic patients: local control and disease-free survival

M. Barral[1], A. Auperin[1], A. Hakime[1], S. Delaloge[1], V. Cartier[1], V. Tacher[1], Y. Otmezguine[2], T. de Baere[1], F. Deschamps[1]; [1]*Villejuif/FR*, [2]*Boulogne Billancourt/FR (matthias_barral@yahoo.fr)*

Purpose: To describe the prognostic factors for the local control rate and the one- and two-year disease-free survival (1- and 2-DFS) after percutaneous thermal ablation therapy (PTAT) in patients with oligometastatic breast cancer.
Methods and Materials: A total of 79 patients with 114 breast cancer metastases involving bones, liver and lung, with a mean diameter of 28.9±16.1 mm [5-86 mm] were treated using PTAT with a curative intent of all metastases. The prognosis factors evaluated were as follows: histological subtype, interval between diagnosis of breast cancer and PTAT, diameter of each metastases at the time of treatment, sum of maximal diameter of all metastases, number of metastases, context of occurrence (synchronous, relapse after complete remission or incomplete response to systemic chemotherapy), progression despite systemic therapy and targeted organ. Local relapse and 1-and 2-DFS were evaluated on cross-sectional imaging according to the onset of enhancement on the ablation scars and to the onset of a new metastases, respectively.
Results: The median follow-up was 18.4 months [RIQ: 8-38 months; range: 53 days-11.5 years]. The local control rate at one and two years was 84.1% and 77.1%. The diameter of the metastases treated was associated with an incomplete local treatment (p=0.034). The 1- and 2-DFS were 55.4% and 31.1%. Triple negative breast cancer metastases were associated with a poorer outcome. There was no post-treatment mortality. The morbidity rate of 15% did not require surgery.
Conclusion: Percutaneous thermal ablation is safe and effective for local control of metastatic breast cancer and is likely to play a major role in future treatment strategies for oligometastatic patients in association with other therapies.

B-0719 14:48

Pancreatic lesions core biopsy - analysis of efficacy and complications

M. Studniarek[1], K. Gwozdziewicz[1], M. Czarnowska-Cubala[1], T. Gorycki[1], P. Szlezak[2]; [1]*Gdansk/PL*, [2]*Bydgoszcz/PL (kgwozdziewicz@wp.pl)*

Purpose: Purpose of this study is to analyze frequency and type of complications after using core needles (16, 18, 20G with 20 mm specimen length) for pancreatic lesions biopsy.
Methods and Materials: In 27 patients a percutaneous core biopsy (CB) of pancreatic tumour (19 solid and 8 mixed) was performed to assess whether these lesion was malignant. In those patients it was impossible to perform the procedure under endoscopic ultrasound guidance. Procedures were monitored under CT fluoroscopy in 5, and US-guided CB in 22 patients. 1 to 3 fragments were taken.
Results: The final diagnosis was established in 85% of cases: in 16 patients pancreatic cancer, 3 with NET, 4 with benign lesions and in 4 patients neoplasm was not confirmed. In 14 patients in obtained material full immunohistochemical diagnostics was established, including CK7, CK8, CK19, CK20, anti-cytokeratin antibodies, chromoganine and synaptophysine, which was expected by oncologist. Possible early complications were observed: pain, bleeding from puncture wound, nausea, pancreatitis, fistula and death. One pancreato-peritoneal fistula was noted, one acute pancreatitis, one prolonged bleeding with hematoma. All patients except one were treated conservatively. In this one patient few consecutive laparotomias were performed, with unsuccessful attempts to repair the fistula, which eventually was successfully treated with endoscopic drainage.
Conclusion: Pancreatic core biopsy is a safe method, allowing to set precise histopathological diagnosis, needed to start proper oncologic treatment. Small percentage (11%) of complications - were not a significant reason for introducing additional treatment, except one case.

B-0720 14:56

Percutaneous microwave ablation (MWA) of renal tumours: intermediate-term results and usefulness of R.E.N.A.L. scoring for predicting outcomes and complications

C. Floridi, L. Nocchi, F. Fontana, A. Ierardi, G. De Marchi, C. Fugazzola, G. Carrafiello; *Varese/IT (chiara.floridi@gmail.com)*

Purpose: We evaluated intermediate-term results after MWA of Renal tumours and retrospectively applied the R.E.N.A.L. (radius, exophytic/endophytic, nearness to collecting system, anterior/posterior and location relative to polar lines) score to renal tumours to determine whether this score correlates with oncological outcomes and complications.
Methods and Materials: Sixty patients with 60 lesions were treated via percutaneous MWA from May 2008 to July 2014. Follow-up (mean 25.7 months, range 3-72 mo). was obtained performing Contrast Enhanced Computed Tomography (CECT) at 1, 3, 6, 12 and 24 months. Technical success (TS), primary technical effectiveness (PTE), secondary technical effectiveness (STE), local tumour progression rate (LTPR), cancer specific survival rate (CSSR), overall survival (OS) were recorded. R.E.N.A.L. tumour scores were recorded to analyze the association between the score and ablation treatment outcomes and complications.
Results: Technical success was 100%, PTE was 95% (3 residual lesions were identified), STE was 100%, CSSR at 1-, 2- and 3-year was 100%; OS at 1-, 2- and 3-year was 100%, 93% and 100%. No major complications were observed. The mean ± SD R.E.N.A.L. nephrometry score of all ablated tumours was 7.7 ± 1.9 (range 4-11). Mean nephrometry score was 7.6 ± 2.2 for tumours with local treatment failure (3/60). Patients with minor complication (5/60) had a mean score of 9.5.
Conclusion: In the intermediate term, percutaneous MWA appears to be a safe and effective treatment for renal tumours. The R.E.N.A.L. nephrometry score could correlate with treatment efficacy and complications but further studies are needed to confirm our experience.

B-0721 15:04

Retrospective comparison between renal tumours treated with RFA and laparoscopic partial nephrectomy

V. Acosta Ruiz, P. Dahlman, E. Brekkan, A. Magnusson, M. Häggman, S. Ladjevardi, M. Lönnemark; *Uppsala/SE (chinilini@hotmail.com)*

Purpose: Nephron-sparing surgery of small renal masses (SRM) can be done by laparoscopic partial nephrectomy (LPN). Radiofrequency Ablation (RFA) has been described as a less invasive treatment alternative. Few studies have compared the results of LPN and RFA treated renal tumours. We aimed to compare RFA and LPN treated SRM with respect to total procedure time, length of hospital stay, complications and treatment results.
Methods and Materials: RFA and LPN treated patients (41 and 36 respectively) were retrospectively compared. Patients were followed between 2007 to 2012 with contrast-enhanced CT scans at 3 (for RFA group only), 6, 12 months and yearly after treatment. Data collection included patient demographics, tumour data (R.E.N.A.L score (RNS), size, histopathological diagnosis), treatment data (total procedure time, hospital stay length, perioperative complications, ablative/operative success) and follow-up results (treatment results).
Results: RFA- and LPN treated tumours did not differ in RNS ($p = 0.41$), patient age ($p = 0.07$) or gender ($p = 0.23$). Both treatment methods had the same final success rate (100% without tumour recurrence). RFA- compared to LPN-treated patients showed a greater technical success rate (98 vs 86%), shorter median total procedure time (166 vs 232 minutes), less postoperative complications (4.8 vs 41.6%) and shorter hospital admission (2 vs 5 days)
Conclusion: Even though RFA treatment may include several treatment sessions, the total procedure time is shorter compared to treatment with LPN. RFA if a safe procedure for patients treated for SRM and has comparable results with LPN.

B-0722 15:12

Radiofrequency ablation of prevertebral sympathetic ganglia in patients with essential arterial hypertension for lowering blood pressure

G. Knyshov, B. Batsak; *Kiev/UA (bats1211@mail.ru)*

Purpose: This study aims to examine the feasibility and safety of radiofrequency ablation prevertebral sympathetic ganglia (RAPS) by the use of a standard electrophysiology (EP) catheter for lowering blood pressure in patient with essential arterial hypertension and hyper sympathetic activity.
Methods and Materials: 31 patients with essential hypertension and hyper sympathetic activity underwent aortography and renal angiography, followed by bilateral RAPS with a standard RF ablation catheter with a 6 Fr diameter. Low-power RF applications have been applied around the renal arteries orifice. Ambulatory (24-h) and office blood pressure recordings were obtained at baseline, 1, 3, 6.12 months after the procedure. In 14 patients, pre- and post-procedural serum measures of renal function and sympathetic activity were obtained: epinephrine; norepinephrine; renin.
Results: Over a 12-month period: 1) the mean systolic/diastolic office blood pressure decreased by -28 ±6 /-14 ±3 mm Hg; 2) the mean systolic/diastolic (24-h) ambulatory blood pressure decreased by -21 ±4 /-11 ±3 mm Hg 2) all patients experienced a decrease in systolic blood pressure of at least 10 mm Hg (range 10 to 55 mm Hg).
Conclusion: Catheter-based RAPS is a novel technique specifically targeting prevertebral sympathetic ganglia. Our preliminary results indicate that the use of a standard RF catheter is feasible and safe for RAPS and shown a significant lowering of mean 24 hour ambulatory BP.Baseline sympathetic activity was the main significant predictor of blood pressure response, whereas no correlation was found between the number of ablation points and the individual changes in office blood pressure.

B-0723 15:20

Laser and radiofrequency ablation in the treatment of benign thyroid nodules

G. Mauri, L. Cova, T. Ierace, A. Baroli, L. Solbiati; *Busto Arsizio/IT (vanni.mauri@gmail.com)*

Purpose: To compare our results in the treatment of benign thyroid nodules with percutaneous laser ablation (PLA) and radiofrequency ablation (RFA).
Methods and Materials: From 2011, 63 patients (12 males, 41 females) underwent percutaneous thermal ablation for a benign thyroid nodule under ultrasound guidance. 32 (4 males, 28 females) were treated with RFA, and 31 (8 males, 23 females) with PLA. Mean nodule volume before ablation, time and energy deposited for ablation, and volume percentage reduction at 1-2, 6 and 12 months were compared.
Results: Mean nodule volume before ablation was 19.2 ± 17.1 ml (mean ± standard deviation) in the PLA group vs 35.1 ± 22.2 ml in the RFA group ($p = 0.002$). Mean time for ablation was significantly longer for PLA (21.1 ± 7.2 min vs 14.9 ± 7.2; $p < 0.001$), while mean energy deplosition was significantly higher in the RFA group (18726 ± 9478 J vs 5493± 2579 J; $p < 0.001$). Mean volume reduction at 1-2 months was 46% ± 20% in thePLA group compared with 49% ± 15% in the RFA group ($p = 0.275$), at 6 months was 66% ± 18% in PLA group and 51 ± 13% in RFA group ($p= 0.409$), and at 12 months was 65% ± 15% in PLA group and 54 ± 19% in RFA group ($p=0.440$).
Conclusion: PLA and RFA achieve similar results in terms of volume reduction at 1-2, 6 and 12 months. PLA requires significantly longer times and lower energy deposition than RFA

14:00 - 15:30 **Room MB 1**

Head and Neck

SS 708

CT including cone beam CT: image quality, dosimetry and clinical applications

Moderators:
B. Gómez-Ansón; Barcelona/ES
L. Ioseliani; Tbilisi/GE

B-0724 14:00

A dentalscan or a multi-layer digital ortopantomography in the study of the jaws? A dosimetric evaluation on a CBCT device

F. Testa[1], E. Fumero[1], E. Roberto[2], S. Chauvie[2], R. Olivero[1], M. Lo Bello[1], D. Fraire[1]; [1]*Bra/IT*, [2]*Cuneo/IT (ftesta@aslcn2.it)*

Purpose: To evaluate the differences in terms of effective dose between a multi-layer digital ortopantomography and a Dentascan, both performed by a CBCT device.
Methods and Materials: We performed a dosimetric evaluation of protocols "SmartPan" (whose results are nine panoramic layers of view of the dental apparatus) and "3D Jaw" (a native three-dimensional acquisition of a single dental arch) on a CBCT device (Planmeca), using an anthropomorphic phantom (Adelson Rando). We made several acquisitions according to different three-dimensional and panoramic protocols; effective doses have been estimated by Montecarlo software (PCXMC).
Results: CBCT effective dose has been measured from experimental data for a single arch as 0.035 mSv in an average patient; the dose in the evaluation of both arches has been measured as 0.083 mSv in an average patient. SmartPan effective dose on an average patient has been calculated as 0.030 mSv.
Conclusion: Even if a bit over the average effective dose proposed in literature for the digital ortopantomography, SmartPan is the CBCT technique of choice to the wide studies of the dental apparatus. By the way, the poor difference in the effective dose between SmartPan and a single-arch CBCT Dentascan suggests that a clinically localized pathology in upper or lower jaw can be studied directly in 3D mode.

B-0725 14:08

Diagnostic performance of cone beam computed tomography and MDCT in diagnostic imaging of the midface: a comparative study on phantoms and cadaver head scans

S. Veldhoen[1], M. Schöllchen[2], H. Hanken[2], C. Precht[1], F.O.O. Henes[2], G. Schön[2], M. Heiland[2], G. Adam[2], M. Regier[2]; [1] *Würzburg/DE*, [2]*Hamburg/DE (veldhoen_s@ukw.de)*

Purpose: To compare MDCT and Cone Beam Computed Tomography (CBCT) regarding radiation dose, spatial resolution, image noise and image quality.
Methods and Materials: CBCT and 256-MDCT were compared based on three scan protocols: Standard-(≈24 mGy) reduced-(≈9 mGy) and low-dose (≈4 mGy). MDCT images were acquired in standard- and high-resolution-mode (HR-MDCT) and reconstructed using filtered back projection and iterative reconstruction (IR). Resolution was assessed using phantom scans providing different amounts of linepairs (lp). Subjective image quality was assessed in scans of 25 cadaver heads using a Likert scale. Objective image noise (OIN) was evaluated in phantom and cadaver scans.
Results: OIN was higher in MDCT of phantom and cadaver scans. IR lowered OIN to comparable values in standard-mode MDCT only. CBCT provided a resolution of 13 lp/cm at standard- and 11 lp/cm at reduced-dose vs. 11 lp/cm and 10 lp/cm in HR-MDCT. Resolution of 10 lp/cm was observed for both devices using low-dose settings. Image quality scores of MDCT and CBCT did not significantly differ at standard-dose (CBCT,3.4; MDCT,3.3; HR-MDCT,3.5; $p> 0.05$). Using the reduced- and low-dose protocols, CBCT was superior (reduced-dose,3.2 vs. 2.8; low dose,3.0 vs. 2.3; $p < 0.001$). Acquisition and reconstruction times were higher for the CBCT device.
Conclusion: CBCT imaging provided better objective and subjective image quality at low-dose settings, when compared to MDCT whereas spatial resolution was equal. Similar performance was observed at higher exposure settings but CBCT then provided better spatial resolution. Modern CBCT devices seem to make use of noise-reduction techniques similar to IR as very low image noise and long reconstruction times were observed.

B-0726 14:16

Pre- and postoperative head radiography and MSCT imaging in patients with zygomatico-orbital trauma

O.Y. Pavlova, N.S. Serova; *Moscow/RU (dr.olgapavlova@gmail.com)*

Purpose: The aim of the study is to establish the standardized approach and necessity of postoperative head multi-slice computed tomography (MSCT) in zygomatico-orbital trauma. Pre- and postoperative head radiography and MSCT scan were compared.
Methods and Materials: A total of 45 patients with zygomatico-orbital trauma were admitted to the hospital on 1-3 day after the injury. Preoperative head radiography and MSCT scan were performed at the day of admission. Postoperative head X-ray and MSCT images were obtained within 10 days after the surgery.
Results: Preoperative head radiography revealed only the most obvious diastatic fractures in frontozygomatic (n=42; 93%), infraorbital (n=29; 64%), zygomaticomaxillary (n=22; 48%) regions and maxillary sinuses opacification (n=35; 77%). MSCT scan allowed better assessment of the injured orbital floor (n=45, 100%) with herniation of the soft tissues into the adjacent maxillary sinus with formation of enophthalmos (n=6, 13%), deformation of eye muscles (n=8, 17%), injured optic nerve (n=2, 4%), fractures of lateral (n=43, 95%) and medial (n=3, 6%) orbital walls. Postoperative head radiography revealed only approximate position of the implanted osteosynthesis elements. Head MSCT scan managed to evaluate the appropriate condition of reconstructed orbital walls and, as well, remaining enophthalmos (n=3, 6%), herniation of the soft tissues (n=1, 2%) and deformation of the eye muscle (n=1, 2%).
Conclusion: The study has proved that head MSCT scan is the best choice for analysis of postoperative effects after zygomatico-orbital trauma. It should be performed in certain time limits and have individual standardized approach in order to exclude possible posttraumatic deformities.

B-0727 14:24

Clinical aspects of imaging quality in visualisation of anterior and lateral skull base

C. Gueldner, J. Voigt, R. Leppek, J. Werner; *Marburg/DE (gueldner@staff.uni-marburg.de)*

Purpose: CBCT and CT have become more important in imaging of head and neck. Aspects of irradiation are not fully clear and aim of this study.
Methods and Materials: Three cadaveric heads were examined each 70 times with different X-ray-adjustments. The imaging quality was evaluated by a checklist of 16 landmarks of anterior and lateral skull base each and correlated to the emitted dosage. Measurements of dosage at parotid glands and eye lenses were performed for several protocols. All examinations were performed at an ENT department together with the department of neuroradiology and department of radiation protection with the CBCT device of Morita (Accu-I-tomo F17, Morita, Kyoto, Japan).
Results: A typical correlation of imaging quality and applied dosage could be seen (high dosage good quality). In high dosages, a saturation effect could be detected for both regions. Regarding the different heads at the range from 2 to 3 mGy (anterior skull base) and from 3 - 5 mGy (lateral skull base), all anatomic landmarks could be still evaluated well. In comparison the previous standard protocol, a reduction of the dosage of 75% at the parotid gland and 90% at the lenses could be realized. Main reason was the change from 360° rotation to 180°. So, no direct irradiation of the lenses existed anymore.
Conclusion: A significant reduction of applied dosage of examination of anterior and lateral skull base by CBCT is possible in daily routine by discussion of the clinical needed imaging quality.

B-0728 14:32

Reducing the dose of CT of paranasal sinuses: possibilities using an iteractive reconstruction algorithm

S.M. Niehues, L.-A. Schaafs, B. Hamm; *Berlin/DE (stefan.niehues@charite.de)*

Purpose: Increasing availability of iteractive reconstruction algorithm (IR) allows decreasing exposure in computed tomography (CT) imaging. One of the frequently performed examination is the CT of the paranasal sinuses. Here, multiple radiosensitive structures are within the scan area urging to reduce the dose. This study will examine the potential of IR in CT studies of the paranasal sinuses.
Methods and Materials: In this retrospective analysis 52 patients were evaluated using filtered back projection (FBP) and iteractive reconstruction (IR). Technical parameters as kV, mA, scan range, DLP, reconstruction algorithm and the noise represented by the average deviation of the HU values were noted. Perceptibility of different anatomical structures as well as the subjective image quality were compared on an ordinal scale.
Results: At 120 kV a median reduction of the DLP from 92 to 78 could be achieved using an iteractive reconstruction algorithm. The visibility of anatomical structures increased (from 6 to 9 points) and image quality (from moderate to good) were classified as significantly better with IR, although the measurable noise slightly increased (median +4.8 HU). A reduction to 80 kV could reduce the DLP to a median of 52 with FBP, with IR to a median DLP of 36. Again, the subjective image quality was rated superior using IR.
Conclusion: The use of an iteractive reconstruction algorithm in CT of paransal sinuses results in a significant reduction of the dose and to a subjectively improved visual impression both at 80 and at 120 kV.

Author Disclosures:
B. Hamm: Board Member; ECR 2015 president. Consultant; Toshiba Medical Systems.

B-0729 14:40

80-kVp neck computed tomography in patients with suspected peritonsillar abscess: evaluation of objective and subjective image quality, and reduction of radiation exposure

J.-E. Scholtz, K. Hüsers, M.H. Albrecht, M. Beeres, M. Kaup, B. Schulz, R.W. Bauer, T.J. Vogl, J.L. Wichmann; *Frankfurt a. Main/DE (janerikscholtz@gmail.com)*

Purpose: To invastigate neck computed tomography (CT) with a reduced tube voltage of 80-kVp in patients with suspected peritonsillar abscess (PTA) regarding objective and subjective image quality, and potential for dose reduction.
Methods and Materials: This retrospective study was approved by the institutional review board, and written informed consent was waived. We retrospectively analyzed 47 patients with clinically suspected PTA using dual-energy CT. Objective and subjective image quality of 80-kVp acquisition were compared with standard blended 120-kVp images. Attenuation of abscess rim enhancement, central necrosis, and several other anatomical structures were measured. Signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and rim-to-abscess CNR (raCNR) were calculated. Subjective image quality was assessed according to the European guidelines on quality criteria for CT. Interobserver agreement was calculated using intraclass correlation coefficient (ICC).
Results: Attenuation of inflammation (141.7±16.3 vs. 93.7±9.3 HU, $p < 0.001$), CNR (9.6±4.8 vs. 5.6±3.8, p=0.001), raCNR (14.3±5.9 vs. 12.4±4.4, p=0.02), and subjective image sharpness (3.6±0.6 vs. 2.8±0.7, $p < 0.001$) were significantly increased in 80-kVp acquisition compared to 120-kVp while subjective and objective image noise were significantly increased with 80-kVp acquisition ($p < 0.001$). Diagnostic acceptability was rated equally well in 80-kVp and 120-kVp images (p=0.180). Overall interobserver agreement was almost perfect (ICC, 0.87). Calculated dose-length product of 80-kVp acquisition was decreased by 49.8% compared to 120-kVp (131.9±16.0 vs. 263.0±36.5 mGy•cm, $p < 0.001$).
Conclusion: 80-kVp neck CT provides increased enhancement of soft tissue inflammation, CNR, raCNR, and improved abscess delineation in patients with PTA compared to standard 120-kVp acquisition while resulting in a significant reduction of radiation exposure.

Author Disclosures:
R.W. Bauer: Speaker; Siemens Healthcare, Computed Tomography division.

B-0730 14:48

Assessment of an advanced monoenergetic reconstruction technique in dual-energy computed tomography of head and neck cancer

M.H. Albrecht, J.-E. Scholtz, R.W. Bauer, M. Kaup, I. Burck, J. Wagenblast, T. Lehnert, T.J. Vogl, J.L. Wichmann; *Frankfurt a. Main/DE (MoritzAlbrecht@gmx.net)*

Purpose: To evaluate the monoenergetic plus (Mono+) post-processing technique in dual-energy computed tomography (DECT) imaging in patients with squamous cell carcinoma (SCC).
Methods and Materials: DECT data of 44 patients (34 male, mean age 55.5±16.0) with histopathologically confirmed SCC were reconstructed as 40, 55, 70 keV Mono+ and as M_0.3 (30% 80 kV) linearly blended series. Attenuation of sternocleidomastoid muscle, internal jugular vein, submandibular gland, tumour enhancement and noise was measured. Three radiologists with > 3 years of experience subjectively assessed image quality, lesion delineation, image sharpness and noise using 5-point scales. Student t test, nonparametric Friedman test and Cohen's kappa (κ) were used for statistical analysis.

Results: 40 keV+ series showed the highest lesion attenuation (248.1±94.1 HU), followed by 55 keV+ reconstructions (150.2±55.5 HU; p=0.001). CNR at 40 keV+ (19.09±13.84) was significantly superior to all other reconstructions (55 keV+, 10.25±9.11; 70 keV+, 7.68±6.31; M_0.3, 5.49±3.28; $p < 0.005$). Overall subjective image quality was highest for 55 keV+ reconstructions (4.53; κ=0.38, p=0.003), followed by 40 keV+ (4.14; κ=0.43, $p < 0.001$) and 70 keV+ reconstructions (4.06; κ=0.32, p=0.005). Differences between 55 keV+ to both 40 and 70 keV+ series were significant ($p < 0.001$), but not between 40 and 70 keV+ (p=0.465). All Mono+ series were superior ($p < 0.004$) to linear blending M_0.3 (3.81; κ=0.280, p=0.056).
Conclusion: Mono+ DECT at low keV+ levels significantly improves CNR and subjective image quality in patients with head and neck SCC, as tumour CNR peaks at 40 keV+ and 55 keV+ images are preferred by observers.

Author Disclosures:
R.W. Bauer: Speaker; On the speakers' bureau of Siemens Healthcare, Computed Tomography division.

B-0731 14:56

Non-linear image blending for dual energy CT improves visualisation of head and neck primary squamous cell carcinoma compared to linear blending technique

J.-E. Scholtz, K. Hüsers, M. Kaup, M. Albrecht, C. Frellesen, R.W. Bauer, J.M. Kerl, T.J. Vogl, J.L. Wichmann; *Frankfurt/DE (janerikscholtz@gmail.com)*

Purpose: To compare visualization of primary head and neck squamous cell carcinoma (SCC) using non-linear blending post-processing techniques in dual energy computed tomography (DECT) compared to standard linear blending regarding subjective and objective image quality.
Methods and Materials: This retrospective study was approved by the institutional review board, and written informed consent was waived. We retrospectively analyzed 47 patients with histologically-confirmed primary head and neck SCC using DECT. Non-linearly blended images were compared with linearly blended 80-/140-kVp images series with varying weighting factors of 0.3, 0.6 and 0.8. Attenuation of tumour lesion, various soft tissue structures, internal jugular vein and image noise were measured, tumour signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. Overall image quality, delineation of tumour lesion, image sharpness and noise level were rated individually by three radiologists using 5-point Likert scales. Interobserver agreement was calculated using intraclass correlation coefficient (ICC).
Results: Enhancement of tumour lesions (non-linear, 137.5 ± 20.1 HU; M_0.3, 92.7 ± 14.4 HU; M_0.6, 110.0 ± 15.4 HU; M_0.8, 123.0 ± 18.2 HU), CNR (non-linear, 12.0 ± 8.0; M_0.3, 4.0 ± 4.7; M_0.6, 7.5 ± 5.5; M_0.8, 8.0 ± 5.5), subjective overall image quality and tumour delineation were significantly increased (all $P < 0.001$) with the non-linear blending technique compared to all linear blending weighting factors. Overall interobserver agreement was substantial (ICC, 0.70; 95% confidence intervals: 0.66-0.73).
Conclusion: Non-linear blending post-processing technique for DECT provides improved objective and subjective image quality of head and neck SCC compared to linearly blended image series.

Author Disclosures:
R.W. Bauer: Speaker; Siemens Healthcare, Computed Tomography division.

B-0732 15:04

Direct and indirect organ dose distribution measurements in fluoroscopic swallow examinations with a modern flat detector system and dose reduction techniques -a phantom study

A. Pomschar[1], J. Weiß[2], K. Neumaier[1], M. Li[1], W. Flatz[1], B. Ertl-Wagner[1], M. Peller[1], M.F. Reiser[1], M. Notohamiprodjo[2]; [1]*Munich/DE*, [2]*Tübingen/DE (Andreas.Pomschar@med.lmu.de)*

Purpose: Dynamic video-fluoroscopic examinations of the pharynx constitute an excellent method to examine the swallowing process. We aimed to evaluate direct dose and scattered radiation for different organs with an Alderson-Rando Phantom applying a modern flat detector system and dose reduction techniques.
Methods and Materials: We performed two dose measurements in an Alderson-Rando phantom for a lateral field of view of the pharynx and the upper esophagus. For each measurement, 60 thermoluminescent dosimeters (TLD) were placed in the examined region and organs of interest. A multifunctional system (Axiom Artis Zee MP, Siemens) was used with special low-dose protocols, noise reduction, automatic copper filtering and pulsed fluoroscopy. Measurements were performed for low-dose fluoroscopy pulsed images (FP) and high-resolution digital radiographs (DR). Tube current was set to FP: 76.8 kV and DR: 68 kV. The tube was positioned 35.5 cm left of the phantom. Distribution of the dose applied to the TLDs was calculated by percentage of the skin dose in the direct beam.
Results: Surface dose per FP was 2.5 µGy and 62 µGy per DR image. The received dose percentage was: left thyroid 76%, right thyroid 26%, left eye 5.4%, right eye 3.5% and less than 0.02% for the gonads.
Conclusion: Dynamic FP imaging can be performed with very low doses. Correct positioning of the FOV is necessary to reduce unwanted direct exposure within the direct beam. Received dose is highest on the side of the tube; gonads receive only very little scatter radiation.

B-0733 15:12

Quantitative analyses of 3-D volumetry and histogram of thyroid gland on CT: can thyroid CT reflect thyroid function in the patients with hypothyroidism?

K. Lee, J. Ryu; *Busan/KR (lkh770429@naver.com)*

Purpose: To analyze 3D volumetry and histogram of thyroid gland on CT and correlate them with thyroid function in the patients with hypothyroidism.
Methods and Materials: We enrolled 149 patients underwent thyroid CT and thyroid function test. We classified 3 groups; euthyroid state (ES) in 86, subclinical hypothyroidism (SH) in 43 and overt hypothyroidism (OH) in 20 patients. Thyroid CT scan was obtained with nonenhanced and contrast-enhanced images. The volume of thyroid gland was automatically calculated on contrast-enhanced images. Histogram of thyroid gland was analyzed on nonenhanced and contrast-enhanced images. Parameters of histogram were mean, median, standard deviation, and coefficients of variation. We compared total volume and histogram parameters in 3 groups.
Results: Total volume of thyroid gland were 15.9 ml ± 5.1 in ES, 18.4 ml ± 8.5 in SH and 31.4 ml ± 54.6 in OH ($p < 0.05$). Mean, median, standard deviation and coefficients of variation of thyroid gland on nonenhanced images were as follows; 94.3, 97.5, 21.3, 0.226 in ES, 76.2, 77, 20, 0.275 in SH and 66.3, 66.6, 17.4, 0.26 in OH ($p < 0.05$). Those on contrast-enhanced images were 180.3, 191.4, 40.5, 0.225 in ES, 180.9, 191.7, 40.1, 0.223 in SH and 174.1, 182.9, 39.5, 0.226 in OH ($p > 0.05$). Cut-off value of attenuation on nonenhanced images was 85.4 between ES and SH and 63.7 between ES and OH.
Conclusion: The patients with hypothyroidism reveal larger volume and lower attenuation with more parenchymal heterogeneity of thyroid gland. Thyroid CT can reflect disease severity in the patients with hypothyroidism.

B-0734 15:20

Comparison of incidental findings between normal and obstructive sleep apnea patients using cone beam computed tomography scans

K. Orhan[1], U. Oz[2], M. Misirli[3], S. Aksoy[3], F. Rasmussen[3]; [1]*Ankara/TR*, [2]*Lefkosa, Mersin 10/TR*, [3]*Lefkosa, Mersin 10,/TR (call53@yahoo.com)*

Purpose: The objective of this study was two folded; (1) to compare the incidental findings of all maxillofacial compartment and airways/paranasal sinuses with and without obstructive sleep apnea (OSAS) patients, and (2) to compare these incidental findings between normal/mild and moderate/severe patients using cone-beam computed tomography (CBCT) scans.
Methods and Materials: A total of 161 patients (92 patients with and 79 patients without OSAS) with CBCT scans were retrospectively investigated. CBCT scans were made with Newtom 3G and 5G (Quantitative Radiology s.r.l., Verona, Italy). Sinuses, nasopharynx, oropharynx, throat, skull, vertebrae, temporomandibular joint (TMJ), maxilla and mandible were checked and classified for incidental findings. A p value less than 0.5 considered statistical significant.
Results: 92 % of the patients without OSAS showed incidental findings. The most prevalent were airway/sinus findings (64 %), followed by, nasal septum deviation, middle ear and mastoid opacification, suggestive for otitis media or mastoiditis (5 %), abnormal vertebral anatomy (4.9%). Similarly 89% patients with OSAS showed also incidental findings which the most prevalent were again airway/sinus findings (70 %). Statistical analysis indicated no statistical significant difference between with/without patients ($p > 0.05$). However, significant difference was found for the degree of OSAS and incidental findings ($p < 0.05$). Severe/moderate OSAS showed more airway/ sinus findings and calcifications then normal/mild OSAS patients.
Conclusion: The high number of findings indicates that CBCT imaging is a helpful tool in the treatment and diagnosis of OSAS. It was found that the incidental findings increase along with the degree of OSAS.

14:00 - 15:30 **Room MB 2**

GI Tract

SS 701b

Colonic imaging

Moderators:
P. Lefere; Roeselare/BE
T. Mang; Vienna/AT

B-0735 14:00

Selection of colon cancer patients for neoadjuvant chemotherapy based on optimised preoperative MDCT A prospective multi-observer radiologic-pathologic agreement study

E. Rosado, A. Germano, A. Costa, R. Theias, A. Gomes, C. Leichsenring, I. Santiago; *Amadora/PT (elsasprr@hotmail.com)*

Purpose: Neoadjuvant chemotherapy (NACT) in potencially-resectable locally-advanced colon cancer (LACC) is likely to prove superiority compared to standard treatment in the phase III FOXTROT Collaborative Group Trial. Thus, identification of LACC, defined as T3≥5 mm or T4, is fundamental and requires accurate noninvasive imaging. The value of optimized preoperative MDCT for that purpose is being assessed.
Methods and Materials: Observational, cross-sectional, prospective study including all patients with colon cancer refered to our Institution´s Radiology Department for preoperative staging between the 1st of October 2013 and the 6th of August 2014. Independent reading of optimized MDCT acquisitions using MPR was performed by 4 radiologists (3.6,15 and 20 years of experience in gastrointestinal imaging). Extramural tumour extension was graded as < 5 mm; ≥5 mm; invasion of peritoneum/fascia/adjacent organ. Surgical specimen analysis was performed by a single pathologist with 12 years of experience in gastrointestinal pathology. Radiologic-Pathologic agreement was assessed.
Results: 48 patients, 26 males and 22 females, with a median age of 74 years (min:45;max:89) were considered eligible. Median time to surgery was 30.5 days (min:1;max:117). Diagnostic sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT for the identification of LACC ranged between 0.64 and 0.82; 0.84 and 0.92; 0.5 and 0.7; 0.88 and 0.97; 0.75 and 0.88; respectively. Mean agreement between observers was 0.88 (SD:0.17) per patient.
Conclusion: Preliminary results suggest that optimized MDCT is a specific, accurate and reproducible method for the selection of colon cancer patients who may benefit from NACT, with minimal risk of overtreatment of low-risk patients.

B-0736 14:08

Computer tomography colonography participation and yield in patients under surveillance for 6-9 mm polyps in a population-based screening trial

C.J. Tutein Nolthenius[1], T.N. Boellaard[1], Y. Nio[1], M.G. Thomeer[2], M. de Haan[3], S. Bipat[1], A. Montauban van Swijndregt[1], J. Stoker[1]; [1]*Amsterdam/NL,* [2]*Rotterdam/NL*, [3]*Amersfoort/NL (c.j.tuteinnolthenius@amc.uva.nl)*

Purpose: Surveillance CT colonography (CTC) has been proposed for 6-9 mm polyps at CTC screening for colorectal cancer, but participation and diagnostic yield of this surveillance strategy are unknown. The yield should be considered when determining overall yield of CTC screening.
Methods and Materials: After participating in an invitational CTC screening trial (COCOS trial), 82 of 982 participants harboured 6-9 mm polyps as the largest lesion (s). These patients were advised to undergo CTC surveillance, after 1.5 years (≥3 polyps) or after 3 years (< 3 polyps). Upon surveillance CTC, participants with ≥1 lesions ≥6 mm were offered colonoscopy. The surveillance CTC yield was defined as the number of patients with advanced neoplasia. This yield was added to the initial primary screening yield, resulting in an overall yield for population screening with CTC. A McNemar test was used to test for significance in yield differences.
Results: Fifty-six of 65 eligible patients (86%) participated in surveillance CTC. Advanced neoplasia was diagnosed in 29.3%. No invasive carcinomas were detected. Addition of the surveillance results to the initial screening CTC yield increased the number of participants with at least one advanced neoplasia (60 to 84) and hereby significantly increased the yield of advanced neoplasia per 100 CTC participants (6.1 to 8.6; $p < 0.001$) and per 100 invitees (2.1 to 2.9; $p < 0.001$).
Conclusion: CTC surveillance for 6-9 mm polyps resulted in a substantial yield of advanced adenomas but not of invasive colorectal cancers. The surveillance results led to a significantly higher yield of population screening with CTC.

Author Disclosures:
J. Stoker: Consultant; consultant voor Robarts.

B-0737 14:16

Diagnostic value of computed tomography for staging colon cancer: a meta-analysis

E. Nerad[1], M.J. Lahaye[2], M. Maas[2], G.L. Beets[2], P. Nelemans[2], R.G.H. Beets-Tan[2]; [1]*Eindhoven/NL*, [2]*Maastricht/NL (nerad19@hotmail.com)*

Purpose: To determine the diagnostic value of pre-operative computed tomography (CT) in detecting colon carcinomas with invasion beyond the muscularis propria (MP) and the presence of malignant lymph nodes.
Methods and Materials: A literature search of Ovid, Embase and Pubmed was performed to identify studies reporting on the accuracy of CT for local staging of colon carcinomas. Data extraction was performed by two observers in consensus. The sensitivity, specificity and diagnostic odds ratio (DOR) were calculated using a bivariate random effects model and hierarchical summary operating curves (HSROC) were generated.
Results: Twenty-four studies fulfilled all the required inclusion criteria determining the invasion beyond the MP and four studies determining invasion depth beyond 5 mm of the MP. Twenty-five studies were included determining nodal involvement. The pooled sensitivity, specificity, DOR for detection of tumour invasion beyond the MP were 90% (CI: 84-94%); 77% (CI: 70-82%); 29.2 (CI: 16.2-52.4). For detection of invasion depth of 5 mm beyond the MP these values were 77% (CI: 66-85%); 70% (CI: 53-83%); 7.8 (CI: 4.3-14.2) and for N-stage 72% (CI: 61-80%); 73% (CI: 58-84%); 6.8 (CI: 3.9-11.7).
Conclusion: Preoperative staging CT is accurate in differentiating between tumours limited to the bowel wall and those invading beyond the MP. However identifying tumours with an invasion depth of > 5 mm beyond the MP and the detection of malignant nodes remain a challenge for CT.

B-0738 14:24

Impact of virtual colonoscopy in the management of patients referred to a tertiary hospital after an incomplete colonoscopy

R. Ferrari[1], L. Bertana[2], D. Bellini[2], T. Biondi[2], D. Caruso[2], A. Laghi[2]; [1]*Rome/IT*, [2]*Latina/IT (ferraririccardo@gmail.com)*

Purpose: To evaluate the changes in therapeutic strategy and surgical approach using virtual colonoscopy in patients referred to a tertiary hospital surgical department after incomplete optical colonoscopy.
Methods and Materials: We retrospectively evaluate 155 patients who were admitted to a tertiary hosptial surgical department after an incomplete colonoscopy from january 2010 and october 2012. All patients were prepared with fluid tagging method and performed a CT colonoscopy during the surgical evaluation. On the basis of virtual colonoscopy report we evaluated changes in the surgical management (double, partial o total colonic resection, planning of changing trocar positioning, necessity of planning an early endoscopic exam after surgery). A 3-year clinical follow-up was performed.
Results: In 54/155 patients we found a second colonic disease that was not the principal reason of admittance in the surgical department changing the surgical and clinical management of the patient (34.8%) (32 second polypoid lesion, 3 colon cancer,1 IBD,18 others); 67 patients had an extra colonic abdominal (100 pathologies) and thoracic (67 pathologies) findings.
Conclusion: In our clinical practice the right preoperative evaluation is mandatory with a mini-invasive robotic and laparoscopy surgery. Virtual colonoscopy demonstrate a significant impact to take the right decision in the management of patients who come to a tertiary hospital with incomplete colonoscopy; in our experience the use of VC changing the surgical managment in 34.8% of the patient.

B-0739 14:32

Virtual colonoscopy under 2 mSv with iterative reconstruction - are we ready?

R. Ferrari, L. Bertana, T. Biondi, D. Bellini, D. Caruso, A. Laghi; *Rome/IT (ferraririccardo@gmail.com)*

Purpose: The aim of our study was to compare the use of very low dose protocol in virtual colonoscopy (VC) with the use of iterative reconstruction protocols.
Methods and Materials: 55 patients underwent VC after incomplete colonoscopy. We performed two randomized different protocols in prone and supine scan: a very low radiation dose (100 Kv, 50 mA, 0.5 s rotation time) with ASIR recon 50%; normal protocol without ASIR recon (120 Kv, 100 mA, 0.5 s rotation time). Same day fluid tagging by 60 ml of gastrografin administered 3 h before the exam was performed. Two different expert radiologists read one series per time at one month of distance. Evaluation of noise of the imagining and image quality was assisted; diagnostic accuracy was compared with weighted-K test. Cad software as a second reader was used, we evaluate false positive numbers in both scans.
Results: Diagnostic accuracy of the same reader was comparable between prone and supine scan (k=0.98); inter-readers agreement was comparable (k=0.91).15 polyps,3 cancer,7 diverticulosis disease were found.17 extracolonic findings were found. Mean mSv of low dose (LD) scans was 0.7;

normal dose (ND) scans was 2.2 mSv. Mean false positive with CAD were comparable (5.6 LD; 5: ND scans).
Conclusion: The correct selection of low dose protocol with iterative reconstruction can decrease the patient radiation exposition with a comparable diagnostic performance. The necessity of limited spatial resolution (polyp> 6 mm) and the high difference in attenuation value between fluid marked residual, air and colon mucosa could justify the use of a very low dose protocol.

B-0740 14:40

Does model-based iterative reconstruction technique provide advantage in ultra-low dose submilisievert CT colonography?

L. Lambert[1], J. Danes[1], L. Simakova[1], J. Jahoda[1], P. Ourednicek[2]; [1]*Prague/CZ*, [2]*Brno/CZ (lambert.lukas@gmail.com)*

Purpose: To evaluate technical and diagnostic performance of model-based reconstruction technique in submilisievert CT colonography.
Methods and Materials: This study was approved by the local Institutional Review Board. Following cathartic preparation and stool tagging with 2.1% barium, 58 patients underwent ultra-low dose CT colonography. Both the prone and supine acquisitions were reconstructed with filtered back projection (FBP), hybrid (HIR) and model-based iterative reconstruction techniques (MBIR). The reconstructions were compared for subjective image quality both in the cross-sectional and endoluminal view on a five point Likert scale by two independent readers. Endoluminal noise was measured in all colonic segments. Colonic lesions were evaluated in consensus and compared with optical colonoscopy.
Results: The dose estimate was 0.41±0.05mSv in supine and 0.42±0.04mSv in prone acquisition. In the endoluminal view, images reconstructed with HIR were rated better than those reconstructed with MBIR. Images reconstructed with MBIR were rated better in the cross-sectional view and had the lowest endoluminal noise ($p < 0.0001$). The readers and computer aided detection recognized all polyps in HIR, but failed to identify one polyp (5%) in MBIR and 11 polyps (58%) in FBP.
Conclusion: Ultra-low dose CT colonography is feasible if iterative reconstruction technique is used. MBIR delivers better quality and noise suppression in the cross-sectional view, whereas HIR provides better images in the endoluminal view. The use of FBP may result in decreased detection of colonic lesions.

Author Disclosures:
P. Ourednicek: Other; Clinical scientist at Philips Healthcare.

B-0741 14:48

Accuracy of ultra-low-dose CTC with iterative reconstructions in the detection of intermediate and diminutive polyps

F. Pancrazi, P. Scalise, A. Mantarro, E. Guidi, D. Gambaccini, M. Bertini, E. Neri, C. Bartolozzi; *Pisa/IT (pancrazi_francesca@libero.it)*

Purpose: To evaluate the role of ultra-low-dose CTC in the detection of diminutive (< 5 mm) and small polyps (6-9 mm) using colonoscopy findings as reference standard.
Methods and Materials: We retrospectively analysed 29 patients who underwent ultra-low-dose CTC with iterative reconstructions (ASIR) (mean effective dose 1.5-2mSv), resulted positive for 38 diminutive and intermediate polyps (diameter 2 to 9 mm). Colonoscopy was performed within 4 weeks by a colonoscopist aware of the CTC findings. The patients had no greater lesion reported both in CTC and colonoscopy and diagnostic quality was considered good in both exams.
Results: The overall sensitivity of CTC by number of polyps was 80%, and specificity 89%. Twenty-five out of 38 polyps were confirmed and resected at colonoscopy; 8 in ascending colon (AC); 6 in transverse colon (TC); 6 in the sigmoid (SC); 3 in the cecum; 2 in descending colon (DC); none in rectum. All polyps reported at CTC in DC were confirmed; polyps were confirmed in 80% of cases in AC, 75%, in cecum; 66.6% in TC and 60% in SC. A total of 13 false positives occurred in the following segments: SC (n=4), AC (n=2); TC (n=3); cecum (n=3); rectum (n=3).
Conclusion: Detection of diminutive and intermediate polyps is affected by a significant number of false positives that mainly occurs in the sigmoid and rectum, where more specific attention should be given in CTC reading. DC represented the colonic segment with the highest CTC diagnostic accuracy.

B-0742 14:56

Image quality assessment of ultra low-dose CT colonography using sinogram-affirmed iterative reconstruction

A. Delli Pizzi, R. Cianci, A. Filippone, M. Timpani, A. Tavoletta, G. Esposito, P. Pulsone, A.R. Cotroneo; *Chieti/IT (andrea.dellipizzi@yahoo.it)*

Purpose: To assess the image quality of ultra-low-dose CT colonography (ULDCTC) using sinogram-affirmed iterative reconstruction (SAFIRE) compared to low dose CT colonography (LDCTC) reconstructed with filtered back projection (FBP).
Methods and Materials: Sixty-three consecutive patients were included. CTC examinations were performed using a 128-row scanner in the supine position with low-dose protocol (automated tube current modulation: 55 ref mAs; FBP) and in the prone position with ultra-low dose protocol (automated tube current modulation: 25 ref mAs; SAFIRE). The mean effective doses, image noise and image quality were compared with the Wilcoxon matched-pairs signed rank test.
Results: The mean effective dose was 0.96 ± 0.38 mSv using ULDCTC compared to 2.47 ± 0.72 mSv using LDCTC ($p \leq 0.0001$). The image noise of ULDCTC was significantly lower than that of LDCTC ($p = 0.03$). The image quality of the ULDCTC was comparable to that of LDCTC ($p = 0.046$).
Conclusion: ULDCTC with SAFIRE allows to significantly reduce the radiation dose without significant image quality degradation compared to LDCTC.

B-0743 15:04

Anatomic variability of the colon: a study with CT-colonography

M. Pancot, R. Girometti, C. Zuiani, M. Bazzocchi; *Udine/IT (martypancot@libero.it)*

Purpose: To assess the variability of colonic morphology using CT-colonography (CTC).
Methods and Materials: We retrospectively evaluated 109 patients (40 male, 69 female; mean Age 68.4 years), who underwent CTC with resulting adequate distension of all colonic segments in at least one patient position. Two readers performed image analysis in consensus in order to assess: (i)the length of the whole colon and each colonic segment; (ii)the degree of tortuosity as per-segment number of acute angles; (iii)the colonic segments type of looping, based on previous classifications with magnetic endoscopic imaging and barium enema. Whole colon length below or above the average±1 standard deviation length of the study population was the reference to define brachy- or dolychocolon, respectively. Analysis was stratified based on patients' gender.
Results: Mean total colon length was 167.4±30.9 cm. Men showed significantly longer colon (176.4±33.9 cm) than women (162.6±27.9 cm) ($p < 0.05$; unpaired t-test), because of longer caecum, descendent and sigmoid segments. Brachycolon and dolychocolon were found in 12.5% and 30% of men, and 21.7% and 8.7% of women, respectively. Average per-colon number of acute angles was 5.4±2.0. Main sites of tortuosity were transverse and sigmoid colon either in men (2.4±0.9 acute angles) or women (2.7±1.2 and 2.1±0.8, respectively). We identified up to nine variants for each segment looping. Most frequent types were "spiral loop" for sigmoid colon (51.4%) and "deep loop" for transverse colon (48.6%).
Conclusion: CTC provides detailed quantitative and qualitative assessment of the colonic anatomy variants.

B-0744 15:12

Treatment of perityphlitic abscess: comparison of interventional and surgical management

B. Mensel, L.I. Partecke, J.-P. Kühn, W. Keßler, M. Patrzyk; *Greifswald/DE (menselb@uni-greifswald.de)*

Purpose: To compare the duration of symptoms, outcome, complications, and additional therapeutic measures after interventional and surgical treatment of appendicitis with perityphlitic abscess, focusing on the need for subsequent appendectomy.
Methods and Materials: We retrospectively included 38 patients with perityphlitic abscess managed by percutaneous drain placement (17 patients, 9 men; group A) or surgery (21 patients, 14 men; group B).
Results: The mean duration of symptoms before treatment was 7.0±2.2 days in group A and 3.0±1.8 days in group B ($p < 0.001$). Treatment was technically successful in all patients. The median drain size in group A was 12 F (IQR: 10.0-13.5 F). The mean duration of posttherapeutic antibiotic treatment was 5.8 ±2.0 days in group A and 4.8 ±2.3 days in group B (p=0.276). The mean hospital stay was 9.6 ±3.2 days in group A and 8.6 ±3.3 days in group B (p=0.3176). The complication rate was 29.4% in group A and 38.1% in group B (p=1.000). Thirteen patients from group A had no appendectomy during the mean follow-up period of 64 months. None of these patients had recurrent appendicitis.
Conclusion: Interventional treatment of perityphlitic abscess is a reliable, effective, and definitive therapeutic option in selected patients compared with surgical management. There is no need for appendectomy in the further course.

B-0745 15:20

Non-traumatic colorectal perforation: assessment with MDCT

P.P. Saturnino; *Naples/IT (pietropsat@hotmail.it)*

Purpose: Colorectal perforations (CRP) are severe conditions with a high mortality rate. The purpose of this study is to review MDCT direct and indirect signs for a correct diagnosis in different cases of CRP who arrive to Emergency-Room (ER).
Methods and Materials: We retrospectively reviewed the MDCT studies of a cohort of 250 patients who arrived to ER from 2012 to 2013 for an acute abdomen and then treated surgically. Abdominal MDCT was performed after the intravenous injection of 100 ml of contrast medium, at a rate of 3 - 4 ml/s. We compared surgical findings with MDCT direct and indirect signs of CRP.
Results: 20 patients underwent surgical repair of CRP. The diagnosis of CRP was based on the direct CT findings, such as discontinuity of the bowel wall and the presence of extraluminal air. The indirect CT findings were represented by bowel wall thickening, abnormal bowel wall enhancement (include interruption or lack of bowel wall enhancement on enhanced scan), abscess and an inflammatory mass adjacent to the bowel. The cause of CRP included malignant neoplasm (n.4), diverticulitis (n.7), blunt trauma (n.1), penetrating trauma (n.2), ischaemia (n.3), inflammatory chronic disease (n.1), mechanical colonic obstruction (n.2). Direct and indirect findings seen on contrast-enhanced MDCT were confirmed at surgery.
Conclusion: In this series of surgically proven CRP, direct and indirect signs of the site and the cause of perforation were identified at MDCT in all 20 cases.

14:00 - 15:30 **Room MB 3**

Cardiac

SS 703

Work-up of coronary artery disease

Moderators:
M. Das; Maastricht/NL
S. Mirsadraee; Edinburgh/UK

B-0746 14:00

Characterisation of human coronary atherosclerotic plaques with phase-contrast imaging

S. Winklhofer[1], S. Peter[2], V. Tischler[1], F. Morsbach[1], P. Modregger[2], M. Stampanoni[2], M. Thali[1], H. Alkadhi[1], P. Stolzmann[1]; [1]*Zurich/CH*, [2]*Villigen/CH (paul.stolzmann@usz.ch)*

Purpose: To investigate the accuracy of X-ray grating interferometry phase-contrast (PC) imaging for the characterisation of human coronary artery plaque.
Methods and Materials: PC and conventional absorption computed tomography imaging was performed ex vivo in this institutional review board-approved study in 40 human coronary artery segments using a synchrotron radiation source. Two independent readers performed qualitative analyses of image quality, plaque components, and plaque classification according to the American Heart Association classification in 38 plaques detected by histopathology, the latter serving as the reference standard. Quantitative measurements of plaque components (i.e., collagen, lipid, smooth muscle, and calcification) were performed and compared among PC and absorption images using analysis of variances (ANOVA) for repeated-measures with post hoc Bonferroni correction.
Results: Image quality was superior in PC as compared with absorption imaging ($P < 0.001$). Plaque components were detected by PC without significant differences to histopathology, whereas absorption imaging detected calcifications without statistical differences only. Of the 38 plaques, accuracy for plaque stage assessment by PC (early vs. advanced) was 100% and characterization was correct in 33 plaques (87%), while conventional absorption imaging allowed for correct characterization of 7 plaques only (13%, $P < 0.001$). Hounsfield units from PC images were significantly different for all plaque components ($P < 0.05$), whereas absorption images showed significant differences ($P < 0.001$) between calcified and other plaque components, but not for collagen, lipid, and smooth muscle ($P=1.00$).
Conclusion: PC imaging allows for accurate characterisation of human coronary artery plaques and for quantitative assessment of plaque components, thereby outperforming absorption imaging.

B-0747 14:08

Double acquisition of CCTA with and without intravenous vasodilator injection for the diagnosis of vasospastic angina: pilot study

E.-J. Kang, K.-N. Lee, J.-H. Lee, H. Kwon, M. Kim; *Busan/KR (medcarrot@naver.com)*

Purpose: To evaluate the feasibility of double acquisition of CCTA with/without IV vasodilator injection for diagnosis of vasospastic angina.
Methods and Materials: 20 consecutive patients with clinically highly suggestive of vasospastic angina were included. All subjects underwent CCTA ('baseline CT') without vasodilator at early in the morning. Within 1 week, all patients underwent another CCTA ('IV nitrate CT') during an continuous injection of intravenous vasodilating agent (isosorbide dinitrate 2 mg/hr). We used positive criteria of vasospastic angina on CCTA as follows: a) Significant stenosis with negative remodeling but no definite plaques, which completely dilated on IV nitrate CT, or b) Diffuse small diameter (< 2 mm) of a major coronary artery with beaded appearance, that completely dilate on IV nitrate CT. We analysis the results of provocative spasm test and CCTA findings.
Results: Fourteen patients showed positive results of spasm provoking test. Among them, 10 patients showed positive and 4 patients showed false negative results on CCTAs; one false negative CCTA showed multiple atherosclerotic plaques that hided coronary spasm, another one false negative CCTA showed the spasm was located at distal branch that was too small diameter to evaluate, the other 2 patients were negative finding on CCTAs even though retrospectively reanalyze. All 6 patients who showed negative results of spasm provoking test were both negative on CCTAs. The diagnostic performances of CCTAs were sensitivity 71%, specificity 100%, PPV100%, NPV 60%.
Conclusion: We speculate double acquisition of CCTA with/without IV vasodilator can increase the sensitivity of variant angina detection.

B-0748 14:16

Diagnostic yield and accuracy of coronary CT angiography after abnormal nuclear myocardial perfusion imaging

F.G. Meinel[1], U.J. Schoepf[2], L.L. Geyer[1], A.M. Khan[2], V.L. Fernandes[2], T.X. O'Brien[2]; [1]*Munich/DE*, [2]*Charleston, SC/US (felix.meinel@med.uni-muenchen.de)*

Purpose: To determine the diagnostic yield and accuracy of coronary CT angiography (CCTA) in patients referred for invasive coronary angiography (ICA) based on clinical concern for coronary artery disease (CAD) and an abnormal nuclear stress myocardial perfusion imaging (MPI) study.
Methods and Materials: In this prospective study, 100 patients (84 men, mean age 59.6 ± 8.9 years) with a clinical history concerning for CAD, leading to an abnormal MPI study and subsequent referral for ICA, were enrolled to additionally undergo CCTA prior to ICA. We analyzed the prevalence of potentially obstructive CAD (≥50% stenosis) on CCTA and clinical predictors of a positive CCTA. We further calculated the diagnostic accuracy of ≥50% stenosis on CCTA for the detection of clinically significant CAD defined as any ≥70% stenosis or ≥50% left main stenosis on ICA.
Results: On CCTA, 54 patients were considered positive for having at least one ≥50% stenosis. Age was the only significant predictor of a positive CCTA result on multivariate analysis. On ICA, 45 patients demonstrated clinically significant CAD. A positive CCTA had 100% sensitivity and 84% specificity with a 100% negative and 83% positive predictive value for clinically significant CAD on a per patient basis.
Conclusion: Almost half of patients with suspected CAD referred for ICA because of an abnormal MPI study demonstrate no obstructive CAD on CCTA. In this setting, CCTA has high sensitivity and negative predictive value for clinically significant CAD and can thus be used as a gatekeeper to ICA.

Author Disclosures:
U.J. Schoepf: Grant Recipient; This study was supported by a research grant provided by GE Healthcare. UJS is a consultant for and/or receives research support from Bayer, Bracco, GE, Medrad, and Siemens. **A.M. Khan:** Other; This material is based upon work supported in part by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development. **V.L. Fernandes:** Other; This material is based upon work supported in part by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development. **T.X. O'Brien:** Other; This material is based upon work supported in part by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development.

B-0749 14:24

Comparison fractional flow reserve (FFR), instantaneous wave-free ratio (iFR) and quantitative assessment SPECT-CT in evaluation of intermediate stenosis

V. Solomyanyy; *Moscow/RU (solo2882@gmail.com)*

Purpose: FFR and iFR is currently used to determine the management of intermediate coronary artery stenosis.Use SPECT/CT require revaluation FFR in intermediate stenosis severity against noninvasive Imaging.
Methods and Materials: In this study 88 patients with ischemic heart disease and 50% to 70% coronary stenosis.All perfusion scans were performed using a camera (BrightView XCT) equipped with a low-energy,high-resolution collimator and with cardiac gating.Protocol one day stress (bicycle test)/rest use with 900 MBq (25mCi) of technetium 99Tc-MIBI.Coronary angiography,which was defined as angiographic moderate (50-70%) was assessed by QCA and pressure wires received iFR,FFR.
Results: The classification agreement of coronary stenoses as significant or non-significant was established between iFR and FFR and between repeated FFR measurements for each 0.05 quantile of FFR values, from 0.2 to 1. Close agreement was observed between iFR and FFR (area under ROC curve= 86%). The optimal iFR cut-off (for an FFR of 0.80) was 0.89. After adjustment for the intrinsic variability of FFR,the classification agreement (accuracy) between iFR and FFR was 94%.SSS,SRS and SDS in the LDA,RCA and RCX artery territory according with AC and NC.Close agreement was observed between SDS and FFR with AC (sensitivity 97%,specificity 91%),NC (sensitivity 96%,specificity 84%).The coronary artery border stenosis was considered hemodynamically significant at a value SDS> 4 with AC and SDS> 3 NC corresponding to one of the main coronary artery.
Conclusion: SPECT/CT can be used to determine the hemodynamic significance of intermediate coronary artery stenosis.SDS with AC is more sensitive and specific for the coronary artery stenosis evaluation.

B-0750 14:32

Impact of coronary CTA use for acute chest pain patients on overall ED performance: system dynamics model analysis

A. Goehler[1], S. Huber[1], F. Nautsch[1], J. Nagurney[2], G. Gazelle[2], U. Hoffmann[2], H. Wong[3]; [1]*New Haven, CT/US*, [2]*Boston, MA/US*, [3]*Toronto, ON/CA (alexander.goehler@yale.edu)*

Purpose: Coronary computed tomographic angiography (CCTA) improves triage efficiency of patients with acute chest pain. The impact of CCTA on Emergency Department (ED) performance for non-cardiac patients is unknown.
Methods and Materials: We reviewed two consecutive years of ED visits to our tertiary hospital to identify chest pain visits that would have met inclusion criteria for the recent CCTA ED trials. For our comparator cohort, we considered all non-cardiac visits assigned to observation status. We developed a System Dynamics model to simulate patient flow through the ED, incorporating patient's characteristics, imaging use, and daily/hourly trends in ED visit volumes.
Results: Among 181K ED visits, we identified 3,494 visits for chest pain eligible for CCTA (age: 56±15 years, 52% male). 76% were placed in observation, 22% were directly discharged from the ED, and 3% had ACS. Of the 3,395 patients with consecutive negative troponins, 52% had additional CAD workup. The comparator cohort included 8,848 ED visits (age: 55±19 years, 47% male). 23% required cross-sectional CT imaging including head (37%), abdominal/pelvis (21%), and CTA-PE (8%). The model predicted well the length of stay (LOS) (model vs. observed in hours) for the current standard of care (target: 21 vs. 19, comparator: 22 vs. 25). Modeling the including of CCTA in the triage of chest pain patients, their average LOS decreased to 18 hours (14% reduction), resulting simultaneously in 5.2% increased capacity for the care of non-cardiac comparator patients.
Conclusion: Preliminary analyses suggest that CCTA use for chest pain patients improves ED performance broadly.

B-0751 14:40

ED triage strategies for acute chest pain - longterm clinical and economic outcomes: going beyond the ROMICAT II trial

A. Goehler[1], T. Mayrhofer[2], A. Pursani[2], H. Lumish[2], J. Nagurney[2], Q. Truong[2], B. Chow[3], G. Gazelle[2], U. Hoffmann[2]; [1]*New Haven, CT/US*, [2]*Boston, MA/US*, [3]*Ottawa, BC/CA (alexander.goehler@yale.edu)*

Purpose: Cardiac CT angiography (CCTA) has proven to be an effective triage strategy for evaluating acute chest pain; however, long-term consequences associated with its improved detection of coronary artery disease (CAD) are unknown.
Methods and Materials: Using ROMICAT II and Ottawa CCTA registry data, we developed a Markov model to compare health and economic outcomes over time for four strategies to evaluate acute chest pain: 1) early CCTA, 2) SOC in ROMICAT II, 3) expert consensus strategy and 4) expedited ED protocol with early discharge and diagnostic testing on an outpatient basis.
Results: The model predicted that SOC correctly identified 43 of 63 patients (68%) with CAD, CCTA 98%, expert consensus 75%, and expedited discharge 46%. Revascularisation rates and total (and therapeutic) costs after 30 days were 3.7%, 5.2%, 4.0%, 2.6%, and $4,144 ($1,643), $4,490 ($1,798), $4,064 ($1,529), and $2,513 ($622), respectively. Combined MI and CV death rates for CCTA were 1.7% lower than SOC, 1.2% lower than expert consensus, and 2.9% lower than expedited discharge. Over the lifetime, this resulted in total quality adjusted life years (QALYs) of 23.05, 23.09, 23.06, 23.02 with lifetime costs of $7,300, $7,700, $7,200, and $5,500, respectively. Differences in QALYs and costs translate into an incremental cost-effectiveness ratio of $49,400/QALY for CCTA versus expedited discharge. Both other strategies were dominated (i.e. inferior).
Conclusion: Though CCTA is associated with greater early testing and revascularisation rates, it is cost-effective in the long-term because the benefits of earlier treatment of obstructive CAD outweigh the increased testing.

B-0752 14:48

Evaluation of diagnostic value of a novel non-invasive coronary computed tomography angiography algorithm versus standard coronary angiography for assessing fractional flow reserve

S. Mangold, M. Renker, S. Baumann, R. Wang, F.G. Meinel, J.L. Wichmann, R.R. Bayer, D.H. Steinberg, U.J. Schoepf; *Charleston, SC/US (stefanie.mangold@med.uni-tuebingen.de)*

Purpose: To investigate the diagnostic performance of a novel CT-based fractional flow reserve (FFR) algorithm, developed for time-efficient in-hospital evaluation of hemodynamically indeterminate coronary lesions detected by coronary CT angiography (cCTA).
Methods and Materials: CT-based FFR was assessed in a blinded fashion in 67 coronary lesions of 53 patients. Pressure guidewire-based FFR < 0.80 served as the reference standard to define hemodynamically significant stenosis and assess the diagnostic performance of CT-based FFR compared to standard evaluation of cCTA (luminal diameter stenosis of ≥50%). The time required for calculation of CT-based FFR values was recorded.
Results: Mean total time for CT-based FFR was 37.5±13.8 min. On a per-lesion and per-patient basis, CT-based FFR resulted in a sensitivity of 85% and 94%, specificity of 85% and 84%, positive predictive value of 71% and 71%, and negative predictive value of 93% and 97%, respectively. The area under the receiver operating characteristics curve on a per-lesion basis was significantly greater for CT-based FFR compared with standard evaluation of cCTA (0.92 versus 0.72, P=0.0049). A similar trend, although not statistically significant, was observed on a per-patient basis (0.91 versus 0.78, P=0.078).
Conclusion: The investigated CT-based FFR algorithm outperforms standard evaluation of cCTA for the detection of hemodynamically significant stenoses while allowing on-site application within clinically viable timeframes.

Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0753 14:56

The effect of coronary calcium deposits and CT acquisition artifacts on coronary CT angiography derived fractional flow reserve, validated by invasive FFR

A. Coenen, M.M. Lubbers, A. Kurata, A. Kono, A. Dedic, R.G. Chelu, M.L. Dijkshoorn, R.-J. van Geuns, K. Nieman; *Rotterdam/NL (adriaancoenen@gmail.com)*

Purpose: Coronary CT angiography (CCTA) is an established examination with a strong ability to rule out coronary artery disease. Fractional flow reserve (FFR) is currently regarded as the standard of reference for coronary artery stenosis severity classification. The application of computational fluid dynamics from CCTA datasets allows for the computation of FFR (CTA-FFR) by simulating the coronary blood flow. In this study we evaluate the effect of coronary artery calcium (CAC) score and CCTA acquisition artifacts on CTA-FFR performance, validated by invasive FFR.
Methods and Materials: In 116 patients CTA-FFR (cFFR 1.4, Siemens Healthcare, Forchheim) was performed and validated with 203 invasive FFR measurements. Diagnostic performance was evaluated for patients with a CAC scores of < 100, 100-400, 400-1000 and > 1000. CCTA scans were scored for the presence of motion, stack-discontinuation and low contrast artifacts in the vessel of interest.
Results: From the 203 vessels 90 (44%) were considered hemodynamically significant (FFR ≤0.80). Overall performance of CTA-FFR was good with sensitivity, specificity and accuracy of 88%(CI95%:79-94%), 65%(55-73%) and 75%(69-81%), respectfully. Increasing CAC scores resulted in a non-significant reduction in specificity from 69%(49-85%) to 48%(26-69%). A reduced specificity of 25%(6-57%) was found for stack-discontinuation. For motion and low contrast there was no difference in performance.

Conclusion: On-site CTA-FFR performs well, within this population with a high prevalence of significant coronary artery disease. A non-significant decrease in specificity was found for increasing CAC scores. A reduction in specificity was found for stack-discontinuation suggesting CTA-FFR is not suitable in the presence of stack-discontinuing artifacts.

Author Disclosures:
M.L. Dijkshoorn: Consultant; Siemens AG. **K. Nieman:** Research/Grant Support; Bayer Healthcare. Speaker; GE Healthcare, Toshiba Medical Systems, Siemens Medical Solutions.

B-0754 15:04

Dynamic first pass CT perfusion imaging of the myocardium vs. intracoronary transluminal attenuation gradient in coronary CT angiography for the assessment of coronary artery stenosis

B.M. Gramer[1], I. Baur[1], M. Rasper[1], V. Leber[1], A. Leber[1], M. Vembar[2], E.J. Rummeny[1], A.M. Huber[1]; [1]*Munich/DE*, [2]*Cleveland, OH/US*
(b.gramer@gmx.de)

Purpose: To compare the diagnostic accuracy of dynamic first pass CT perfusion (CTP) imaging and the transluminal attenuation gradient derived from coronary CT angiography in the assessment of coronary artery stenosis.
Methods and Materials: 34 patients with suspicion of coronary artery disease, who underwent invasive coronary angiography (CA) and assessment of intermediate coronary artery lesions (50-75% diameter reduction) by an invasive pressure wire examination (FFR) were included. All patients underwent a coronary CTA and a dynamic CTP examination under adenosine stress at a 256 slice CT scanner with an 8 cm wide detector. Myocardial blood flow was determined using the dynamic first pass CTP data. Transluminal attenuation gradient (TAG) was calculated as the linear regression coeffcient between luminal attenuation and the distance of the location in the coronary artery from its origin. MBF and TAG were compared with the results CA and FFR. ROC curves were calculated. Sensitivity and specificity were calculated using Youden´s index.
Results: The area under the ROC curve was 0.92 (0.80 to 0.95) for MBF and 0.64 (0.46 to 0.793) for TAG (p=0.002). The optimal threshold using Youden´s index was 1.51 for TAG and 1.21 for MBF. Sensitivity and specificity for detection of hemodynamically relevant coronary artery lesions were 71.4 (41.9-91.4) and 73.2 (57.1- 85.8) for TAG. Sensitivity and specificity were 90.9 (8.7-98.5) and 84.6 (65.1- 95.5) for MBF.
Conclusion: MBF derived from dynamic CTP imaging of the myocardium is superior compared to the TAG derived from coronary CTA for the assessment of coronary artery stenosis.

Author Disclosures:
M. Vembar: Employee; Philips Medical Systems.

B-0755 15:12

Incremental diagnostic value of functional CT for the assessment of hemodynamically significant coronary artery disease: a meta-analysis

R.A.P. Takx[1], T. Leiner[2], U. Hoffmann[1]; [1]*Boston, MA/US*, [2]*Utrecht/NL*
(richard.takx@gmail.com)

Purpose: Coronary CT angiography (CCTA) is an excellent technique for ruling out coronary artery disease (CAD). Nevertheless, recently several techniques to provide additional functional assessment of the hemodynamic significance of CAD have been introduced. We performed a meta-analysis to determine the incremental value of adding myocardial perfusion, coronary transluminal attenuation gradient (TAG) and coronary fractional flow reserve CT (FFRCT) to anatomic CAD for the detection of hemodynamically significant CAD.
Methods and Materials: We systematically searched electronic databases for studies using invasive coronary angiography combined with FFR for assessment of intermediate coronary stenoses as the reference standard. A random-effects model was used for computing pooled sensitivity, specificity, likelihood ratios and the diagnostic odds ratio. Analyses were performed on vessel and patient levels. Since CCTA itself already has an excellent sensitivity, specificity was chosen as the main outcome measure.
Results: 35 studies (6214 vessels/2482 patients) satisfied the predefined inclusion criteria. Across all CCTA studies, at vessel level anatomic assessment of > 50% stenosis by CCTA had a specificity of 0.63[0.61-0.66]. Adding information on myocardial perfusion (specificity: 0.86[0.83-0.88]) and TAG to anatomic CAD (specificity: 0.81[0.73-0.87]) provided a significantly increment in specificity. FFRCT alone also yielded improved results (specificity: 0.76[0.73-0.79]). At patient level CCTA had a specificity of 0.49[0.45-0.52]. Adding myocardial perfusion and FFRCT provided a significant increment in specificity (0.79[0.70-0.87] and 0.70[0.65-0.75], respectively).
Conclusion: Adding functional information to anatomic CCTA provides significant improvement in specificity as compared to invasive angiography and FFR and has the potential lower the number of inappropriate referrals for revascularisation.

B-0756 15:20

Regadenoson-stress dynamic myocardial perfusion with computed tomography - diagnostic performance and contribution in patients prior major vascular surgery

J. Baxa, J. Ferda, M. Hromadka, J. Sedivy, T. Matouskova, B. Kreuzberg;
Pilsen/CZ (baxaj@fnplzen.cz)

Purpose: We assessed the benefit of a combined protocol including coronary CT angiography (cCTA) and regadenoson-induced dynamic stress CT perfusion (rsCTP) in patients referred to major vascular surgery with low pre-test probability of coronary heart disease (CHD).
Methods and Materials: The prospective study included 54 patients (mean age 63±7 years) with occlusive peripheral artery disease (PAD) or abdominal aortic aneurysm (AAA) referred for major surgery, who underwent cCTA and rsCTP examination protocol (dual-source CT). Diagnostic accuracy in detecting of significant stenosis (≥50%) was evaluated for cCTA alone and cCTA+rsCTP combined assessment in 27 patients underwent invasive coronary angiography (ICA) based on CT positive cCTA+rsCTP finding. Peri- and postoperative cardiac events were followed in all patients underwent surgery.
Results: Positive CTA+rsCTP findings were observed in 25 patients (stress induced ischemia). In 7 patients followed PCI and in 5 patients CABG. PCI (in 6 patients) or CABG (in 5 patients) was recommended in case of symptoms onset. 27 patients underwent planned vascular surgery without any peri- and postoperative cardiac complications. Evaluation of cCTA+rsCTP had higher diagnostic accuracy of significant stenosis detection over cCTA (per-segment: sensitivity 98vs.94%, specificity 94vs.67%; per-vessel: sensitivity 97vs.93%, specificity 93vs.67%. The statistically significant improvement was confirmed in specificity assessment (p=0.002).
Conclusion: Our results demonstrate a significant additional value of rsCTP in assessment of stenosis significance. A combined CTA+rsCTP protocol was feasible as an alternative stress test with high diagnostic performance in patients referred for major vascular surgery.

Friday, March 6

10:30 - 12:00 **Room C**

Breast

SS 1002
Breast MRI indications and MR-guided biopsy

Moderators:
G. Esen; Istanbul/TR
S. Schrading; Aachen/DE

B-0757 10:30

Worldwide practice of breast MRI: insights from the MIPA study applications - the MIPA study group

G. Di Leo[1], R.M. Trimboli[1], I. Ioan[2], L.A. Carbonaro[1], T.H. Helbich[3], F.J. Gilbert[4], N. Houssami[5], F. Sardanelli[1]; [1]*San Donato Milanese/IT*, [2]*Milan/IT*, [3]*Vienna/AT*, [4]*Rotterdam/NL*, [5]*Sydney/AU (gianni.dileo77@gmail.com)*

Purpose: The MIPA study is an ongoing observational individual-patient data meta-analysis. We present data provided during the initial phase for center selection.
Methods and Materials: In 2012, an international call was open for application. Centers described their breast MRI practice, including magnetic field strength, use of T2-weighted or DWI sequences, technical details, number of MRI examinations and number of MRI-guided biopsies performed yearly, and indications. Data were presented as median and percentiles.
Results: We received 97 applications from Europe (n=71), Asia (n=13), South America (n=7), North America (n=2), Australia (n=2), and Africa (n=2). Magnetic field strength was 1 T in one center (1%), 1.5 T in 52 (55%), 3.0 T in 15 (16%), 1.5 T plus 3.0 T in 26 (27%), and 7 T in one (1%). All centers use a T2-weighted sequence, 16 of these (17%) STIR; 65/92 (71%) add DWI. Spatial resolution of dynamic study (pixel, mm2) 0.80 (0.64–1.00); ≥2.25 in only 4 centers (7%). Slice thickness (mm) was 1.5 (1.0-2.0); ≥3 in nine centers (10%). Time resolution (s) was 67 (58-89). Number of breast MRI performed yearly 439 (201-750); ≥1000 in 17 centers (18%). Centers offered MR-guided biopsy and performed 12 (2-24) procedures per year.
Conclusion: Most applications came from high-volume state-of-art centers using standardized high-temporal and spatial resolution dynamic technique; more than 70% add DWI. More than 40% of centers have 3-T magnets.

Author Disclosures:
G. Di Leo: Other; Sponsored by Bracco Imaging SpA. **R.M. Trimboli:** Other; Sponsored by Bracco Imaging SpA. **L.A. Carbonaro:** Other; Sponsored by Bracco Imaging SpA. **F. Sardanelli:** Speaker; Bracco Imaging SpA.

B-0758 10:38

Is late-phase information necessary for dynamic evaluation of breast cancer?

M.U. Dalmis, A. Gubern-Mérida, S. Vreemann, B. Platel, R.M. Mann, N. Karssemeijer; *Nijmegen/NL (mehmet.dalmis@radboudumc.nl)*

Purpose: Novel breast MRI protocols evaluate early contrast uptake of lesions, using a short acquisition time and high-temporal resolution (tRes). However, these acquisitions do not provide information about late phase enhancement (curve-type). In this study, we investigated whether adding late phase information to early contrast uptake dynamics improves the differentiation between benign and malignant lesions as measured with a computer-aided diagnosis (CADx) system.
Methods and Materials: 106 malignant and 44 benign lesions were evaluated, which were imaged with a 4.3 seconds tRes sequence for the initial 100 seconds and a high-spatial resolution sequence for the subsequent 510 seconds. The locations of the lesions were marked manually. The CAD system automatically segmented the lesions and extracted six features that describe the early contrast uptake. These features were used in a random forest classifier for malignant/benign classification. In the second step, washout rate (WR) of the lesions obtained from the late phase acquisitions were added to these features and classification was repeated. The classification accuracies of both methods were compared using ROC analysis.
Results: The area under the curve (AUC) was 0.816 with high tRes early contrast uptake dynamics features alone. Adding the WR feature slightly increased the AUC value to 0.824, where the difference was not statistically significant.
Conclusion: Addition of late phase information on top of high tRes early uptake dynamics did not increase the diagnostic performance significantly. This result supports the feasibility of shorter MRI protocols for classification of breast lesions.

Author Disclosures:
N. Karssemeijer: Advisory Board; Matakina Ltd. CEO; ScreenPoint Medical BV. Consultant; QView Mecical Inc. Founder; QView Medical Inc, Matakina Ltd., ScreenPoint Medical B.V. Shareholder; QView Medical Inc, Matakina Ltd., ScreenPoint Medical B.V.

B-0759 10:46

MRI for diagnosis of malignancy in mammographic microcalcifications: a systematic review and meta-analysis

B. Bennani-Baiti, P.A.T. Baltzer; *Vienna/AT (barbara.bennani-baiti@meduniwien.ac.at)*

Purpose: Assess the validity of breast MRI to diagnose breast cancer in microcalcifications detected by mammography.
Methods and Materials: Two investigators independently performed a systematic review using predefined search terms. Discrepancies were resolved by final consensus cross-evaluation. We selected studies that applied contrast enhanced MRI for assessing mammographic BI-RADS 3-5 microcalcifications. Standard of reference had to be established by histopathology or clinical follow-up. Study design, technical parameters, number of true positives, false positives, false negatives and true negatives were extracted from the original publications, and possible bias was determined using the QUADAS 2 applet. Statistical analysis included data pooling, forest plot construction, and heterogeneity testing.
Results: 14 studies met our inclusion criteria. These comprised 1109 lesions, including 617 benign and 492 malignant lesions. The number of lesions per study ranged from 35 to 172. The sensitivity ranged from 33.3% to 95.0%, with a pooled sensitivity of 82.9% (random effects model; substantial heterogeneity; p less than 0.0001). The specificity was also heterogeneous (p less than 0.0001) and ranged from 41.3% to 98.7%. Based on a random effects model, the pooled specificity was 79.1%. There was no publication bias based on study size or prevalence of malignancy (p more than 0.05).
Conclusion: Depending on patient preselection and assessment criteria, MRI may or may not reliably detect malignancy in mammographic microcalcifications. Pending that proper patient preselection is carried out, the data support the application of MRI in diagnosing mammographic microcalcifications.

B-0760 10:54

Breast MRI adds high negative predictive value in a large cohort of patients with microcalcifications BI-RADS 3 to 5

A. Cervera Araez, J. Camps Herrero, E. Garcia Oliver, V. Ricart Selma, M. Forment Navarro, C. Martinez Rubio, J. Cano Gimeno, I. Martinez Gómez; *Valencia/ES (aca82@hotmail.com)*

Purpose: To analyze the diagnostic accuracy of breast MRI in patients with BI-RADS 3-5 microcalcifications.
Methods and Materials: Retrospective data analysis of 204 consecutive patients with a diagnosis of microcalcifications BIRADS 3-5, and a breast MRI with a T2 FSE sequence and a 3D dynamic T1GRE sequence of variable spatial resolution (< 3 mm). MRI was considered positive when enhancement in the area of the microcalcifications was seen, regardless of the enhancement curve. Gold standard was histology. No pathology with a follow-up greater than 24 months were considered negative.
Results: Between 2003-2014, 204 patients with 205 lesions were included. Mean age was 56.1 years (range 32-84). Patients were screen-detected in 62.2%. Positive findings were found in 96/205 lesions (46.8%) and negative findings were seen in 109/205 (53.2%) lesions. Percutaneous biopsy was performed in 185 (90.7%) patients with 14G in 68.6% and with 9G in 33%. 71 patients (34.8%) underwent surgery. Pathology determined 77/205 lesions to be malignant (35.5%). Malignancy rates in patients with mammographic BI-RADS 3 to 5 were 10.5%, 43.3% and 60% respectively. 20 patients with BI-RADS 3-4 lesions and no histology had a mean follow-up of 50.5 months (24.4-95.1) without a malignancy. Diagnostic accuracy of breast MRI: sensitivity 84.8%, specificity 76.4%, PPV 69% and NPV 89%. False negative MRI exams missed 12 DCIS: two measuring 1 mm, and 5/12 radiologist-false negative.
Conclusion: A negative Breast MRI can potentially avoid biopsies in patients with mammographic BI-RADS 3 and 4 lesions due to its high sensitivity and NPV.

B-0761 11:02

Evaluation of T1/T2 ratios in a pilot study as a potential biomarker of biopsy - proven benign and malignant breast lesions in correlation with histopathological disease stage

M. Malikova[1], J.N. Tkacz[1], P.J. Slanetz[1], A. Aakil[1], C.-Y. Guo[2], H. Jara[1]; [1]*Boston, MA/US*, [2]*Taipei City/TW (mmalikov@bu.edu)*

Purpose: To study a potential role of quantitative MRI (qMRI) using T1/T2 ratios to differentiate benign from malignant breast lesions, assess contralateral breast involvement and monitor response to treatment.

Methods and Materials: A cross sectional study of 84 women with breast lesions were scanned with the mixed-TSE pulse sequence, which is multispectral in T1 and T2, therefore, affords maps of T1/T2. qMRI assessment of the same quadrant of contralateral breast, that did not have known cancerous lesion, was performed and compared to the breast that was subjected to chemotherapy and/or radiation therapy in order to monitor response to treatment.
Results: Elevated T1/T2 means of 7.14 ± 1.05 (N=12) were observed for biopsy proven malignant lesions, 6.49 ± 0.63 (N=33) for malignant lesions that were treated prior to qMRI with chemotherapy and/or radiation as compared to 3.97 ± 0.43 (N=39) for benign lesions. Three out of 33 examined subjects in post-treatment group had an elevated T1/T2 ratios detected in contralateral breast. Subsequent biopsy and histopathology analysis confirmed contralateral breast involvement. The higher stage of cancer determined by histopathology analysis was also strongly associated with higher T1/T2 ratio (p=0.0198). Estrogen, progesterone and Her2/neu triple negative receptors status was strongly correlated with higher T1/T2 ratio (p=0.0019, p=0.0021, and p=0.0030; respectively).
Conclusion: The T1/T2 ratios provide measures that strongly correlate with histopathological findings. This quantitative information of tissue properties can provide basis for improving the specificity of diagnostic breast imaging and serve as a tool to assess response to treatment and contralateral breast involvement.

B-0762 11:10

Magnetic resonance imaging: evaluation of edema of the breast and the role of T2 STIR sequence in the characterisation of malignant and benign lesions

R. Di Miscio, V. Casali, D. Cannata, E. Miglio, M. Telesca, M. Luciani, F. Pediconi; *Rome/IT (srdimiscio@libero.it)*

Purpose: To determine the role of MR imaging in differentiating benign and malignant lesions of edema of the breast.
Methods and Materials: Between January 2004 and March 2013, 1509 women underwent breast MRI with contrast medium for suspicious lesions to ' mammography and / or ultrasound. Patients with lesions BI- RADS 3, 4 and 5 examined by MRI were subsequently subjected to histological or cytological evaluation. MR examinations were performed on high-field magnet (3 Tesla) with pre- contrast T2-weighted STIR sequences and dynamic 3D FLASH T1 - weighted images before and after administration of 0.1 mmol / kg of contrast agent (Gd- BOPTA (Multihance ®). Patients were divided into 3 groups based on the characteristics of edema: diffuse unilateral edema, absence of edema and perifocal edema.
Results: Edema was observed in 1329/1509 patients and malignant lesions were identified in 1080/1509. In 792/1080 patients edema was diffuse, perifocal in 288/1080. 429/1509 patients showed benign lesions and in 124/429 edema was diffuse, while in 305/429 perifocal. The diffuse edema was seen more frequently in malignant lesions than in benign, the difference between the type of edema between the two groups of lesions (benign and malignant) was significant ($p > 0.01$).
Conclusion: The evaluation of edema with T2 STIR allows you to obtain important information for a more accurate differentiation between benign and malignant lesions.

B-0763 11:18

Can morphological analysis of phyllodes tumour predict the likelihood of malignancy in breast MRI?

G. Choi[1], O. Woo[1], H. Shin[1], E. Hong[1], K. Cho[1], B. Seo[2]; [1]*Seoul/KR*, [2]*Ansan/KR (cgyjulie@gmail.com)*

Purpose: To evaluate the multimodality imaging findings of phyllodes tumour of the breast and correlate its imaging findings with histologic grade and suggest radiologic clues to distinguish malignant from benign.
Methods and Materials: Radiologic images and clinical histories of 59 patients with histologically verified phyllodes tumours were retrospectively studied. All patients were female and between the ages of 15 and 68 years (mean age, 44.6 years). Mammography (n=52), breast US (n=59), breast CT (n=6) and breast MR imaging (n=26) were performed. The diagnosis of phyllodes tumours of the breast was pathologically confirmed by means of examination of the specimens obtained at surgical biopsy. We correlated radiologic findings with pathologic results.
Results: 33 masses were benign, 12 masses were borderline, and 14 masses were malignant. The mean size was 5.5 cm for the benign phyllodes tumours, 4.2 cm for the borderline tumours, and 12.6 cm for the malignant tumours. Internal haemorrhage and cystic change with irregularly enhancing wall were significantly associated with malignant histologic grade ($p < 0.001$). However, the size, tumour shape, margin and internal enhancement pattern did not correlate with histologic grade.
Conclusion: A phyllodes tumour greater than 6 cm in diameter suggests a higher likelihood of malignancy; however, the radiologic characteristics of benign and malignant tumours overlapped substantially. Internal haemorrhage and cystic change with irregularly enhancing wall are suggestive of malignant phyllodes tumour of the breast.

B-0764 11:26

Diagnostic accuracy of breast MRI in the evaluation of patients with suspecious nipple discharge

V. Casali, M. Telesca, M. Luciani, S. Liberali, F. Pediconi, E. Miglio, R. Di Miscio; *Rome/IT (valeria.casali84@gmail.com)*

Purpose: To investigate the role and the diagnostic accuracy of Breast Magnetic Resonance Imaging (MRI) in the evaluation of patients with suspeciuos discharge from the nipple.
Methods and Materials: 68 patients with suspicious nipple discharge underwent MRI using a 1.5T scan with the following protocol: pre-contrast T2-weighted TIRM sequences, T1 weighted 3D sequences aquired before and after gadobenate dimeglumine administration (Multihance 0.1 mml/Kg). MRI findings were divided according to BIRADS creteria into two groups: benigns (BIRADS 1-2-3) and maligns (BIRADS 4-5). 42 patients underwent surgery, 26 patients were clinically and instrumentally followed-up during 24 months. Histological and clinical findings after 24 month were compared to MRI findings.
Results: MRI identified 28 cases of BIRADS 4-5, 24 of which were found to be malignant at histological examination. In the 40 cases classified as BIRADS 1-2-3, 14 lesions were confirmed as benign by definitive histological examination, 2 lesions were found to be a malignant tumour and 24 patients had negative follow-up at 24 months. Sensitivity, specificity and diagnostic accuracy of MRI were respectively 93%, 92% and 92% with a positive predictive value of 87% and negative predictive value of 96%.
Conclusion: Breast MRI is an accurate method in the evaluation of patients with suspicious nipple secretion. A negative MRI can direct patients to follow-up rather than surgery.

B-0765 11:34

Mammographic architectural distorsions: taking advantage of the NPV due to MRI

E. Garcia Oliver, J. Camps Herrero, A. Cervera Araez, V. Ricart Selma, C. Martínez Rubio, J. Cano Gimeno, M. Forment Navarro, I. Martínez Gómez; *Alzira/ES (elegarol@gmail.com)*

Purpose: To analyse the diagnostic accuracy of breast MRI in patients with a diagnosis of architectural distorsion or radial scar.
Methods and Materials: Retrospective data analysis of 63 consecutive patients in whom we performed breast MRI with a T2 FSE sequence and a 3D dynamic T1 GRE sequence of variable spatial resolution (< 3 mm slice thickness). MRI was considered positive when enhancement in the area of the distorsion was seen, regardless of the enhancement curve. Gold standard was histology. No pathology with a follow-up of greater than 24 months were considered negative.
Results: Between May 2003 and March 2014, 88 patients were studied. 25 patients were excluded due to insufficient follow-up, leaving 63 patients with 64 lesions for analysis.
Mean age was 48.9 years (range 29-75). Patients were screen detected in 43.5%. Positive findings with MRI were found in 26/64 lesions (40.6%) and negative findings were seen in 38/64 (59.3%) lesions. Percutaneous biopsy was performed in 44 patients (70%), 11 of which underwent two biopsies. Thirty-seven patients (34.8%) underwent surgery. Pathology determined 9/64 lesions to be malignant (14.06%), 13/64 (20%) high-risk and 26/64 (40.6%) benign. Sixteen (25.4%) patients with distorsions and no histology had a mean follow-up of 44.4 months (24.9-99.43) without a diagnosis of malignancy. Diagnostic accuracy of breast MRI: sensitivity 80%, specificity 66.67%, PPV 30.77% and NPV 94.74%. False negative MRI exams missed 2 low-grade DCIS.
Conclusion: Breast MRI can avoid breast biopsy in patients with architectural distorsions and no enhancement due to its high NPV.

B-0766 11:42

Breast MR biopsy: pathological and radiological correlation

C. Dratwa[1], A. Jalaguier-Coudray[2], J. Thomassin-Piana[2], J. Chopier[1], I. Thomassin-Naggara[1]; [1]*Paris/FR*, [2]*Marseille/FR (chloedratwa@gmail.com)*

Purpose: To optimize radio pathological correlation of MR-guided breast biopsy.
Methods and Materials: Databases of two centres were queried to identify MR-guided MR biopsies performed between Jan 2009 and Feb 2013 and a cohort of 197 women with 208 lesions was identified. Three radiologists retrospectively analysed all prebiopsy MRI examinations and rated the lesion recommended for biopsy according to the new BI-RADS lexicon. Then, three pathologists analyzed all biopsy samples to describe the lesion of interest, its interface with the surrounding breast tissue and other focal and diffuse associated features. Pathologists and radiologists jointly verified the correlation between MR images and pathological features.
Results: The malignancy rate was 25.9% (54/208) with an underestimation rate of 5.7% (12/208). Invasive carcinoma corresponded more frequently to mass than NME or focus ($p < 0.0001$). Biopsied lesions confirmed as benign, including fibroadenoma or papilloma, corresponded equally frequently to an enhancing mass or a NME. A visible interface at pathology between a biopsied lesion and the surrounding breast tissue was more frequently identified in mass enhancement compared to NME or focus (p=0.0003). Regional NME was correlated with a high degree of fibrosis (p=0.001) and the presence of PASH (p=0.0007). Linear or segmental NME was correlated with the presence of periductal mastitis (p=0.0003).
Conclusion: Our study confirms that radiopathological correlation is difficult after breast MR biopsy but some histological criteria exist that may help to validate an MR-guided biopsy benign result.

Author Disclosures:
I. Thomassin-Naggara: Speaker; GE.

B-0767 11:50

MR-guided vacuum-assisted breast biopsy: influence of biopsy device, lesion type and size on false negative results and underestimation rates

C. Spick, T.H. Helbich, K. Pinker-Domenig, H. Bickel, S.H. Polanec, G. Wengert, H. Magometschnigg, P.A.T. Baltzer; *Vienna/AT (claudio.spick@gmail.com)*

Purpose: To assess the influence of biopsy device, lesion type and size on underestimation rates in MR-guided vacuum-assisted breast biopsy (VABB).
Methods and Materials: This retrospective IRB-approved study included 467 consecutive patients (mean age 52, range 18-87 years) undergoing 487 MR-guided VABB using three different 8 to 10-gauge biopsy devices (Mammotome 8-gauge, M; Atec 9-gauge, A; Vacora 10-gauge, V). VABB data (lesion type, size, biopsy device and histopathology) were compared to the final outcome (surgery in case of biopsy-proven malignancy, borderline lesions (B3) and/or discrepancy between VABB and imaging findings; follow-up of 24 months in case of benign findings). Appropriate statistical tests were used.
Results: Final diagnosis was malignant in 104 (21.4%) and benign in 383 (78.6%). Surgical results were in agreement with VABB in 465/487 (95.5%, kappa=0.85); Eleven benign VABB results were false negative (2/73 M, 1/95 A, 8/160 V), all were identified as inconsistent findings between imaging and VABB results. 11/77 (14.3%) B3 lesions proved to be malignant (3/26 A, 3/12 M, 4/39 V) and 5/34 (14.7%) DCIS were upgraded to invasive cancer. Underestimation rates and false negative biopsy rates showed no statistically significant association with biopsy device, lesion size and type ($P > 0.05$).
Conclusion: MRI-guided biopsy is an accurate procedure for diagnosis of MRI-only lesions independent from lesion characteristics and the biopsy device used. False negatives are rare. B3 lesions have to undergo subsequent surgery due to a substantial underestimation rate.

10:30 - 12:00 **Room Z**

Vascular

SS 1015

Low dose and low contrast in vascular imaging

Moderators:
M. Maynar; Santa Cruz de Tenerife/ES
G. Tsoumakidou; Strasbourg/FR

B-0768 10:30

How does patient breathing influence contrast enhancement in central arteries?

A. Gutzeit[1], C. Reischauer[1], J.E. Roos[2], J.M. Froehlich[1]; [1]*Lucerne/CH*, [2]*Durham, NC/US (agutzeit2000@gmail.com)*

Purpose: Optimal contrast within the pulmonary artery is achieved by the maximum amount of contrast-enhanced blood flowing through the superior vena cava (SVC), while minimum amounts of non-contrasted blood should originate from the inferior vena cava (IVC). To analyze how various breathing techniques influence vena cava blood flow ratios.
Methods and Materials: Phase-contrast pulse sequences on a 1.5 T MRI magnet were used for flow quantification (mean flow (mL/s), stroke volume (Vol) in the SVC and IVC in volunteers. Different breathing manoeuvers were analysed repeatedly: free breathing; inspiration; expiration; suction against resistance, and Valsalva. To standardise breathing commands, volunteers performed suction and Valsalva manoeuvers with an MR-compatible manometer.
Results: Suction against resistance was associated with a significant drop of the IVC/SVC flow quotient (mean 1.63 $p = 0.05$ at -10 mmHg and 1.48 [1.1-1.9] $p = 0.01$ at -20 mmHg) corresponding to increased blood flow from SVC and diminished flow originating from the IVC. The remaining breathing commands (free breathing 2.2; inspiration 2.4; expiration 2.4; Valsalva 10 mmHg 2.3; Valsalva 20 mmHg 2.6; and Valsalva 30 mmHg 2.2) showed no differences (p larger than 0.05).
Conclusion: Suction against resistance caused a significant drop in the IVC/SVC quotient. Theoretically, this breathing manoeuver might significantly improve the enhancement characteristics of CT pulmonary studies.

Author Disclosures:
J.M. Froehlich: Consultant; Guerbet.

B-0769 10:38

Factors influencing contrast bolus geometry during dynamic CTA: in-vitro evaluation using a pulsatile flow model and in-vivo application

J. Lee, J. Kwon; *Daegu/KR (jonglee@knu.ac.kr)*

Purpose: For compounder-less evaluation of the influencing parameters on the first-pass contrast bolus geometry during CT angiography and to test the results in-vivo.
Methods and Materials: A self-made closed-circuit pulsatile flow system was used for simulating pulmonary-aortic circulation. Heart rate, contrast injection rate, iodine concentration, and tube voltage were set to 50-90 bpm, 1-5 ml/sec, 270-379 mg/mL, and 80-120 kVp. The other CT scanning parameters were fixed as constants. Single slice CT scan repeated for 90 seconds in 0.45-sec interval. Time-HU curve parameters were compared with input variables using a step-wise multiple regression analysis. Under a fixed iodine delivery rate (IDR), two different iodine concentrations were compared during cardiac CT (320 and 400 mg/mL). Signal-to-noise ratio (SNR) and average HU were measured.
Results: Total 135 data sets were acquired. The peak enhancement increased mainly by faster IDR and additionally by lower tube voltage (R^2=0.816 and 0.919, $p < 0.001$). Whereas, iodine concentration and heart rate showed no incremental impact on peak enhancement. The time-to-peak enhancement was shortened by higher heart rate and additionally by faster IDR (R^2=0.860 and 0.900, $p < 0.001$). This influence increased by sequentially adding IDR and iodine concentration. In cardiac CT with fixed IDR, there was no significant difference of arterial SNR and HU between two iodine concentration groups (462 versus 445 HU, 33 versus 30 SNR in aorta, $p > 0.49$).
Conclusion: IDR, heart rate, and tube voltage were critical variables to bolus geometry, whereas iodine concentration was an insignificant factor. Proper kVp and IDR generates proper bolus geometry independently on the formulation of iodine contrast media.

B-0770 10:46

Advanced model-based monoenergetic dual-energy CTA of the abdomen: optimisation of keV settings

M.H. Albrecht, J.-E. Scholtz, K. Hüsers, M. Kaup, A.M. Bucher, R.W. Bauer, T. Lehnert, T.J. Vogl, J.L. Wichmann; *Frankfurt a. Main/DE (MoritzAlbrecht@gmx.net)*

Purpose: To compare objective image quality parameters in abdominal dual-energy computed tomography angiography (DE-CTA) using an advanced model-based monoenergetic (Mono+) reconstruction algorithm compared to standard linearly blended images.
Methods and Materials: 55 patients (36 men; mean age, 64.2 ± 12.7 years) who underwent abdominal DE-CTA were included in this retrospective study. Mono+ images were reconstructed at 40, 50, 60, 70, 80, 90 and 100 keV levels and as linearly blended M_0.6 images (60% 80 kV). Based on measurements of various regions of interests contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were calculated for common hepatic, splenic, superior mesenteric and left renal artery, respectively. A Student t test was used for statistical analysis.
Results: Mono+ DE-CTA series showed a statistically superior CNR for 40, 50, 60, 70 and 80 keV ($p < 0.31$) compared to M_0.6 images for all investigated arteries except for superior mesenteric artery at 80 keV+ (p=0.08). CNR at 40 keV+ revealed a relative mean increase of 287.7 ± 14.1 % compared to linearly blended images regarding all assessed arteries ($p < 0.001$). SNR of Mono+ images was higher compared to M_0.6 at 40, 50, 60 and 70 keV with consistently statistical significance only for common hepatic and splenic artery ($p < 0.009$).
Conclusion: Compared to linearly blended images, abdominal DE-CTA at low keV levels using Mono+ enables superior objective image quality and might therefore allow for a increased diagnostic performance and a reduction of required contrast media.

Author Disclosures:
R.W. Bauer: Speaker; On the speakers' bureau of Siemens Healthcare, Computed Tomography division.

B-0771 10:54

Optimisation study of image quality of pulmonary angiography: volume helical shuttle technology with low-osmolar contrast medium

Y. Zhou, P. Hou, J.B. Gao; *Zhengzhou/CN (zhouyue779@163.com)*

Purpose: To access the image quality of of volume helical shuttle (VHS) in spectrum CT with low-osmolar contrast medium for CT pulmonary artery angiography (CTPA).
Methods and Materials: Group A included CTPA of thirty patients (BMI:18.8~24.2) with contrast (iopromide 370 mgI/ml) with VHS mode of the CTPA, while thirty patients (BMI: 18.1~23.6) in group B with low-osmolar contrast (iodixanol 270 mgI/ml). Images of four different phases were got after four consecutive scans. Size-specific dose estimates and contrast-to-noise ratio (CNR) were calculated. Image quality was subjectively assessed by two readers separately.
Results: The percentages of the four paths to be the best path were 15.38%, 46.15%, 30.77%, 7.7% for group A and 12.15%, 57.63%, 21.31%, 8.91% for group B, respectively. In the best path, there were no statistically significant differences in average CT value of main pulmonary artery (MPA) (281.74±49.83 vs. 329.21±41.63 HU, *P*=0.989), image noise (18.7±3.8 vs. 17.9±3.4 HU; *P*=0.141) and CNR (3.354±0.561vs 3.563±0.496, *P*= 0.179) between group A and B. The percentage of average CT value in MPA more than 300 HU in group A had no significant difference from that of group B (*P*=0.179). The subjective grading of MPA, lobar pulmonary artery and segmental pulmonary artery were not significantly different between two groups (4.1±0.9 vs. 4.0±0.9, *P*=0.179; 3.500±0.608 vs 3.604±0.675, *P*=0.577; 3.48±0.67 vs 3.50±0.30; *P*=0.914).
Conclusion: VHS in spectrum CT with low-osmolar contrast allows for decreasing the iodine load at CTPA while maintaining image quality.

B-0772 11:02

Comparison of the diagnostic efficacy of three iodinated contrast media with different ioine concentrations for coronary CTA: a randomised European multicenter trial

B. Cabeza[1], J.-F. Paul[2], H.-C. Becker[3], A. Laghi[4], S. Achenbach[5], S. Leschka[6]; [1]*Madrid/ES*, [2]*Paris/FR*, [3]*Munich/DE*, [4]*Latina/IT*, [5]*Erlangen/DE*, [6]*St. Gallen/CH (beatrizcabeza66@gmail.com)*

Purpose: To assess the diagnostic efficacy of iobitridol (Xenetix® 350) compared to iopromide (Ultravist® 370) and iomeprol (Iomeron® 400) in the visualization of coronary arteries.
Methods and Materials: Prospective, randomised, multicenter, double blind, non-inferiority phase IV trial including 468 patients with suspected coronary artery disease (CAD) and scheduled to undergo CT angiography. The primary endpoint was the CT scan evaluability for CAD diagnosis in terms of quality and interpretability of images. It was based on the full evaluation of 18 coronary segments for each patient and assessed by 2 off-site independent readers. Secondary endpoints included safety and efficacy parameters of the 3 contrast media (mainly image quality, stenosis assessment, and signal quantification).
Results: Out of the 452 patients completed for the primary analysis, 92.1% had their 18 segments fully evaluable in the iobitridol group, vs. 94.6 and 95.4% in the iomeprol and iopromide groups respectively. Non-inferiority for the primary outcome was statistically demonstrated ($p < 0.05$). Mean image quality was good to excellent for each of the 3 contrast media, and no relevant differences were observed for the other secondary endpoints between the 3 groups. The mass of iodine (in g) injected was significantly different between the 3 groups: 27.8±3.4 (iobitridol), 29.3±3.8 (iopromide) and 31.7±3.8 (iomeprol), $p < 0.001$. Eventually, the good general safety profile of products was confirmed.
Conclusion: Coronary CT angiography using Xenetix® 350 is non-inferior to higher concentration contrast agents regarding image quality and evaluability while the amount of iodine required can be significantly reduced.

Author Disclosures:
B. Cabeza: Research/Grant Support; Guerbet has sponsored the study.
A. Laghi: Speaker; Speaker for GE, Bayer, Alfa-wassermann, Bracco. Other; Research agreement with GE.

B-0773 11:10

Is automated kV selection for radiation dose reduction independent from contrast media concentration in CT

M. Kok[1], C. Mihl[1], A. Seehofnerova[1], J. Turek[1], G. Jost[2], U. Haberland[3], J.E. Wildberger[1], M. Das[1]; [1]*Maastricht/NL*, [2]*Berlin/DE*, [3]*Forchheim/DE (madeleine.kok@mumc.nl)*

Purpose: The purpose of this study was to evaluate radiation dose reduction in CT angiography (CTA) of the aorta and the impact of contrast media (CM) concentration on dose reduction.
Methods and Materials: A circulation phantom with thoracic-abdominal vasculature was used. Four different CM concentrations (300/350/370/400 mg I/ml) were administered maintaining identical iodine delivery rates (1.8 g I/s) and total iodine dose (20 g). Three different CTA scan protocols were used. A: No dose modulation; B: CAREDose4D; C: CAREkV. Other scan parameters were kept constant: 128x0.6 mm coll., pitch 0.9, 120 kV, qual. mAsref 210, rot. time 0.5s, slice thickness 2 mm/1.4 mm, kernel B31f. Attenuation values (Hounsfield Units [HU]) in 6 predefined intravascular sites (3 thoracic, 3 abdominal) were measured and dose-length product was documented to calculate effective dose (mSv). All values were analysed in SPSS 20 using Kruskal-Wallis test and two-way ANOVA.
Results: Dose parameters were (protocol A; B and C): 120 kV, 210 mAs; 120 kV, 97 mAs and 80 kV, 166 mAs. The attenuation values and signal-to-noise ratios were comparable between all different CM concentrations; all p-values > 0.05. There was a significant reduction in the effective dose (mean±SD) for protocols B (2.03±0.1 mSv) and C (1.00±0.0 mSv) compared to protocol A (4.34±0.0 mSv). The dose was reduced by 53% for protocol B and by 77% for protocol C.
Conclusion: Automated tube current modulation allows radiation dose reduction up to 53% and automated tube voltage selection up to 77% respectively, independently from CM concentration if iodine delivery rate en total iodine load are normalised.

Author Disclosures:
G. Jost: Research/Grant Support; Grant support. **U. Haberland:** Research/Grant Support; Research support.

B-0774 11:18

Low-kV CTA with low contrast medium volume using 256-slice and 16-slice CT scans: comparison of diagnostic accuracy and radiation dose exposure

C.R.G.L. Talei Franzesi, D. Ippolito, P.A. Bonaffini, D. Fior, O. Minutolo, S. Sironi; *Monza/IT (ctfdoc@hotmail.com)*

Purpose: To compare the diagnostic performance and the dose exposure of abdominal aorta low-kV CT-angiography (CTA) with low contrast medium volume, performed on 256-slice (100 kV;40 mL) and 16-slice (90 kV;50 mL) CT-scanners.
Methods and Materials: A total of 101 patients with abdominal aorta disease were prospectively enrolled in this study. Fifty-six patients underwent 256-MDCT scan examination (Brilliance-iCT;Philips) of abdominal aorta with low-kV setting (100 kV;automated tube modulation), standard pitch (0.915) and 40 mL of contrast volume (4 mL/s;350 mg/mL). Forty-five patients were examined using a 16-MDCT scan (Brilliance16P;Philips) with low-kV (90 kV;350 mAs), high pitch (1.062) and 50 mL of contrast volume (4 mL/s;350 mg/mL). Density

measurements (HU) were performed in the lumen of abdominal aorta,renal arteries and common iliac arteries. Vessels enhancement,radiation dose exposure (dose-length product,DLP) and signal-to-noise ratio (SNR) were calculated,compared and statistically analyzed between the two groups.
Results: All exams reached high diagnostic accuracy rate,allowing proper visualization of the abdominal aorta and its main branches as well as the vascular wall.Higher density measurements were obtained in 256-slice protocol (mean attenuation value of abdominal aorta 344 HU, renal arteries 331 HU and common iliac arteries 323 HU) as compared to 16-slice study (mean attenuation value of abdominal aorta 307 HU, renal arteries 289 HU and common iliac arteries 295 HU), with a significant difference between the two groups ($p < 0.05$). The radiation dose exposure was significantly lower ($p < 0.05$) in the 256-slice protocol (mean DLP:335 mGy*cm) than in the 16-slice protocol (mean DLP:509 mGy*cm), with an overall reduction of 35%. The mean SNR in the 256-slice protocol did not differ significantly in comparison to the 16-slice protocol.
Conclusion: Low-kV 256-slice CTA protocol,combined with low contrast medium volume (40 mL), reduces significantly the radiation dose exposure in comparison with low-kV 16-CT-protocol with low contrast medium volume (50 mL), maintaining proper diagnostic performance, with no significant increase in image noise.

B-0775 11:26

Contrast media reduction in CTA using low kV settings

M. Kok, C. Mihl, A. Seehofnerova, S. Altintas, B.L.J.H. Kietselaer, J. Turek, J.E. Wildberger, M. Das; *Maastricht/NL (madeleine.kok@mumc.nl)*

Purpose: Using lower kV in CT angiography (CTA) will result in higher attenuation values. Purpose of this study was to investigate how to reduce contrast media (CM) volume in lower kV while keeping attenuation values diagnostically sufficient.
Methods and Materials: CM (300 mg I/ml) was used and injected in a circulation phantom (Blood Pressure 120/80 mmHg, Heart Rate 60 bpm). Serial CT scans were performed: 128x0.6 mm coll., mAs 142, cycletime 0.43s, gantry rot.time 0.28s, delay 10s, slice thickness 1 mm/0.7 mm and kernel B30f. Initially, the same injection protocol (volume=40 ml, flow rate=5.3 ml/s, iodine delivery rate (IDR)=1.6 g I/s and total iodine=12 g I, constant injection time (7.5s)) was used for each kV setting (120 - 70 kV). After that, the IDR was decreased as sole parameter by steps of 0.2 g I/s at a until diagnostically insufficient attenuation values (< 325 Hounsfield Units [HU]) were encountered. Attenuation values were measured and compared in the ascending aorta (AA), descending aorta (DA) and left main coronary artery (LM).
Results: Using identical injection parameters for each kV, attenuation values (HU±SD) were: 326±2 (120 kV); 406±3 (100 kV); 524±3 (80 kV); 651±4 (70 kV). Minimal IDR and iodine load for lower kV settings were: 1.4 g I/s and 10.5 g I (100 kV); 1.0 g I/s and 7.5 g I (80 kV); 0.8 g I/s and 6.0 g I (70 kV).
Conclusion: Iodine load and CM volume could be reduced by 12.5%, 37.5% and 50% in 100, 80 and 70 kV respectively compared to 120 kV. This could play an important role in terms of patient safety and lowering costs.

B-0776 11:34

Low-dose 256-MDCT coronary angiography: effect of hybrid iterative reconstruction technique on image quality and diagnostic accuracy in comparison with DSA

E.V. Kondratyev, V. Shirokov, P. Davydenko, G.G. Karmazanovsky; *Moscow/RU (evgenykondratiev@gmail.com)*

Purpose: To evaluate the effect of hybrid iterative reconstruction (HIR) on image quality and diagnostic accuracy of low-dose coronary CTA.
Methods and Materials: 46 patients were divided into two groups. Retrospective ECG-gating was used. The scanning protocol was 120 kVp 800 mAs in first group, 100 kVp 800 mAs in second group, data from second group were reconstructed using FBP and HIR (level 5). We compared quantitative and qualitative parameters among two groups in six coronary segments. Student's t-test, Friedman test and Mann-Whitney U-test were performed for analysis. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy of CTA were calculated on segment-based level.
Results: The mean BMI was 27±2.75 kg/m2 and 26.13±4 kg/m2 in first and second group (p=0.41). Mean arterial attenuation was about 25% higher in second group (386±73 HU vs. 289±42 HU;$p < 0.0001$) Image noise in second group (33.5±11 HU) was significantly higher than in the first (24.8±8.5 HU,p=0.0002). Effective dose was 18.9±2.3mZv, 9.4±1.1mZv, respectively (p=0.0001). There was significant difference in visual quality between groups (p=0.017). Up to 42% of noise reduction was achieved using HIR (p=0.00001). The image quality increased dramatically in low-dose group, and was comparable between the groups ($p < 0.0001$) when applying HIR. Evaluation of the presence of significant (≥70%) stenosis revealed a sensitivity, specificity, accuracy, PPV and NPV of 88% 97.5%, 94.7%,93.7% and 95% for low-dose group, 87%, 92%, 92%, 94% and 94% for the first group.
Conclusion: Average radiation dose reduction up to 51% was achieved using "100 kV" protocol providing decreased but sufficient image quality. HIR significantly improves image quality, reduces noise, preserving high diagnostic performance of the CTA.

B-0777 11:42

Evaluability of low dose CTA for carotid arteries using new model-based iterative reconstruction

A.D. Annoni, A. Formenti, G. Pontone, M. Petullà, E. Nobili, S. Mushtaq, P. Montorsi, M. Pepi, D. Andreini; *Milan/IT (andrea.annoni@ccfm.it)*

Purpose: To assess evaluability of ultra low dose CT angiography (CTA) for carotid arteries using new model-based iterative reconstruction (MBIR).
Methods and Materials: 200 patients, referred to our hospital for CTA of the carotid arteries were enrolled in our study and randomized into two groups:Group 1 (100 patients, low dose CTA with MBIR) and Group 2 (100 patients, standard CTA acquisition with adaptive statistical iterative reconstruction algorithm (ASIR)). The image quality of carotid arteries and Willis circle was evaluated with a 4-point Likert-scale. For each exam attenuation, image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) at level of common carotid artery (CCA) and internal carotid artery (ICA) and Effective Dose (ED)were evaluated and compared between two groups.
Results: The two groups were homogeneous in terms of population characteristics. The image quality score was comparable between Group 1 and Group 2 ($p > 0.5$)for the carotid arteries but with more noise at level of the Willis circle in group 1 exams. Mean attenuation values were comparable between Group 1 and Group 2 (p=0.5) with overall higher values in group 1. Group 1 showed significant lower noise in comparison with group 2 ($p < 0.005$) and significant higher values of SNR and CNR ($p < 0.005$). Group 1 showed a significantly lower mean ED in comparison with Group 2 (1.7±0.2 versus 3.9±0.5 mSv respectively; $p < 0.005$) with an overall radiation dose reduction up to 56%.
Conclusion: ultra low dose CTA for carotid arteries using new model-based iterative reconstruction is feasible and allows to perform good quality exams with very low radiation exposure

B-0778 11:50

Virtual monochromatic spectral CT with low iodine concentration contrast medium in Budd-Chiari syndrome: investigation of image quality and detection

Y. Zhou, J.B. Gao; *Zhengzhou/CN (zhouyue779@163.com)*

Purpose: Budd-Chiari Syndrome result from hepatic vein (HV) and (or) above the opening of inferior vena cava (IVC) obstruction caused by a portal hypertension. We assessed the effect of low iodine concentration contrast medium in virtual monochromaticspectral (VMS) with adaptive statistical iterative reconstruction (ASIR) on image quality at Budd-Chiari Syndrome.
Methods and Materials: 106 patients with Budd-Chiari Syndrome were prospectively randomised to one of two spectral CTA protocols: group A:80/140 kVp, 370 mgI/mL iopromide and filtered back projection (FBP) (n=56; 56.3±8.9years); Group B: 80/140 kVp, 270-mgI/mL iodixanol and ASIR (n=50; 58.5±11.5 years). Attenuation and signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), the lesion conspicuity scores (LCS) and overall image quality scores (OQS) in portal vein (PV), IVC, HV were calculated.
Results: There were no statistically significant differences in PV, IVC and HV attenuation (210.7±28.1 vs. 203.0±32.6 HU,*P*=0.673; 174.3±30.1 vs. 167.9±32.6 HU,*P*=0.577; 172.4±22.8 vs. 168.1±27.9 HU,*P*=0.612) between group A and B at 70KeV. SNR, CNR, LCS and OQS of group B in PV, IVC and HV at 70KeV were significantly higher than that of group A (SNR:21.4±6.0 vs. 14.2±4.9, *P*=0.001; 16.7±5.2 vs.12.3±3.7,*P*=0.001; 15.1±4.6 vs. 12.1±3.8,*P*=0.01 CNR: 7.0±2.8 vs. 5.9±2.3,*P*=0.001; 6.1±1.9 vs. 4.8±2.1,*P*=0.015; 6.3±2.2 vs. 4.9±1.7,*P*=0.000 LCS: 3.36 ±0.51 vs 2.94 ±0.45, *P*=0.011; 3.48±0.67 vs 2.90±0.57; P=0.001; 3.47±0.87 vs 2.99±0.21; P=0.001 OQS: 3.61±0.36 vs 2.95±0.38, P=0.000; 3.94±0.18 vs 3.66±0.35, P=0.008; 3.63±0.45 vs 3.30±0.17, P=0.016).
Conclusion: VMS-ASIR images at 70 keV associated with low-osmolar contrast can greatly reduce contrast media dose and further improve the image quality of VMS imaging.

10:30 - 12:00 **Room M**

Physics in Radiology

SS 1013
Optimisation of patient dose in CT

Moderators:
A. Del Guerra; Pisa/IT
A. Kowalik; Poznan/PL

K-17 10:30
Keynote lecture
A. Del Guerra; *Pisa/IT*

B-0779 10:39
Virtual unenhanced images of the abdomen with third-generation dual-source dual-energy CT and advanced modeled iterative reconstruction: image quality, attenuation and radiation dose
C.N. De Cecco, A.D. Hardie, G. Muscogiuri, J.L. Wichmann, C. Canstein, P. Costello, U.J. Schoepf; *Charleston, SC/US (carlodececco@gmail.com)*

Purpose: To compare objective and subjective image quality and radiation dose between virtual unenhanced (VU) and conventional unenhanced (CU) abdominal 3rd generation dual-source dual-energy computed tomography (DECT) datasets and the impact of third-generation iterative reconstruction (ADMIRE).
Methods and Materials: 25 patients underwent triphasic abdominal CT including single-energy CU (120 kV, 147 ref.mAs) and DE arterial and portal venous phase acquisitions (100/Sn150 kV, 180/90 ref.mAs). VU images were generated from arterial (AVU) and portal venous (PVU) phases. CU, AVU and PVU datasets were reconstructed using filtered back projection (FBP) and ADMIRE (strength 3). Two radiologists analyzed image quality using a five-point scale. Radiation dose, attenuation and noise of abdominal organs and aortic calcifications were recorded for FBP and ADMIRE in CU, AVU and PVU datasets.
Results: Mean image quality scores of DECT VU images with ADMIRE were not significantly different from CU (4.83±0.12) for both AVU (4.79±0.9) and PVU (4.75±0.14) (all $p>.05$). Mean attenuation of liver, spleen, pancreas, renal cortex, aorta, and retroperitoneal fat did not differ significantly (all $p>.05$). However, mean attenuation of small calcified aortic plaques was significantly reduced with VU (393±36, 184±53, 255±62 HU for CU, AVU and PVU, respectively; $p<.01$). Mean radiation dose of single- and dual-energy acquisitions did not differ significantly (3.8±1.25, 3.9±1.26, 3.9±1.27 mSv for CU, AVU and PVU, respectively, $p>.05$). Calculated potential dose reduction by omitting CU was 32.7%.
Conclusion: Third-generation DECT VU images with ADMIRE demonstrated comparable image quality as CU besides an inadequate calcium subtraction and may allow for substantial dose reduction.

Author Disclosures:
C. Canstein: Employee; Siemens Medical Solutions. **U.J. Schoepf:** Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco,GE, Medrad, Siemens.

B-0780 10:47
Diagnostic ultra-low dose CT with a novel ultrafast compressed sensing algorithm
S. Hashemi Amroabadi, S. Homampour, N.S. Paul; *Toronto, ON/CA (sayedmasoud.hashemiamroabadi@mail.utoronto.ca)*

Purpose: Limited-angle CT (LACT) is of interest in cardiothoracic applications for improved temporal resolution and radiation dose reduction. However, LACT with conventional filtered back projection (FBP) has non-diagnostic image quality. We describe a novel Ultra-Fast Compressed Sensing (UF-CS) reconstruction algorithm that results in diagnostic images with LACT.
Methods and Materials: To accelerate image reconstruction UF-CS decomposes the process into a series of less complex sub-problems, using helical cone-beam to parallel-beam rebinning and direct Fourier reconstruction. An "error-adaptation-weight" is introduced to overcome the rebinning error, and a measure of similarity between image patches is utilized to improve the reconstruction accuracy. Aquilion ONE CT scanner (TMS, Japan) was used to obtain images from a purpose built comprehensive coronary plaque phantom with 4 tube-current levels (20 to 150 mA), 120 kV, 1sec rotation, and pitch-factor of 0.641 and from patients (120 kVp, 50 mAs). Images reconstructed using FBP from full-projections were used as the reference standard and compared to images reconstructed using FBP and UF-CS, from 100 degree projections. Qualitative image evaluation was performed using a continuous linear scale of 1-5 (Excellent). Statistical analysis was performed using the paired Student T-test.
Results: Image quality scores: LACT FBP= mean 1±0; UF-CS= mean 2.75±0.75. There was no statistical difference in image quality between UF-CS and the full angle FBP images ($p=0.05$). There was a significant difference between full angle and LACT FBP images.
Conclusion: Novel UF-CS provides comparable diagnostic image quality to FBP for cardiothoracic CT images using ~50% less radiation dose and a ~four-fold increase in temporal resolution.

B-0781 10:55
Size-specific dose estimate can be used to calculate patient-specific blood dose from paediatric CT examinations
C. Franck, C. Vandevoorde, P. Smeets, R. Achten, K. Verstraete, H. Thierens, K. Bacher; *Ghent/BE (caro.franck@ugent.be)*

Purpose: CT dose reduction is particularly important for the paediatric population. Several studies show a correlation between DNA damage and the patient's blood dose. Therefore, we evaluated a method to calculate patient-specific blood dose from paediatric chest and abdominopelvic CT examinations.
Methods and Materials: Full-body CT images, acquired during PET/CT, from 10 paediatric patients (5 males, 5 females; age range 2-16y) were used to create individualized 3D full-body voxelmodels. Using the latter models, 3D CT dose distributions of chest and abdominopelvic scans (80, 100 and 120 kVp) were calculated using Monte-Carlo simulations (ImpactMC). Blood dose was calculated as a weighted sum of simulated individual organ doses. As in conventional CT the available image data is limited to the scanrange, a second simulation and blood dose calculation was performed using only the thoracic and abdominopelvic region of the original voxelmodels. For each simulation, the size-specific dose estimate (SSDE) was calculated.
Results: Blood dose calculations, based on the thoracic and abdominopelvic scanrange models, showed excellent agreement with the blood doses using the full-body voxelmodels (average relative difference 0.6% and 9.3%). Furthermore, the patient's blood dose showed a significant strong linear correlation with SSDE ($R > 0.9$, $p < 0.001$).
Conclusion: Even though clinical CT images are mostly not covering the whole body of the patient, they can be used as a 3D-voxelmodel for blood dose calculation. In addition, SSDE can be used to estimate patient-specific blood dose in paediatric chest and abdominopelvic CT's.

B-0782 11:03
Assessment of high cumulative patient doses of repetitive CT examinations
M. Das, C.R.L.P. Jeukens, R.S. Schnerr, S. Niesen, J.E. Wildberger; *Maastricht/NL (m.das@mumc.nl)*

Purpose: In daily routine patients often undergo multiple CT examinations within a short time frame. Our purpose was to evaluate patients who received a cumulative effective dose of more than 100 mSv with repeat CT examinations.
Methods and Materials: 15000 consecutive CT examinations were systematically analyzed using a dedicated dose monitoring software (Radimetrics™, Bayer Healthcare) within a time period between 08/2013-08/2014. All patients with a cumulative effective dose above 100 mSv were identified. Besides patient specific parameters (sex, age, weight) patients were analyzed with respect to cumulative effective dose, number of CT scans and scan series, dose per CT scan, time interval of the scans, clinical scan indications and anatomical scan regions, respectively.
Results: A small fraction (0.27%) of forty-one patients were identified (63% male, mean age 62, range 24-83, mean weight 82 kg). On average, these patients received 8.5 CTs (range 2-20) with 3.5 series per scan within a time frame of 172 days (range 8-320). Mean cumulative effective dose was 132 mSv (range 103-301). Most frequent scan indications were: oncology, abdominal imaging for abscess and drainage as well as complications after surgery. Most frequent scan region was the abdomen (n=150) with an average effective dose of 13mSv (range 2.5-49), followed by combined thorax/abdomen protocols (n=39, mean 21mSv, range 6.4-57).
Conclusion: Only in a fraction of patients cumulative dose can become very high. As clinical indications are justifying each examination and average radiation dose per scan was acceptable, these cumulative doses may represent common clinical practice in severely ill patients.

Author Disclosures:
M. Das: Grant Recipient; Siemens, Bayer, Philips. Speaker; Siemens, Bayer. **J.E. Wildberger:** Grant Recipient; Siemens, Bayer, Philips, GE. Speaker; Siemens, Bayer, Philips.

B-0783 11:11

Data distributions and the impact of iterative reconstruction algorithms from the first three years of the Australian MDCT DRL project (2011-2014)

A.B. Wallace, P. Thomas, A. Hayton; *Yallambie/AU*
(anthony.wallace@arpansa.gov.au)

Purpose: The Australian Radiation Protection & Nuclear Safety Agency (ARPANSA) National Diagnostic Reference Level Service (NDRLS) has been surveying MDCT facilities since August 2011. Over 30% of CT facilities have registered with the service, logging over 2000 compliant surveys which are used in the development of national DRLs.
Methods and Materials: The survey data was analysed using commercial software and broken down into categories of state, body habits, age group, facility type, spread of $CTDI_{vol}$, dose length product (DLP), scan length, weight, use of iterative reconstruction and year of survey.
Results: Dosimetric data analysis of combined $CTDI_{vol}$ and DLP show a strong consistency over the survey periods using the 95% confidence intervals as an indicator. However, analysing variation between the same protocols, with and without the application of iterative reconstruction (IR) algorithms, shows an average dose reduction of between 20 and 30% with IR.
Conclusion: The NDRLS MDCT Survey is ongoing and all facilities are encouraged to register and participate. It demonstrates a snapshot of current CT practice nationally and indicates that, in terms of international dosimetry, Australia is in the mid-range of the distribution. It has given strong evidence of the beneficial impact of IR algorithms on patient dosimetry.

B-0784 11:19

Patient doses in standard CT examinations: results of a nationwide survey in Germany

A.A. Schegerer[1], H.-D. Nagel[2], G. Stamm[3], G. Brix[1]; [1]*Neuherberg/DE*, [2]*Buchholz/DE*, [3]*Hannover/DE (aschegerer@bfs.de)*

Purpose: The aim of the study was to determine representative dose values applied in standard CT examinations in daily clinical practice in Germany.
Methods and Materials: Based on a nationwide survey in 2012/2013, dose parameters were derived from user-specified protocols of 33 standard CT studies. Effective doses were computed using the tissue weighting factors of ICRP Publication 103.
Results: 300 questionnaires, relating to ca. 10% of all medical CT scanners, could be evaluated. The results of the survey are representative for Germany. Among others, the following results were obtained: As compared to a previous nationwide survey in 2003, CTDIvol has decreased up to 66%, on average by 23%. The DLP has not equally decreased (on average by 12%). Automated dose regulation, dual energy mode, and iterative reconstruction algorithms are used on average by 72%, 2%, and 20%, respectively. As compared to scanners where conventional reconstruction algorithms are used, CTDIvol could be reduced by 15%, on average, using iterative algorithms. The CTDIvol used for examinations of hard-contrast objects do not significantly differ from the CTDIvol used for the examination of soft-contrast objects in the same body region.
Conclusion: Patient dose in CT can be further reduced by adapting CT protocols to the medical aim of the examination, and the scan length to the region of interest in particular. The smaller decrease of the DLP, in contrast to the CTDIvol, can only be explained by larger scan lengths used an improved exploitation of the dose reduction potential of modern CT technology.

B-0785 11:27

Intra-institution CT dose surveys in adults: what sample size for what precision?

S. Taylor[1], A. Van Muylem[2], P.A.A. Gevenois[2], D. Tack[3]; [1]*Mons/BE*, [2]*Brussels/BE*, [3]*Baudour/BE (stephengtaylor@gmail.com)*

Purpose: To determine the values and variabilities of dose-length product (DLP) per CT acquisition and to propose the minimum sample size required warranting sufficient reliability.
Methods and Materials: DLP of 10,663 acquisitions performed between May 2012 and May 2013 on the abdomen, thorax, lumbar spine, head, cervical spine and the sinuses were collected. The variability of DLP means was investigated according to the sample size (from 10 to 1000 acquisitions) and to body weight (67-73 kg, 60-80 kg, and no weight selection). The dispersion of DLP distribution characterized by the 95 % confidence interval in percentage of the median of this distribution was calculated for increasing sample sizes. We deduced by interpolation the sample size that set a 95% CI lower than 10% of the median (CI95/med< 10%).
Results: For small sample sizes (10 to 20 patients) and no weight selection, the mean DLP of one sample may range from 0.50 to 1.50 times its value. Samples sizes, ensuring CI95/med< 10% may range from 40 to 900 depending on the body region. None of the current survey methods reaches a CI95/med< 10%. The absolute DLP value representative of a CT dose and used for diagnostic reference level (DRL) depends on the body weight selection.
Conclusion: In survey studies, the DLP and DRL representative of a given examination depend on body weight selection, variability is high, and requires using large data samples ranging from 40 to 900 subjects depending on the anatomical region explored, in order to warrant a variability below 10%.

B-0786 11:35

How much is the effective dose varying between follow-up examinations performed on the same CT scanner, when using the same imaging protocol?

S. Suntharalingam, F.F. Stecker, N. Guberina, M. Forsting, J.M. Theysohn, A. Ringelstein, T. Schlosser, K. Nassenstein; *Essen/DE*
(Saravanabavaan.Suntharalingam@uk-essen.de)

Purpose: To retrospectively determine dose variability between follow-up examinations performed on the same CT scanner with the same imaging protocol.
Methods and Materials: Effective Dose (ED) was estimated in accordance to the recommendations of ICRP 103 retrospectively for 50 patients (25 male, 25 female, mean age: 57.2) at three times of CT examination. Data were assessed using Bayer's dose-monitoring software radimetrics. At each time a CT of the chest (CH), the liver (LI), and the abdomen (AB) was performed using the same scan protocol on the same scanner (Siemens Definition FLASH). Automated tube current modulation "CARE Dose 4D" and automated tube voltage selection "CARE KV" (Siemens) were used.
Results: The median ED was 4.5 mSv for CH, 4.3 mSv for LI, and 6.7 mSv for AB. The median difference of ED between follow-up examinations was 0.5 mSv for CH, 0.4 mSv for LI, and 0.7 mSv for AB, the maximal 7.6 mSv for CH, 4.4 mSv for LI, and 9.5 mSv for AB. Multiple regression analysis showed, that the single external influencing factors - differences in abdominal diameter (as surrogate for patients` weight), in scan length, and in table height - determine the differences in ED only to 35% in CH, to 63% in LI, and to 49% in AB.
Conclusion: A significant variance in the ED exists between follow-up CTs even when the same CT scanner and scan protocol is used. This variance is caused to a significant portion by the automated dose reduction algorithms.

B-0787 11:43

Estimation of organ dose from tube current modulated CT of the torso: SSDE vs MC simulation

X. Lopez Rendon[1], G. Zhang[1], H. Bosmans[1], R.H. Oyen[1], F. Zanca[2]; [1]*Leuven/BE*, [2]*Diegem/BE (xochitl.lopezrendon@uzleuven.be)*

Purpose: To evaluate the correlation between the size specific dose estimate (SSDE) and patient specific organ dose calculated with Monte Carlo for chest CT scans of patients with normal BMI.
Methods and Materials: Thirteen (13) adult patients (5 female, 8 male) underwent a thorax scan performed with TCM (CareDose 4D, Siemens Definition Flash) at 120 kVp and 110 reference mAs. Specific voxel phantoms were created for these patients. We retrieved the BMI, the CTDIvol displayed in the patient dose report and the TCM information. The water equivalent thicknesses of the lateral and anterior-posterior patient diameters were estimated and used to calculate effective diameter. The CTDIvol and patient size (expressed as effective diameter) were used to calculate the SSDE. Dose to the lungs and breasts were calculated using Monte Carlo simulation (EGSnrc) on the generated voxel phantoms (gold standard). Tube current modulation was accounted for in the MC simulation. Correlation between SSDE and organ doses was studied.
Results: Doses obtained with Monte Carlo were for the breast 5.8 ± 0.9 mGy (female) and for the lungs 8.6 ± 1.3 mGy (all). A good correlation (R2=0.7) was found between breast dose and SSDE calculated with the average water equivalent effective diameter, while for the lungs the correlation with SSDE was weaker (R2= 0.5).
Conclusion: This study suggests that SSDE might be a reliable indicator of organ dose for patients with normal BMI and scanned with TCM. Generalized conclusions require studies with a higher number of patients, for other BMI classes and protocols.

Author Disclosures:
H. Bosmans: Founder; co-founder Qaelum NV. Research/Grant Support; Siemens AG. **F. Zanca:** Employee; GE Healthcare.

B-0788 11:51

Quantitative comparison of single-acquisition dual-energy iodine maps as a reduced dose alternative to abdominal CT-perfusion measurements

S. Skornitzke, F. Fritz, M. Klauß, J. Hansen, G. Pahn, L. Grenacher, H.-U. Kauczor, W. Stiller; *Heidelberg/DE*
(Stephan.Skornitzke@med.uni-heidelberg.de)

Purpose: Evaluation of the replacement of abdominal CT-perfusion measurements by quantitative single-acquisition dual-energy (DE) iodine maps and estimation of dose reduction potential.
Methods and Materials: CT-perfusion sequences were dynamically acquired over 51 seconds (34 acquisitions every 1.5s) in 24 patients with histologically verified pancreatic carcinoma using dual-source DECT at tube voltages of 80 kV_p and 140 kV_p. Using software developed in-house, perfusion maps were calculated from 80 kV_p images using the Maximum-slope model after deformable motion-correction. Additionally, quantitative iodine maps were calculated for each of the 34 DECT acquisitions. Within a manual segmentation of the pancreas voxel-by-voxel correlation was calculated between the perfusion map and each of the iodine maps for each patient for determining the time of maximum correlation t_{max}. Regions of interest (ROIs) were placed inside the tumour and inside healthy pancreatic tissue. Correlation between mean perfusion values and mean iodine concentrations within these ROIs at t_{max} was calculated for the patient sample.
Results: Average t_{max} was 33.0±6.9s after contrast agent injection. Average perfusion values for healthy tissue and tumour were 65.9±27.2 ml/mls and 40.6±33.1 ml/mls; average iodine concentrations at t_{max} were 2.0±0.8 mg/ml and 1.7±1.0 mg/ml. Correlation between perfusion values and iodine concentrations was high (0.81). Average effective dose reduction was 94% when comparing a single DECT acquisition at t_{max} to the 80 kV_p CT-perfusion sequence (0.18mSv/2.96mSv).
Conclusion: Quantitative iodine maps correlate well with abdominal CT-perfusion measurements, suggesting that quantitative iodine maps from a single acquisition might replace abdominal CT-perfusion measurements with careful calibration of the acquisition time, leading to large reductions in patient dose.

Author Disclosures:
H.-U. Kauczor: Research/Grant Support; Siemens. Speaker; Böhringer Ingelheim, Bayer, Novartis, Siemens, Almirall.

10:30 - 12:00 **Room N**

Cardiac

SS 1003a

Myocardial perfusion imaging

Moderators:
R.W. Bauer; Frankfurt/DE
G.I. Kirova-Nedialkova; Sofia/BG

B-0789 10:30

The pattern of myocardial perfusion in patients with intermediate and significant coronary artery stenosis

K.W. Zavadovsky, M.O. Gulya, Y.B. Lishmanov, L.N. Maslov, V.V. Saushkin; *Tomsk/RU (konstzav@gmail.com)*

Purpose: The aim of this study was to assess myocardial perfusion in patients with coronary artery disease (CAD) and intermediate and significant coronary artery stenosis.
Methods and Materials: The study consisted of 58 patients (age: 63.1±7.1 years) with clinical signs of CAD. All patients underwent MDCT coronary angiography and myocardial perfusion imaging at rest and in combination with pharmacological adenosine stress test. Based on SPECT data, we analysed summed stress score (SSS), rest score (SRS), difference score (SDS), severity map, and extent map. Based on MDCT data, we analysed the presence of coronary artery stenosis and its degree (by minimal diameter and area size). According to MDCT data, all patients were divided in two groups: I - intermediate coronary artery stenosis > 40 70%.
Results: Correlation analysis showed significant correlation between SSS and stenosis degree by minimal diameter ($r=0.28$; $p < 0.05$) and area size ($r=0.25$; $p < 0.05$). We also found correlation between stenosis degree by area and SDS ($r=0.31$; $p < 0.05$) and reversibility on the extent maps ($r=0.31$; $p < 0.05$). The SPECT indexes of myocardial perfusion in I and II groups have statistically significant differences.
Conclusion: Degree of coronary artery stenosis had weak correlation with impaired myocardial perfusion. Data showed that 20±12.7% of patients with intermediate coronary artery stenosis had scintigraphic pattern similar to that of patients with coronary artery stenosis > 70%.

B-0790 10:38

Usefulness of resting myocardial perfusion imaging of coronary CT angiography in patients with acute symptom in the emergency department: perfusion analysis of color-coded three-dimensional volume rendering

S. Kim, D. Cha, Y. Choe; *Seoul/KR (cdisampp@gmail.com)*

Purpose: To evaluate the usefulness of resting CT-Myocardial Perfusion imaging (CT-MPI) of Coronary CT Angiography (CCTA) using color-coded three dimensional - volume rendering (3D-VR) imaging in symptomatic patients visiting the emergency department (ED).
Methods and Materials: This retrospective study included 53 consecutive patients with low-to-intermediate clinical risk of coronary artery disease (CAD) who visited the ED between December 1st 2012 and July 30th 2014. They underwent CCTA and subsequent invasive coronary angiogram (ICA). Two investigators assessed coronary artery stenosis on CCTA. Vessels with uninterpretable segments due to artifacts or poor opacification were considered as significantly stenotic. Then, color-coded 3D-VR imaging was interpreted and the stenosis degree was reclassified using the results. All estimates of diagnostic accuracy were calculated before and after rest perfusion analysis using 3D-VR with ICA as reference standard.
Results: The diagnostic accuracy parameters per vessel for the detection of ≥ 70% stenosis before and after rest CT-MPI using color-coded 3D-VR analysis changed as follows: sensitivity, from 98% to 89%; specificity, from 76% to 99%; positive predictive value (PPV), from 68% to 98%; negative predictive value (NPV), from 99% to 95%; and accuracy, 84% to 96%. The addition of rest CT-MPI with 3D-VR imaging resulted in reclassification from one class of stenosis severity to another in a significant number of vessels with threshold of 70% stenosis (net reclassification improvement [NRI], 0.140; $p = 0.02$).
Conclusion: Rest CT-MPI using color-coded 3D-VR imaging provides incremental value in the detection of significant CAD in patients with low-to-intermediate risk visiting the ED.

B-0791 10:46

Four-dimensional whole-heart computed tomography perfusion of the myocardium with visual analysis using temporal averaging of three-dimensional datasets: feasibility study

C. Kendziorra, A. Shaban, M. Rief, P.D. Bady, S. Feger, M. Dewey; *Berlin/DE (carsten.kendziorra@charite.de)*

Purpose: To assess the feasibility of dynamic (4D) whole-heart computed tomography perfusion (CTP) of the myocardium and the value of temporal averaging of consecutive 3D datasets from different heartbeats for visual assessment.
Methods and Materials: We analysed 30 patients with suspected or known coronary artery disease (CAD) who underwent 320-row coronary CT angiography (CTA) and myocardial CTP. All CTP examinations were initiated after 3 min of intravenous infusion of adenosine (140 µg/kg/min) and were performed dynamically covering the entire heart every heartbeat over a period of 20±3 heart beats. Temporal averaging for improved dynamic CTP visualisation was analysed for the combination of two, three, four, six, and eight consecutive 3D datasets.
Results: In all 30 patients, myocardial 4D CTP was feasible and temporal averaging was successfully implemented for all planned combinations. The combination of three consecutive 3D datasets for temporal averaging showed best performance in the analysis of all CTP image quality parameters: noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), subjective image quality, and diagnostic accuracy with an SNR improvement by a factor of 2.2±1.3 and 1.3±0.9 for CNR.
Conclusion: Four-dimensional whole-heart CTP of the myocardium is feasible. Temporal averaging improves image quality and assessment of perfusion defects.

Author Disclosures:
M. Dewey: Author; "Coronary CT Angiography", Springer, 2009, "Cardiac CT", Springer 2011 and 2014. Consultant; Guerbet. Grant Recipient; Heisenberg Program of the German Research Foundation (DFG) for a Professorship (DE 1361/14-1). Research/Grant Support; FP7 Program of the European Commission for the randomized multicenter DISCHARGE trial (603266-2, HEALTH-2012.2.4.-2), European Regional Development Fund (20072013 2/05, 20072013 2/48), German Heart Foundation/German Foundation of Heart Research (F/23/08, F/27/10), Joint program of the DFG and the German Federal Ministry of Education and Research (BMBF) for meta-analyses (01KG1013, 01KG1110, 01KG1110), GE Healthcare, Bracco, Guerbet, Toshiba Medical Systems. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, Bayer-Schering. Other; Cardiac CT Courses in Berlin: www.CT-kurs.de.

B-0792 10:54

Quantitative analysis of myocardial perfusion using a Langendorff pig heart model: concept and results

G. Pelgrim[1], M. Das[2], U. Haberland[3], S. Van Tuijl[4], M. Stijnen[4], E. Klotz[3], M. Oudkerk[1], J.E. Wildberger[2], R. Vliegenthart[1]; [1]*Groningen/NL*, [2]*Maastricht/NL*, [3]*Forchheim/DE*, [4]*Eindhoven/NL (gjpelgrim@gmail.com)*

Purpose: Different computed tomography (CT) perfusion techniques are under investigation to analyse patients with intermediate grade stenosis. In this study, we tested the feasibility of a CT-compatible, ex-vivo, perfused porcine heart model.
Methods and Materials: Five porcine hearts were perfused according to the Langendorff model. Circulatory parameters such as blood flow, arterial pressure and heart rate were monitored throughout the experiment. Dynamic perfusion scanning was performed using second generation dual-source CT (Definition Flash, Siemens,Erlangen,Germany) using 100 kV with 350 mAs/rot. An adjustable stenosis was induced in the circumflex artery (Cx), set to predefined fractional flow reserve (FFR) values, measured by a pressure wire. CT-derived myocardial perfusion parameters were analysed at FFR of 1.0/0.7/0.5/0.3/0.0.
Results: Pacemaker-induced heart rhythm was generally stable. During most of the experiment, mean blood flow ranged between 0.6-1.2 l/min, mean arterial pressure varied between 80 and 110 mm/Hg, and mean heart rate ranged from 70 to 130. Blood flow decreased and arterial pressure increased by approximately 10% after inducing stenosis with FFR≤0.50. CT images did not show major artefacts due to model setup. Dynamic perfusion scanning was possible across the range of stenosis grades. Perfusion defects of Cx myocardial segments matched with increasing stenosis grade. Blood flow and blood volume analysis showed significant downward trends at increasing stenosis grades (Mann-Whitney U test), with blood flow values decreasing from 160 to 30 ml/100 ml/min.
Conclusion: An adapted Langendorff porcine heart model is feasible in a CT environment and provides control over physiological parameters. This may allow standardized in-depth validation of quantitative CT perfusion techniques.

Author Disclosures:
U. Haberland: Employee; Siemens AG. **S. Van Tuijl:** Employee; Lifetecgroup. **M. Stijnen:** Employee; Lifetecgroup. **E. Klotz:** Employee; Siemens AG. **R. Vliegenthart:** Research/Grant Support; NWO.

B-0793 11:02

Semi-automated global quantification of left ventricular myocardial perfusion at stress dynamic CT: diagnostic performance for detection of territorial perfusion deficits

J.L. Wichmann[1], F.G. Meinel[1], C.N. De Cecco[1], A. Varga-Szemes[1], G. Muscogiuri[1], P.M. Cannaò[1], Y.H. Choe[2], Y. Wang[3], U.J. Schoepf[1]; [1]*Charleston, SC/US*, [2]*Seoul/KR*, [3]*Beijing/CN (docwichmann@gmail.com)*

Purpose: To evaluate the diagnostic performance of semi-automated global quantification of left ventricular myocardial perfusion derived from stress dynamic CT myocardial perfusion imaging (CTMPI) for detection of regional perfusion deficits.
Methods and Materials: Dynamic CTMPI datasets of 71 patients were analyzed using semi-automated volume-based software to calculate global myocardial blood flow (MBF), myocardial blood volume (MBV) and volume transfer constant (Ktrans). Optimal cutoff-values to assess the diagnostic performance of these parameters for the detection of 1, 2, and 3 vessel territories with perfusion deficits in comparison with visual analysis were calculated.
Results: Non-significant differences (P=0.694) were found for average global MBF in patients without perfusion deficits and single-territory perfusion deficits. Significant differences were found for mean global MBF in patients with perfusion deficits in two ($P < 0.0058$) and three vessel territories ($P < 0.0003$). Calculated optimal thresholds for global MBF and MBV resulted in a sensitivity, specificity, and negative predictive value (NPV) of 100% for the detection of three-vessel territory perfusion deficits. For the detection of ≥2 territories with perfusion deficits, global MBF was superior to other parameters (sensitivity 81.3%, specificity 90.9%, NPV 94.3%).
Conclusion: Semi-automated global quantification of left ventricular MBF during stress dynamic CTMPI shows high diagnostic accuracy for the detection of ≥2 vessel territories with perfusion deficits, allowing for a rapid identification of patients with multi-territorial myocardial perfusion deficits.

Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0794 11:10

Left ventricular myocardial perfusion at stress dynamic CT: multi-center evaluation of relative and absolute territorial myocardial blood flow in patients with coronary artery stenosis

J.L. Wichmann[1], C.N. De Cecco[1], F.G. Meinel[1], A. Varga-Szemes[1], G. Muscogiuri[1], P.M. Cannaò[1], Y.H. Choe[2], Y. Wang[3], U.J. Schoepf[1]; [1]*Charleston, SC/US*, [2]*Seoul/KR*, [3]*Beijing/CN (docwichmann@gmail.com)*

Purpose: To evaluate differences in the diagnostic performance of relative and absolute territorial myocardial blood flow (MBF) measurements derived from stress dynamic computed tomography myocardial perfusion imaging (CTMPI) for the detection of coronary artery stenosis.
Methods and Materials: Dynamic CTMPI and coronary CT angiography (CCTA) datasets of 137 patients (mean age, 60.9 ± 8.4 years) with suspected or known coronary artery disease from multi-center trials were retrospectively analyzed. For each myocardial territory, absolute MBF and the MBF relative to remote myocardium (MBFratio) were calculated. CCTA datasets were visually assessed in consensus by two observers.
Results: On visual CCTA analysis, 137/411 (33.3%) vessels demonstrated significant stenosis (< 50% luminal narrowing). Mean MBF was significantly lower in myocardial territories with detected stenosis compared to territories without stenosis of the supplying vessel (80.7 ± 33.7 mL per 100 mL/min versus 140.0 ± 38.4 mL per 100 mL/min; $P < 0.0001$). Receiver operating curve analysis demonstrated better discrimination by MBFratio compared to absolute MBF values (area under the curve, 0.925 versus 0.882; P=0.0022).
Conclusion: For the evaluation of stress dynamic CTMPI datasets, the MBFratio demonstrated a superior diagnostic performance for the detection of hemodynamically significant coronary artery stenosis as detected by CCTA compared to absolute territorial MBF values.

Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

B-0795 11:18

Cardiac dual-energy computed tomography reduces beam-hardening artefacts in a phantom study

J. Choe, J. Kang, D.H. Yang, T.-H. Lim; *Seoul/KR (jooae23@gmail.com)*

Purpose: To evaluate the potential of cardiac dual-energy CT (DECT) with gemstone spectral imaging (GSI) for reducing beam-hardening artifacts from high iodine contrast concentration and variable heart rates compared with single-energy (conventional polychromatic) CT.
Methods and Materials: DECT and single-energy CT (100 kVp, 120 kVp) were scanned on a cardiac phantom in different enhancement of heart and aorta (250, 300, 500, and 600 HU) and heart rates (50, 60, 70, 80, 90, 100 and 110 beats/min). Data sets were post-processed by GSI with monochromatic reconstruction on 40-140 keV. For the total 72 data sets, attenuation of area of artifact (expressed as HU) and the reference was measured and the attenuation difference was calculated. Attenuation difference, suggesting beam-hardening artifacts, was compared among GSI images and single-energy CT.
Results: Beam-hardening artifacts was less in GSI with monochromatic reconstruction with different heart and aorta enhancement ($p < 0.05$); especially on 500 HU, attenuation difference in 70 keV of GSI versus 100 kVp and 120 kVp of single-energy CT, 59.5 versus 118.5 and 156.8 HU. And the degree of reduction of beam-hardening artifact varies with level of energy of monochromatic reconstruction from 40 to 140 keV and above 70 keV allows most reduction of beam-hardening artifact. The beam-hardening artifacts also increase in proportion to the increase in heart rate.
Conclusion: In cardiac DECT, GSI with monochromatic reconstruction offers significant beam-hardening artifact reduction compared with the single-energy images. The degree of reduction is variable according to the enhancement of heart and aorta and the heart rate.

B-0796 11:26

Quantitative myocardial perfusion with dual-energy CT: iodine concentration differences between normal and ischemic myocardium

R. Oca Pernas, C. Delgado, C. Trinidad, D. Mera, A. Bustos, M. Vázquez; *Vigo/ES (roqueoca@hotmail.com)*

Purpose: To investigate whether dual-energy multidetector row computed tomographic (DECT) imaging with iodine quantification is able to distinguish between normal and ischemic myocardial tissue.
Methods and Materials: 36 consecutive cardiac adenosine stress DECT of patients with suspicion of coronary artery disease (72% men; 62.6±10.7 years) were retrospectively evaluated by two blinded radiologists. Cardiac MRI was available in all of the patients. Perfusion defects were visually determinated using Dual-Energy postprocessing in cardiac short axis color-coded iodine maps. Results were compared with MRI as the gold standard with the 17 AHA

segment classification. Myocardial iodine concentration was calculated drawing freehand regions of interest that contoured the segments in color-coded iodine maps. Iodine concentration differences between healthy and DECT abnormal segments were calculated using parametric tests. Interobserver agreement was assessed with an intraclass correlation coefficient.
Results: 612 cardiac segments were evaluated (normal: 478; pathologic: 77; not-assessed: 57). Stress DECT accuracy diagnostic values, compared with MRI, were: sensitivity: 73%, specificity: 96%, positive predictive value: 72%, negative predictive value: 96%; overall accuracy: 92%. Iodine concentration in DECT normal segments was: 2.56 ± 0.69 mg/mL, and in pathologic segments: 1.38 ± 0.62 mg/mL ($p < 0.001$). Intraclass correlation coefficient was 0.831.
Conclusion: Cardiac stress DECT with iodine quantification is able to distinguish between normal myocardial tissue and pathologic myocardium.

B-0797 11:34

Myocardium: dynamic CT perfusion imaging: a comparison to coronary angiography/FFR and to MR first pass perfusion imaging
A.M. Huber[1], B.M. Gramer[1], V. Leber[1], M. Rasper[1], D. Münzel[1], A. Leber[1], E. Hoffmann[1], M. Vembar[2], E.J. Rummeny[1]; [1]*Munich/DE*, [2]*Cleveland, OH/US (armin.huber@tum.de)*

Purpose: To determine the diagnostic accuracy of dynamic computed tomographic (CTP) perfusion imaging of the myocardium compared to CA and (FFR) measurement and to MR perfusion imaging of the myocardium.
Methods and Materials: Thirty-two consecutive patients in adenosine stress conditions underwent dynamic CT perfusion imaging (14 consecutive data sets) performed by using a 256-section scanner with an 8-cm detector and without table movement. Myocardial blood flow (MBF) was determined quantitatively. Results were compared with those of coronary angiography and FFR measurement by using a receiver operating characteristic (ROC) analysis. In addition results were compared to MR perfusion imaging using the parameter MPRI. In addition, threshold values based on the Youden´s index and sensitivity and specificity were calculated.
Results: The comparison of CTP with the invasive reference method coronary angiography and FFR showed an area under the ROC curve, a sensitivity, and a specificity of 0.86, 75.9% (95% CI: 56.5%, 89.7%), and 100% (95% CI: 94.6%, 100%) for the quantitative parameter MBF.The thresholds determined by using the Youden´s index was 1.64 mL/g/min. The comparison to MR perfusion imaging showed an area under the ROC curve, a sensitivity and a specificity of 0.90, 83.3 % (95% CI: 63.5%, 92.7%), 86.6 % (95% CI: 70.2 %, 93.2 %).
Conclusion: Dynamic CT perfusion imaging of the myocardium using the quantitative parameter MBF shows a similar diagnostic accuracy, when compared to the invasive reference methods coronary angiography and FFR and when compared to MR first pass perfusion imaging of the myocardium.

Author Disclosures:
M. Vembar: Employee; Philips.

B-0798 11:42

Impact of iterative reconstruction on objective and subjective image quality parameters in 256-slice MDCT dynamic myocardial perfusion imaging
B.M. Gramer, M. Rasper, V. Leber, A. Leber, E.J. Rummeny, A.M. Huber; *Munich/DE (b.gramer@gmx.de)*

Purpose: To evaluate a new iterative reconstruction (IR) algorithm for radiation dose, image quality (IQ), signal-to-noise (SNR) and contrast-to-noise ratio (CNR) in multidetector computed tomography (MDCT) dynamic myocardial perfusion imaging (MPI).
Methods and Materials: 20 consecutive patients were examined by dynamic CT perfusion imaging (14 consecutive data sets) using a 256-slice scanner with 8 cm detector without table movement under adenosine stress (80 kV, 250 mAs per data set). Images were reconstructed with filtered backprojection (FBP) and six different levels of IR (L1-L6). Image quality (5-point-scale), noise, CNR and SNR (ischaemic vs. normal myocardium) were evaluated.
Results: IR improves SNR of normal myocardium (2.8 ± 2.6 with FBP) up to 4.1 ± 2.2 (IR L6) and for the ischaemic myocardium (0.7 ± 1.5 with FBP) up to 1.0 ± 1.7 (IR L6). Likewise, CNR was improved from 2.3 ± 2.1 (FBP) to 3.5 ± 1.6 (IR L6). Noise was reduced from 45.4 ± 10.1 (FBP) to 30.5 ± 12.0 (IR L6). Compared to FBP, no significant loss of image quality was observed up to an IR level of 6 ($p > 0.01$).
Conclusion: Appropriate levels of IR can improve SNR and CNR by a noise reduction of about 30 %. Thus, radiation dose may be reduced by appropriate use of IR in dynamic CT-MPI without negative impact on image quality.

B-0799 11:50

Relationship among stenosis severity and CT-derived myocardial blood flow in patients with coronary artery disease
A. Rossi[1], A. Wragg[1], E. Klotz[2], F. Pugliese[1]; [1]*London/UK*, [2]*Forchheim/DE (a.rossi@qmul.ac.uk)*

Purpose: Current guidelines suggest that flow-limiting coronary stenoses causing insufficient blood supply to the myocardium may be treated to relief symptoms and to improve prognosis. The functional significance of intermediate coronary stenosis is difficult to determine from anatomical information derived from invasive coronary angiography (ICA). The aim of our study was to assess the relationship between hyperaemic myocardial blood flow (MBF) and myocardial flow reserve (MFR) by dynamic CT perfusion (CTP) imaging and stenosis severity by ICA in patients with stable chest pain.
Methods and Materials: Forty-seven patients with stable chest pain referred to ICA and invasive fractional flow reserve (FFR) were included in the study. All patients underwent stress and rest dynamic CTP using a second-generation dual- source CT. Hyperaemic and rest MBF were computed using a model-based parametric deconvolution method. MFR was calculated as the ratio of hyperaemic MBF and rest MBF. Stenosis severity was classified as mild (≤30% diameter reduction), intermediate non-functionally significant (INFS, 30%-85% and FFR> 0.80), intermediate functionally significant (IFS, 30%-85% and FFR≤0.80), and severe (≥85%).
Results: A total of 133 coronary vessels and myocardial territories were analyzed. Hyperaemic MBF and MFR progressively decreased with increasing stenosis severity following a non-linear relationship (all p-values < 0.001). Hyperaemic MBF was significantly lower in IFS coronary stenoses compared to INFS coronary stenoses (76±22 ml/100 ml/min vs 112±39 ml/100 ml/min, $p < 0.05$). Myocardial flow reserve was significantly lower in IFS stenoses compared to INFS stenoses (1.1±0.3 vs 1.7±0.7, $p < 0.05$).
Conclusion: In intermediate stenoses, hyperaemic MBF can discriminate IFS from INFS coronary stenoses.

Author Disclosures:
E. Klotz: Employee; Siemens Healthcare Sector.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 1010a

Tumours, systemic diseases and muscles

Moderators:
M.C. De Jonge; Amsterdam/NL
A. Yakimov; Moscow/RU

B-0800 10:30

Routinely performed multiparametric MRI helps to differentiate subtypes of myxoid tumours
N. Alberti, X. Buy, M. Kind; *Bordeaux/FR (nicoalbertibdx@gmail.com)*

Purpose: To retrospectively evaluate the ability of multiparametric magnetic resonance (MR) imaging to differentiate benign and malignant myxoid tumours of soft tissue.
Methods and Materials: MR images from consecutive 95 pathologically proven solid myxoid tumours of soft tissues reported as follows: 17 myxomas, 9 peripheral nerve sheath tumours (PNST), 24 myxoid liposarcomas (MLPS), 33 myxofibrosarcomas (MFS), 8 low-grade fibromyxoid sarcomas (LGFMS) and 4 extraskeletal myxoid chondrosarcomas (EMC) were evaluated. 3 radiologists blinded to pathology results independently reviewed dynamic contrast-enhanced T1- and T2-weighted images. Multiple criteria were described and analysed: 1) the greatest dimension of each tumour mass; 2) tumour location (strictly intramuscular/other); 3) lesion margin (well defined/infiltrative); 4) signal intensity on T1 and T2 weighted images (WI) : the amount of fluid signal (moderate / diffuse); presence or absence of fatty/hemorrhagic component; presence or absence of pseudo-cystic appearance; 5) tumour periphery: presence/absence of peritumoural edema; fat split sign and/or "shiny cap"; 6) after contrast injection: tumoural enhancement intensity; presence or absence of tail sign, fibrosis, and/or necrosis.
Results: Discrimination of benign (myxoma and PNST) and malignant myxoid tumours was possible on the basis of this reproducible combination: 1) tumour margins: well limited, 2) amount of fluid signal area: diffuse, 3) absence of fibrosis/tail sign/pseudocystic appearance/ hemorrhagic or fatty component (sensitivity of 96% (25/26), specificity of 96% (66/69) and accuracy of 96% (91/95)).
Conclusion: MR imaging provides criteria able to accurately distinguish benign and malignant myxoid containing tumours of soft tissue. Moreover, an original decisional algorithm is proposed.

B-0801 10:38

Whole-body screening of mastocytosis: intraindividual comparison of whole-body MRI vs bone scintigraphy

M.M. Ong, K.A. Buesing, A. Reiter, S.O. Schoenberg, S. Haneder; *Mannheim/DE*

Purpose: To compare the diagnostic value and discrimination of whole body (wb)-MRI against bone scintigraphy in the screening of patients with systemic mastocytosis.
Methods and Materials: In this retrospective institutional review board approved study 23 consecutive patients (10 women, 13 men; mean age 57±13.6) with histopathologically proven mastocytosis according to the current WHO criteria underwent both a wb-MRI at 1.5 T and a bone scintigraphy. The MRI protocol included coronal and sagittal T1w-TSE and TIRM/STIR sequences and the bone scintigraphy used 99m technetium labeled diphosphonates as a tracer. Image comparison by two board-certified radiologists according to each modality included determination of the extent of pathologic bone marrow signal in the spine and the extremities. Additionally, discordant findings between both modalities were assessed and compared by using Fisher's exact test.
Results: All imaging studies were rated as sufficient in all patients. On a per patient level, intra-individual comparison of wb-MRI vs. bone scintigraphy revealed a higher number of bone marrow involvement by MRI (MRI n=21 vs. bone scintigraphy n=18, p> 0.05). If bone marrow was affected, MRI showed a total spine involvement in 95% (20/21) in contrast to bone scintigraphy which only revealed a total spine involvement in 33% (6/18, p<0.0001). In addition, bone marrow involvement included the upper and lower extremities in 95% (20/21) in MRI and in 89% (16/18) in bone scintigraphy (p> 0.05).
Conclusion: The current study has shown that wb-MRI shows a higher diagnostic confidence than bone scintigraphy leading to a higher detection rate of bone marrow involvement and spreading.

B-0802 10:46

Volume k-trans on dynamic contrast-enhanced MR imaging in musculoskeletal tumours: correlation with intravoxel incoherent motion-derived parameters and volume apparent diffusion coefficients at 3.0 T

Y. Kim, W.-H. Jee, J.-Y. Jung, Y. Son, Y.-G. Chung; *Seoul/KR (whjee12@gmail.com)*

Purpose: To retrospectively determine whether the volume transfer constant (Ktrans) on dynamic contranst-enhanced (DCE) MR imaging correlate with the intravoxel incoherent motion (IVIM)-derived parameters and volume apparent diffusion coefficients (ADCvolume) in musculoskeletal tumours at 3.0 IVIM diffusion-weighted (DW) imaging at 3.0 T.
Methods and Materials: This study included 35 patients who underwent 3 T MR imaging including DCE MRI and IVIM DWI at 3.0 T. There were 24 men and 11 women (mean age 57 years, range 19-79). IVIM DWI was obtained with nine b values (0 - 800 sec/mm^2). IVIM-derived parameters included perfusion-related incoherent microcirculation (pseudodiffusion coefficient), perfusion fraction, and pure diffusion coefficient. Measurements were performed by using DCE MRI perfusion analysis software with manual VOI (volume of interest) placement and a semiautomatic lesion segmentation. Volume Ktrans, ADCvolume extracted using monoexponential signal model from total tumour volume, and IVIM-related parameters, were obtained in whole tumour volume on histograms analysis solution.
Results: There were 25 malignant and 10 benign tumours in this study. Volume Ktrans at DCE MRI showed significant correlation with IVIM-derived pseudodiffusion coefficient (r = 0.475, P =.0004). There was significant inverse correlation between volume Ktrans and IVIM-derived pure diffusion coefficient (r = -0.340, P =.046). However, Ktrans showed no significant correlation with ADCvolume and IVIM-derived perfusion fraction (r = -0.325, P >.05; r = 0.242, P >.05, respectively).
Conclusion: Ktrans correlate with IVIM-derived pseudodiffusion coefficient and inversely correlate with IVIM-derived pure diffusion coefficient in the musculoskeletal tumours at 3.0 T DWI.

Author Disclosures:
Y. Son: Employee; Siemens.

B-0803 10:54

Myxoid soft tissue tumours: are MRI signsreliable? A 95-case retrospective study

N. Alberti, X. Buy, M. Kind; *Bordeaux/FR (nicoalbertibdx@gmail.com)*

Purpose: The purpose of this study is to evaluate the reliability of different signs used in the literature to distinguish benign and malignant myxoid containing tumours.
Methods and Materials: 2 independent radiologists reviewed 95 MRI of 26 benign (17 myxomas, 9 Schwannoma) and 69 malignant tumours (24 myxoid liposarcoma, 33 myxofibrosarcomas, 8 low-grade fibromyxosarcomas and 4 extrasquelettal chondrosarcomas); benign criteria previously published are analysed in terms of presence or absence: 1) fine adipose hyper-intense T1 line between tumour tissue and muscle or other structure so-called fat rim and fat split signs; 2) polar triangular shaped hyper-intense T2 oedema so-called bright cap sign; 3) fine hypointense T2 lines of residual muscle fibres into myxoid tumour matrix so-called strand sign; 4) Percentage of well-defined tumour among both groups.
Results: All benign tumours are well limited but also 63% of malignant lesions. Sensibility and specificity of the fat split sign are 0.73 and 0.89, respectively, with 27% false-positive rate (7 malignant tumours); while sensibility and specificity of the bright cap sign are 0.61 and 0.81 with a 45% false-positive rate (13 malignant tumours). Strand sign is only present in myxoma with 2/17 false-negative cases.
Conclusion: Fat rim or bright cap signs are not specific of benign tumours and are encountered in malignancy. Other criteria should be used in association to avoid misdiagnosis while strand sign is a specific characteristic of myxoma.

B-0804 11:02

Functional MRI (DW-MRI)in the characterisation of Ewing sarcoma: its role in characterising bone marrow and soft tissue involvement and tumour necrosis

S.L. Juvekar, S.M. Desai, A. Gulia; *Mumbai/IN (sljuvekar@gmail.com)*

Purpose: To explore the potential of perfusion corrected diffusion weighted MR imaging in characterising Ewing's Sarcoma. Based on ADC values to differentiate active versus inactive disease.
Methods and Materials: 20 histopathologically proven patients with Ewing's sarcoma underwent MR imaging using FSET1W, FSET2W, STIR, Diffusion Weighted Echo planar Imaging (EPI) and post contrast fat saturated T1W sequences on 1.5 T scanner. Bone marrow and soft tissue involvement and tumour necrosis was assessed using Apparent Diffusion Coefficient (ADC) maps. The periosteal reaction was also evaluated using ADC maps.
Results: The ADC values of the involved bone segment versus uninvolved segment showed significant differences. The ADC values of tumour were 0.7 ± 0.4 x 10-3 mm2/s (mean ± SD). The ADC values of nontumoural segment were 1.8 ± 0.7 x 10-3 mm2/s (mean ±SD).The necrotic areas showed ADC values of 2.8 ± 0.6 x 10-3 mm2/s (mean ±SD). The differences in ADC values of the involved and uninvolved marrow were highly significant. The marrow infiltrated by tumour showed ADC values of 1.2 ± 0.8 x 10-3 mm2/s.
Conclusion: DW-MRI can differentiate between edema and tumoural involvement and it can better predict edema and actual involvement and hence can be used for pretreatment tumour detection and tumour characterization. It can also be useful in assessing response to Neoadjuvant Chemotherapy (NACT) and post definitive treatment to assess response and detect possible tumour recurrence.

B-0805 11:10

High-resolution ultrasound of peripheral nerves in systemic sclerosis: a pilot study of computer-aided quantitative assessment of nerve density

B. Bignotti[1], G. Tagliafico[1], G. Massimo[1], N. Panico$_2$, F. Zaottini[1], S. Airaldi[1], C. Martinoli[1], A. Tagliafico[1]; [1]*Genoa/IT*, [2]*Lavagna/IT (bignottibianca@gmail.com)*

Purpose: To quantitatively evaluate and compare nerve density in patients with limited cutaneous systemic sclerosis (lcSSc) and controls using high-resolution ultrasound (US).
Methods and Materials: N=40 patients and n=40 age and sex-matched controls were prospectively enrolled. US examination (17-5 MHz probe) of the median nerve at the elbow was performed bilaterally in each participant. A customized software (with semi-automatic and automatic interface) quantified the ratio between the hypoechoic and hyperechoic areas of peripheral nerves on ultrasound. Nerve density was defined as: hypoechoic pixels/total pixels. Statistical analysis included Mann-Whitney U-test of patients versus controls and subgroup analysis of symptomatic and non-symptomatic patients. Intra and inter-observer agreement was calculated (three independent readers). A complete automatic evaluation was also performed.
Results: 160 median nerves were evaluated. On US, nerve density resulted significantly reduced in lcSSc patients compared to controls (56±4 vs 41±3 p < 0.01). Subgroup analysis showed that symptomatic patients (n=15) had reduced nerve density compared to non-symptomatic (n=25) patients (39± 5 vs 43± 4 p < 0.01). Intra-observer agreement was very good (K=0.82). Inter-observer agreements were good: reader 1 vs reader 2: k =0.78 (95% confidence interval 0.65 to 0.91); reader 2 vs reader 3: k= 0.72 (95% confidence interval 0.65 to 0.82); reader 3 vs reader 1: k= 0.71 (95% confidence interval 0.64 to 0.81). A significant difference between the automated and the semi-automated software was found (p < 0.01).
Conclusion: In lcSSc nerve density is reduced possibly due to an increased hyperechoic connective component.

B-0806 11:18

Simultaneous [18 F]-FDG PET/MRI vs. PET/CT for local staging of soft tissue sarcoma

M.C. Herbrik[1], T.D. Poeppel[1], J. Grueneisen[1], K. Beiderwellen[1], L. Podleska[1], P. Heusch[2], T.C. Lauenstein[1], L. Umutlu[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE (michael.herbrik@uk-essen.de)*

Purpose: The aim of this study was to evaluate the diagnostic potential of simultaneous [18 F]-FDG PET/MRI in comparison to [18 F]-FDG PET/CT for local staging of soft tissue sarcomas.
Methods and Materials: 30 patients with proven soft tissue sarcoma underwent a contrast-enhanced [18 F]FDG-PET/CT (Biograph mCT 128, Siemens) and a subsequent contrast-enhanced [18 F]FDG-PET/MRI examination (Biograph mMR, Siemens; 0.5 mmol / kg BW Dotarem, Guerbet). The MR scan protocol comprised : 1) STIR cor, 2) T2 TSE ax, 3) fat-saturated T1w TSE post contrast ax. and cor. Qualitative analysis of the corresponding datasets (PET/CT, PET/MRI) was performed by two radiologists regarding (1) tumour extent, (2) tumour conspicuity, (3) infiltration of surrounding tissue and (4) artefact impairment (4 point ordinal scale) as well as diagnostic confidence (3-point ordinal scale). All available data (histology, prior examinations, PET/CT, PET/MRI, follow-up examinations) served as standard of reference. Wilcon rank test was used to test for statistical significance.
Results: All examinations were performed successfully without relevant side effects or artefact impairment. PET/MRI showed superior ratings for assessment of tumour extent (PET/MRI mean 3.6 vs PET/CT mean 3.4), tumour conspicuity (PET/MRI mean 3.6 vs PET/CT mean 3.0) as well as infiltration of surrounding tissue (PET/MRI mean 3.7 vs PET/CT mean 2.9; $p < 0.05$). Furthermore, PET/MRI offered higher diagnostic confidence over PET/CT (PET/MRI:2.7, PET/CT:2.5; $p < 0.05$).
Conclusion: PET/MRI enables superior assessment of soft tissue sarcomas, revealing improved delineation of tumour extent as well as infiltration of surrounding tissue at higher diagnostic confidence.

B-0807 11:26

Diagnostic performance of real-time elastography in miscellaneous limb soft tissue masses

P. Pelotti, G. Facchini, P. Spinnato, G. Filonzi, A. Bazzocchi, A. Moio, G. Filonzi, U. Albisinni; *Bologna/IT (giancarlo.facchini@gmail.com)*

Purpose: To evaluate the role of elastography in the characterization of benign vs. malignant soft-tissue masses.
Methods and Materials: We enrolled 28 females and 27 males (55.0±15.0 years) with limb soft-tissue masses which underwent an agobiopsy guided by ultrasound. Each lesion, immediately before the biopsy, was examined with B-Mode, Color- and Power-Doppler and strain elastography (Hi Vision Preirus; HitachiMedical Corporation; 3-7 MHz linear array transducer) by an expert musculoskeletal radiologist. In the absence of universally accepted scoring criteria, the elastograms were graded on a simplified semi-quantitative 4-point scale (ES0-3) comparing the lesion to surrounding subcutaneous fat and muscle. The scale was: ES0 (softer than surrounding tissues); ES1 (soft as surrounding tissues); ES2 (mild stiffness); ES3 (stiff). The exam did not include a quantitative elastography evaluation.
Results: On histopathological examination 23/55 lesions resulted malignant (34.3 %_ 22 sarcomas, 1 hepatocellular carcinoma metastasis) and 32/55 benign (65.7 %_9 schwannomas, 4 lipomas, 4 angiomas, 3 villonodular-synovitis, 2 mixomas, 2 fibromatosis, 2 granulomas, 5 cysts, 1 miofibroblastic proliferation).We considered ES0 and ES1 pattern of benign lesions, while ES2 and ES3 pattern of malignant lesions. Consequently, the area under the ROC curve resulted 86.0 % (CI 68.6-94.7 %) in malignancy distinction (sensitivity 92.7 %; specificity 61.9 %). We obtained 1 false negative (hepatocellular-carcinoma metastasis) and 13 false positives represented by schwannomas (9/35), mixomas (2/35) and fibromatosis (2/35).
Conclusion: Data from real-time qualitative ultrasound elastography may be a useful addition to conventional sonography as a sensitive malignancy/benignancy differentiation technique, able to help in soft-tissue lesion characterization.

B-0808 11:34

Useful tool in virtopsy: postmortal 31P magnetic resonance spectroscopy of the skeletal muscle: α-ATP/Pi ratio

J. Yamamura[1], T. Schmidt[1], S. Keller[1], J. Wang[2], G. Adam[1], R. Fischer[1]; [1]*Hamburg/DE*, [2]*Hamburg, TX/US (j.yamamura@uke.uni-hamburg.de)*

Purpose: Phosphor magnetic resonance spectroscopy (31P MRS) is an established method for metabolic examinations of resting and exercising skeletal muscle. So far, there are no MRS investigations of corpses. The aim of this study was to investigate the temporal pattern of phosphor metabolites in the adductor magnus muscle postmortem and to check the value of MRS as a forensic tool especially for the determination of the time of death.
Methods and Materials: 21 corpses, died of natural cause, were examined (13 male, 8 female; age: 70.5±8.7y, weight 74±18 kg). A control group of 3 male subjects (mean age: 38.7±24.5 y, range: 24-67y, mean body weight: 81±17 kg) was examined at a single time point as well. 31P MRS was performed on a 1.5-T MRI. A standard 31P surface coil in the patient table, placed under the thigh, was employed. To measure the concentration of the phosphor metabolites, scans were repeated in intervals of one hour over a period from 2 to 24 h postmortem (p.m). The core temperature was rectally measured throughout the MRI examination.
Results: The mean core temperature decreased from 36.0 °C to 25.7 °C. In vivo and ex vivo spectra showed characteristically different metabolite concentrations. The α-ATP/Pi ratio decreased exponentially from 0.445 to 0.032 ($r2 = 0.997$, $p < 0.001$).
Conclusion: There is a characteristical postmortal time pattern of the phosphor metabolites. Especially, the α-ATP/Pi ratio could be useful as a forensic tool because of its significant exponential postmortal time course.

B-0809 11:42

Multiparamentric MRI at 7 T for the non invasive assessment of acute ischemic and non-ischemic muscle damage

A. Palmisano, A. Esposito, T. Canu, F. Lo Russo, F. De Cobelli, A. Del Maschio; *Milan/IT (palmisano.anna@hsr.it)*

Purpose: Quantitative non-invasive evaluation of muscle damage has important role on clinical and preclinical research. Aim was to set up and validate a non-invasive MR protocol for the quantitative assessment of muscle damage/healing process in murine models of acute ischemic and non-ischemic damage.
Methods and Materials: A MR protocol on a 7T magnet (Bruker) based on the acquisition of T2w-MSME sequences, for the assessment of T2 relaxation time (T2-rt), and EPI-DTI sequences, for the quantification of fractional anisotropy (FA), was performed in 24 mice before i.m. injection of cardiotoxin (CTX) and after 1, 3, 5, 7, 10, 15, 30 days; and 1.3,5.7,14.21 days after femoral artery ligation in 10 mice. In this group DCE-MRI was performed and Ktrans evaluated. MRI parameters were compared to histological findings at each time-point.
Results: After i.m. injection of CTX: T2-rt peaked at day 3 with a progressive return to normal values; FA drops at day 1 with an increase over normal values between day 7-15. A strong correlation was found between T2-rt and leukocyte infiltrates ($r=0.92, p < 0.003$), and between FA and % of regenerating fibres ($r=0.88, p < 0.001$). In mouse model of acute ischemic damage T2-rt and FA had a similar trend but with a slower kinetic. Ktrans droped after damage for absent perfusion and increase over normal value between day 7-14, paralleling to vascular regeneration ($r:0.73, p < 0.001$).
Conclusion: Multiparametric MRI offers an effective and complete evaluation of muscle damage/healing process. T2-mapping e DTI allow an accurate quantitative monitoring of inflammatory infiltration and muscle regeneration occurring after acute damage

B-0810 11:50

Gadolinium retention in musculoskeletal soft tissue with normal renal function; macrocyclic Gd contrast agent versus linear chelate Gd contrast agent

H. Goto, T. Maeda, H. Hara, T. Akisue, K. Sugimura; *Kobe City/JP*

Purpose: 1. To compare the Gadolinium concentration in human bone tissue between macrocyclic contrast agent and linear chelate contrast agent under standard clinical dose. 2. To evaluate the relationships with renal function and Gd concentration in bone tissue.
Methods and Materials: Eleven patients underwent contrast-enhanced MRI before surgical resection of bone tumour. Nine male patients and two female patients (13 to 43 years old). Patients divided into two groups (Gd-DTPA-BMA-group vs Gd-DOTA-group). After administration of 0.1 mmol Gd/kg of Gd-DTPA-BMA (n=5) or Gd-DOTA (n=6) to patients with bone tumour undergoing surgical resection, bone specimens (normal tissues in the resection margin of tumour) were collected and analyzed Gd concentration by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Surgical resection of bone tumour was performed within 8 to 14days after MRI. Renal function (eGFR) in each patients was evaluated before MRI examination. Gd concentration in bone tissue and eGFR were compared Gd-DTPA-BMA group with Gd-DOTA group. The differences between two groups were determined using a non-paired t-test. Statistical significance was difined as $p < 0.05$.
Results: Bone tissue retention of Gd was 625.2±374.5 ng Gd/g for Gd-DTPA-BMA group versus 141.7±91.5 ng Gd/g for Gd-DOTA group, and statistically significant difference of Gd concentration in bone was observed ($*p < 0.05$). However, there was no statistically significant difference in eGFR (83.2±5.6 versus 86.2±12.5 ml/min/1.73m2) and the number of days before surgery (11.9±0.9 versus 11.2±2.5 days).

Conclusion: Typical linear Gd chelate may leave higher Gd concentration in bone than macrocyclic Gd chelate in patient with nomal renal function.

Author Disclosures:
H. Goto: Research/Grant Support; Guerbet Japan. **T. Maeda:** Research/Grant Support; Guerbet Japan. **H. Hara:** Research/Grant Support; Guerbet Japan. **T. Akisue:** Research/Grant Support; Guerbet Japan. **K. Sugimura:** Research/Grant Support; Guerbet Japan.

10:30 - 12:00 **Room E2**

Neuro

SS 1011
Ischaemic stroke (1)

Moderators:
E. Avdagic; Sarajevo/BA
A. Bonafe; Montpellier/FR

B-0811 10:30

Can DWI-FLAIR mismatch pattern on MRI be replaced by b1000-b0 mismatch for the prediction of time from symptom onset in acute ischemic stroke?
A. Geraldo, L. Berner, J. Haesebaert, T. Cho, A. Chabrol, T. Ritzenthaler, N. Nighoghossian, Y. Berthèzene; *Lyon/FR (anafilipageraldo@gmail.com)*

Purpose: To test whether a mismatch in the visibility of a lesion in b1000sec/mm2 and in b0sec/mm2 can substitute the DWI-FLAIR mismatch as a surrogate of stroke age.
Methods and Materials: We analyzed clinical and MRI data from patients included in the European multicenter IKNOW database with known stroke onset time and positive findings in b1000sec/mm2 at admission. Two independent readers assessed parenchymal lesions conspicuity on FLAIR and subclassified them as «FLAIR-positive» or «FLAIR-negative» (frank hypersignal versus absent or subtle hypersignal). Visual detection of ischemic lesions on b0sec/mm2 images was performed by two different raters and also considered as «b0-positive» or «b0-negative» (presence versus absense of lesion detection). The accuracy ((sensitivity, specificity, 95% confidence interval (CI), positive predictive value (PPV) and negative predictive value (NPV)) of lesion visibility on b0sec/mm2 images as compared to FLAIR sequences was determined. Interrater agreement was also calculated.
Results: The study included 122 patients (68 males; median age 67.4 years), with both stroke onset before (n=85) and after (n=27) 4.5h. Globally, b1000-b0 mismatch performed with b0 as compared to DWI-FLAIR mismatch approach showed a sensibility of 91.18%(CI76.32-98.14), a specificity of 85.90%(CI78.17-93.62), a PPV of 73.81%(CI60.51-87.1) and a NPV of 96.71%(CI87.98-99.11).
Conclusion: b1000-b0 mismatch appears to be an alternative to the classical DWI-FLAIR mismatch as a «tissue clock» for determining stroke age. We propose its application whenever there is a dubious judgement of lesions on FLAIR or in case this sequence is degrated by artefacts.

B-0812 10:38

CT angiography and CT perfusion for outcome prediction in patients with suspected acute ischemic stroke
T. van Seeters, B.K. Velthuis; *Utrecht/NL (T.vanSeeters@umcutrecht.nl)*

Purpose: To determine the value of CT angiography (CTA) and CT perfusion (CTP) in addition to patient characteristics and non-contrast CT (NCCT) for outcome prediction after suspected ischemic stroke.
Methods and Materials: Between May 2009 and August 2013, 1374 patients with suspected ischemic stroke of less than nine hours duration were included in the Dutch acute stroke study (DUST), a prospective multicenter cohort study. Patient characteristics, NCCT, CTA, and CTP parameters were related to clinical outcome after 90 days. Four multivariable logistic regression models were developed in 60% of the population, based on patient characteristics and NCCT (model 1), with addition of CTA (model 2a), CTP (model 2b), and combined CTA/CTP parameters (model 3). Models were validated in the remaining 40%.
Results: Poor outcome (modified Rankin Scale score 3-6) occurred in 501 patients (36.5%). All CTA and CTP parameters were predictors of poor outcome in univariable analyses. Multivariable analyses in the derivation set showed an area under the curve (AUC) of 0.84 (95% CI 0.81-0.86) for patient characteristics and non-contrast CT. AUC values were 0.85 (0.82-0.88) when CTA parameters were added, 0.84 (0.81-0.87) after addition of CTP, and 0.85 (0.83-0.88) when both CTA and CTP were added. In the validation set, AUC values of the four models were 0.78 (0.73-0.82), 0.79 (0.75-0.83), 0.78 (0.74-0.82), and 0.79 (0.75-0.83), respectively. Calibration of the models was satisfactory.
Conclusion: CTA and CTP parameters are strong predictors of 90 day clinical outcome, although their additional prognostic value over patient characteristics and non-contrast CT is limited.

Author Disclosures:
B.K. Velthuis: Research/Grant Support; Dutch Heart Foundation (2008T034), NutsOhra Foundation (0903-012).

B-0813 10:46

Patterns of altered susceptibility during seizures: the value of susceptibility weighted imaging (SWI) in detecting ictal events
R.K. Verma, F. Wagner, E. Abela, E. Springer, A. Huber, K. Schindler, C. Weisstanner, J. Gralla, R. Wiest; *Berne/CH (verma@gmx.ch)*

Purpose: To investigate pathological alterations of cortical veins appearance in SWI in patients experiencing status epilepticus (SE).
Methods and Materials: 26 patients (16 with NCSE -confirmed by electroencephalogram (EEG)- and 10 patients with CSE -confirmed by seizure event-) underwent MRI in an acute setting, including SWI, dynamic susceptibility contrast MR-imaging (DSC) and diffusion-weighted imaging (DWI). SWI sequences were retrospectively analyzed and correlated with DWI and DSC.
Results: 8/26 patients showed a pattern of generally diminished cortical veins in SWI with bihemispheric symmetrical hyperperfusion; none with diffusion restriction (DR) in DWI. 7/26 patients showed again generally diminished cortical veins, but with multifocal hyperperfusion in the perfusion maps; 4 showed an associated focal DR. 8/26 showed unifocal diminished cortical veins in SWI with associated unifocal hyperperfusion; 5 of them with DR. 3/26 showed focal prominent cortical veins (compared to the opposite side) with associated focal hypoperfusion; none of them with diffusion restriction.
Conclusion: In our study SWI showed different patterns of cortical veins appearance in SE from generally or focally diminished to focally prominent cortical veins. In all cases SWI showed a pathological pattern of cortical veins in SE. Therefore SWI is a very helpful tool in the diagnosis of SE, especially in NCSE, which is known to be underdiagnosed.

B-0814 10:54

Detection of small-vessel occlusions using high-resolution wavelet-based CT angiography derived from whole-brain CT perfusion data in acute ischaemic stroke
W.G. Kunz, L. Havla, W.H. Sommer, O. Dietrich, B. Ertl-Wagner, M.F. Reiser, K.M. Thierfelder; *Munich/DE (wolfgang.kunz@med.lmu.de)*

Purpose: To evaluate a newly developed wavelet-based CTA (WaveCTA) derived from dynamic whole-brain CT perfusion datasets in stroke patients in which conventional single-phase CTA (spCTA) failed to demonstrate a vessel occlusion.
Methods and Materials: Patients out of a retrospective cohort of 690 consecutive patients who had underwent multiparametric CT due to suspected acute ischemic stroke were included in this IRB-approved study. Inclusion criteria were: (1) CT perfusion deficit, (2) no evidence of occlusion in spCTA, and (3) acute ischemic non-watershed infarction as confirmed by follow-up MRI or CT within 72hrs. WaveCTA images were calculated from whole-brain CT perfusion datasets after initial rigid-body motion correction using the wavelet transform (Paul wavelet, order 1) of each pixel attenuation time course, from which the angiographic signal intensity was extracted as the maximum of the wavelet power spectrum. WaveCTA was analysed by two blinded and experienced readers with respect to presence and location of vessel occlusion.
Results: Forty-eight patients (7.0%, mean age 74.8 yrs, range 34-89) fulfilled the inclusion criteria. WaveCTA reconstruction was successful in all patients. Overall, in 10 (20.8%) of these patients with negative spCTA, an occlusion could be identified by WaveCTA. In particular, 8 (16.7%) occlusions were found on the M2 level, and 2 (4.2%) on the M3 level.
Conclusion: WaveCTA is a promising new angiographic reconstruction technique of whole-brain CT perfusion data. It allows, in some cases, the detection of vessel occlusions that are missed by spCTA.

B-0815 11:02

Findings associated with space-occupying cerebral edema in patients with large middle cerebral artery infarcts on follow-up: a CT angiography and CT perfusion study
A.D. Horsch[1], J.W. Dankbaar[1], T.A. Stemerdink[1], E. Bennink[1], J.L. Kappelle[1], J. Hofmeijer[2], H.W. De Jong[1], Y. Van der Graaf[1], B.K. Velthuis[1]; [1]*Utrecht/NL*, [2]*Arnhem/NL (alexanderhorsch@gmail.com)*

Purpose: Space-occupying cerebral edema is a devastating complication of acute middle cerebral artery (MCA) ischemic stroke. It is unclear why only some patients with large infarcts on follow-up, develop edema. Better knowledge of factors related to edema formation could aid treatment strategies. This study aims to identify variables that play a role in the development of edema.

Methods and Materials: From the DUST study, 92 patients were selected with infarcts > 2/3 of MCA territory on follow-up non-contrast CT (NCCT). Space-occupying edema was defined as midline shift ≥6 mm. Admission patient and treatment characteristics were collected. Admission CT parameters were dense-vessel sign, ASPECTS on NCCT and CT perfusion (CTP) (cerebral blood volume, CBV and mean transit time, MTT), and occlusion site, clot burden and collaterals on CT angiography. Permeability on admission CTP and day 3 recanalization and reperfusion status were obtained if available. Associations between these variables and edema were analyzed with univariate logistic regression. Odds ratios, adjusted for age and NIHSS were obtained with multivariate logistic regression.
Results: Edema developed in 34 patients (37%). Adjusted odds ratios (aOR) for edema were higher with lower ASPECTS on NCCT (aOR 1.20, 95%CI 1.01-1.42) and CBV (aOR 1.35, 95%CI 1.09-1.67), lentiform nucleus involvement (aOR 3.01, 95%CI 1.19-7.61), permeability (aOR 2.49, 95%CI 1.21-5.13), higher clot burden (aOR 8.29, 95%CI 2.06-33.44) and poor collaterals (aOR 2.91, 95%CI 1.08-7.86).
Conclusion: Extensive occlusion, poor collaterals and a larger CBV deficit with lentiform nucleus involvement and increased permeability, play a role in space-occupying edema development of MCA infarcts.

B-0816 11:10

Arterial spin labelling in identifying tissue salvage: is the technique a useful predictor of good recovery after acute ischaemic stroke?
F. Bozzetti, S. Piccinini, G. Crisi; *Parma/IT (bozzetti.francesca@gmail.com)*

Purpose: Arterial spin labelling (ASL) is a relatively new MR perfusion technique for quantitatively measuring cerebral blood flow (CBF) by taking advantage of arterial water as a freely diffusable tracer. Our purpose is to validate this technique and correlate CBF-measurements with clinical recovery in a six-months-follow-up.
Methods and Materials: From April 2013 to December 2013 fifty-two patients (35 male and 17 female) with an acute hemispheric ischaemic stroke were imaged within 6 hours of symptom onset with perfusion CT (CT-P), and at 24 hours with MRI perfusion imaging, including ASL on a 3.0 T Scanner. Baseline CTP was used to define tissue at risk. This was used to determine persistent hypoperfusion or hyperperfusion on 24-hour ASL maps. National Institutes of Health Stroke Scale (NIHSS) and modified Rankin Score were used to value the clinical outcome at the discharge, after 1 month and after six months from the Acute Stroke.
Results: Using 24-hour-ASL, 24 of 52 patients showed hyperperfusion, and 26 showed persistent hypoperfusion. Two patiens didn't show any alteration. Compared to patients with persistent hypoperfusion on ASL, patients with hyperperfusion was also associated with improved early clinical outcome, expecially at the discharge NIHSS and Rankin Scores ($p < 0.05$, t-student test). Kaplan-Maier curves show a significantly better survival in patients with hyperperfusion on ASL than patients with hypoperfusion. Chi-squared Test confirms that six-months survival is significantly higher in patients with hyperperfusion ($p < 0.05$).
Conclusion: Hyperperfusion of the initially ishemic area identified on 24 hour-ASL identifies patients with better clinical outcome and survival.

B-0817 11:18

Is Alberta stroke program early CT score (ASPECTS) a useful tool in the assessment of acute stroke patients?
J.E.T. Alves, T. Rodrigues, A.L. Sousa, Â. Carneiro, R. Felgueiras, J. Xavier; *Porto/PT (zeedualves@gmail.com)*

Purpose: To assess the prognostic value of baseline and 24h follow-up ASPECTS in predicting stroke patients' functional outcome and to determine if baseline dichotomized ASPECTS could help selecting patients for intra-arterial thrombectomy (IAT).
Methods and Materials: Retrospective review of pretreatment and 24h follow-up CTs of 115 consecutive patients admitted with acute anterior circulation stroke who underwent IV thrombolysis and/or IAT. Baseline and follow-up ASPECTS were independently graded by two neuroradiologists and a consensus classification was given. Patients were stratified into those with ASPECTS ≤7 or > 7. Good clinical outcome was considered if 3-month mRS ≤2.
Results: Inter-rater agreement for baseline (Intraclass correlation coefficient, ICC 0.82 $p < 0.001$) and follow-up (ICC 0.89 $p < 0.001$) ASPECTS was very good. There was no significant association between baseline ASPECTS and clinical outcome (Mann-Whitney U test p=0.241). After adjusting for age, initial NIHSS and recanalization status, there was a positive association between higher 24h ASPECTS and good clinical outcome (odds ratio 1.50; p=0.009). In the group of patients submitted to IAT (n=58), baseline dichotomized ASPECTS showed no significant association with recanalization status (Freeman-Halton extension of Fisher's exact test p=0.247) nor with clinical outcome (Pearson's $\chi 2$ test p=0.284).
Conclusion: ASPECTS is a reliable method to assess the extent of anterior circulation ischemic lesions and, when applied to 24h follow-up CT, may be a useful early predictor of clinical outcome. Baseline ASPECTS does not correlate with functional outcome and, when dichotomized (≤7 vs > 7), does not seem to help selecting stroke patients for intra-arterial thrombectomy.

B-0818 11:26

Imaging related predictors of favorable outcome in acute ischemic stroke treated by thrombectomy
A. Balodis, M. Radzina, K. Kupcs, E. Miglāne, J. Savlovskis; *Riga/LV (arturs.balodis7@gmail.com)*

Purpose: Evaluate the factors that affect the clinical outcome of acute ischemic stroke in patients with endovascular treatment.
Methods and Materials: This was retrospective study including 96 patients with middle cerebral artery occlusion. All patients had endovascular thrombectomy as main reperfusion therapy. Collaterals were analysed by two groups (poor vs. good). Thrombus-length was measured on CTA and DSA. Lesion size was evaluated by semiquantitative method on CT perfusion using ASPECTS score. Short-outcome was measured as difference between neurological status evaluated by NIHSS score on admission and at discharge.
Results: In this study, 49 men, 47 women, mean age 70.22±9.36 (SD) years. Mean time until thrombectomy was 217.98±74.95 (SD) min. Mean thrombus-length was 14 mm, range 5-27 mm. Collaterals were good in 36 patients (38%), and poor in 60 patient (62%) with inter-rater reliability Kappa=0.85 (p=0.001). Lesion size was evaluated on CT perfusion maps using ASPECTS score (mean 7.7±1.8 (SD)). Mean NIHSS on admission was 16±4.5 (SD), at discharge 6±6.2 (SD). There was a positive correlation between longer thrombus and higher NIHSS score at admission (p=0.002) and after thrombectomy (p=0.001). There was statistically significant correlation between ASPECTS core and collaterals p=0.012. Baseline ASPECTS was statistically significant predictor for a favorable outcome (p=0.04), as well as collaterals (p=0.017). Longer time to treatment (> 200 min) was associated with unfavorable outcome (p=0.08).
Conclusion: Main imaging related predictors for acute stroke short-term outcome were collaterals and lesion size at admission, but time to treatment and thrombus length influenced treatment outcome.

B-0819 11:34

Effects of radiation dose reduction in volume perfusion CT imaging of acute ischaemic stroke
A. Othman[1], C. Brockmann[1], M.A. Brockmann[1], Z. Yang[2], J. Kim[2], M. Wiesmann[1]; [1]*Aachen/DE*, [2]*Seoul/KR (ahmed.e.othman@googlemail.com)*

Purpose: To examine the influence of reduced tube current and thus radiation dose on image quality and sensitivity of Volume Perfusion CT (VPCT) maps regarding the detection of ischaemic brain lesions.
Methods and Materials: VPCT data of 20 patients with symptoms of acute MCA-occlusion (onset < 6h) acquired at 80 kV and 180 mAs were included. We generated Low-Dose-VPCT datasets (80%, 60%, 40% and 20% of the original tube current levels) by using a realistic low-dose simulation technique based on sinogram synthesis and quantum noise modeling. Perfusion maps (CBV, CBF, MTT, TTP, TTD) were created using a deconvolution-based commercial software. Signal-to-noise-ratio (SNR) measures were performed. Qualitative analyses were conducted by two blinded readers who furthermore assessed the presence/absence of ischaemic lesions (nonviable-tissue, tissue-at-risk) and scored CBV and CBF maps using a modified-ASPECTS-score.
Results: While SNR of low-dose datasets were significantly lower than the original datasets at all reduced dose levels ($p < .001$), only the 40% and 20% datasets were significantly inferior to the original datasets with regard to qualitative scores ($p < .001$). No significant correlation between SNR and qualitative scores was detected. Compared to original datasets, reduced-dose data at 80%, 60%, 40% and 20% level showed sensitivity values of 1.0, 1.0, 0.97, and 0.75, with inter-observer-agreements of 1.0, 1.0, 1.0, and 0.77, respectively for the detection of ischaemic lesions.
Conclusion: Results of this study indicate that Low-Dose Volume Perfusion CT (down to 40% of original radiation dose) produces sufficient perfusion maps for the detection of ischaemic brain lesions.

B-0820 11:42

Improved prediction of ischaemic stroke outcome using combined ASPECTS and the NIHSS

K.W. Wanambiro[1], J. Jowi[2], S.W. Ponda[1]; [1]*Nairobi/KE*, [2]*Kisumu/KE (drkevinwere@gmail.com)*

Purpose: To determine the additional value of combining the Alberta stroke program Early CT score (ASPECTS) and National institute of health stroke scale (NIHSS) score in predicting outcome of patients with ischaemic stroke.
Methods and Materials: Patients with ischaemic stroke were identified and pretreatment non-contrast CT (NCCT) ASPECTS was computed as well as the NIHSS score at admission. Patients were then followed up during hospitalisation and in the neurology clinic up to 28 days. At 28 days, the modified Rankin scale (mRS) was scored. Patients were classified as major or minor stroke using ASPECTS and NIHSS and the differences in outcome between the two groups identified. The primary outcome measure was mRS score at 28 days. The other measures were length of hospital stay, in-hospital mortality, and need for ICU care. Odds ratios for the association of MCA (middle cerebral artery territory) topographical regions with poor outcome were done. mRS score 4 at day 28 was considered as poor outcome.
Results: The combined NIHSS and ASPECTS was found to be better at predicting day 28 mRS compared to the same tools used independently. The negative predictive value is 64% compared to 44% for ASPECTS and 55% for NIHSS. The odds ratio was 11.3 for the combination and 4 for ASPECTS. No MCA topographical region was found to have increased association with poor outcome.
Conclusion: Combination of ASPECTS and NIHSS improves the predictive value for poor outcome in ischaemic stroke. Patients with ischaemic stroke should be evaluated by both classification tools.

B-0821 11:50

Leptomeningeal score (LMs) on computed tomography angiography can predict clinical outcome in patients with acute ischaemic stroke (AIS)

E. Puglielli[1], R. Lattanzi[1], M. Fuschi[1], V. Di Mizio[1], V. Di Egidio[2]; [1]*Teramo/IT*, [2]*Pescrara/IT (edopug@hotmail.com)*

Purpose: Aim of this study was to systematically review the importance of LMs in the outcome after AIS and identify a reliable score system for grading collateral flow.
Methods and Materials: 95 consecutive patients with AIS (mean age 55.7y, April 2009-September 2014), on-set less than 6 hours for the anterior circulation and 12 for the verbtebrobasilar one, undergoing endovascular multimodal treatment after basal CT, Computed Tomography Angiography. The LMs is based on scoring pial and lenticulostriate collaterals arteries (0, no; 1, less; 2, equal or more prominent compared with matching region in opposite emisphere) in 6 ASPECTS regions (M1-6) plus anterior cerebral artery region and basal ganglia. Good clinical outcome was defined as mRS ≤ 2 at 90 days.
Results: In our series 55/95 (48.17%) had a good (17-20), 31/95 (32.63%) a medium (11-16), and 9/95 (9.47%) a poor (0-10) LMs. Interrater reliability was high, with an intraclass correlation coefficient of 0.87 (95% CI, 0.77%-0.95%). On univariate analysis, slight single vascular risk factor was associated with the presence of poor LMs (P ≥.30 for all comparisons). In multivariable analysis, the LMs (good versus poor: OR, 15.8; 95% CI, 3.3%-97.4%; medium versus poor: OR, 9.5, 95% CI, 1.7%-50.6%), age (< 80 years), baseline ASPECTS (≥ 8), and CTP were independent predictors of good clinical outcome.
Conclusion: LMs appear to be as a strong imaging parameter for predicting clinical outcomes in patients with AIS and can therefore be used for imaging-based patient selection.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 1016

Advances in imaging metastatic disease

Moderators:
D. Filippiadis; Athens/GR
M. Müller-Schimpfle; Frankfurt a. Main/DE

K-18 10:30

Keynote lecture

M. Müller-Schimpfle; *Frankfurt a. Main/DE*

B-0822 10:39

Whole brain 3D T1w-VISTA for the diagnosis of small brain metastases at 3.0 Tesla

N.N. Kammer[1], E. Coppenrath[1], K.M. Treitl[1], H. Kooijman[2], M.F. Reiser[1], T. Saam[1]; [1]*Munich/DE*, [2]*Hamburg/DE (nora.kammer@med.uni-muenchen.de)*

Purpose: To evaluate a commercially not available contrast-enhanced (CE) sub-millimeter isotropic 3D whole brain black-blood T1w-TSE sequence with variable flip angles (T1w-VISTA) in comparison with a conventional CE MP-RAGE for the diagnosis of small brain metastases.
Methods and Materials: We prospectively included 48 patients with known or suspected intracranial tumours and 15 control patients. All patients underwent both standard CE MP-RAGE (0.8 mm3 isotropic, 4:46 minutes) and CE T1w-VISTA (0.75 mm3 isotropic, 4:43 minutes) at 3 Tesla in random order. Total number of metastases, maximum diameter, visual assessment of contrast enhancement (3-point Likert scale), contrast-to-noise ratio (CNR) and diagnostic confidence (5-point Likert scale) were assessed.
Results: Significantly more metastases were found in the T1w-VISTA compared to the conventional MP-RAGE (63 metastases vs. 37 metastases; $p < 0.05$). Metastases only detected in T1w-VISTA (N=26) were significantly smaller than those detected in both sequences (4.3±3.7 mm vs. 11.3±10.7 mm; p=0.0022). Visual assessment of contrast enhancement was rated significantly higher in the VISTA sequence ($p < 0.0001$). Mean CNR of metastases was 24.2±17.5 for T1w-VISTA and 12.7±11.5 for MP-RAGE (p=0.0003). Diagnostic confidence in T1w-VISTA was significantly higher compared to MP-RAGE (p=0.0387).
Conclusion: Black-blood 3D T1w-VISTA provides significant higher contrast-to-noise ratio of metastases, leading to a higher number of detected metastases and a higher diagnostic confidence compared to conventional MP-RAGE sequences.

Author Disclosures:
H. Kooijman: Employee; Philips Healthcare.

B-0823 10:47

Differentiation of primary brain tumours from metastases: quantitative evaluation of multi-parameters from diffusion and DCE-MR perfusion in tumour parenchyma and peritumoural area

J. Zhao, J. Chu, J. Yang, Z. Yang, B. Luo; *Guangzhou/CN (truechu@hotmail.com)*

Purpose: To quantitatively evaluate the efficiency of perfusion parameters and ADC in tumour parenchyma (TP) and peritumoural (PT) area for discriminating primary brain tumours (PBT) from metastases.
Methods and Materials: 35 patients (M: 21, F: 14, median age: 41y) with suspected malignant brain tumours were prospectively evaluated by DWI and DCE-MR. For each tumour, 10-15 regions of interest (ROIs) were manually placed on TP and PT area. Perfusion parameters (Ktrans, Ve, Kep and iAUC) and ADC were calculated. Their diagnostic efficiency and correlations with Ki 67 were assessed.
Results: The diagnosis of 35 patients (PBT: n=30 and metastases: n=5) were pathologically proved. In TP, mean Ktrans, Ve and iAUC of PBT were significantly lower than of metastases ($P < 0.000$) and iAUC showed the highest diagnostic value (AUC: 0.80) (the sensitivity, specificity and cut-off point of iAUC were 100%, 55% and 7.06). In PT area, only mean ADC showed significant difference (p=0.001) and the sensitivity, specificity and cut-off point were 88%, 56% and 1.47 mm2/s.

Combining analysis of TP and PT area, mean Ktrans, Ve, iAUC and ADC could significantly discriminate PBT from metastases and, similar within TP, iAUC showed highest diagnostic power (AUC: 0.64), while, different within TP, iAUC showed higher specificity (70%) but lower sensitivity (64%). Further, only inverse correlation (r=-0.65) between ADC and Ki67 was found in TP area (P=0.005).
Conclusion: Mean Ktrans, Ve and iAUC in TP and ADC in PT area may help differentiate PBT from metastases and mean ADC was inversely correlated with Ki67.

B-0824 10:55

Volumetric dynamic contrast enhanced computed tomography (DCE-CT) for preoperative assessment of the vascularity of spinal metastases

C. Lauridsen[1], C. Clausen[2], M. Lundsgaard[2], B. Dahl[1], M. Bachman[1], S. Frevert[1], L. Lonn[1]; [1]*Copenhagen/DK*, [2]*Herlev/DK (Cala@phmetropol.dk)*

Purpose: To investigate the feasibility of measuring and grading the vascularity of spinal metastases using dynamic contrast enhanced CT (DCE-CT).
Methods and Materials: Prior to surgical treatment of symptomatic metastatic spinal cord compression, patients were examined using DCE-CT. The 320-detector row CT scanner allowed a volumetric acquisition over a range of 16 cm, covering three to four vertebrae. Image analysis was performed at a dedicated workstation, encompassing quantitative and qualitative measurement of the arterial flow (AF) in mL/min/100 mL of the vertebrae. The perfusion values were analysed using a single input, maximum slope model. This abstract reveals data from five patients, being the first of a planned study including 15 patients. The AF assessed by DCE-CT of affected and non-affected vertebrae will be compared, and furthermore, the correlation between AF and intraoperative blood loss will be examined.
Results: In two patients the AF differed markedly between the affected and non-affected vertebrae (83.4 vs. 32.6 and 78.1 vs. 35.3 (mL/min/100 mL) respectively)). These metastases were from neuroendocrine lung cancer and non-small-cell lung carcinoma. The remaining three patients with similar AF in both affected and non-affected vertebrae had metastases from prostate cancer (2) and bladder cancer (1). The median AF of the non-affected vertebrae was 35.2 mL/min/100 mL (range 15.9 to 54.8 mL/min/100 mL).
Conclusion: The preliminary results from DCE-CT in spinal metastases indicate that non-affected vertebrae demonstrate similar AF values. In two of five patients higher AF values were detected in the affected compared to non-affected vertebrae, suggesting hypervascularity.

B-0825 11:03

Superb microvascular imaging (SMI): applying a new contrast-free ultrasound technique for the analysis of the microvascular structure in suspect lymph nodes

T. Diekhoff, T. Fischer; *Berlin/DE (torsten.diekhoff@charite.de)*

Purpose: Besides the shape and echogenicity of a lymph node (LN) the vascularisation and the distribution of vessels inside the LN is crucial for the decision between malignant transformation or reactive inflammatory changes. However, due to technical limitations of colour-coded Doppler ultrasound (CCDUS) and power Doppler (PD) the microvascular structure cannot be visualised. SMI resembles a new sonographic technique that is capable of depicting even smallest vessels. The aim of this study was to compare SMI with CCDUS and PD in analysing the vascular structure of LNs in patients with malignant melanoma.
Methods and Materials: 28 patients with malignant melanoma and Clark's level III-IV were investigated with SMI in addition to the standard protocol including B-mode, CCDUS and PD. The investigations were executed in the frequency range between 14 and 18 MHz. Fine-needle aspiration cytology (FNAC) and/or a surgical excision were performed to prove the results.
Results: The images created by SMI were subjectively superior to those of CCDUS and PD in both reactively enlarged LN and metastases. SMI showed microvascularisation in 6 lesions that were considered avascular in the other techniques. The primary diagnosis was changed in 10 out of 28 cases by SMI proven malignant by FNAC or excision. There were 2 false positive detections.
Conclusion: SMI is a unique technique to analyse the microvascular structure that is useful for distinction of malignant or reactive lesions in lymph nodes. Analysis of microvascularisation using SMI opens new possibilities in diagnostic imaging and treatment control of malignant and inflammatory diseases.

Author Disclosures:
T. Fischer: Equipment Support Recipient; Toshiba MS.

B-0826 11:11

Impact of the patient age on flip-flop phenomenon in lung metastasis from thyroid cancer

T. Isoda, S. Baba, Y. Maruoka, Y. Kitamura, M. Sasaki, H. Honda; *Fukuoka/JP (taisoda@radiol.med.kyushu-u.ac.jp)*

Purpose: FDG avid thyroid cancer lesions accumulate radioiodine with lower frequency, which is so called flip-flop phenomenon. The aim of this study was to analyze the impact of patient age to flip-flop phenomenon in the metastasized pulmonary lesions.
Methods and Materials: The cases of 75 patients who had radioiodine therapy for lung metastasis were studied retrospectively (age 17-73 yrs, median: 60 yrs; males : females, 22 : 53). We analyzed the relationship between the absence of iodine uptake and FDG avidity in the metastasized pulmonary lesions and compared the result between the two groups (age ≧ 60 yrs vs. age < 60 yrs).
Results: In younger patients (< 60 yrs), 7 out of 14 patients (50%) with FDG avid lung metastasis showed iodine uptake in the pulmonary lesion. On the other hand, 7 out of 30 patients (23.3%) with FDG avid lung metastasis showed pulmonary uptake in the older patients (≧ 60 yrs).
Conclusion: Our results show that the influence of FDG avidity to iodine uptake in the lung metastasis is varied depending on the patient age and younger patients with FDG avid lung metastasis still have the chance for a successful radioiodine therapy. Therefore, it is suggested that radioiodine therapy should be performed for the young patients even when their pulmonary lesions show FDG uptake.

B-0827 11:19

Accuracy of [18 F]-FDG PET/MRI for the detection of liver metastases

K. Beiderwellen[1], L. Geraldo[2], V. Ruhlmann[1], P. Heusch[3], B. Gomez[1], F. Nensa[1], L. Umutlu[1], T.C. Lauenstein[1]; [1]*Essen/DE*, [2]*Barcelona/ES*, [3]*Düsseldorf/DE (karsten.beiderwellen@uk-essen.de)*

Purpose: To compare the diagnostic accuracy of [18 F]FDG-PET/CT with PET/MRI for the detection of liver metastases.
Methods and Materials: 32 patients with solid malignancies underwent [18 F]FDG-PET/CT and subsequent PET/MRI of the liver. Two readers assessed data sets regarding lesion characterization (benign, indeterminate, malignant), conspicuity (4-point scale) and diagnostic confidence (3-point scale). An imaging follow-up of more than 75 days (185±92 days) and/-or histopathological specimen served as standard of reference. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated for both modalities. Accuracy was determined by calculating the area under the receiver operating characteristic (ROC) curve. Values of conspicuity and diagnostic confidence were compared using Wilcoxon-signed-rank test.
Results: The standard of reference revealed 113 liver lesions in 26 patients (malignant: n=45; benign: n=68). For PET/MRI a higher accuracy (PET/CT: 82.4%; PET/MRI: 96.1%; $p < 0.001$) as well as sensitivity (67.8% vs. 92.2%, $p < 0.01$) and NPV (82.0% vs. 95.1%, $p < 0.05$) were observed. PET/MRI offered higher lesion conspicuity (PET/CT: 2.0±1.1 [median: 2; range 0-3]; PET/MRI: 2.8±0.5 [median: 3; range 0-3]; $p < 0.001$) and diagnostic confidence (PET/CT: 2.0±0.8 [median: 2; range: 1-3]; PET/MRI 2.6±0.6 [median: 3; range: 1-3]; $p < 0.001$). Furthermore, PET/MRI enabled the detection of additional PET-negative metastases (reader 1: 10; reader 2: 12).
Conclusion: PET/MRI offers higher diagnostic accuracy compared to PET/CT for the detection of liver metastases. In patients without contraindications to MRI (pacemaker, etc)., [18 F]-FDG PET/MRI represents a powerful new alternative to PET/CT in the evaluation of possible liver metastases.

Author Disclosures:
K. Beiderwellen: Speaker; Siemens, Healthcare Sector. **L. Umutlu:** Consultant; Bayer Healthcare. Speaker; Bayer Healthcare.

B-0828 11:27

Diagnostic accuracy of imaging methods for the diagnosis of skeletal malignancies: retrospective analysis against pathology-proven reference

B. Lange[1], M. Nielsen[2], J. Andersen[2], H. Lilholt[2], M. Vyberg[2], L. Petersen[2]; [1]*Hilleroed/DK*, [2]*Aalborg/DK (bl@benedictelange.dk)*

Purpose: Diagnostic imaging of skeletal malignancies can be performed by a variety of methods. The presentation of metastases may vary considerably with the type of osseous reaction as well as with the anatomical location. Using bioptic pathology diagnoses as the reference, the aim of this study was retrospectively to examine the diagnostic accuracy of imaging examinations on suspected skeletal malignancies.
Methods and Materials: A total of 605 patients were identified. Diagnostic imaging with x-ray, CT, MRI, bone scintigraphy, SPECT/CT and FDG-PET/CT performed within 6 months of the biopsy were reviewed. Results were expressed as sensitivity, specificity, positive and negative predictive values.

Results: A total of 395 eligible patients (216 men and 179 women) with 409 biopsies were included in the analysis. FDG-PET/CT showed the best sensitivity (sensitivity 92%, specificity 63%, PPV 84 %, NPV 80 %), followed by MRI (91/83/87/88 %). X-ray and CT were found to have the best specificity (33/96/86/66 % and 76/89/91/71 %, respectively). Bone scintigraphy showed the modest diagnostic properties (74/63/87/86 %). MRI proved to have the best combination of sensitivity and specificity (91 and 83 %) and best PPV and NPV.
Conclusion: Among modern imaging modalities, the sensitivity for the detection of skeletal malignancies (mostly bone metastasis) was not better than 91-92 %. MRI proved to have the best combination of sensitivity and specificity (91 and 83 %) and best PPV and NPV. These findings indicate that results of imaging investigations should be read cautiously and in the context of other clinical and laboratory findings.

B-0829 11:35

Dynamic contrast-enhanced magnetic resonance imaging in benign and malignant sclerotic bone lesions

P. Kosucu, S. Süleyman, H. Kavgaci, A. Karacin, A. Küpeli; *Trabzon/TR (polatkosucu@hotmail.com)*

Purpose: We aimed to determine whether the dynamic contrast MRI (DC-MRI) is useful to distinguish between metastatic and benign sclerotic bone lesions.
Methods and Materials: DC-MRI is performed to 39 patients with sclerotic bone lesions both to the lesions and healthy bone tissue. Benign group consisted 10 cases while malignant group included 29 cases. We evaluated the peak value of the contrasting percentage and the ratio of the peak value of the contrasting percentage of the sclerotic lesions, the peak value of the contrasting percentage of the healthy bone tissue and the curves of time-signal intensity.
Results: The peak value of contrasting percentage in benign group was between 31- 111, and the avarage was 63.6, in the malignant goup it was between 41- 209, and the avarage was 125.1. The difference of the peak value of contrasting between the malignant group and benign group was statistically significant. The ratio of this value in the benign group was 0.4 minimum, 2.7 maximum with the avarage of 1.17, and in the malignant group minimum 1.2, maximum 16.08, with the avarage of 5.08. We found type D time-signal intensity patern in 24 cases, type C in 11 cases, type B in 3 cases and type E in one case.
Conclusion: DC-MRI can be used to discriminate metastatic and benign sclerotic bone lesions by evaluating the peak value of contrasting percentage and the ratio of this value and the curves of time-signal intensity.

B-0830 11:43

Detection of distant metastases in patients with primary breast cancer: is 18 FDG-PET/CT better than conventional imaging?

A.G.V. Bitencourt, R.R. Cunha, J.F.A. Conrado, W.P. Andrade, E.N.P. Lima, R. Chojniak; *Sao Paulo/BR (almirgvb@yahoo.com.br)*

Purpose: To compare 18 FDG-PET/CT and conventional imaging tests for the detection of distant metastases in patients with primary breast cancer.
Methods and Materials: We retrospectively evaluated 81 patients with primary breast cancer that were submitted to 18 FDG-PET/CT before treatment. 18 FDG-PET/CT and conventional imaging findings were compared with findings on biopsy, subsequent imaging, or clinical follow-up. Conventional imaging included: bone scintigraphy; chest X-ray (14.5%) or CT (85.5%); and abdomen ultrasound (10.8%), CT (87.8%) or MRI (1.4%).
Results: Patient's mean age was 44.9±12.0 years (range, 24-73 years). The size of the primary breast tumour varied from 19 to 150 mm (mean 55.8±24.5 mm), being 39.2% T2, 34.2% T3 and 26.6% T4. Distant metastases were observed in 9 patients (11.1%). 18 FDG-PET/CT and conventional imaging identified distant metastases in 8 patients each (9.8%), demonstrating the same sensibility (88.9%). Conventional imaging did not show metastases to mediastinal lymph nodes and sternum that were identified on 18 FDG-PET/CT in on patient. 18 FDG-PET/CT did not demonstrate a bone metastasis in one patient that was evident on bone scintigraphy. In the remaining cases, metastasis lesions were identified on both 18 FDG-PET/CT and conventional imaging. 18 FDG-PET/CT also found benign / inflammatory lesions in 9 patients (11.1%).
Conclusion: There was no difference in the sensibility of 18 FDG-PET/CT and conventional imaging for the detection of distant metastasis in patients with primary breast cancer. Unlike other studies that have shown that 18 FDG-PET/CT is superior to conventional imaging for detection of distant metastases, in our series most cases performed chest and abdomen CT for staging.

B-0831 11:51

Palliation of painful bone metastases: the "Rizzoli" experience

A. Bazzocchi[1], G. Facchini[1], P. Spinnato[1], E. Rimondi[1], M. Battaglia[1], S. Donatiello[2], G. Filonzi[1], U. Albisinni[1]; [1]*Bologna/IT*, [2]*Modena/IT (salvo.donatiello@gmail.com)*

Purpose: The aim of this work is to evaluate the clinical outcome of patients affected by painful bone metastases and submitted to magnetic resonance guided focused ultrasound (MRgFUS) at the "Rizzoli" Orthopaedic Institute (Bologna, Italy).
Methods and Materials: 75 secondary bone lesions affecting 64 patients (61.5±7.9 years-old) were treated, with different primary cancers (breast, kidney, lung, colorectal, prostate, thyroid, stomach, soft-tissue sarcoma, and Ewing sarcoma). The lesions were located at: pelvis (40); femur (16); ribs (6); humerus (4); sacrum (6); spine (1); scapula (1); calcaneus (1). All patients were clinically examined (VAS,QoL) at baseline with a 1-, 3-, 6-, and 12-month follow-up (FU).
Results: 68/75 (90.6%) lesions were evaluated after 1 month, 62 lesions reached the 3-month (82.6%), 41 the 6-month (54.6%) and 12 the 12-month (16%) FU point. On a lesion-based approach, VAS score at baseline was 5.00 ± 3.00. This decreased to 2.2 ± 2.3 ($\Delta\% = 42.01\%$) at 1 month, and to 1.8 ± 2.2, 2.1 ± 2.5, and 1.5 ± 1.9 after 3, 6 and 12 months respectively (ΔVAS% vs. baseline: 52.4%, 39.9% and 57.4%)(p=0.001). A statistically significant difference between baseline and all follow-up time points was observed for pain severity (p=0.001). In 31\68 lesions (45.5%) the VAS dropped to 0 at one month FU; VAS persisted at 0 in 31 patients up to 3 months, in 18 up to 6 months, and in 8 up to 12 months.
Conclusion: MRgFUS is a safe and effective palliation for painful bone metastases with a high pain response rate.

10:30 - 12:00 **Room F2**

GI Tract

SS 1001

Rectal cancer and anorectal imaging

Moderators:
L. Curvo-Semedo; Coimbra/PT
F. Maccioni; Rome/IT

K-19 10:30

Keynote lecture

L. Blomqvist; *Stockholm/SE*

B-0832 10:39

Magnetisation transfer (MT) Imaging as a tool to quantify post-chemoradiation fibrosis in rectal cancer: does it help in the assessment of tumour response?

M.H. Martens[1], D.M.J. Lambregts[1], N. Papanikolaou[2], S. Alefantinou[2], M. Maas[1], G.C. Manikis[2], K. Marias[2], G.L. Beets[1], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Iraklion/GR (d.lambregts@mumc.nl)*

Purpose: Although MRI is one of the main tools for rectal tumour response evaluation after chemoradiotherapy (CRT), MRI experiences difficulties in interpreting post-radiation fibrosis. Promising results have been reported for single-slice magnetisation transfer (MT) imaging to quantify post-radiation fibrosis in rectal cancer. Aim was to evaluate if multislice MT-imaging of the whole tumour area can predict the pathological tumour regression grade (TRG) after CRT.
Methods and Materials: 30 patients treated with CRT underwent a restaging MRI (1.5 T) including a multislice MT sequence, covering the entire area of the tumour bed. Two independent/blinded readers drew regions of interest on the magnetisation transfer ratio (MTR) map, covering all potentially suspicious remaining tumour/fibrotic areas. From the whole volume of these ROIs, mean MTR and histogram parameters (median,min,max,skewness,kurtosis,SD,5-95% percentiles), were calculated. Histological TRG served as the reference standard to discriminate between predominant fibrosis (TRG1-3) versus predominant tumour (TRG4-5).
Results: Mean MTR rendered an area under the Receiver Operator Characteristics Curve (AUC) of 0.70 (reader 1) and 0.87 (reader 2) to differentiate between TRG1-3 versus TRG4-5. Best results were obtained for the 95th percentile of the MTR, with an AUC of 0.80 (reader 1) and 0.91 (reader 2). Interoberserver agreement for MTR measurements was moderate (ICC 0.50).
Conclusion: MT imaging is a promising tool to quantify fibrosis after CRT in rectal cancer. In particular the histogram parameter 95th percentile results in good AUCs op to 0.91 to discriminate patients with predominant fibrosis. The main drawback is the limited interobserver agreement.

B-0833 10:47

Performance of texture analysis, diffusion-weighted imaging and perfusion imaging in predicting tumoural response to neoadjuvant chemoradiotherapy in rectal cancer patients studied with 3-T MR

M. Ciolina[1], C. De Cecco$_2$, B. Ganeshan[3], M. Rengo[2], D. Bellini[2], A. Laghi[1]; [1]*Rome/IT*, [2]*Latina/IT*, [3]*London/UK (mariaciolina@gmail.com)*

Purpose: To determine the performance of texture analysis (TA), diffusion-weighted imaging (DWI), and perfusion MR (pMR) in predicting tumoural response in patients treated with neoadjuvant chemoradiotherapy (CRT).
Methods and Materials: Population consisted of 12 patients with rectal cancer, who underwent pre-treatment 3-T MRI. Texture analysis (kurtosis), ADC and pMR parameters (IAUGC, Ktrans, Ve, Kep) were quantified using commercial research software algorithms. After CRT, all patients underwent complete surgical resection and the surgical specimen served as gold standard. Receiver operating characteristic (ROC) curve analysis was performed to assess the discriminatory power of texture parameters to predict complete response.
Results: Pathological complete response (pCR), partial response (PR) and no response (NR) were found in 6, 3 and 3 patients, respectively. Baseline kurtosis was significantly lower in pCR in comparison with PR+NR (p=.01). Among ADC and pMR parameters, only Ve was significantly lower in the pCR compared to PR/NR (p=.01). A significant negative correlation between kurtosis and ADC (r=-0.650, p=0.022) was observed. The areas under the curve (AUC) to discriminate patients with pCR from patients with PR/NR were 0.861 for kurtosis, 0.694 for IAUGC, 0.569 for Ktrans, 0.861 for Ve, 0.668 for Kep and 0.556 for ADC. The discriminatory power was significant for kurtosis (p=0.001) and Ve (p=0.003). The optimal cutoff for the identification of pCR was ≤0.192 for kurtosis (100% sensitivity, 67% specificity) and ≤0.311 for Ve (83% sensitivity, 83% specificity).
Conclusion: Baseline TA and pMRI parameters have the potential to act as imaging biomarkers of tumoural response to neoadjuvant chemoradiotherapy.

B-0834 10:55

Follow-up with MRI of rectal cancer treated by TEM: recurrence detection and inter-observer reproducibility

M. Maas[1], M. Martens[1], C. van Berlo[1], W. Deserno[2], J. Leijtens[2], G.L. Beets[1], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Roermond/NL (moniquemaas@live.nl)*

Purpose: Small rectal cancers can be treated with transanal endoscopic microsurgery (TEM). Postoperative changes make follow-up with MRI challenging. Aim was to evaluate post-TEM-MRI at different time points for recurrence detection and assess interobserver-reproducibility.
Methods and Materials: 38 patients underwent TEM (8 after CRT). MRI was performed every 3-4 months during follow-up and consisted of T2W-MRI±DWI. 122 MRIs were performed with mean 3 MRI per patient. Seven patients recurred. MRIs were evaluated by 2 readers with different experience by confidence level (CL) scoring for recurrence, reproducibility was evaluated with weighted-κ-statistics.
Results: For all MRIs AUC for recurrence detection was 0.79&0.73 for T2W-MRI and 0.69&0.76 for DWI. During follow-up AUC increased from 0.55-0.67 at T2W-MRI and from 0.57-0.73 for the most experienced reader. Interobserver-reproducibility increased during follow-up for T2W-MRI from κ0.127 to 0.429. For DWI reproducibility was fair (κ0.38-0.40) which was stable during follow-up. Nodal staging had stable moderate reproducibility (κ0.53). At the first MRI after TEM higher CL scores were given at DWI than at T2W-MRI, this difference disappeared from the second MRI during follow-up. Number of equivocal scores decreased during follow-up. Iso-intensity in bowel wall and/or mesorectal fat were predictive for recurrence.
Conclusion: The first post-TEM MRI is difficult to assess. After the first MRI accuracy for recurrence detection increases, due to the possibility to compare with earlier studies. There is a learning curve during follow-up leading to more certainty in readers. Reproducibility is fair-moderate, but increases during follow-up. Iso-intensity in bowel wall and/or mesorectal fat were predictive for recurrence.

B-0835 11:03

Added value of diffusion-weighted MRI for early detection of tumour response to preoperative chemoradiation therapy, in locally advanced rectal cancer: correlation with histopathologic analysis

M. Mumoli, D. Ippolito, C. Talei Franzesi, O. Minutolo, P.A. Bonaffini, S. Sironi; *Monza/IT (marte83@tiscali.it)*

Purpose: To investigate the diagnostic value of apparent diffusion coefficient (ADC),in the assessment of tumour response to neoadjuvant chemoradiation therapy (CRT)in patients with locally advanced rectal cancer (LARC), correlated to tumour regression grade (TRG)obtained at histopathologic analysis.
Methods and Materials: Seventy patients with locally advanced rectal cancer (≥T3 or lymphnode positive)were evaluated before and after CRT treatment.Each patient scan consists of multiplanar T2 and T1 combined with diffusion-weighted sequences using a 1.5 T MRI system.Quantitative ADC in pre and post-CRT MRI, by outlining freehand region of interest (ROIs)on the site of the lesion,was assessed.Diagnostic accuracy of ADC values for predicting treatment response,correlated with histopathological TRG, was evaluated according to Mandard's classification[responders (TRG1-2) and non-responders (TRG 3-5)].
Results: Patients were assigned to responders group (n=48)or non-responders group (n=22)on the basis of histopathologic examination. Before CRT, no significant difference in ADC values between responders vs non-responders were obtained: responders group (862×10−3 s/mm2 ± 206) vs non-responders (877×10−3 s/mm2 ± 168). After CRT, the mean tumour ADC increased significantly in responders group (1444 × 10−3 s/mm2 ± 231) than in the nondownstaged group (1.267 × 10−3 s/mm2 ± 203). The post-CRT ADC using ROC analysis, demonstrated the best cut-off value of 1,298 x 10-3 s/mm2, in determing responders patients yelding a sensitivity of 86% and specificity of 72%.
Conclusion: The quantitative rating of post-CRT in ADC map, represents a non-invasive tool,useful in restaging of patients with LARC, showing high accuracy as a predictor of tumour response to neoadjuvant chemo-radiation therapy (CRT) compared to histopathologic analysis.

B-0836 11:11

Reproducibility of evaluation of invasion depth of rectal cancer into the mesorectal fat: can we reliably discern T3ab from T3cd tumours?

M. Maas[1], G.L. Beets[1], M. Ageitos Casais[2], X. Li[3], S.-X. Rao[4], M.M. van Heeswijk[1], R. Beckers[1], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Santiago de Compostela/ES*, [3]*Beijing/CN*, [4]*Shanghai/CN (moniquemaas@live.nl)*

Purpose: One of the important aspects of rectal cancer staging is the measurement of the invasion depth of a tumour into the mesorectal fat in millimetres. This determines whether there is a T3ab (< 5 mm) or T3cd (> 5 mm) tumour, which can change treatment. Measurement of this factor can be arbitrary. Aim was to evaluate reproducibility of the measurement of invasion depth into the mesorectal fat by different readers.
Methods and Materials: Sixty-one patients with a pathologically proven T3 tumour were selected. Two readers with different experience in reading rectal cancer MRI (2 years and 5 years) measured the maximal depth of invasion of tumour into mesorectal fat in the axial plane perpendicular to the tumour axis. Clock position of the measurement was registered. ICC and Bland-Altman plots were used for analyses.
Results: Intraclass correlation coefficient was 0.61. The Bland-Altman plot showed a mean difference between measurements of 2.45 (SD 3.53) mm with limits of agreement of -4.45 to 9.39. Differences between measurements ranged from -9 to 15 mm. In 36% of patients the clock position of the measurements of both readers were not in the same quadrant.
Conclusion: Reproducibility of measurement of invasion depth of tumour into the mesorectal fat is low, both with regard to the depth and to the location of the deepest invasion. Therefore, the disctinction between T3ab and T3cd tumours is unreliable and should not be used for treatment decisions.

B-0837 11:19

DWI for assessment of rectal cancer nodes after chemoradiotherapy: does the absence of nodes on DWI predict a ypN0 status?

M.M. van Heeswijk, D.M.J. Lambregts, W.M. Palm, B.M.F. Hendriks, G.L. Beets, R.G.H. Beets-Tan; *Maastricht/NL (miguel.palm@mumc.nl)*

Purpose: Diffusion-weighted MRI (DWI) is a very sensitive technique to detect lymph nodes. Assessment of a node negative status after chemoradiaton is important, mainly when considering organ-saving treatments in patients with a good tumour response. Aim was to test the hypothesis that absence of nodes on DWI after chemoradiation (CRT) is concordant with a ypN0 status.
Methods and Materials: 97 rectal cancer patients treated with CRT followed by a restaging MRI (at 1.5 T) including DWI (highest b-value b1000) were included. Two independent readers counted the number of nodes visible on DWI after CRT. The number of nodes observed on DWI (0 vs ≥1) was compared with the number of positive nodes at histopathology (yN0 vs yN+).
Results: 79 patients were ypN0 and 18 were ypN+. In 9 patients no nodes were observed on DWI by both readers, which was concordant with a yN0-status in all 9 (100%) cases. In the other 70 ypN0 patients a median of 3 (range 1-17) nodes was counted on DWI. In the 18 patients with a ypN+ status, a median number of 4 (range 1-7) nodes was observed on DWI.
Conclusion: Although the absence of lymph nodes on DWI is not a frequent finding, it is a reliable predictor of an actual ypN0 status after neoadjuvant CRT in patients with locally advanced rectal cancer. As such, DWI can be a helpful tool to select node negative patients after CRT.

B-0838 11:27

Comparison between MRI and water soluble contrast enema in evaluating complications after colorectal anastomosis and protective ileostomy in patient with rectal cancer

E. Raimondi, M. Bassi, V. Pollastri, R. Rizzati, M. Giganti, G. Benea; *Ferrara/IT (dr.edoardo.raimondi@gmail.com)*

Purpose: To evaluate the diagnostic accuracy of magnetic resonance imaging (MRI) in post-surgery complications in patients with rectal cancer that underwent colorectal anastomosis, in comparison with water soluble contrast enema (WSCE).
Methods and Materials: From January to October 2013, 31 patients who underwent surgery with colorectal anastomosis and protective ileostomy waiting for recanalisation were evaluated with both MRI and WSCE. Single contrast enema was obtained with the infusion of 50 ml of Gastrografin® through rectal catheterisation; computed radiography images were acquired at 1 fps. MRI pelvis evaluation was performed after rectal opacification with 60 cc of water based gel, multiplanar acquisition of T1 and T2 weighted images before and after i.v. infusion of contrast agent. WSCE and MRI findings were compared in evaluating patency of colorectal anastomosis and contingent fistulae, perianastomotic leaks or abscesses.
Results: Both MRI and WSCE evaluated anastomosis patency in 29/31, fistulae in 10/31 and perianastomotic leaks in 7/31, however only MRI was able to detect the presence of abscesses in 6/31 patients. In 2/31 patients both MRI and WSCE showed a stenotic tract, but only MRI was able to evaluate the presence of a perianastomotic cancer recurrence; MRI was also able to identify the contextual presence of locoregional lymphadenopathy.
Conclusion: In preoperative planning, before recanalisation, MRI is more accurate than WSCE in order to identify post-surgery complications in patients with colorectal cancer that underwent colorectal anastomosis, evaluating the patency and showing the contingent presence of perianastomotic abscesses, cancer recurrence and contextual locoregional lymphadenopathy.

B-0839 11:35

Primary cystic lesions of the retrorectal space: MRI evaluation, histopathology confirmation and clinical assessment

R.S. Dwarkasing, S. Verschuuren, G. van Leenders, L. Braun, W. Schouten, G.P. Krestin; *Rotterdam/NL (r.s.dwarkasing@erasmusmc.nl)*

Purpose: To present an overview of primary cystic lesions of the retrorectal space and investigate MR imaging characteristics which may indicate malignancy.
Methods and Materials: Patients were referred to a tertiary center for colorectal surgery. MRI was performed on 1.5 T. Lesions were proven by histopathology and clinical assessement. MRI was reviewed by two radiologists separately. Interobserver agreement was assessed (Cohen's test) for each lesion characteristic separately. Significance of differences between malignant and benign lesions were calculated with a 95% confidence level (Fisher's exact test).
Results: 28 patients (22 female, 8 male) with 31 lesions were included. Lesions were subdivided into 5 groups: tailgut cyst, epidermoid and dermoid cyst, teratoma, colorectal origin, neurogenic origin. Tailgut cyst was the most prevalent (16/31, 52 %). Five patients had malignancy (18%); on lesion level 5 out of 31 (16%). Lesions from colorectal origin had the highest percentage of malignancy (3/4, 75%). Solid tissue component was found in all 5 (100 %) malignant lesions, whereas only 2 (8%) of benign lesions demonstrated solid tissue components ($p < 0.05$, with a difference of 92.3% (95% CI = [82.1% - 102.6%]).For unilocularity, multilocularity, debris, septa and wall thickening, differences were not significant between malignant and benign lesions. The interobserver agreement between both readers was perfect (kappa = 1) for all characteristics except debris (kappa = 0.795).
Conclusion: Eighteen percent of patients with primary cystic lesions of the retrorectal space has a malignant lesion with MRI findings of solid tissue components (100 %) most suggestive of malignancy.

B-0840 11:43

Rectal MRI of fistula-in-ano: diagnostic values of diffusion-weighted imaging (DWI)

S. Ahn, J. Park, S. Moon, D. Lee, S. Park, J. Lim; *Seoul/KR (83ahnse@hanmail.net)*

Purpose: To investigate the diagnostic performance of DWI in fistula-in-ano.
Methods and Materials: This study included 46 patients who underwent rectal MRI to evaluate fistula-in-ano. A history of Crohn's disease (CD) and fistulectomy were reviewed. Two radiologists retrospectively reviewed rectal MRI with consensus three times at 2-week intervals. The first review assessed the presence of perianal lesions, fistula type, and lesion conspicuity with T2WI. The second review assessed fistula conspicuity with CE-FS-T1WI and T2WI. The third assessed fistula conspicuity with DWI (b-value=1000) and T2WI. Lesion conspicuity was scored from 1 to 4: 1, unclear fistula tract; 2, visible fistula tract with unclear margin; 3, distinct fistula tract with partial obscuration; and 4, distinct fistula without obscuration. The lesion conspicuity was compared between CE-FS-T1WI and DWI using Wilcoxon rank-sum test. Lesion conspicuity according to the clinical history was assessed using Mann-Whitney *U*-test.
Results: Of 46 patients, 39 had perianal lesions in rectal MRI (14 complex fistulas, 12 intersphincteric fistulas, 5 trans-sphincteric fistulas, 4 perianal abscesses, 4 anal fissures); Thirty patients with CD and 9 patients had fistulectomy histories. The mean lesion conspicuity score of T2WI, CE-FS-T1WI, and DWI was 3.11±0.689, 3.29±0.732, and 3.55±0.724. There was no significant difference between CE-FS-T1WI and DWI (p=0.096). Lesion conspicuity was significantly better with DWI than T2WI (p=0.010). With DWI, lesion conspicuity was significantly better in patients with CD than those without CD (p=0.004).
Conclusion: The lesion conspicuity of DWI was similar to that of CE-FS-T1WI, and significantly better in the patients with CD.

B-0841 11:51

Local staging of rectal cancer: performance comparison between 3D transrectal ultrasound and 3-Tesla magnetic resonance imaging

E. Guidi[1], L. Faggioni[1], R. Scandiffio[1], R. Balestri[1], G. D'Ippolito[2], E. Neri[1], P. Buccianti[1], C. Bartolozzi[1]; [1]*Pisa/IT*, [2]*São Paulo/BR (elisaguidi83@hotmail.it)*

Purpose: To evaluate the agreement between 3D transrectal ultrasound (TRUS) and magnetic resonance imaging (MRI) in preoperative staging of rectal cancer.
Methods and Materials: 50 patients with rectal cancer underwent TRUS and 3-Tesla MRI for preoperative staging. With both imaging techniques were evaluated the following features: lesion site, tumour longitudinal extent, distance between lesion and puborectalis muscle, levator ani muscles infiltration, depth of extramural spread and lymph nodes involvement. The correlation between MRI and ultrasound data was calculated for each parameter using the Spearman rank test and considering statistically significant p-values < 0.05.
Results: TRUS and MRI showed a statistically significant correlation for the lesion site ($rs = 0.8597$, $p < 0.0001$), the tumour longitudinal extent ($rs = 0.446$, $p = 0.0022$), the distance between lesion and puborectalis muscle ($rs = 0.80$, $p < 0.0001$) and the depth of extramural spread ($rs = 0.5279$, $p < 0.0001$). Moreover, TRUS and MRI was able to demonstrate the levator ani muscles infiltration with an overall agreement of 78% and the lymph nodes involvement with an accordance of 76%. MRI allowed, however, the evaluation of other very important features for the correct staging of rectal cancer, in particular the distance between lesion and mesorectal fascia.
Conclusion: The excellent agreement between MRI and TRUS in preoperative staging of rectal cancer argues in favor of the use of MRI, because it also allows a more comprehensive local assessment.

10:30 - 12:00 **Room D1**

Chest

SS 1004

Pulmonary hypertension and thromboembolic disease

Moderators:
E.E.J.G. Coche; Brussels/BE
B. Graca; Coimbra/PT

B-0842 10:30

Are we overcalling pulmonary embolism and why? Discordance in interpretation of CTPA between general and chest radiologists

B. Hutchinson[1], P. Navin[1], E. Marom[2], M. Truong[2], J. Bruzzi[1]; [1]*Galway/IE*, [2]*Houston, TX/US (barryhutchinson82@gmail.com)*

Purpose: To evaluate the level of discordance between general radiologists and the consensus opinion of a panel of subspecialty chest radiologists in the diagnosis of pulmonary embolism (PE) by CT pulmonary angiography (CTPA).
Methods and Materials: A retrospective review was performed of all CTPAs performed in a university hospital over a12-month period. Studies reported as positive for PE were re-interpreted independently by 3 subspecialty chest radiologists with greater than 10 years experience. A discordance was considered to have occurred between this panel and the original interpreting radiologist when all 3 considered a CTPA was negative for PE. The location and potential causes for these discordances were recorded.
Results: A total of 937 CTPAs were performed over the study period. PE was diagnosed in the initial report in 174 of these cases (18.6%). There was discordance between the 3 chest radiologists and the original radiologist in 45 of 174 (25.9%) cases. Discordance occurred more often where the original reported PE was solitary (46.2% of solitary PE diagnoses were discordant) and located in a segmental or subsegmental pulmonary artery (26.9% of segmental and 59.4% of subsegmental PE diagnoses were discordant). The most common cause of discordance was breathing artefact, followed by beam-hardening artefact.
Conclusion: In routine clinical practice, PEs diagnosed by CTPA are frequently over-reported, when compared to the consensus opinion of a panel of expert chest radiologists. Improvements in the quality of CTPA examination and increased familiarity with potential diagnostic pitfalls in CTPA are recommended to minimise misdiagnosis of PE.

B-0844 10:38

Pulmonary infarction in CT pulmonary angiography: correlation with thrombus distribution and signs of right heart strain for risk stratification

L.F.M. Beenen, C.M. Schaefer-Prokop, J. Stoker, P. Gerrits, H.R. Buller, S. Middeldorp; *Amsterdam/NL (l.f.beenen@amc.uva.nl)*

Purpose: Pulmonary infarction is a readily accessible CT- finding in patients with acute pulmonary embolism (PE). Whether the presence of infarction is helpful for risk stratification is unknown. We aimed to assess the correlation between pulmonary infarction and signs of right ventricular strain.
Methods and Materials: We evaluated baseline CT-scans in a random sample of 940 patients with PE who participated in an international RCT comparing a new direct oral anticoagulant with warfarin. The following CT-parameters were scored: RV/LV ratio (> 1.0) on axial views, septum bowing, pulmonary trunk diameter > 29 mm, thrombus distribution (most proximal thrombus location), presence of pulmonary infarction. Serum NT-proBNP (biomarker of cardiac failure) was determined. Differences of these parameters were assessed between patients with and without pulmonary infarction using Chi-square test for dichotomous variables. A p-value < 0.05 was considered statistically significant.
Results: In 100 patients (10.6%) a pulmonary infarction was diagnosed. In the infarction group, more patients were < 65 years old (83.0% vs. 63.1%) and less central emboli were seen (33.0% vs 52.6%). Increased RV/LV ratio, septum bowing and pulmonary trunk dilatation were observed less frequently in the infarction group than in the non-infarction group (15.0% vs 29.6%, 14.0% vs 26.8% and 33.0% vs 33.0%, respectively). An increased NT-proBNP was seen less frequently in the infarction group than in the non-infarction group (12.0 vs 28.8% patients, $p < 0.0004$).
Conclusion: Pulmonary infarction occurs less frequently in patients with central emboli and shows no correlation with signs of right ventricular strain.

Author Disclosures:
L.F.M. Beenen: Research/Grant Support; Daichii Sankyo. **H.R. Buller:** Consultant; Bayer, Boehringer-Ingelheim, Bristol-Myers Squibb, Isis Pharmaceuticals, Thrombogenics. Research/Grant Support; Bayer and Pfizer. **S. Middeldorp:** Consultant; Bayer and Bristol-Myers. Research/Grant Support; GlaxoSmithKline, Bristol-Myers Squibb–Pfizer, and Sanquin. Speaker; Bayer, GlaxoSmithKline, Bristol-.

B-0845 10:46

Does accuracy of MSCT signs of right ventricular dysfunction depend on the time since the onset of symptoms in patients with acute pulmonary embolism?

G. Staskiewicz, E. Czekajska-Chehab, S. Uhlig, E. Siek, A. Tomaszewski, J. Przegalinski, A. Drop; *Lublin/PL (grzegorz.staskiewicz@gmail.com)*

Purpose: Right ventricular dysfunction (RVD) in the course of acute pulmonary embolism (PE) is a significant risk factor of mortality. As multiple possible CT-based signs of RVD are reported, the purpose of the study was to assess, whether the accuracy of these signs depends on the time since the onset of symptoms.
Methods and Materials: One hundred and thirty-seven consecutive MSCTPA studies of patients with confirmed acute PE and echocardiographic assessment of RVD were retrospectively analysed. Patients were divided into three groups according to time since the onset of symptoms: group 1: up to 2 days, group 2: 3-4 days, group 3: more than 4 days. PE severity was graded with the pulmonary obstruction score according to Qanadli et al. Short axis CT measurements of heart chambers and diameters of mediastinal vessels were performed. Performance of the parameters for RVD identification was compared with Mann-Whitney test and ROC curves.
Results: RVD was observed in 76 patients (55% of the study group). In group 1, the best RVD predictors were diameters of pulmonary artery (ROC = 0.75), followed by superior and inferior vena cava. In group 2, the best predictors were right ventricle short axis (RV) (ROC =0.86) and Qanadli score (ROC = 0.81). In group 3, it was RV short axis (ROC = 0.84) and RV/LV ratio (ROC = 0.79).
Conclusion: Accuracy of CT-based RVD signs is different depending on the time of onset of clinical symptoms. Therefore, it should be taken into account while assessing RVD in PE patients diagnosed with MSCTPA.

B-0846 10:54

Can coronary artery calcifications on CT pulmonary angiography predict right heart strain?

M.C. Williams[1], N. Morley[1], K. Muir[1], E.J.R. van Beek[1], J.H. Reid[2], J. Murchison[1]; [1]*Edinburgh/UK*, [2]*Melrose/UK (michelle.williams@ed.ac.uk)*

Purpose: Coronary artery calcification (CAC) can be identified on computed tomography pulmonary angiogram (CTPA). This study assesses the association between CAC and evidence of right heart strain on CTPA.
Methods and Materials: Images of 400 consecutive patients with pulmonary embolism (PE) were assessed. PE severity was assessed with Miller scores (1-5, mild; 6-11, moderate; 12-16, severe). Ratio of right to left ventricular size was assessed on axial orientations. A ratio greater than 1 provided evidence of right heart strain. CAC was assessed on a four-point scale in left main stem, left anterior descending, left circumflex and right coronary arteries (0, none; 1, mild; 2, moderate; 3, severe) and summed to give a total score.
Results: Mean age was 66 years (95%CI 65.68) and 50.1% were male. Median Miller score was 6 (IQR 2.14) and based on this 48% of PE were mild, 21% moderate and 32% severe. Mean ventricle ratio was 1.08 (1.05.1.11) and 55% had a ratio of greater than 1. Median ordinal CAC score was 2 (0.7) with 31% having no calcification, 37% mild calcification, 12% severe left side calcification, 5% severe right side calcification, and 67% severe bilateral calcification. Ventricular ratio was greater in patients with severe right side calcification (1.21 (0.87.1.55)) compared to patients with severe left side calcification (1.00 (0.95.1.05)), severe bilateral calcification (1.09 (1.01.1.16)), or mild or no calcification (1.09 (1.06.1.13). However, these differences were not statistically significant.
Conclusion: Coronary artery calcification is prevalent in patients with PE. Right coronary artery calcification may predispose to right ventricular strain in PE.

Author Disclosures:
E.J.H. van Beek: Speaker; Speaker fees at educational meeting. Toshiba.

B-0847 11:02

Dual-energy CT pulmonary perfusion maps improve the detection of small pulmonary embolism: a multi-rater study

S. Fischer, N. Schultheis, C. Frellesen, M. Kaup, W. Kromen, P. Dewes, J.-E. Scholtz, T.J. Vogl, R.W. Bauer; *Frankfurt a. Main/DE (sebastian.fischer@kgu.de)*

Purpose: To evaluate the impact of pulmonary perfusion maps (PPM) on the detection of small pulmonary embolism (PE) in dual-energy pulmonary CT angiography (DECT).
Methods and Materials: 25 patients underwent pulmonary CT angiography (pCTA) for clinically suspected PE on third-generation dual-source DECT (Somatom Force, Siemens; 128x0.6 mm collimation, 90 kV/60 mAs for tube A, 150 kV+Sn filter/46 mAs for tube B, AEC activated). The following reconstructions, each with 3 mm slice thickness and increment in both coronal and axial plane, were calculated from DECT data using an angiography and lung window: 1) MPR, 2) MIP, 3) MIP fused with PPM. Four radiologists with 0.5-4 years of CT experience independently reviewed the series for the presence of PE in each pulmonary segment (500 segments in total). Detection rate was compared using Friedman ANOVA. Interrater-reliability was analyzed by two-way random ICC according to Fleiss' kappa.
Results: Overall, PE was seen in 41.2±0.2 segments on MPR (8.59%) and in 45.8±1.0 segments on MIP reconstructions (9.53%). With 59.5±0.12 segments of detected PE on fused MIP/PPM (12.4%) the relative detection rate was significantly improved ($p < 0.01$) against MPR (+30.7%) or MIP (+23.1%) alone. There was a strong accordance regarding interrater-reliability (k=0.878) without significant impact of radiologic experience on the frequency of PE detection ($p > 0.08$).
Conclusion: DECT-derived pulmonary perfusion maps significantly improve the detection rate of small PE in radiologists with low to intermediate CT experience. They form a substantial advantage for PE detection compared to solely MPR or MIP reconstructions and should hence always be offered for reading.

Author Disclosures:
R.W. Bauer: Consultant; Siemens Healthcare.

B-0848 11:10

Evaluation of multi-phase post-mortem CT-angiography for the investigation of pulmonary embolism

A. Perini[1], J. Grimm[2], C. Egger[2], C. Bruguier[2], E. Silingardi[1], S. Grabherr[2]; [1]*Modena/IT*, [2]*Lausanne/CH (jochen.grimm@chuv.ch)*

Purpose: Multi-phase post-mortem CT-angiography (MPMCTA) is increasingly being recognized as a valuable tool to explore the vascular system. Its sensitivity for detecting vascular lesions is superior to conventional autopsy. However, one of its limitations is the difficulty to diagnose pulmonary embolism (PE) due to post-mortem blood clots and remaining blood which are regularly situated in the pulmonary arteries (PA) creating artefacts mimicking PE. This study explores an eventual possibility to distinguish between those artefacts and real PE.
Methods and Materials: We evaluated 416 medicolegal cases. All cases underwent native CT-scan, PM-angiography, complete conventional autopsy and histological examination. We selected 123 cases of pulmonary arterial luminal filling defects described during the venous phase of MPMCTA. Their radiological interpretation was compared with autopsy and histological examination. We also investigated possible correlation between artefacts in PA and those in other parts of the vascular system.
Results: MPMCTA findings were interpreted as post-mortem clots in 57 cases, suspected PE in 4 cases and unspecific in 62 cases. Only in one case a confirmed PE was interpreted as post-mortem clot on MPMCTA images. In 6 out of 62 unspecific cases, autopsy and histological examinations revealed intravital PE. In 3 out of 4 suspected cases, PE was confirmed by autopsy and histology findings. By confronting the prevalence of filling defects in PA to those in the other vessels, it could be demonstrated that these are closely related.
Conclusion: MPMCTA, when correctly interpreted, allows diagnosis of PE with a high degree of certainty.

B-0849 11:18

A nomogram based on CT pulmonary angiography for prediction of pulmonary hypertension in patients without pulmonary embolism

A. Bendet, H. Shmueli, S.Z. Adam, T. Ziv-Baran, S. Berliner, Y. Topilsky, G. Aviram; *Tel Aviv/IL (udibendet@gmail.com)*

Purpose: To utilize cardiovascular data of computerized tomographic pulmonary angiography (CTPA) for facilitating the identification of pulmonary hypertension (PH) in patients without acute pulmonary embolism (PE).
Methods and Materials: The institutional human research committee approved this retrospective study; informed consent was waived. Patients without PE who underwent CTPA and echocardiography within 24 hours of each other between 12/2008-10/2012 were retrospectively identified. Each CTPA was assessed for the diameters of the pulmonary artery (PA), aorta (AO), right ventricle (RV) and left ventricle (LV), as well as the severity of reflux of contrast. The volumes of each cardiac compartment were calculated. Doppler echocardiography served as a reference standard for PH. Classification trees were used to categorise CTPA parameters. Backward logistic regression was used to build a prediction model for PH evaluated with 10-fold cross-validation and presented as a nomogram.
Results: The final study group included 182 patients, of whom 98 (54%) were diagnosed as having PH based on echocardiography. Age ≥67 years (OR=4.46), reflux grade ≥3 (OR=2.63), right atrial (RA) volume ≥106 cm3 (OR=3.59), PA diameter ≥28 mm (OR=2.52) and PA/AO diameter ≥0.86 (OR=2.17) were independently associated with PH. The logistic model showed good discrimination ability (AUC=0.844, discrimination slope=0.359). Tenfold cross-validation (threshold value of 0.4) showed 85.7% sensitivity, 60.7% specificity, 71.3% positive predictive value, 76.1% negative predictive value and 73.1% accuracy for identifying PH.
Conclusion: Cardiovascular data derived from CTPA can be utilized to predict PH and to create a nomogram which may facilitate identification of PH after exclusion of acute PE.

B-0850 11:26

Angio-CT in the evaluation of patients with chronic thromboembolic pulmonary hypertension undergoing pulmonary endarterectomy: radiological and hemodynamic assessment

S. Porelli, M. Giannotta, M.B. Leone, M. Cefarelli, S. Martin Suarez, N. Galié, M. Zompatori; *Bologna/IT (sayuri.porelli@gmail.com)*

Purpose: This retrospective study sought to evaluate the relationship between radiological and hemodynamic parameters in patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH) who underwent Pulmonary Endarterectomy (PEA). We also introduced a modified Qanadli Index to assess chronic pulmonary arterial obstruction severity and analyzed its relationship with hemodynamic parameters.
Methods and Materials: Between March 2006 and November 2013, fifty-three patients (M:F=28:25, mean age 54) affected by CTEPH underwent hemodynamic and Angio-CT evaluation before and after PEA. Hemodynamic assessment considered the values of mean Pulmonary Artery Pressure (mPAP) and Pulmonary Artery Resistance (RAP), obtained through right heart catheterization. Radiological evaluation included Angio-CT signs of pulmonary hypertension. Student's T-test, one-way ANOVA and linear regression were used for statistical analysis.
Results: A significant statistical difference was observed for mPAP and RAP and for most radiological parameters evaluated before and after PEA, in particular diameter of main, right and left pulmonary arteries, right atrium and right ventricle, coronary sinus, superior vena cava, azygos vein, right ventricle wall thickness and tricuspid regurgitation ($p < 0.01$). mPAP percent difference correlated both with variation of main and right pulmonary artery diameters and with change in mosaic perfusion ($p < 0.05$). Post-surgical variations in our modified Qanadli Index showed a significant relationship with mPAP percent difference ($p < 0.05$).
Conclusion: Our findings confirm the diagnostic role of Angio-CT in evaluating patients with CTEPH. In particular, Angio-CT, eventually combined with our modified Qanadli Index, can be useful in assessing hemodynamic changes after PEA, especially when right heart catheterization is contraindicated or not possible.

B-0851 11:34

Comparison of diagnostic performance of pulmonary MRA and CTA in patients with chronic thromboembolic pulmonary hypertension

E.A. Mershina, V. Sinitsyn, M. Komarova, K. Mershin, N. Danilov; *Moscow/RU (elena_mershina@mail.ru)*

Purpose: To evaluate the diagnostic performance of pulmonary contrast-enhanced MR angiography (CEMRA) and multi-detector CT angiography (MDCTA) in patients with CTEPH.
Methods and Materials: 14 patients with CTEPH (m/f - 4/10; mean age 45.8±12.7 yrs) were examined by MDCTA, CEMRA and selective digital subtraction angiography (DSA) within 10 days. MDCTA was performed using dual-energy mode. Pulmonary dynamic multiphase CEMRA was performed with 1.5-T MR system. Two readers separately evaluated each imaging technique (28 main, 84 lobar and 216 segmental arteries) for analysis of pulmonary arteries (PA) morphology, grading of lesions and pulmonary perfusion. Three-point grading scale for evaluation of each parameter was used. A joint interpretation of all three techniques served was the reference standard.
Results: Based on the image quality, all examinations were diagnostic. Sensitivity and specificity of CEMRA in diagnosis of PA lesions were 81.2 % and 98.5%, compared with MDCTA. MDCTA was superior for the depiction of intraluminal "webs and bands" and for the grading of PA wall thickening. Strong correlation was obtained between MDCTA and CEMRA for detection of stenoses/occlusions of PA and presence/absence of perfusion defects ($r=0.8$ $p < 0.001$ and $r=0.9$ $p < 0.001$, respectively). No cases of surgically accessible CTEPH were missed with either modality.
Conclusion: MDCTA is the most adequate technique for assessment of the pulmonary arteries in the diagnostic workup of CTEPH patients. CEMRA has lower sensitivity at the segmental level, but still it is suitable both for assessment of pulmonary vessel morphology and perfusion studies, and may serve as an alternative to MDCTA.

B-0852 11:42

Lung perfusion characteristics in pulmonary arterial hypertension and peripheral forms of chronic thromboembolic pulmonary hypertension: dual-energy CT

J. Giordano, N. Tacelli, C. Hossein-Foucher, A. Duhamel, J. Remy, M. Remy-Jardin; *Lille/FR (martine.remy@chru-lille.fr)*

Purpose: To compare lung perfusion changes in PAH and pCTEPH.
Methods and Materials: 33 patients with PAH (Group 1; n=20) and pCTEPH (Group 2; n=13) underwent a dual-source, dual-energy chest CTA enabling analysis of morphological (i.e., abnormal lung attenuation, nodular ground glass opacities and CT features of neovascularity) and perfusion alterations (i.e., PE-type defects; large areas of hypoattenuation and "patchy" abnormalities) at a segmental level (20 segments/patient; total: 660 segments). The interpretation of diagnostic and perfusion images was independently performed by consensus between two readers.
Results: At a patient level : (a) perfusion abnormalities were significantly less frequent in Group 1 (11/20; 55%) than in Group 2 (12/13; 92%) ($p=0.04$); (b) no correlation was found between the level of mean pulmonary arterial pressure (PAP) and the presence of perfusion abnormalities ($p> 0.05$). The type of perfusion alterations significantly differed between the two groups ($p < 0.0001$): (a) in Group 1, 161 out of the 166 (97%) segments with abnormal perfusion showed patchy perfusion defects; (b) in Group 2, the abnormalities seen in the 152 segments with perfusion alterations consisted of patchy defects (89/152; 59%), triangular (57/152; 37%) or large (6/152; 4%) areas of hypoperfusion. Paired comparison of diagnostic and perfusion images showed alterations of lung perfusion without morphological abnormalities in the corresponding segments in 52% (86/166) of Group 1 abnormal segments and 32% (49/152) of Group 2 abnormal segments.
Conclusion: Lung perfusion alterations at DECT are less frequent and more homogeneous in PAH than in pCTEPH.

10:30 - 12:00 **Room D2**

Interventional Radiology

SS 1009

Percutaneous ablation in liver tumours

Moderators:
T. Denecke; Berlin/DE
F. Orsi; Milan/IT

K-20 10:30

Keynote lecture

A. Adam; *London/UK*

B-0853 10:39

MRI-monitored ablation using size adjustable coaxial electrochemical ablation: initial experience with a novel technique

B.H. Ge, C.N. Weber, G.J. Nadolski, T.P. Gade, S.J. Hunt, M.C. Soulen, M. Itkin; *Philadelphia, PA/US*

Purpose: Electrochemical ablation is a pH-mediated percutaneous ablation technique utilising direct current (DC) electricity. Advantages over thermal ablation include a sharp margin, decreased non-target injury, and immunity to heat sink effects. Disadvantages historically included long ablation times and difficult monitoring ablation. We test a coaxial design to rapidly create a size adjustable ablation using MRI monitoring.
Methods and Materials: A 32-volt DC generator supplied an 18 gauge platinum anode centred within a cage consisting of ten 16 gauge nitinol cathodes. Safety, feasibility, and ablation rate were calculated for six trials of 3, 4, 5, and 6 cm diameter ablations ($n = 24$) on ex vivo bovine liver. Ablations were repeated on normal swine liver monitored by multiplanar multisequence MRI and verified by gross pathology.
Results: The maximum anode ablation temperature (61 oC) was achieved within 10 minutes. No heat was produced at the cathodes and current scatter was less than 0.05 mA. Local pH was 3.2 at the anode and 13.8 at the cathode. All ablations were contained within the cathode cage with heat- and pH-mediated coagulation at the anode and pH-mediated liquefaction at the cathode. Complete ablation was achieved within 15, 20, 35 and 40 minutes for 3, 4, 5, and 6 cm diameters, respectively, with T1 and T2 signal changes on MR corresponding to gross pathology.
Conclusion: The coaxial design considerably improved electrochemical ablation rates with times similar to current thermal techniques. The MRI compatibility allows for active monitoring and real-time adjustments.

B-0854 10:47

In vitro artefact assessment of a prototype MR-compatible microwave antenna for MR-guided tumour ablation and comparison with a standard MR-compatible radiofrequency ablation device

R. Hoffmann, F. Eibofner, E. Kessler, H. Rempp, J. Weiß, K. Nikolaou, S. Clasen; *Tübingen/DE (ruediger.hoffmann@med.uni-tuebingen.de)*

Purpose: To evaluate and compare artefact configuration and diameters in a magnetic resonance (MR) compatible prototype Microwave (MW) applicator and a standard MR compatible radiofrequency (RF) applicator for MR-guided tumour ablation.
Methods and Materials: Both applicators were tested in a phantom study at 1.5 T field strength with three sequences: T1-weighted three-dimensional Volume Interpolated Breathhold Examination (T1 VIBE), T1-weighted Fast Low Angle Shot (T1 FLASH), T2-weighted Turbo Spin Echo (T2 TSE). Applicator orientation was varied between 0°, 45° and 90° to the main magnetic field (B0), as were the slice orientation (axial, coronal, sagittal). Needle tip location error (TLE) was assessed and artefact diameter were calculated at the applicator shaft and tip. ANOVA and post hoc testing were performed to assess the influence of imaging parameters on artefacts.
Results: MW applicator artefact consisted of a decent shaft artefact (2.3±0.8 mm standard deviation (SD)) and an oval artefact (16.5±1.8 mm SD) close to the applicator tip in all sequences. The tip itself showed a small artefact with a length of 2.2±1.4 mm beyond the oval artefact. RF applicator artefact measured 8.9±4.7 mm at the shaft and 9.0±2.0 mm at the tip. TLE of MW and RF applicator were -1.3±0.6 mm and -0.1±0.9 mm, respectively. Significantly smallest RF applicator artefact diameters were measured with the applicator orientation parallel to B0 ($p < 0.001$). No influence of MW applicator orientation to BO was found. For both applicators, significantly largest artefacts were measured with T1w FLASH sequence ($P=0.003$).
Conclusion: Artefact of the MW applicator is satisfactory and seems useable for MR-guided ablation procedures.

B-0855 10:55

Co-registration of inspiratory and expiratory datasets for treatment planning for robotic-assisted liver thermal ablation

B.J. Abdullah[1], C. Yeong[1], P. Dumpuri[2], D. Yamini[2], A. Tirumalai[2], A. Kulkarni[2]; [1]*Kuala Lumpur/MY*, [2]*Florence, OR/US (basrij@ummc.edu.my)*

Purpose: Several studies have shown that a 5 mm ablative margin appears to be associated with a lower rate of local tumour progression after percutaneous radiofrequency liver ablations. The purpose of this study was to evaluate the accuracy of a commercially available registration algorithm and to determine if the algorithm could be used to assess safety margins in ablation procedures.
Methods and Materials: End-inspiration and end-expiration images for thirteen patients were used to determine the accuracy of registration algorithm available in a workstation (MAXIO, Perfint Healthcare, USA). For liver ablation, the workstation supports a segmentation based non-rigid registration algorithm. A non-expert user segmented the livers and registered the end-inspiration images to the end-expiration images. Accuracy of the registration algorithm was evaluated by identifying pairs of tumour centroids between co-registered images followed by computing the 2D and 3D distances between the pairs of tumour centroids.
Results: Averaging across all thirteen patients the distances (after registration) between the tumour centroids were: 2.5 ± 2.7 mm along the axial plane, 1.6 ± 1.6 mm along the coronal plane, 1.0 ± 0.8 mm along the sagittal plane and 3.5 ± 2.8 mm in 3D. Though the mean registration error was less than 5 mm for all the patients, in four out of the thirteen patients, either the 2D or 3D distance was greater than 5 mm.
Conclusion: While the preliminary work showed promising results, a larger sample size is needed for further investigation.

B-0856 11:03

Real-time respiratory motion compensation of the liver using 4D ultrasound and GPU

J. Banerjee, C. Klink, E.D. Peters, W.J. Niessen, A. Moelker, T.v. Walsum; *Rotterdam/NL (j.banerjee@erasmusmc.nl)*

Purpose: Procedures such as Radiofrequency Ablation (RFA) and Transjugular Intrahepatic Portosystemic Shunt (TIPS) placement are minimally invasive image-guided alternatives to surgical procedures. 4D ultrasound (US) has great potential for these interventions, as it provides real-time 3D imaging. However, respiratory liver motion hampers adequate visualization of the target region. Therefore we propose a method to compensate breathing motion using real-time 3D US registration. Additionally the approach would help in keeping the registration up to date in US fusion imaging.
Methods and Materials: Our registration method consists of four basic steps: a) Point Selection, b) Block-matching, c) Outliers Rejection, and d) Computation of a rigid transformation using the inliers. The block-matching uses a similarity metric to establish point correspondences between volumes. The outlier rejection uses geometric consistency to remove erroneous matchings from the block-matching. The rigid transformation is computed using singular value decomposition method.
Results: Thirteen 4D US volume sequences were acquired from six healthy volunteers at 6 Hz from an iU22 Philips machine. Pairs of frames were selected from these sequences such that they are representative of the whole breathing cycle. For 85 pairs of 3D US volumes acquired from 4D US sequences, a mean registration error of 1.3 mm is achieved. A graphics processing unit (GPU) implementation runs the 3D US registration at 8 Hz.
Conclusion: We proposed and evaluated 3D US to US registration approach for motion compensation of liver. Additionally we demonstrate that a GPU implementation of our approach can be used in real-time.

B-0857 11:11

Comparison between radiofrequency ablation and surgical resection by using propensity score matching for hepatocellular carcinoma within Milan criteria

A. Hocquelet, N. Frulio, C. Salut, C. Cassinotto, M. Bouzgarrou, H. Trillaud, P. Balageas; *Bordeaux/FR (nonobdx@gmail.com)*

Purpose: To compare survival and complication rates after radiofrequency ablation (RFA) versus surgical resection (SR) in patients with hepatocellular carcinoma (HCC) within Milan criteria.
Methods and Materials: We retrospectively and consecutively included all patients with first occurrence of HCC within Milan criteria receiving SR or RFA as first-line treatment from January 2004 to December 2013. The cumulative overall survival (OS) and the disease-free survival (DFS) were compared after propensity score matching.
Results: After matching 128 patients (64 per treatment arms) were retained for analysis. Matching variables were not significantly different between SR and RFA groups. After a median follow-up of 34.1 months (interquartile range: 18.7-60.3), the respective 1- 3- and 5-years OS for SR and RFA groups were 92.9%, 79.1%, 59.9% and 95.2%, 62.3%, 54.5%, P=0.209. The respective 1-, 3- and 5-years DFS for SR and RFA group were 69%, 44.1%, 17% and 64.5%, 40.1%, 24.5%, P=0.757. Five-years OS and DFS were not significantly different for patients with HCC> 30 mm across the SR and the RFA group, 61.1% versus 41.9% (P=0.069) and 16% versus 27 % (p=0.963), respectively. Local tumour progression rates were respectively 2.3% (1/43) of recurrence for the SR group and 12.2% (5/41) for the RFA group, P=0.105. After the first HCC recurrence, 87.8% of RFA patients (36/41) and 74.4% in SR patients (32/43) were still within Milan criteria, P=0.166.
Conclusion: This propensity score-matching study has shown that RFA and SR had similar OS and DFS for hepatocellular carcinoma within Milan criteria in a European population.

B-0858 11:19

Microwave ablation (MWA) in malignant liver tumours: comparative evaluation of local tumour control and survival rates using two different microwave generator systems

T.J. Vogl, A. Hagar, N.N.N. Naguib, N.-E.A. Nour Eldin, W.O. Bechstein, S. Zeuzem; *Frankfurt a. Main/DE (t.vogl@em.uni-frankfurt.de)*

Purpose: To comparatively evaluate local tumour control and survival rates in patients with liver metastases using microwave ablation (MWA) with a low frequency (LF)(915 MHz) vs. high frequency (HF)(2.45 GHz) system.
Methods and Materials: In this retrospective study 221 patients (111 men/110 women; mean 61.7 years, range 26-89) were treated for 256 liver metastases in 257 sessions using MWA. Inclusion criteria: < 5 liver metastases, ≤5 cm). 94 patients underwent 133 LF-MWAs, 127 patients 223 HF-MWAs. MRI was performed at 24 hours, 3, 6, 12, 18, and 24 months post ablation. The two groups were compared with the Fisher's exact test. Survival rates were calculated from first ablation using the Kaplan-Meier test. Volume decrease of the ablated region was evaluated with the Kruskal-Wallis method.
Results: Mean initial coagulation volume of LF-MWA was 19.1 mL vs. HF-MWA 39.9 mL; no significant differences were observed regarding volume changes (p> 0.271). In LF-MWA 13/133 metastases (9.8%) showed local recurrence, in HF-MWA 10/223 (4.5%). Colorectal-cancer patients treated with LF-MWA developed new metastases in 2/28 cases (7.1%), with HF-MWA in 3/37 (8.2%) cases. Patients with hepatocellular metastases developed new metastases with NF-MWA in 8/37 (21.6%), with HF-MWA in 4/39 (8.2%) cases. 1-year overall survival rate (OSR) was 98.9% for LF-MWA and 100% for HF-MWA; 2-year OSR 95.7% for LF-MWA and 97.6% for HF-MWA; 4-year OSR 82.9% for LF-MWA and 92.9% for HF-MWA. 4-year progression-free survival was 47.9% for LF-MWA and 70.9% for HF-MWA.
Conclusion: Both MWA systems are effective treatment options for oligonodular liver metastases with significantly higher 4-year survival and lower recurrence rates for HF-MWA.

B-0859 11:27

New concept in microwave ablation (MWA) of liver and lung malignancies: does MWA with thermosphere technology reproduce a predictable spheric ablation zone?

T.J. Vogl, L. Basten, B. Panahi, N.-E.A. Nour-Eldin, N.N.N. Naguib; *Frankfurt a. Main/DE (t.vogl@em.uni-frankfurt.de)*

Purpose: To evaluate the formation of a spheric ablation zone after treatment of liver and lung metastases up to 3 cm in diameter using microwave ablation (MWA) with thermosphere technology.
Methods and Materials: In this prospective study 33 metastases of 32 patients (11 men, 21 women; mean 59.9 years; range 27-82) were treated in 33 sessions (24 sessions: liver, 9 sessions: lung) using MWA with thermosphere technology. Tumour volume pre ablation and ablation volume 24 hours post ablation were correlated as parameters in CT and MRI in sagittal and transverse slice orientation. Deviation of ratio sagittal/transverse ablation volume from the target value of 1.00 corresponding to a sphere was used to evaluate the spherical shape of the ablation zone.
Results: Average deviation of ratio sagittal/transverse from target value 1.00 in MRI is 0.095 (liver 0.098; lung 0.101). 31/33 ablation zones (93.9%) range between 0.8< 1< 1.2 (95.8% liver; 88.9% lung), 28/33 (84.8%) range between 0.85< 1< 1.15 (87.5% liver; 77.8% lung), 20/33 (60.6%) range between 0.9< 1< 1.1 (58.3% liver; 66.7% lung). Average deviation in CT is 0.109 (liver 0.108; lung 0.113). 32/33 (97%) range between 0.8< 1< 1.2 (95.8% liver; 100% lung), 25/33 (75.8%) range between 0.85< 1< 1.15 (83.3% liver; 55.6% lung), 17/33 (51.5%) range between 0.9< 1< 1.1 (54.2% liver; 44.4% lung). Complete ablation was achieved in all lesions (A0-ablation).
Conclusion: MWA of liver and lung malignancies with thermosphere technology reproduces an ablation zone almost identical to a sphere in the majority of interventions. Lesions up to 3 cm in diameter are fully controlled after MWA.

B-0860 11:35

Local ablation of unresectable liver malignancies using CT-guided high-dose rate brachytherapy or CT-guided radiofrequency ablation: a cost comparison

D. Schnapauff[1], F. Collettin[1], B. Gebauer[1], B. Hamm[1], M.H. Maurer[2]; [1]*Berlin/DE*, [2]*Berne/CH (dirk.schnapauff@charite.de)*

Purpose: To compare the costs of CT-guided high-dose rate brachytherapy (CT-HDRBT) and CT-guided radiofrequency ablation (CT-RFA) as two alternative minimally invasive treatment methods for malignant hepatic lesions.
Methods and Materials: For the treatment of unresectable liver malignancy, 30 patients (19 men, 11 woman; mean age 69.3 ± 6.2 years) underwent CT-HDRBT to the liver, and a further 12 patients (mean age 67.5 ± 5.1) underwent radiofrequency ablation for the same reason. Prorated costs of equipment use (purchase, depreciation and maintenance), costs of staff and expenditure for disposables were identified and compared. A sensitivity analysis model was created to analyse the dependence of costs on the number of patients treated annually.
Results: Total costs of CT-HDRBT were 565.84 per patient compared to 1846.20 per treatment for CT-RFA. Staff costs and equipment costs per patient were slightly higher for CT-HDRBT (391.00) compared to CT-RFA (332.16), whereas the price for disposables of CT -RFA (1514.04) was much higher compared to those of CT-HDRBT (174.84) lea ding to an overall cost advantage of CT-HDRBT. The sensitivity analysis revealed that CT-HDRBT is less expensive per patient compared to CT-RFA when treating 39 patients and more annually.
Conclusion: CT-HDRBT is more cost-effective compared to CT-RFA for treating unresectable hepatic malignancies.

Author Disclosures:
B. Hamm: Shareholder; All pharmaceutical companies.

B-0861 11:43

Assessment of various types of US findings after irreversible electroporation in porcine liver: comparison with radiofrequency ablation

K. Sugimoto, Y. Kobayashi, F. Moriyasu; *Tokyo/JP (sugimoto@tokyo-med.ac.jp)*

Purpose: To assess the various ultrasound (US) findings, including B-mode, shear-wave elastography (SWE), and contrast-enhanced US (CEUS), for accurately assessing the ablation margins after irreversible electroporation (IRE) based on radiologic-pathologic correlation, and also to compare these findings between IRE and radiofrequency (RF) ablation.
Methods and Materials: Both IRE (n = 9) and RF ablation (n = 3) were performed in vivo in three pig livers. Each ablation zone was imaged using each method immediately after the procedure and also 90 minutes later. The ablation zones were evaluated based on gross pathologic and histopathologic findings in samples from the animals sacrificed 2 hours after last ablation. The characteristics and dimensions of the histologic ablation zones were qualitatively and quantitatively compared against each US finding.
Results: In B-mode US at 90 minutes after IRE, the ablation zones appeared as hyperechoic areas with a peripheral hyperechoic rim, showing excellent correlation ($r2 = 0.905$, $P < .0001$) with gross pathologic findings. SWE showed that tissue stiffness in the IRE ablation zones increased over time. CEUS depicted the IRE ablation zones as hypovascular areas in the portal phase, showing the highest correlation ($r2 = 0.923$, $P < .0001$) with gross pathologic findings. The RF ablation zones were clearly visualized by B-mode US. SWE showed that tissue stiffness after RF ablation was higher than that after IRE. CEUS depicted the RF ablation zones as avascular areas.
Conclusion: Both IRE and RF ablation zones can be most accurately predicted by portal-phase CEUS measurements obtained immediately after ablation.

B-0862 11:51

Ablation of colorectal liver metastases by irreversible electroporation: results of the COLDFIRE-I ablate-and-resect study

H.J. Scheffer, K. Nielsen, A.A.J.M. van Tilborg, J.M. Vieveen, G. Kazemier, H.W.M. Niessen, S. Meijer, P. van den Tol, M.R. Meijerink; *Amsterdam/NL (hj.scheffer@vumc.nl)*

Purpose: Irreversible electroporation (IRE) is a new ablation technique that relies on high-voltage electrical pulses. This clinical study evaluates the pathological response of colorectal liver metastases (CRLM) treated with IRE and the clinical safety and feasibility.
Methods and Materials: Ten patients with resectable CRLM were included. During laparotomy, the metastases were treated with IRE and resected 60 min later. Safety and feasibility were assessed based on adverse events, laboratory values, technical success and intra-operative ultrasound findings. Tissue response was assessed using triphenyl tetrazolium chloride (TTC) vitality staining and (immuno)histochemical stainings (HE, complement-3d and caspase-3).
Results: Ten lesions with a mean diameter of 2.4 cm were successfully electroporated and resected, on average, 84 min later (range 51-153 min). One minor transient cardiac arrhythmia occurred during IRE. Ultrasound showed a sharply demarcated hypoechoic ablation zone around the tumour. TTC showed avitality of all lesions, covering the complete tumour in 8/10 lesions. Although immunohistochemistry proved heterogeneous and difficult to interpret within the tumours, it confirmed irreversible cell damage in the tumour-free margin of all specimens.
Conclusion: This ablate-and-resect study demonstrated avitality caused by IRE of CRLM in humans. Further characterisation of tissue- and tumour-specific electrical properties is warranted to improve ablation protocols for maximised tissue ablation.

10:30 - 12:00 **Room K**

Radiographers

SS 1014

Radiation dose optimisation

Moderators:
D.R. Kool; Nijmegen/NL
D. Pekarovic; Ljubljana/SI

B-0863 10:30

Incorrectly placed gonad shields: influence on radiation dose in abdominal CT with automatic exposure correction

M.W. Kusk; *Esbjerg/DK (martin.weber.kusk@rsyd.dk)*

Purpose: To compare the dose behaviour of automatic exposure correction (AEC) systems from four different vendors in the presence of high-absorption lead gonad cups.
Methods and Materials: An anthropomorphic body phantom was scanned on 4 different multislice CT systems (GE, Siemens, Philips, Toshiba) using standard abdominal CT protocol. For each scanner, a series of 10 scans was performed with a fixed length of scan projection radiograph (SPR) and a standard lead gonad cup in each of the following configurations: A: no gonad cup. B: gonad cup in SPR, but 2 cm distal of scan range.C: Gonad cup 2 cm inside scan range. All series were scanned in both caudo-cranial and cranio-caudal directions. Dose-Length-Product (DLP) was noted from scanner-generated dose reports. One-way ANOVA with Bonferroni test was used to detect differences in average DLP. DICOM-tags were harvested from the images using a freeware tool and mA was plotted vs. Z-position to visualise longitudinal dose distribution.
Results: 3 of 4 scanners showed statistically significant relative dose increase in the presence of gonad cups. The largest increase was 236%. One scanner reported same dose in all scan series. Where dose increase occured, this happened in the distal part of the scan range, except for the angular modulation on the Philips scanner, where longitudinal dose distribution was almost uniform.
Conclusion: Radiographers need to be aware of how specific AEC-systems functions, especially in departments with different scanner models. Appropriate measures must be taken when positioning patients and adjusting parameters in order to avoid unnecessary radiation exposure.

B-0864 10:38

Maintaining image quality in paediatric chest CT while lowering dose using sinogram affirmed iterative reconstruction

A. Sanderud[1], A. Gomes[2], A. Vallinga[3], A. Vouillamoz[4], A.M. Raszkowski[1], J.W. Rook[3], N. Campbell[5], S. Borge[1], C. Buissink[3]; [1]*Oslo/NO*, [2]*Lisbon/PT*, [3]*Groningen/NL*, [4]*Lausanne/CH*, [5]*Salford/UK (audun.sanderud@hioa.no)*

Purpose: To compare image quality and dose in paediatric chest CT images from filtered back projection (FBP) with images from five different strengths of Sinogram-Affirmed Iterative Reconstruction (SAFIRE). Children have higher radiosensitivity and longer life expectancies than adults do and it is important to investigate the dose reduction potential of the new high strength SAFIRE iterative reconstruction methods on paediatric CT images.

Methods and Materials: Using a multi-slice CT, scans of six series of an ATOM® Dosimetry Verification Phantom of a 5-year-old patient with different values of kV (80, 110) and mAs (25, 50, 100). 72 images were reconstructed with FBP and five strengths of SAFIRE and two values of slice thickness (1 mm, 3 mm). Ten observers evaluated the subjective image quality of all images. Dose was estimated with CT-Expo. Statistical analysis was completed for sharpness and contrast.
Results: FBP required a higher dose than all SAFIRE strengths to obtain the same image quality for sharpness and contrast. A rating of 4 (= good) using SAFIRE 5 required dose of 3.4 mSv regarding sharpness and 4.3 mSv regarding contrast, whereas FBP needed 6.8 mSv. Contrast clinical acceptance rate was improved by the higher voltage (110 kV) for all doses in comparison to 80 kV, which required a higher dose for acceptable image quality. 3 mm images had typically better quality than 1 mm images.
Conclusion: SAFIRE 5 was optimal for dose reduction. Dose is reduced by 50% for contrast quality and 37% for sharpness quality in comparison to FBP.

B-0865 10:46

The influence of isocenter gantry patient positioning for paediatric head CT examinations in eye lens dose, using in-plane vinyl bismuth and barium shielding

F. Pereira, F. Carvalho, M. Malva, G. Paulo, J. Santos; *Coimbra/PT (florwhpereira@gmail.com)*

Purpose: Evaluate the influence of isocenter gantry patient positioning in eye lens dose, during paediatric head Computed Tomography (CT) examinations using bismuth and barium shielding.
Methods and Materials: Head CT examinations were performed in axial mode with and without in-plane shielding (vinyl bismuth and barium) in a anthropomorphic paediatric phantom (ATOM-705) with three different patient positioning (head isocenter, 4 cm anterior and posterior). Eye lens dose was measured with Unfors Patient Skin Dose and CT dose was obtained from the dose report. To compare image noise three Regions Of Interest (ROI-1 cm2) per CT examination (orbits, periphery and central) were analysed using RadiAnt DICOM Viewer (64-bit) software.
Results: CT dose levels decreased with anterior centring however eye lens dose increased. The higher eye lens dose reduction (29-33%) was obtained using bismuth protection. The impact on image noise was similar for both shielding, affecting exclusively the periphery.
Conclusion: The best dose and image quality combination was obtained in gantry isocenter using tube current and tube voltage modulation.

B-0866 10:54

Phantom study: the impact of obesity on abdominal CT radiation dose and image quality

A.A. Qurashi, L.A. Rainford, S. Foley; *Dublin/IE (qetharah@hotmail.com)*

Purpose: To evaluate the impact of obesity on abdominal organs doses and image quality in CT.
Methods and Materials: Anthropomorphic phantoms layered with either none, one or two 1.5-cm-thick circumferential animal fat packs to simulate average, overweight and obese patient sizes were imaged using a 128MDCT scanner. Abdominal protocols were applied: protocol A, using ATCM with quality reference mAs of 250; protocol B used 250 manual mAs and 120 KVp. MOSFET dosimeters measured 12 internal organ dose. Objective image quality was determined by noise measurements within three ROIs on five consecutive slices at the level of L4-L5.
Results: The stomach received the highest organ doses for the average size phantom: 35.8 mGy and 61 mGy for protocols A and B respectively. Kidneys recorded the lowest organ dose: 5 mGy and 10.3 mGy. By adding one and two fat layers, protocol A recorded increased DLP (15 & 55%), stomach (18 & 35%) and kidney doses (35 and 45%) for the overweight and obese conditions respectively. Protocol B reduced stomach (10 and 30%) and kidney dose (15 and 35%) for the overweight and obese phantoms respectively. Despite increasing phantom size, no significant difference in image noise was identified within or between protocols A (range, 12.2-14.1 SD) and B (range, 11.2-14.8 SD) ($p > 0.05$).
Conclusion: Organ doses and DLP increased significantly when ATCM was used for simulated obese patients. No significant difference in image noise was noted for the two experimental scanning protocols.

B-0867 11:02

Cardiac computed tomography dose levels: a national approach and comparison with other cardiac radiation procedures

D. Vicente[1], V. Dessandier[1], A. Pimenta[2], C. Almeida[3], D. Silva[4], R. Gaspar[1], G. Paulo[1], J. Santos[1]; [1]*Coimbra/PT*, [2]*Porto/PT*, [3]*Lisbon/PT*, [4]*Algarve/PT (joanasantos@estescoimbra.pt)*

Purpose: The aim of this study is to obtain Portuguese cardiac Computed Tomography (CT) Diagnostic Reference Levels (DRLs) and compare the effective dose values with other cardiac examinations performed in Portugal and international studies.
Methods and Materials: CT dose values and chest anteroposterior diameter (direct measurement on the images) were retrospectively collected in four centres of excellence representing different regions of Portugal, in order to calculate the DRLs based on the 75th percentile CT values.
Results: The sample was composed by 108 individuals, without significant differences in chest diameter. Significant differences were found between local DRL's across the centres. The proposed DRL for cardiac CT is 32 mGy. The obtained cardiac CT effective dose value is higher than a diagnostic angiography and similar to a cardiac angioplasty.
Conclusion: The obtained dose values should be optimised. Procedures justification must be reconsidered and the radiation examinations risk must be analysed taking into account the clinical indications.

B-0868 11:10

Is iterative reconstruction for CT worth the investment? A retrospective study of dose reduction and image quality

L.V. Magee, P. Ball; *Dundonald/UK (loumagee77@hotmail.com)*

Purpose: To retrospectively review the Computed Tomography (CT) dose reduction and image quality before and after the introduction of Iterative Reconstruction (IR) for various anatomical areas.
Methods and Materials: 80 patients with unchanging weight, who had CT before and after the introduction of statistical based Iterative Reconstruction (iDose^4, Philips Healthcare) were identified using RIS search. The dose was recorded by DLP and CTDI (vol). The images were anonymised, graded using a 5 point Liekert score and categorised to be IR or non-IR by a blinded radiologist (PB).
Results: CT chest and abdomen examinations had a mean DLP reduction of 45.3% and 36.2% and corresponding mean CTDi (vol) reduction of 45.3% and 35.2% respectively. CT brains had a mean DLP reduction of 27.6% and non-variable CTDi (vol) reduction of 29.3%. CT retrospective cardiac and CT calcium score examinations had mean DLP reductions of 45.6% and 46.5% and mean CTDI (vol) reductions of 39.1% and 48.4% respectively. There was no statistical difference in image quality between IR and non-IR images in any category using the Mann-Whitney U-Test. The radiologist could correctly distinguish the IR images in 45% of CT brain and CT calcium score examinations, 35% of CT cardiac scans, 72% of CT chest scans and 76% of CT abdomen examinations.
Conclusion: The study highlights the significant patient dose reduction using IR in all areas of CT without a loss of image quality. IR is a worthy investment and should be widely adopted to improve patient safety in keeping with ALARA principles.

B-0869 11:18

Radioprotection in CT scans: use of bismuth, barium and lead shields

R. Pescada, P. Sousa, A.F.C.L. Abrantes, L.P. Ribeiro, R.P.P. Almeida, S. Rodrigues, K.B. Azevedo, J.P. Pinheiro; *Faro/PT (kbazevedo@ualg.pt)*

Purpose: The primary goal was to evaluate the effectiveness of bismuth, barium and lead shields in reducing the radiation dose and to evaluate the effect of the breast shield on image quality.
Methods and Materials: This study was carried out at a Radiology department and 80 exposures were made (40 without shielding and 40 with shielding) using the standard CT protocols for the head, chest, abdomen and lower limb. For this purpose, 16 optically stimulated luminescence (OSL) dosimeters were used to measure the entrance skin dose, 1 full body anthropomorphic phantom and a Gammex 464 phantom for image quality control.
Results: Application of the eye shield during the head CT scan reduced the radiation dose in 3%. The breast shield reduced the dose in 34% during the thorax CT scan and 36% during the abdominal CT scan. Regarding scattered radiation, the use of breast shield and thyroid shield reduced the dose in 65% and 22%, respectively, during the head CT exam. As for the thorax CT scan, the thyroid and eye lens shields reduced the dose in 73% and 49%, respectively, Regarding the image quality, in terms of spatial resolution, there were no differences between images obtained with and without protection, since it were seen 7 pairs of lines in each image.
Conclusion: The use of individual protection should be taken into acount, since it can reduced the radiation dose in radiosensitive organs during CT scans, attending the ALARA principle.

B-0871 11:26

Development of a software application for the registration and monitoring of diagnostic reference levels

A.F.C.L. Abrantes, B. Braga, L.P. Ribeiro, P. Sousa, R.P.P. Almeida, S. Rodrigues, S. Rodrigues, J.P. Pinheiro, N.F. Pinto; *Faro/PT (jppinheiro@ualg.pt)*

Purpose: Develop a computer application for registration and monitoring of radiation doses to which patients are exposed and to establish diagnostic reference levels (DLR's) for different radiology techniques.
Methods and Materials: Quality control tests to equipment were performed and using a sample of 1017 exams in all considered techniques, anthropometric characteristics of patients and technical parameters of the exams were collected. These data were used to create the application "x-ray dose calculator & register", using Microsoft Excel for windows, where several variables have been introduced like the radiology technique, exposure parameters, patient data, type of examination, quality control and calibration data. The application performs the recording and calculation of doses (entrance skin dose and effective dose) allowing the creation of two types of reports, a general report and an individual report.
Results: The general report allows to make a general analysis of the radiation doses to which patients were exposed in each examination in a given time interval and the individual report will verify all exams done by one patient. For the values of DRL's established, there are differences between these and the values from other studies and guidelines, but our values are in line or below comparing with those.
Conclusion: This application provides a way to bridge a gap in radiology facilities that are not prepared to correspond with what is required by law, including the need of having available the radiation doses to which patients are exposed and the need to keep radiation doses consistent with the DRL.

B-0872 11:34

Design of an ultra-low dose non-contrast kidney stone CT protocol with a radiation dose ≤ 1mSv

S. Moerup[1], D. Skov- Hansen[2], O. Graumann[3]; [1]*Odense/DK*, [2]*Kolding/DK*, [3]*Aarhus/DK (sdmo@ucl.dk)*

Purpose: To design an ultra-low dose non-contrast kidney stone CT protocol, with a radiation dose ≤ 1mSv.
Methods and Materials: To imitate patients with kidney stones a pilot study was created by using a chest phantom (N1 "Lungmann", KYOTO Kagaku, Japan). Inside the upper abdomen of the phantom three cheeses were placed 1) one with a 5 mm phlebolith, 2) two uric acid kidney stones and 3) two cysteine kidney stones, the sizes of ≤5 mm and 5-10 mm. A 64-multidetector CT-scanner (Discovery CT750 HD; GE Healthcare, Milwaukee, US) with dose-modulation and a noise index of 70 was used. Firstly the mA-interval was changed and the kV was set at 120, secondly the kV was set at 100 and 80 with similar mA-setting. In total 30 CT-scans were performed. Two radiographers reviewed the CT scans and selected 16 CT-scans based on image quality and radiation dose. The 16 CT-scans were randomized and review by two uroradiologists, who rated the images bases on kidney visualization (size, location, composition and Hounsfield value) and diagnostic usefulness.
Results: We found that the must suitable CT protocol was with the following settings: 120 kV, a dose-modulation between 10-50 mA and noise index of 70. The CT protocol had an effective dose of 1.05mSv. Data suggest that CT scans with kV < 120 can affect kidney stones visibility.
Conclusion: We found a theoretically ultra-low dose non-contrast CT protocol, with a radiation dose ≤ 1mSv. Further studies needs to be performed before the protocol can be implemented in clinical use.

B-0873 11:42

CT dose optimisation software synergy: a clinical perspective

L.R. O'Hora; *Dublin/IE (lohora@mater.ie)*

Purpose: To compare the clinical radiation doses between CT scanners with and without iterative reconstruction and automatic kVp selection for 4 common CT examinations.
Methods and Materials: Dose length product data (DLP) was retrospectively collected via the hospital PACS system for two identical model CT scanners (Siemens Somatom AS 64 slice model) for randomly selected patients on the four most common CT examinations preformed (brain, abdomen, pulmonary angiography and thorax-abdomen-pelvis). Scanner B had both iterative reconstruction and kVp modulation available, otherwise identical protocols, staff and patient population were used throughout. Descriptive statistics and ANOVA testing were used to compare radiation doses between three groups scanned using either routine protocols, iterative reconstruction or a combination of iterative reconstruction and kVp modulation.
Results: Data was collected on a total of 4011 patients, 1643 having routine imaging, 1077 with iterative reconstruction and 1291 scanned with both iterative reconstruction and automatic kVp selection. Statistically significant dose reductions of 16-31% were achieved using iterative reconstruction alone and 24-42% when both iterative reconstruction and automatic kVp selection were combined (p=0.001).
Conclusion: Combined use of both iterative reconstruction and automatic kVp selection offers dose savings of up to 42% in routine CT imaging and should be encouraged.

10:30 - 12:00 **Room MB 1**

Head and Neck

SS 1008

Thyroid and parathyroid imaging

Moderators:
A. Lévai; Budapest/HU
J. Olliff; Birmingham/UK

B-0874 10:30

Role of quantitative diffusion-weighted MRI and 1H MR spectroscopy in distinguishing between benign and malignant thyroid nodules

R.A. Elshafey, A. Elattar, M. Melees, N. Esheba; *Tanta/EG (drrashaelshafey@yahoo.co.uk)*

Purpose: Is to evaluate the role of quantitative diffusion MRI and 1H MR spectroscopy in differentiation between benign and malignant thyroid nodules.
Methods and Materials: Prospective study was conducted on 25 patients with 41 thyroid nodules (11 male, 14 female), age range, 16-74 years with mean 45.3 years) collected from wards and clinics of Internal Medicine and General Surgery Departments, 20 healthy individuals as control cases were included in the study. 1.5-T 1H-MR Spectroscopy (at echo-times (TE) 144 and 35 ms) and diffusion-weighted imaging (b value 0, 250 and 1000 s/mm2) were performed and the results were correlated with histopathological results.
Results: The mean ADC of the malignant thyroid nodules (13 nodules) was (0.59 + 0.24x10-3 mm2/s) while that of the benign thyroid nodules (28 nodules) (was (1.78 + 0.21x 10-3 mm2/s) (p value < 0.0001). Choline is present in all malignant nodules (13 nodules) and 2 benign nodules (mild elevation) while absent in 26 other benign nodules. Choline/ creatine ratio in malignant nodules ranged from 1.3-5.4., while in 2 benign nodules was 0.9 and 1.1. The sensitivity, specificity, PPV, NPV and overall accuracy of diffusion and MRS in differentiating benign from malignant thyroid nodules were 100%, 93%, 96%,100% and 79% respectively.
Conclusion: MRS and diffusion WI are useful noninvasive diagnostic modalities in differentiation between benign and malignant thyroid nodules.

B-0875 10:38

The role of magnetic resonance spectroscopyas a pre-surgical diagnostic modality in thyroid nodules

L. Aghaghazvini, P. Pirouzi, H. Sharifian, N. Yazdani, S. Kooraki, A. Ghadiri; *Tehran/IR (la_ghazvini@yahoo.com)*

Purpose: To evaluate the role of magnetic resonance spectroscopy (MRS)for differentiation of benign from malignant thyroid nodules in correlation with histopathology data.
Methods and Materials: MRS was carried out by using a 3 Tesla magnet on 15 patients with total number of 32 thyroid nodules larger than 1 cm3.All nodules were surgically removed either because of proven or suspected malignancy or cosmetic reasons. Choline (Cho) to Creatine (Cr) ratio was assessed at 135 and 270 time of echo (TE) on each nodule and ROC curve was used to determine optimal cut-off points. Findings were compared with postophistopathology data.
Results: There were 23 benign and 9 malignant lesions (7papillary and 2 follicular thyroid neoplasms). ACho to Cr ratio cut-off point of 2.5 was very wellcorrelated with histopathology results (sensitivity = 75%; specificity = 100%; PPV = 100%; NPV= 92%) while at cut-off point of 1.5, sensitivity = 75%; specificity = 87%; PPV = 67%; NPV= 92% were detected. MRS data at TE of 270 ms was unreliable and mainly un-interpretable due to motion artifacts.
Conclusion: This study showed that magnetic resonance spectroscopy at TE of 135 ms could be used as a highly specific modality for preoperative differentiation of benign from malignant thyroid nodules.

B-0876 10:46

Comparison between two thyroid ultrasound classification systems for characterisation of thyroid nodules

G.A. Ashamallah, M.A. El-Adalany; *Mansoura/EG*
(germeenalbair@gmail.com)

Purpose: To compare between TIRADS and thyroid ultrasound classification system proposed by Kim and his colleagues.
Methods and Materials: Prospective analysis of ultrasound and power Duplex images of 450 patients (100 M, 350 F; age range 10-70 yrs) with thyroid gland disease was conducted. The thyroid lesions were categorized into 5 groups: TIRADS 1, Normal thyroid gland; TIRADS 2, begnin aspects; TIRADS 3, probably benign aspects; TIRADS 4 A, low suspicious aspects; TIRADS 4B & TIRADS 5, high suspicious aspects.Next, the detected nodules in 370 patients were devided into solid and mixed nodules and rated according to Kim et al., classification. The final diagnosis was done by biopsy (n=370) and clinical follow-up (n=80). Statistical analysis in comparison with pathological findings was calculated.
Results: The odds ratio (OR) was 7 for (TIRADS5), 2 for (TIRADS 4B), 0.67 for (TIRADS 4 A), 0.2 for (TIRADS3) and 0.1 for (TIRADS1&2).the PPV of malignancy rises gradually from 0% for (TIRADS1&2) to 6.7% for (TIRADS 3&4 A) to 20% for (TIRADS 4B) and reaches 67% for (TIRADS5). (TIRADS 5) showed 100% sensitivity, 86% specificity and 89% accuracy. OR for malignant mixed nodule as classified by kim et al., was 3.9 with 100% sensitivity, 73% specificity, 81% accuracy. The malignant category for solid nodules had OR of 11.4, 60% sensitivity,70% specificity,96% accuracy,20%PPV and 93 % NPV.
Conclusion: TIRADS classification is reliable, easier and simpler than other classification system for reporting.IT has higher sensitivity and specificity for prediction of thyroid malignancy.

B-0877 10:54

Role of ARFI in risk stratification of thyroid nodules by TIRADS

B. Raghavan, D. Sundaram; *Chennai/IN (drbagyam@gmail.com)*

Purpose: The aim of the study is to detect the impact of ARFI elastography on TIRADS categorization in risk stratification of thyroid nodules.
Methods and Materials: 130 thyroid nodules in 79 patients were examined with conventional ultrasound as well as VTQ and VTI methods of ARFI elastography technique. The imaging findings were correlated with fine needle aspiration cytology results. Tissue elasticity was expressed as shearwave velocity (m/s) in VTQ method and as black and white colour coded images in VTI method. Diagnostic ability of each method was assessed by receiver operatoring characteristic curve (ROC).
Results: VTI and VTQ were determined for all the nodules and they were categorised by TIRADS.28 nodules were grouped under TIRADS category 4 and 5 based on ultrasound. 42% of the TIRADS 4 A nodules and 64% of TIRADS 4B nodules were correctly downstaged by VTQ method. 42% of the TIRADS 4 A nodules and 64% of TIRADS 4B nodules were correctly downstaged by VTQ method. 57 % in TIRADS category 4 A and 70 in category 4B were down staged by VTI method.
Conclusion: Both VTQ and VTI methods have high sensitivity and specificity in differentiating benign and malignant nodules. Both of these ARFI methods downs stages atleast 50% of the undetermined nodules under TIRADS category. The ARFI can reduces the false positive rate of ultrasound and reduces the number of unnecessary FNAC or biopsies.

B-0878 11:02

Do US-strain elastography improve diagnostic performance of multiparametric ultrasound in the differentiation of benign and malignant thyroid nodules?

N. Di Leo, V. Cantisani, M. Di Segni, P. Ricci, C. Catalano, F. D'ambrosio;
Rome/IT (nicola.dileo130287@gmail.com)

Purpose: To evaluate the diagnostic efficacy and interobserver agreement of Q-elastographycompared and combined with Color-Doppler US (Echo-score) in the differentiation of benign from malignant solid thyroid nodules.
Methods and Materials: 440 solid thyroid nodules in 328 consecutive patients were examined in this prospective study with gray scale and color Doppler ultrasound (CDUS) and Q-elastography by two operators with different experience. Nodules with hypoechogenicity, poorly defined margins, microcalcifications, and intralesional vascularity (pattern III) at color Doppler ultrasound were classified as suspicious. The diagnostic performances of CDUS features and Q-elastography and of the combination of both were estimated and compared using ROC analysis. Interobserver agreement of CDUS and Q-elastography results was assessed with Cohen's k statistic.
Results: Q-elastography showed sensitivity of 89% and specificity of 91% for the operator 1 (with a strain ratio best cut-off point at 2.20), and sensitivity of 82 % and specificity of 81 % for operator 2 (with a strain ratio best cut-off point at 2). The performance of Q-elastography was superior than CDUS features for both operator ($p < 0.1$). Q-elastography in combination with US increased sensitivity and specificity of Echo-score from 58 and 69% to 92 and 92% for both the operators. Reproducibility of the findings was excellent both for Q-elastography and good for echo-score.
Conclusion: The use of combined Q-elastography and echo-score is more accurate in the characterization of thyroid nodules than colour-Doppler ultrasound features. Q-elastography showed lower interobserver variability and its application in the current daily clinical practice may limit unnecessary FNAC

B-0879 11:10

Preoperative ultrasound of papillary thyroid carcinoma (PTC): evaluation of predictive factors for extrathyroidal extension

H.-S. Ahn, S. Park, S. Kim, M. Seo, B. Chung; *Seoul/KR*
(ach0224@gmail.com)

Purpose: To evaluate predictive factors of the extrathyroidal extension of papillary thyroid carcinoma (PTC) on preoperative ultrasound and compare utility and accuracy of factors for diagnostic performance.
Methods and Materials: This study included preoperative ultrasound of 139 PTC which confirmed by surgery between November 2011 and March 2012. We retrospectively reviewed variable US findings of nodules including several measuring methods for contact the thyroid capsule of the nodule (degree of perimeter ratio (%), abutting length to the capsule (mm), presence of protrusion (yes/no). Ultrasonographic findings were compared with pathologic results after surgery and diagnostic accuracy of each US finding was calculated.
Results: Of the 139 PTC, extrathyroidal extension was present in 50 (36%) based on pathologic results (84% sensitivity, 59.6% specificity, 53.8% positive predictive value, and 86.9% negative predictive value). Mean size of the nodule was significantly different between PTC with and without extrathyroidal extension ($P = 0.000$). US T-stage was predicted extrathyroidal extension ($P = 0.000$). All of measuring methods for contact thyroid capsule of the nodule were statistically correlated with extrathyroidal extension in univariate analysis ($P < 0.05$). In multivariate analysis, More than 25% of perimeter ratio of nodule showed highest odds ratio (OR: 18.429, 95% CL: 5.076-66.906).
Conclusion: Preoperative sonography is a helpful to predict extrathyroidal extension of papillary thyroid cancer. Lesion size and T-stage on ultrasound were useful predictive factors for extrathyroidal extension. Among US finding of contact thyroid capsule, more than 25% of perimeter ratio showed highest odds ratio.

B-0880 11:18

Comparison of clinical and sonographic characteristics for distinguishing follicular adenoma and carcinoma and the predictive factors of malignancy in thyroid follicular neoplasm

S. Park, S. Kim, H.-S. Ahn, M. Seo, J. Yoo, J. Choi; *Seoul/KR*

Purpose: This study aimed to identify the clinical and ultrasonographic features of follicular adenomas and carcinomas to improve the diagnostic accuracy and prediction of malignancy in patients with follicular neoplasm.
Methods and Materials: This retrospective study included 29 pathologically proven follicular carcinomas and 70 follicular adenomas in 99 patients who underwent thyroid surgery. We analyzed the clinical and sonographic features associated with each tumour, including the patient's age and sex, maximum tumour diameter, internal composition, echogenicity, echotexture, shape, margin, calcification, final assessment, cystic changes, and peripheral halo. The significance of clinical and sonographic variables was determined in a univariate analysis and backward elimination logistic regression analysis.
Results: In the univariate analysis, a nodule size > 4 cm was more frequent in the follicular adenomas ($p = 0.03$). Isoechogenicity and hypoechogenicity, heterogeneous echotexture, an ill-defined margin, microcalcification or rim calcification, and incomplete halo were significantly more frequent in the follicular carcinomas than in the follicular adenomas ($p < 0.05$). Among the follicular carcinomas, cystic change was more frequent in the widely invasive than in the minimally invasive carcinomas ($p = 0.03$). In addition, 2 variables, an ill-defined margin and incomplete halo, remained in the final model after performing a multivariate logistic regression analysis.
Conclusion: An ill-defined margin and incomplete halo might be independent predictors of follicular carcinoma when distinguishing follicular adenomas and carcinomas. A larger tumour size, heterogeneity, isoechogenicity and hypoechogenicity, microcalcification or rim calcification, an ill-defined margin, and incomplete peripheral halo were more frequently observed in the follicular carcinomas.

B-0881 11:26

Evaluation of underlying lymphocytic thyroiditis with histogram analysis using gray scale ultrasound images

J. Seo, G. Kim, E.-K. Kim, J. Kwak; *Seoul/KR (mangiinyu@gmail.com)*

Purpose: To evaluate the diagnostic performance of quantitative parameters obtained from histogram analysis using gray scale ultrasound (US) images in the diagnosis of patients with lymphocytic thyroiditis (LT).
Methods and Materials: The 505 patients underwent preoperative staging US and thyroid surgery in our institution. Three radiologists retrospectively reviewed 505 gray scale US images and classified the images according to the presence/existence of LT. After two months, each reviewer repeated the process with the same 505 US images in a randomly mixed order. The intra- and interobserver variability of three reviewers was analyzed with the generalized kappa value. The individual US images were postprocessed with MatLab software for histogram analysis. Four parameters (mean value, standard deviation, skewness and kurtosis) were obtained for each case and the index was calculated from the principal component analysis (PCA). Diagnostic performances were compared.
Results: Of 505 patients, 125 (24.8%) had LT and 380 (75.2%) had normal thyroid parenchyma on pathology. The kappa value of intraobserver variance ranged from -0.002 to 0.781 and the overall kappa value of interobserver variance was 0.570 and 0.214 in the first and second test, respectively. The sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of the three reviewers versus the PCA index from the histogram were as follows: 28.0-83.2%, 43.7-82.6%, 53.5-79.0%, 24.6-56.2%, and 75.2-88.9% versus 58.4%, 72.4%, 68.9%, 41.0% and 84.1%, respectively.
Conclusion: The histogram analysis of gray scale US images provided reliable and quantitative information about LT and was comparable with the performer's assessment in diagnostic performance.

B-0882 11:34

Can ARFI elastography be used to differentiate parathyroid from thyroid lesions?

A. Chandramohan, D. Abraham, M.T. Manipadam, T.V. Paul; *Vellore/IN (anuradhachandramohan@gmail.com)*

Purpose: To compare elasticity index (EI) and shear wave velocity (SWV) of parathyroid lesions and thyroid nodules.
Methods and Materials: IRB approved prospective study where ARFI elastography was performed on consecutive patient's with primary hyperparathyroidism and positive Tc99m Sestamibi scintigraphy and patients with solid thyroid nodules on thyroid ultrasound. SWV (m/s) and EI (Asteria four point scale) were obtained using virtual touch quantification (VTQ) and virtual touch imaging (VTI) software respectively. Only patients with surgical histopathology (35 parathyroid lesions, 38 benign thyroid nodules (BTN) and 58 malignant thyroid nodules (MTN)) were included for final analysis. SWV and EI of parathyroid and thyroid nodules were compared.
Results: There were 29 solitary adenomas, 2 double adenomas, 2 parathyroid hyperplasia in 32 patients (14 male,18 females) with age of 42.2±12.2 years; serum corrected calcium and PTH was 11.01±1.02 mg/dL and 421±416 ng/L respectively; size and weight was 20.4±9.7 mm 486.7±156 mg respectively. Mean SWV of parathyroid lesion (1.71±0.65 m/s) was significantly different from benign (2.14±0.77 m/s) and malignant (4.7±2.81 m/s) thyroid nodules, $p < 0.05$; so was the EI, chi square = 89.6, $p < 0.000$. Majority of parathyroid lesions (n=25, 71.4%) had EI of 2 with speckled (n=30, 85.7%) pattern, none showed EI of 4. ROC analysis showed an area under the curve of 0.714 and 0.773 respectively for VTI and VTQ respectively to differentiate parathyroid and thyroid lesion.
Conclusion: ARFI elastography can be used as an additional tool to differentiate thyroid and parathyroid lesions.

B-0883 11:42

MR appearance of parathyroid adenomas at 3 T in patients with primary hyperparathyroidism: the value of imaging for pre-operative localisation

A. Iannarelli, B. Sacconi, R. Argirò, C. Cipriani, S. Minisola, C. Catalano, M. Bezzi, D. Diacinti; *Rome/IT (angelo.iannarelli@gmail.com)*

Purpose: To identify frequent MRI features of parathyroid adenomas (PTAs) in patients with primary hyperparathyroidism and to evaluate image quality and usefulness of different sequences.
Methods and Materials: 38 patients with primary hyperparathyroidism underwent 3 T MR scan. All patients had positive US and Tc-99 sestamibi positive scans, for a total amount of 45 PTAs. T2 IDEAL FSE sequences and T1 IDEAL sequences before and after contrast administration were performed. Once PTA was identified, two radiologists in consensus evaluated the presence of five features: hyperintensity, homogeneous or "marbled" appearance and elongated morphology on T2 sequences; cleavage plane from thyroid gland on T2 outphase IDEAL sequences; rapid enhancement in post-contrast T1-weighted images. Image quality for T2-weighted sequences and usefulness for post-contrast T1-weighted and T2 outphase sequences were also subjectively assessed by consensus.
Results: PTAs were considered hyperintense in 44/46 (95.7%), marbled in 30/46 (65.2%) and oblong in 38/46 (82.6%). Cleavage plane was observed in 36/46 (78.3%), rapid enhancement in 20/46 (43.5%). T2-weighted FSE sequences showed both overall excellent fat suppression and image quality (averages scores 3.2 and 3.1). T2 IDEAL-FSE outphase sequences demonstrated to be quite useful (2.8), whereas post-contrast T1-weighted images showed a lower grade of usefulness (2.4).
Conclusion: T2-hyperintensity, marbled and oblong appearance and presence of cleavage plane from thyroid are frequent features of PTAs. T2-weighted IDEAL FSE sequences are generally adequate and useful in depicting PTAs.

B-0884 11:50

The role of MR in the preoperative management of primary hyperparathyroidism in clinical practice: single-center experience with a 3 T MR

B. Sacconi, R. Argirò, A. Iannarelli, C. Cipriani, S. Minisola, C. Catalano, M. Bezzi, D. Diacinti; *Rome/IT*

Purpose: To review our experience with 105 patients with primary hyperparathyroidism (PHPT) studied with 3 T-MR.
Methods and Materials: One hundred and five patients with PHPT and previous sonographic and Tc-99 sestamibi studies were included (90 F/15M; mean age 65.4 years). All patients underwent a 3 T-MR study, with T2-weighted IDEAL FSE and T1-IDEAL sequences before and after contrast injection. Patients were evaluated regarding clinical status, first-line imaging and MR results. Type of surgery, pathology results and interval between MR and surgery were recorded.
Results: Mean PTH and calcium levels were 1.45±0.13 mmol/L and 10.2±94.5pg/mL, respectively; 40/105 patients had symptoms of PHPT (38.1%). Forty-seven patients had positive ultrasonography and Tc99-sestamibi (group-A), 58 had negative or discordant scans (group-B). MR was positive in 46/47 patients in group A (97.9%) and in 36/58 in group B (62.1%), for a total of 117 enlarged glands (10 patients had more than one enlarged gland, 4 had ectopic glands). Twenty-seven patients underwent surgery (20 mini-invasive and 7 open-neck surgery; 26 adenomas and 1 carcinoma). Mean interval between MR and surgery was 4.7 months. In surgical patients, MRI was positive in 26/27 (96.3%) (1 obese patient not properly studied).
Conclusion: MR is a useful radiation-free technique for preoperative localization of parathyroid disease and for definitive diagnosis when first-line techniques are negative/discordant. MR is also useful in persistent post-surgical PHPT or when multiglandular /ectopic disease is suspected. Reliable data, however, are difficult to extrapolate even in a large cohort of patient, due to variable follow-up and low rate of surgical confirmation.

10:30 - 12:00 **Room MB 2**

Paediatric

SS 1012

Abdominal imaging

Moderators:
M. Haliloglu; Ankara/TR
A.S. Littooij; Leiden/NL

B-0885 10:30

Re-appraising ultrasonography as the first line diagnostic modality in surgical causes of paediatric acute abdomen

I. Goel, R. Anand, M. Narula, S. Choudhury; *New Delhi/IN (ish.goel06@gmail.com)*

Purpose: The purpose of study is to review the role of high resolution abdominal Sonography as first line diagnostic modality in surgical causes of paediatric acute abdomen.
Methods and Materials: This prospective study comprised of 41 paediatric patients (M:F 28:13) who underwent abdominal sonography (Phillips iU22) from October 2013 to September 2014. Patients with history of abdominal trauma and acute gastroenteritis were excluded. Ultrasound findings were correlated with per-operative findings. The diagnostic accuracy of sonography was measured by ROC, sensitivity and specificity with 95% C.I.'s. Internal consistency among radiologists was assessed by adjusted kappa coefficient with matched pair McNemar test.
Results: Amongst 41 cases examined during study period surgical cause of acute abdomen was diagnosed in 34 cases. The most frequent cause in our study group was intussusception (n = 15). Other causes included 9 cases of appendicitis, 4 cases of IHPS, 3 cases of midgut volvulus, 2 cases of Meckel's diverticulitis and 1 case of infected duplication cyst. No surgical cause could be identified in remaining 7 cases after undergoing operative procedure (including

diagnostic laparoscopy and laparotomy). The overall sensitivity and specificity of sonography is 97.06% and 85.71% having a significant correlation with per-operative findings with ROC 0.91 and p value < 0.001 (95% C.I. 75.7% - 97.3%). Overall inter-observer agreement is good (kappa 0.845).
Conclusion: In the setting of acute abdominal conditions with surgical causes in paediatric population, Ultrasonography continues to prove an extremely effective and readily available first line diagnostic tool, requiring no patient preparation or radiation exposure.

B-0886 10:38

Comparison of axial T2-weighted BLADE and respiratory triggering turbo spin-echo sequences in the paediatric abdomen

J. Lee, Y. Choi, J.-E. Cheon, S. Lee, H.-H. Cho, S.-M. Shin, W. Kim, I.-O. Kim; *Seoul/KR (lee87jh@gmail.com)*

Purpose: To compare the capabilities of BLADE (proprietary name for periodically rotated overlapping parallel lines with enhanced reconstruction, Siemens, Erlangen, Germany), a kind of radial k-space sampling techniques, and respiratory triggering T2-weighted turbo spin-echo (TSE) MR sequences in paediatric abdominal imaging.
Methods and Materials: Axial T2-weighted BLADE and respiratory triggering-TSE without fat suppression were performed in 32 abdominal MR examinations for children who could not hold their breath. For qualitative analysis, overall image quality, the presence of respiratory motion, bowel motion, and radial artifacts and lesion conspicuity were retrospectively assessed by three radiologists, using 5 or 4-scaled scoring systems. Signal uniformity of each sequence was evaluated for a quantitative comparison. The acquisition times for each sequence were compared.
Results: The BLADE technique showed improved overall image quality (3.35 ±0.85 vs. 2.59 ±0.59, $p < 0.001$), reduced respiratory motion artifact (0.51±0.56 vs. 1.89±0.68, $p < 0.001$), and improved lesion conspicuity (3.54±0.88 vs. 2.92±0.77, p=0.006) compared to respiratory triggering-TSE. The bowel motion artifact scores were similar for both sequences (1.65±0.77 vs. 1.79±0.74, p=0.691). BLADE introduced a "radial" artifact that was not observed on the respiratory triggering-TSE images (1.10±0.85 vs. 0, $p < 0.001$). BLADE was associated with diminished signal variation compared with respiratory triggering-TSE in the liver, spleen, and air ($p < 0.001$). The mean acquisition times for BLADE and respiratory triggering-TSE were 2 min, 14 s and 2 min, 9 s, respectively.
Conclusion: BLADE improved the quality and reduced respiratory motion artifacts in young children compared with respiratory triggering-TSE.

B-0887 10:46

Fibrosing liver diseases in paediatric age: MRI investigation by diagnostic maps of slow diffusion and fast diffusion generated from a multiple b values DWI sequence through IVIM model

P. Gulino, A. Ciccarone, D. Cozzi, D. Salpietro, C. Defilippi; *Florence/IT (pietrogulino@yahoo.it)*

Purpose: Our work focuses on generating and evaluating diagnostic maps of slow diffusion and fast diffusion using IVIM model in children, comparing the results in patients with healthy subjects.
Methods and Materials: We employed the bi-exponential algorithm of Le Bihan to study the two compartments of fast diffusion (f) and slow diffusion (D). Home-made MATLAB was developed to generate maps of IVIM parameters. We studied two groups of paediatric patients, one of 5 healthy volunteers and one of 10 patients with fibrosing liver disease. All patients underwent liver MRI (with acquisition of a respiratory-triggered DWI sequence with 11/13 b values) and biopsy. For each patient, four maps were extracted: ADCf (D, slow diffusion coefficient), PPC (D*, pseudodiffusion coefficient), PFC (f, perfusion fraction) and Flow (fxD*). ROIs have been placed on each map in each liver segment, their values were extracted and included in the statistical analysis.
Results: P value < 0.05 was considered statistically significant. The mean values (with SD) in the group of patients are: D = 0.814 ± 0.08 × 10-3 mm2/s ($P < 0.001$), D* = 93.69 ± 37 × 10-3 mm2/s (P = 0.024), f = 16.9 ± 4.1 % (P = 0.041), Flow = 163.4 ± 86.5 × 10-3 mm2/s (P = 0.012).
Conclusion: All results are statistically significant. In particular, the D parameter shows the highest reproducibility and the lower standard deviation in our population, suggesting a promising use of slow diffusion coefficient to evaluate the diffusion in liver and the consequent quantification of fibrosis.

B-0888 10:54

Quantification of liver steatosis in paediatric population: comparison of ^{1}H MRS and Triple-echo GRE sequence with liver biopsy as reference standard

M. Di Martino, L. Pacifico, M. Bezzi, F. Zaccagna, B. Sacconi, C. Chiesa, C. Catalano; *Rome/IT (micdimartino@hotmail.it)*

Purpose: Our aim was to compare a triple-echo 2D gradient-echo sequence (FAST-MR) with ^{1}H Magnetic Resonance Spectroscopy (MR-S) in the quantification of liver fat in children with Non-Alcoholic Fatty Liver Disease and liver biopsy as the reference standard.
Methods and Materials: The study has been approved by the local ethical committee and written informed consent has been obtained from all participants and their legal guardians before the study. Twenty-six children with Non-Alcoholic Fatty Liver Disease (NAFLD) underwent liver biopsy to assess the presence of nonalcoholic steatohepatitis (NASH) or other likely independent or competing liver diseases. Assessment of liver fat fraction at MR was performed with high field magnet (3 T) by using 2D gradient-echo triple-echo T1-weighted sequence with low flip angle and single-voxel point-resolved ^{1}H -MRS, corrected for T1and T2* decays. Linear regression, Lin coefficient and Spearman correlation test were used to evaluate correlation between histology, MRS and FAST-MR. Mann-Witney-U test and Multivariate analysis were performed to analyzed continuous variables.
Results: Linear regression and Lin analysis revealed a good fit between histology and MRS with a correlation and concordance of 0.81and 0.5. Good correlation among histology and the two MR techniques was also reported when different grade of steatosis were considered (ρ.74 - ρ.70).
Conclusion: A breath-hold triple-echo gradient-echo sequence with a low flip angle and correction for T2* decay is accurate for quantifying liver steatosis.

B-0889 11:02

Imaging approach in infantile cholestasis evaluation: utility and efficacy of US signs in biliary atresia

L. Monti, M. Salsano, G. Soglia, M. Colella Bisogno, A. Simonetti, G. Torre, P. Rossi, L. Bonomo, P. Tomà; *Rome/IT (marco.salsano@hotmail.it)*

Purpose: Discrimination of biliary atresia (BA) from other causes of infantile cholestasis (IC) represents a challenge. A prompt diagnosis of BA can help to improve patient outcome. The aim of this study is to define and validate a diagnostic system to discriminate biliary atresia from other causes of neonatal cholestasis.
Methods and Materials: Clinical, laboratoristic, ultrasonographic (US) and color Doppler US findings were retrospectively reviewed in patients with diagnosis of IC between April 2009 and July 2014. 88 patients were included; BA and non-BA were confirmed in 46 and 42 patients respectively.
Results: In the diagnosis of BA, sensitivity, specificity and accuracy of triangular cord sign and sub-capsular flow were 76%,100%,87% and 78%,98%,87% respectively. Hepatic artery diameter was significantly higher in BA (mean±standard deviation: 2.47±0.55 mm) compared to non-BA group (1.81±0.21 mm;$P < 0.05$) while there were no statistically significant difference between BA and non-BA groups as regards portal vein diameter. Liver profile alteration and gallbladder abnormality in shape and lenght on US images showed an accuracy in the diagnosis of BA respectively of 82%,93%,91%. Almost all patients with BA showed clay stool (96%) compared to 10 cases in non-BA patients. Gamma-glutamyltranspeptidase was significantly higher in the non-BA group ($P < 0.05$), whereas other clinical and laboratory findings were comparable in both groups.
Conclusion: The presence of subcaspsular flow, triangular cord sign, Glisson capsule and gallbladder alterations at US exam, represent the most sensitive findings able to discriminate biliary atresia from other cholestatic pathologies. Laboratory and clinical data can help in diagnosis but are not discriminative.

B-0890 11:10

Impact of hepatic arterial haemodynamics in predicting early hepatic arterial thrombosis in paediatric recipients after living donor liver transplantation

L.-H. Gu, H. Fang, F. Li, S. Zhang, C. Shen, L. Han; *Shanghai/CN (renjiglh@126.com)*

Purpose: Hepatic arterial thrombosis (HAT) is a serious complication of liver transplantation, and early diagnosis is important. We used Doppler ultrasonography (US) to evaluate the changes in hepatic arterial haemodynamics that occur following living donor liver transplantation (LDLT) in paediatric recipients, with a view to assessing the utility of these parameters in predicting early HAT.

Methods and Materials: A retrospective review of 144 paediatric recipients (73 males, 71 females) who underwent routine Doppler US in the first week after LDLT was undertaken, and changes in hepatic arterial haemodynamics were assessed. The hepatic arterial resistance index (HARI) and hepatic arterial peak systolic velocity (HAPSV) were compared in patients with early HAT (defined as occurring in the first postoperative week) and a control group, and the utility of these parameters in predicting early HAT after LDLT were determined.
Results: A total of 11 peadiatric recipients experienced early HAT, being diagnosed on average 4.5 days after LDLT. HARI and HAPSV values were significantly different between the early HAT group and controls. HARI values < 0.6 on the day before the onset of early HAT were able to predict for HAT development with a sensitivity of 95.2% and specificity of 81.8%.
Conclusion: HARI values < 0.6 one day prior to early HAT development have a high sensitivity and specificity for the prediction of early HAT. This provides evidence for routine Doppler US examination in these patients, and supports consideration of more intensive anticoagulation in these high-risk patients.

B-0891 11:18

The role of magnetic resonance enterography in the evaluation of activity of paediatric Crohn's disease

F. Al Bunni, M. Zuliani, F. Pomerri; *Padua/IT (faise83@gmail.com)*

Purpose: The objective of this study is to evaluate the feasibility of our protocol of bowel preparation to MRE investigation in paediatric population diagnosed with Crohn's disease in terms of sensitivity of MRE compared to colonoscopy; moreover, to validate a correlation between Magnetic Resonance Index of Activity (MaRIA) and the Simple Endoscopic Score for Crohn's Disease (SES-CD) and the Paediatric Crohn's Disease Activity Index (PCDAI).
Methods and Materials: We retrospectively reviewed MRE investigations on 32 patients (age 7-18; median 14.5) diagnosed with CD. Activity disease was measured by PCDAI. MRE were performed at 1.5 T after bowel cleansing and bowel luminal distension with PEG solution (20 ml/Kg) as oral contrast and gadolinium chelate (0.1 mmol/Kg) as intravenous contrast. MRE was evaluated with MaRIA score taking into account the small bowel and colon findings. 24 out of 32 patients' ileo-colonoscopies were reviewed and scored with SES-CD; Spearman's Rho correlation was used.
Results: The sensitivity of MRE related, respectively, to terminal ileum and colonic involvement was 71% and 94% on a per-patient basis and 51% per-segment basis. Small bowel involvement, except terminal ileum, was detected in 13 patients. A significant correlation was observed between global MaRIA score and SES-CD ($n=24$; $r=0.70$; $p < 0.05$); moderate correlation between global MaRIA score and PCDAI ($n=32$; $r=0.50$; $p < 0.01$).
Conclusion: The performed MRE protocol allowed to detect both ileum and colonic involvement in paediatric population with CD and supported the global MaRIA score as an imaging-based quantitative index of activity disease correlated with endoscopic and clinical activity indices.

B-0892 11:26

Radiation reduction in the follow-up of abdominal trauma imaging using contrast-enhanced ultrasound

A.-M. Deganello, E. Konstantatou, O. Romanos, M. Sellars, P. Sidhu; *London/UK (adeganello@nhs.net)*

Purpose: To determine the value of CEUS in the follow-up of children and young adults who sustained solid abdominal viscera injuries, in comparison to CT in view of radiation exposure reduction.
Methods and Materials: Retrospective review of CT database, of children and young adults referred for abdominal trauma over a 16-year period (1998-2013). We documented the number of CT and CEUS scans performed at follow-up and compared their results. We also recorded the number of patients who had CEUS alone as follow-up investigation. CEUS scans were performed by experienced radiologists, following informed parental consent with no adverse events.
Results: A total of 766 children and young adults (female: 161, Male: 605, mean age 15 yrs, range 9m-20y) were referred to CT for abdominal trauma. 112/766 (14.6%) patients had at least one follow-up CT scan for solid organ abdominal injury, and of these, 37/112 (33%) patients underwent CEUS: in all cases, complications were correctly diagnosed on CEUS when compared to CT. In 3 of these cases, CEUS diagnosed lesions not seen on CT. After the introduction of CEUS in 2011, 30/75 (40%) patients followed-up for solid organ injury at presentation had only CEUS. Two trauma patients were initially and solely investigated with CEUS due to the mechanism of injury.
Conclusion: Our experience demonstrates the usefulness and accuracy of CEUS compared to CT in the follow-up of hepatic, renal and splenic injuries. With the introduction of CEUS, we were able to reduce the number of CT scans performed in the follow-up, reducing the high cumulative radiation burden.

B-0893 11:34

High-resolution MRI for preoperative workup of neonates with an anorectal malformation: a direct comparison with rectofistulography using surgical findings as reference standard

M.G. Thomeer, A. Devos, M. Lequin, N. De Graaf, M. Meradji, I. De Blaauw, C. Sloots; *Rotterdam/NL (m.thomeer@erasmusmc.nl)*

Purpose: To compare MRI and rectofistulography with surgical findings (reference standard) in neonates with an anorectal malformation (ARM).
Methods and Materials: Thirty-three neonates (22 boys) with ARM were included. All underwent preoperatively high-resolution MRI (without sedation or contrast instillation) and rectofistulography. Results of the different modalities were compared with surgical findings concerning Krickenberg classification and level of rectal pouch using McNemar's test.
Results: There were nine patients with a bulbar recto-urethral fistula, six with a prostatic recto-urethral fistula, five with a vestibular fistula, five with a cloacal malformation, four without fistula, one with a H-type fistula, one with anal stenosis, one with a rectoperineal fistula and one with a bladder neck fistula. MRI and rectofistulography predicted anatomy correct in 88% (29/33) and 61 % (20/33), respectively ($p=0.012$). The distal end of the rectal pouch was correctly predicted in 88%(29/33) and 67% (22/33), respectively ($p=0.065$). The length of the common channel in cloacal malformation was correctly predicted in all with MRI (100 %, 5/5) and in 80 % (4/5) with rectofistulography. During rectofistulography, two perforations of bowel occurred.
Conclusion: MRI is minimally as accurate as rectofistulography for the evaluation of ARM. This MRI protocol can probably replace rectofistulography in the preoperative workup.

B-0894 11:42

The role of functional MR urography (fMRU) in the evaluation of unilateral hydronephrosis in children

A. Ntoulia, L. LeCompte, M. Adeb, D. Khrichenko, S. Lambert, P. Casale, K. Darge; *Philadelphia, PA/US (ntouliaa@email.chop.edu)*

Purpose: To evaluate with functional MR Urography (fMRU) kidneys with unilateral hydronephrosis (HN) in children.
Methods and Materials: Children with unilateral HN who underwent fMRU were retrospectively evaluated. Kidneys with HN were morphology described in conventional MR sequences, and functional indices were calculated in the dynamic sequences following gadolinium administration and compared with the contralateral normal kidney in the same patient.
Results: 34 patients, 20 males-14 females, mean age 3.9 years (range: 0.1-17.6 years) were included for analysis. The mean intrarenal-pelvis, extrarenal-pelvis and calyceal diameters of kidneys with HN were 21.4 mm (±6 mm), 31.2 mm (±8.3 mm) and 10.5 mm (±2.3 mm), respectively. In kidneys with HN, morphological evaluation revealed decreased corticomedullary differentiation (n=9, 26%), parenchymal thinning (n=22, 65%), increased signal intensity in T2-weighted-sequences (n=10, 29%), contrast swirling (n=7, 21%), urine-contrast level (n=26, 76%) and crossing vessel (n= 9, 26%). Additionally, in kidneys with HN the mean calyceal transit time was 2:43 (range: 1:39-5:06), the mean renal transit time was 9:58 (range: 2:50-33:57) and the mean time-to-peak was 3:12 (range: 1:49-7:38), all significantly increased compared to normal kidneys. There was 12.3% mean difference in patlak differential renal function (pDRF) between kidneys with HN and the contralateral normal kidneys. FMRU determined that 25/34 kidneys with HN were obstructed and surgical intervention was performed in 23/25.
Conclusion: Optimal comparison between kidneys with HN and the contralateral normal kidneys demonstrated that the combination of morphologic and functional fMRU parameters enables differentiation between obstructed and non-obstructed kidneys. pDRF appears to be the most important index for functional evaluation.

B-0895 11:50

Contrast-enhanced voiding urosonography with a second-generation ultrasound contrast agent for diagnosis of vesicoureteric reflux in 1350 children: the experience of a single center

F. Papadopoulou[1], A. Ntoulia[2], K. Darge[2]; [1]*Thessaloniki/GR*, [2]*Philadelphia, PA/US (fpapadopoulou@hotmail.com)*

Purpose: To evaluate the diagnostic performance and safety of intravesical administration of a-second-generation ultrasound contrast-agent (UCA) for the diagnosis of vesicoureteric reflux (VUR) in children.
Methods and Materials: 1350 children (587boys/763 girls, mean-age 2.6y, range 15d-17y) with 2720 pelvi-ureter-units, underwent contrast-enhanced voiding urosonography (ceVUS) to rule out VUR and urethral pathology. A second-generation UCA (SonoVue®, Bracco, Milan) was administered intravesically through 5-8 F feeding-tube at a dose of 0.5 ml/bladder filling. Possible adverse-events were monitored during the examination and followed-up for 7 days after the ceVUS by phone-calls. Urine analysis and culture were

performed 3-5d before ceVUS in all children and 24-48h in any patient reported with adverse-events.
Results: VUR was detected in 450/1350 (33%) patients (162boys/288 girls). This was in 653 pelvi-ureter-units (reflux-grade distribution: grade I=1, grade II=276, grade III=266, grade IV=100, grade V=10). The urethra was normal in all children. Mean duration of examination was 14±7 min, including urethral imaging. Minor adverse-events were reported in 45 (3.3%) children. These included dysuria (n=39), abdominal pain (n=2), increased frequency of micturition (n=1), vomiting (n=1), perineal irritation (n=1), and urinary-tract-infection after ceVUS (n=1). The onset of adverse-events were subacute in 92% and delayed in 8% and were self-limited non-requiring hospitalization.
Conclusion: There were no serious adverse-events with intravesical use of SonoVue®. Only a few minor adverse-events were reported during ceVUS most likely due to catheterization process. Thus ceVUS with intravesical administration of a second generation UCA (SonoVue®) for VUR and urethral pathology detection is a safe and reliable diagnostic procedure in children.

10:30 - 12:00 **Room MB 3**

Cardiac

SS 1003b
Non-ischaemic myocardial disease

Moderators:
I. Carbone; Rome/IT
S.D. Rud; St. Petersburg/RU

B-0896 10:30
Late gadolinium enhancement in MRI for cardiomyopathies: a quantitative comparison of 2D and 3D acquisition
F. Morsbach, S. Gordic, M. Niemann, H. Alkadhi, R. Goetti, R. Manka; *Zurich/CH (fabian.morsbach@usz.ch)*

Purpose: To determine whether the quantification of myocardial fibrosis in patients with Fabry disease and hypertrophic cardiomyopathy (HCM) using a late gadolinium enhancement (LGE) single-breath-hold three-dimensional (3D) inversion recovery magnetic resonance (MR) imaging sequence is comparable with a clinically established two-dimensional (2D) multi-breath-hold sequence.
Methods and Materials: 40 consecutive patients (18 men; mean age 50±17) with either Fabry disease (n=18) or HCM (n=22) were enrolled in this prospective study. Studies were conducted on a 1.5-T clinical MR imaging system. Spatial resolution was the same for 3D and 2D images. Datasets were analysed for subjective image and quantitative evaluation of myocardial mass (grams), fibrotic mass (grams) and total fibrotic tissues percentage.
Results: There was no significant difference in subjective image quality between acquisitions for either disease (p=0.1 and p=0.3). In patients with Fabry, there were no significant differences in myocardial mass between 3D and 2D acquisition (p=0.55), as well as for fibrous tissue mass (p=0.89) and total fibrous percentage (p=0.67). Bland-Altman analysis showed good agreement between 3D and 2D datasets for myocardial mass, fibrous tissue mass, total fibrous percentage. In patients with HCM, there was no significant differences in myocardial mass between 3D and 2D acquisition (p=0.48), as well as for fibrous tissue mass and total fibrous percentage (p=0.67). Bland-Altman analysis showed good agreement between 3D and 2D datasets for myocardial mass fibrous tissue mass, total fibrous percentage. Acquisition time was significantly shorter for 3D sequences (25s) as compared to 2D sequence (349s, $p < 0.001$).
Conclusion: 3D LGE imaging enables comparable quantification of fibrous myocardial tissue compared to a 2D sequence at a faster acquisition rate.

B-0897 10:38
Prognostic value of late enhancement in cardiac magnetic resonance in patients with dilated cardiomyopathy: systematic review and meta-analysis
F. Secchi, E. Resta, P.M. Cannaò, M. Petrini, G. Di Leo, F. Sardanelli; *Milan/IT (francescosecchimd@gmail.com)*

Purpose: To systematically review the prognostic value of late gadolinium enhancement (LGE) at cardiac magnetic resonance (CMR) in patients with dilated cardiomyopathy (DCM).
Methods and Materials: A literature search was performed on Medline and Embase for original articles estimating the LGE prognostic value in patients with DCM. Original articles had to assess mortality for cardiac and non-cardiac causes, sudden cardiac death, sudden death avoided, and hospitalization for cardiac failure. Heterogeneity (I2) was evaluated using the Cochrane Q statistics: p-value < 0.100 were considered significant. Pooled odd ratio (OR) and 95% confidence interval (CI: 95%) were calculated using Comprehensive Meta Analysis.
Results: Out of 691 articles initially retrieved, 6 prospective clinical trials were selected for a total of 1,017 patients. All analyzed studies were performed using a 1.5-T MR unit. LGE was positively correlated with all considered clinical outcomes. Pooled mortality for all causes showed I2=33% (p=0.202) and OR=2.6 (95%CI 1.7–4.0; $p < 0.001$); hospitalization for cardiac failure showed I2=24% (p=0.257) and OR=2.7 (95%CI 1.8–4.1; $p < 0.001$); sudden cardiac death showed I2=0% (p=0.895) and OR=3.2 (95%CI 1.6–6.3; p=0.001); death for cardiac causes showed I2=0% (p=0.782) and OR=3.5 (95%CI 2.2–5.7; $p < 0.001$); sudden death avoided showed I2=0% (p=0.815) and OR=6.3 (95%CI 3.4–11.6; $p < 0.001$).
Conclusion: LGE at CMR in patients with CMD is closely related to a more negative prognosis if compare to patients without LGE.

B-0898 10:46
Extent of myocardial fibrosis by LGE, pre- and post-contrast T1 and ECV in patients with hypertrophic cardiomyopathy referenced to normal appearing myocardium or healthy volunteers
M. Avanesov, D. Säring, M. Patten, U.K. Radunski, K. Muellerleile, C. Stehning, E. Tahir, G. Adam, G. Lund; *Hamburg/DE (m.avanesov@uke.de)*

Purpose: Evaluation of myocardial fibrosis using pre- and post-contrast T1, ECV and LGE in patients with hypertrophic cardiomyopathy (HCM) referenced to normal appearing myocardium and to normal values of healthy volunteers.
Methods and Materials: CMR was performed in 21 patients with HCM (56±4.6years,10 women). Myocardial lesions were assessed on 3 representative short axes of the apex, center and basis of the left ventricle (LV) by LGE-images, pre- and post-contrast T1 maps and ECV maps. Size of fibrosis was quantified in percent of LV myocardium by a threshold method relative to normal appearing myocardium and relative to normal values assessed from 20 healthy volunteers on T1 and ECV maps.
Results: Extent of fibrosis relative to normal appearing myocardium was 20±15%LV on LGE images and 17±16%LV on ECV maps (p=0.49). Smaller fibrosis sizes were found on native T1maps with 14±12%LV (p=0.017) and on post-contrast T1maps with 11±08%LV (p=0.02). Referring to normal values of healthy volunteers size of myocardial fibrosis was significantly lager with 35±4%LV on native T1, 49±26%LV on post-contrast T1 and 61±16%LV on ECV maps compared to values referenced to normal appearing myocardium ($P < 0.01$).
Conclusion: Referring to normal appearing myocardium similar fibrosis sizes were obtained by LGE and ECV, but smaller fibrosis sizes were measured by native and post-contrast T1. Significantly larger fibrosis sizes were found with all mapping techniques when measurements were referenced to normal values of healthy volunteers, indicating a much larger fibrosis burden in HCM patients than currently observed with LGE imaging.

B-0899 10:54
Prognostic CMR parameters for heart failure and arrhythmias in large cohort of well treated thalassemia major patients
C. Tudisca[1], A. Meloni[2], E. Grassedonio[1], M. Restaino[3], F. Terrazzino[1], C. Argento[4], N. Vallone[5], M. Midiri[1], A. Pepe[2]; [1]*Palermo/IT*, [2]*Pisa/IT*, [3]*Taranto/IT*, [4]*Agrigento/IT*, [5]*Catania/IT (chiaratudisca@gmail.com)*

Purpose: Cardiac complications are the main cause of death in thalassemia major (™) patients. Cardiovascular Magnetic Resonance (CMR) plays a key role in their management, assessing myocardial iron overload (MIO), biventricular function, atrial dimensions, and myocardial fibrosis (MF). We evaluated the predictive value of CMR parameters for heart failure (HF) and arrhythmias.
Methods and Materials: We followed prospectively 487 ™ patients (29.5±9.0 years;222 males) free of a cardiac complications at the first CMR.All prognostic variables associated with the outcome at the univariate Cox model were placed in the multivariate model and were ruled out if they did not significantly improve the adjustment.
Results: Mean follow-up time was 58±18 months. We recorded 19 episodes of HF. Male sex (MS), heart iron, ventricular dysfunction (VD), ventricular dilation, atrial dilation (AD), and MF were significant univariate prognosticators. In the multivariate analysis the independent predictive factors were an homogeneous pattern of MIO (compared to no MIO) (HR=5.81, 95%CI=1.42-23.74, P=0.014), MF (HR=4.93, 95%CI=1.71-14.71, P=0.003) and VD (HR=3.45, 95%CI=1.19-9.98, P=0.022).Arrhythmias occurred in 19 patients. MS, AD and VD were significant univariate prognosticators. In the multivariate analysis the independent predictive factors were MS (HR=3.17, 95%CI=1.02-9.87, P=0.047) and AD (HR=3.07, 95%CI=1.14-8.23, P=0.026).Serum ferritin and liver iron were not predictive factors for HF or arrhythmias.
Conclusion: We detected few cardiac events thanks to a MR-guided, patient-specific adjustment of the chelation therapy.Severe and homogeneous MIO, MF and VD identify patients at high risk of HF. Heart T2* doesn't have any power in predicting arrhythmias while MS and AD are independent prognosticators.

B-0900 11:02

Isolated left ventricular non-compaction (LVNC) in patients with b-thalassemia: 41 months follow-up with cardiac magnetic resonance

M. Gatti, R. Faletti, A. Veltri, A. Piga, F. Longo, G. Gandini, R. Bonamini; *Turin/IT (marcogatti17@gmail.com)*

Purpose: Analyse the clinical and the radiological evolution of LVNC in patients with b-thalassemia evaluated with cardiac magnetic resonance (CMR).
Methods and Materials: Between September 2007 and January 2013, 628 patients with b-thalassemia underwent CMR, evaluating LV end-diastolic (LVEDV) and end-systolic (LVESV) volumes, LV ejection fraction (LVEF), cardiac output and heart-liver T2*. Forty-seven patients (7.5%) fulfilled the CMR the criteria proposed by Petersen and Jacquier for LVNC: NC/C = 2.50-4.18 mean 4.03 and NC/(NC+C)% = 23%-49%, mean 34%. None of them had neuromuscular disorder or congenital heart disease. Each patient had laboratory measurements for total haemoglobin, serum ferritin and alanine aminotransferase levels. The liver iron concentration was also measured noninvasively by a SQUID and Liver stiffness was evaluated by transient elastography. A full physical examination was performed and all patients underwent ECG. Thirty-three patients with CMR diagnosis of LVNC (48% males, mean age 31.3±6.7y) were re-evaluated with the same protocol after a period of 6-61 months (mean 41).
Results: All patients with LVNC at baseline were still alive at the end of follow-up. None of those patients had evidence of ventricular dysfunction, arrhythmias or thromboembolic events. The CMR quantitative parameters showed high correlation at baseline and at follow-up: LVEF (Base=52.3±5.5 Follow-up=54.6±5.0 p=0.89), LVEDV (Base=159.5±38.1 Follow-up=158.2±39.0 p=0.38). Quantitative estimation of NC remained unchanged during the follow-up (p=0.9).
Conclusion: Patients with b-thalassemia have a higher prevalence of LVNC than general population. There weren't changes in CMR parameters and there wasn't evidence of clinical adverse events in those patients during the follow-up.

B-0901 11:10

Isolated non-compaction of the left ventricle: correlation between clinical and genetic manifestations of the disease and cardiac MR parameters

E.A. Mershina, O. Larina, V. Sinitsyn, R. Myasnikov, M. Kharlap, O. Kulikova, S. Boytsov; *Moscow/RU (Larina-Olga@yandex.ru)*

Purpose: To correlate clinical manifestations and results of CMRI in patients with isolated non-compaction of the left ventricle.
Methods and Materials: 22 patients with verified non-compaction cardiomyopathy were recruited in the study in 2012-2014. Initial clinical manifestations of the disease were heart failure symptoms or severe rhythm disturbances. Genetic analysis was performed in all patients. CMR was performed with 1.5 T-scanner using standard cardiac protocol for assessment of cardiac morphology, function and myocardial viability.
Results: 55% pts had symptoms of heart failure, 59% pts suffered from frequent runs of ventricular tachycardia, and 18% pts experienced episodes of paroxysmal atrial fibrillation. 31% pts had episodes of syncope. LGE MRI detected signs of focal myocardial fibrosis in 27% pts. Genetic analysis revealed gene mutations in 3 pts in genes MYH7, DMD, FLNA. Most of the patients had significant decrease of LV systolic function (mean ejection fraction was 31±14%) and dilatation of LV (mean EDS 66.3±8.5 mm). Involvement of LV apical and/or mid-ventricular segments (predominantly, anterior and lateral) was found in all cases. Significant correlation was found between indexed end-diastolic volume (EDV) and myocardial mass (MM) of compacted and non-compacted layers of LV myocardium ($r=0.84$, $p < 0.05$ and $r=0.83$, $p < 0.05$, corr). The correlation between LV end-diastolic size, LV ejection fraction and trabeculation index was not found.
Conclusion: Non-compaction cardiomyopathy manifests itself with heart failure and severe rhythm disturbances. Some gene mutations are typical for this group of patients. CMRI revealed significant correlation between indexed EDV and MM of compacted and non-compacted layers of LV myocardium.

B-0902 11:18

Semiquantitative assessment of low and high b value DWI for detecting myocardial edema in acute myocarditis

J. Broncano[1], A. Luna[2], T. Martin Noguerol[2], J. Sanchez-Gonzalez[3]; [1]*Córdoba/ES*, [2]*Jaen/ES*, [3]*Madrid/ES (j.broncano.c@htime.org)*

Purpose: Evaluate the clinical feasibility and accuracy of semiquantitative analysis of DWI with low and high b value in patients with acute myocarditis compared to T2 STIR.
Methods and Materials: 18 patients with confirmed acute myocarditis and 9 control subjects were submitted to cardiac MRI. The cardiac MRI protocol included short-axis black blood T2 STIR, delayed enhancement and DWI. MRI studies were performed using a 1.5T Magnet. We performed a whole cardiac SSh EPI DWI sequence including three b values (0, 50 and 300 mm2/s) with cardiac trigger, acquired in diastole and apnea. Semiquantitative analysis of the ADC map by plotting ROIs on areas of inflamed myocardium showing high signal intensity on both b50 and b300 mm2/s (ADCb300) and in those regions with high signal intensity on b50 mm2/s that loss signal at b300 mm2/s (ADCb50). The ratio of signal intensity of T2 STIR myocardium vs pectoral muscle (T2 Ratio), ADCb50 Ratio (ADCb50/ADCpectoral) and ADCb300 Ratio (ADCb300/ADCpectoral) were obtained.
Results: Significant differences between patients with acute myocarditis in comparison to normal controls were found in T2 Ratio (2.73 ± 0.68 vs. 1.57 ± 0.36: $p < 0.001$) and ADCb300 Ratio (3.15 ± 1.09 vs. 2.18 ± 1.04; p: 0.015). ROC curves revealed a high area under the curve of T2 Ratio (0.975; $p < 0.001$) and ADCb300 Ratio (0.790; p: 0.016).
Conclusion: DWI (ADCb300 Ratio) detect myocardial edema in a similar manner to T2 STIR. Contrarily to ADCb50 Ratio, ADCb300 Ratio obtained significant differences among patients with acute myocarditis compared to control group.

Author Disclosures:
J. Sanchez-Gonzalez: Employee; Philips Healthcare. Equipment Support Recipient; Philips Healthcare.

B-0903 11:26

Cardiac diffusion-weighted MR imaging in acute myocarditis: initial experience

J.-P. Laissy, V. Gaxotte, A. BenDriss, J.-M. Serfaty; *Paris/FR (jean-pierre.laissy@bch.aphp.fr)*

Purpose: To prospectively determine diffusion-weighted cardiac MR imaging (DWI) patterns and accuracy in patients with acute myocarditis, by comparison with comprehensive cardiac magnetic resonance (CMR) sequences.
Methods and Materials: Thirty-eight consecutive patients referred for CMR with a clinical presentation suggestive of acute myocarditis were included. MR examinations were performed at rest and included DWI, black-blood fat-suppressed T2-weighted, first-pass perfusion, and delayed-enhancement (DE) sequences. Abnormal DWI areas were matched to abnormal DE areas. The apparent diffusion coefficient (ADC) was measured in abnormal DE (ADE) areas and compared to neighbouring normal myocardium (NNM) at DE and remote normal myocardium (RNM) areas.
Results: Qualitative assessment of DWI compared with DE images yielded a sensitivity of 92% for the detection of myocarditis. DWI patterns were significantly correlated with DE patterns, with focal or multifocal nonsegmental nonsubendocardial hypersignals (DWI, 2.78 ± 0.62 segments vs DE, 3.36 ± 0.63 segments, p = ns), predominantly in an inferolateral location. Segment-by-segment comparison showed a high level of correlation ($y = (0.91)x + 0.47$, $r = 0.9049$). The absolute ADCs of ADE area (0.00751±0.00042 mm2/s) and NNM close to ADE area (0.00824±0.0004 mm2/s) were not significantly different, whereas they differed significantly from those of RNM (0.00928±0.00049 mm2/s) as well as relative ADCs.
Conclusion: Myocardial involvement in myocarditis seems to be more extensive, on the basis of absolute ADC measurements at DWI imaging, than expected at DE imaging. Hence, this sequence should help better appreciate the real extent of myocardial injury in myocarditis.

B-0904 11:34

Prognostic value of different cardiac magnetic resonance (CMR) patterns in patients with acute myocarditis

M. Cava, G. Benedetti, D. Palumbo, G. Fragasso, A. Esposito, A. Del Maschio, F. De Cobelli; *Milan/IT (cava.mariangela@hsr.it)*

Purpose: CMR is employed as non-invasive diagnostic tool in acute myocarditis, but its accuracy may differ according to clinical presentations. Our aim was to evaluate CMR presentation at diagnosis according to clinical setting and its predictive role as prognostic imaging marker.
Methods and Materials: 59 pts (43±13y) with clinical and CMR diagnostic criteria for myocarditis were enrolled in this prospective study. CMR protocol included biventricular function, myocardial edema (T2-STIR) and late gadolinium-enhancement (LGE). 38 pts underwent clinical FU (34±21 months); in 20 pts CMR was performed at 6-months-FU.
Results: According to prevalent edema and LGE localization and distribution, 3 pattern were identified: lateral subepicardial (LS 48%), septal mesocardial (SM 40%) and diffuse patchy (P 12%). Patients were divided according to clinical presentation: 43 with infarct-like symptoms (73%), 11 arrhythmias (25%) and 5 both. SM was significantly associated with arrhythmic presentation (p=0.042). LS showed significantly higher CK-MB (p=0.016) and Troponin (p=0.003) values, with higher T2-ratio (p=0.05). P had lower LVEF% (p=0.005) and higher LGE% (p=0.05). At FU CMR edema was still present in 30% pts; 75% pts showed LGE, more persistent when septal (p=0.038). LGE% at CMR at diagnosis showed inverse relationship with follow-up LVEF

(p=0.041). Septal damage pattern showed to be related with arrhythmic events during FU period as well (p=0.029).
Conclusion: CMR helps to characterize recurrent myocardial damage patterns in acute myocarditis and their evolution pathway, in connection with different clinical presentations. In particular, in pts with arrhythmic events CMR identified frequent damage on septal wall.

B-0905 11:42

Multi-parametric myocardial mapping of patients with Anderson Fabry disease: regional distribution of changes in T1, T2 relaxation and ECV
T.C. Walter[1], G. Knobloch[1], A. Sandek[1], V. Ding-Reinelt[1], P. Freyhardt[1], A. Krebs[2], T. Denecke[1], B. Hamm[1], M. Makowski[1]; [1]*Berlin/DE*, [2]*Prague/CZ (thula.walter@charite.de)*

Purpose: Anderson Fabry disease (AFD) is a rare X-linked disorder affecting associated with increased intracellular glycosphingolipid deposition, which decreases myocardial T1-relaxation times. The aim of this study was to evaluate regional changes in T1/T2 relaxation and extracellular volume fraction (ECV) in patients with AFD compared to patients with hypertrophic cardiomyopathy and controls.
Methods and Materials: In this prospective study, 16 patients with genetically confirmed AFD, 8 patients with hypertrophic cardiomyopathy (HCM) and 8 healthy volunteers were included. The ethics committee approved the study. T1 Mapping was performed using ECG triggered Modified Look-Locker Inversion Recovery (MOLLI). A T2-prepared (T2p) TrueFISP sequence was used to produce single-shot T2-weighted images with different T2 preparation times to calculate T2 maps. Pre-contrast T1 and T2-mapping and post-contrast T1-mapping was performed on a 1.5-T magnet in addition to standard cardiac imaging protocols. Images were analysed based on the AHA-17-segment model. T1 and T2 values were matched with a 2-tailed t-test for each group.
Results: In patients with AFD, significant T1 relaxation shortening was observed in the septal and in anterior and inferior segments compared to patients with HCM and healthy volunteers (920±85 vs.1008±53 vs.988±50 ms, $p < 0.05$). In regions adjacent to late enhancement, significantly prolonged T2-relaxation was measured in patients with AFD and HCM vs. controls (59±6 vs.62±6 vs.52±6 ms, $p < 0.05$). There was no significant difference ($p > 0.05$) in ECV.
Conclusion: Non-contrast T1/T2 mapping techniques are promising novel tools for the identification of patients with AFD allowing the quantification of myocardial glycosphingolipid accumulation and inflammation. These tools could improve follow-up and assessment of response to treatment compared to conventional MRI techniques.

Author Disclosures:
B. Hamm: Other; Research Consultant, Bayer AG Research Consultant, Toshiba Corporation Stockholder, Siemens AG Stockholder, General Electric Company Research Grant, Toshiba Corporation Research Grant, Koninklijke Phi. **M. Makowski:** Research/Grant Support; DFG Grant.

10:30 - 12:00 **Room MB 4**

Musculoskeletal

SS 1010b

Hand, upper extremity

Moderators:
I. Beggs; Edinburgh/UK
E. Drakonaki; Iraklion/GR

B-0907 10:30

Diagnostic work-up of scapholunate dissociation: cine-MR imaging as a new approach
E. Rathmann, I. Langner, K. Rebecca, S. Langner, N. Hosten; *Greifswald/DE (rathmanne@uni-greifswald.de)*

Purpose: Posttraumatic injuries of the scapholunate ligament (SLL) may cause scapholunate dissociation (SLD) which bears a high risk of osteoarthritis. Dynamic instability can only be assessed by cineradiography. The aim of the study was to evaluate diagnostic accuracy of cine-MRI for the assessment of SLD in comparison to arthroscopy.
Methods and Materials: 23 patients with suspected SLD underwent static MRI and cine-MRI of wrist at 3 T. Cine-MRI and cineradiography were performed from extreme radial to ulnar abduction and during clenching/unclenching of the fist with a temporal resolution of 5 and 12.5 images/s respectively. Afterwards all patients underwent arthroscopy. Images were evaluated by one hand surgeon and one experienced MSK radiologist blinded for intraoperative findings. Evaluation criteria were: scapholunate (sl) distance, sl alignment, synchronous motion of carpal bones and continuity of Gilula lines. Sensitivity, specificity, positive (pLR) and negativ (nLR) likelihood ratio for cine-MRI with respect to intraoperative findings were calculated. A p-value < 0.05 was considered statistically significant.
Results: Cine-MRI was of diagnostic quality in all patients. There was no statistical significant difference between cineradiography and cine-MRI (p=0.081). SLD was correctly diagnosed in 5 patients and excluded in 16 patients. SLD was diagnosed false positive and negative in one case each. Sensitivity and specificity of cine-MRI for SLD was 83% and 94%, respectively. PLR and nLR was 13.83 and 0.18 respectively.
Conclusion: Cine-MRI has a high sensitivity and specificity for the diagnosis of SLD. It can be easily integrated in conventional MR imaging and may eliminate the need for cineradiography.

B-0908 10:38

Ultra-high field MR-microscopy of fetal forearm - ex vivo assessment of the ossification patterns
P.-C. Krüger[1], I. Langner[1], T. Stahnke[2], O. Stachs[2], S. Langner[1], N. Hosten[1]; [1]*Greifswald/DE*, [2]*Rostock/DE (paul-ch.krueger@uni-greifswald.de)*

Purpose: Evaluation of fetal ossification requires histological workup an therefore can only be performed ex vivo. Ultra-high field MR imaging allows the acquisition of images with a spatial resolution within µm-range (MR-microscopy, MRM). The aim of the study was to correlate MRM of fetal ossification with conventional histology.
Methods and Materials: MRM was performed in 8 ex vivo fetal forearms between 8 and 12 gestational week using a 7.1T MR system (ClinScan, Bruker, Ettlingen) with a 1 cm small loop coil for signal detection. A 3D T2-weighted sequence with a spatial resolution of isotropic 39 µm was acquired in all specimen. Imaging time was 17 min per specimen. Afterwards all specimen underwent conventional histological work-up with HE stain and a dedicated stain for evaluation of ossification centers.
Results: Ossification of the foreamr can be visualized starting at the 8 gestational week, whereas ossification of the metacarpal bones can be visualized at the 10 gestational wek within the metaphysis. Ossification centers of the carpal bones, however, can be visualized at the 8 gestational week. There was excellent correlation between MRM and conventional histology.
Conclusion: MRM allows the non-invasive assessment of fetal ossification of the forearm with excellent correlation to conventional histology. With increasing availability of ultra-high field scanners MRM may play an important role in preclinical research.

B-0909 10:46

Accelerated diffusion tensor imaging of the median nerve using simultaneous multi-slice echo planar imaging with blipped CAIPIRINHA
L. Filli, M. Piccirelli, D. Kenkel, A. Boss, G. Andreisek, V.M. Runge, R. Guggenberger; *Zurich/CH (lukas.filli@usz.ch)*

Purpose: To investigate the feasibility of accelerated diffusion tensor imaging (DTI) of the median nerve using simultaneous multi-slice echo planar imaging (EPI) acquisition with blipped CAIPIRINHA.
Methods and Materials: After institutional review board approval, the median nerves of eight healthy volunteers (mean age, 29.4 years) were examined at 3.0 T (SOMATOM Skyra, Siemens Healthcare, Erlangen, Germany) using a 16-channel hand/wrist coil. A standard EPI sequence was performed (b-value, 1000 s/mm2) without acceleration as well as with 2-fold and 3-fold slice acceleration. The fractional anisotropy (FA) and mean diffusivity (MD) were measured in all three acquisitions by two independent readers. Intra-class correlation coefficients (ICCs) were calculated to assess the inter-observer reliability. Quality of median nerve tractography (number of tracks, average track length, track homogeneity and anatomical accuracy) was compared between the three acquisitions using multivariate ANOVA and Kruskal-Wallis test.
Results: Acquisition time was 6:08 min for standard DTI, 3:38 min for 2-fold acceleration and 2:31 min for 3-fold acceleration. Inter-observer reliability was almost perfect (FA: ICCs 0.801-0.871; MD: ICCs 0.886-0.931). No significant differences were found between the three acquisitions in terms of FA (standard DTI: 0.620±0.058; 2-fold acceleration: 0.642±0.058; 3-fold acceleration: 0.644±0.061; p-values≥0.217) and MD (standard DTI: 1.076±0.080 mm2/s; 2-fold acceleration: 1.016±0.123 mm2/s; 3-fold acceleration: 0.979±0.153 mm2/s; p-values≥0.074). A 2-fold slice acceleration yielded similar tractography quality compared to standard DTI (p-values> 0.05). With 3-fold slice acceleration, however, the average track length and track homogeneity decreased significantly (p-values=0.006-0.041).
Conclusion: Accelerated DTI of the median nerve is feasible with a 2-fold acceleration yielding similar results as standard DTI.

Author Disclosures:
G. Andreisek: Grant Recipient; Siemens. **V.M. Runge:** Grant Recipient; Siemens.

B-0910 10:54

Evaluation of lesions of the internal ligaments of the wrist: conventional magnetic resonance imaging vs MR arthrography

H.A. Kamal; *Cairo/EG (hebakamala@yahoo.com)*

Purpose: The aim of this study is to assess the diagnostic value of direct MR arthrography compared to conventional MR imaging in the diagnosis of different pathologic entities affecting the internal ligaments of the wrist, mainly the scapholunate and lunotriquetral ligaments.
Methods and Materials: This study included 51 patients complaining of chronic wrist pain. Conventional MRI and MR arthrography (MRA) were done in all cases.
Results: A comparison of the sensitivity of conventional MRI versus MRA was done by correlating the final diagnosis of each modality with the results of arthroscopy. Regarding complete SLL tears, MRI revealed a SEN, SPE and ACC of 61.54%, 96.77%, and 86.36%, while MRA showed a SEN, SPE and ACC of 92.31%, 100%, and 97.73%, respectively, partial SLL tears, un-enhanced MRI revealed SEN, SPE and ACC of 10%, 94.12%, and 75%, while MRA showed 66.67%, 85.71%, and 81.82%, respectively, complete LTL tears un-enhanced MRI revealed a SEN, SPE, and ACC of 25%, 100%, and 79.5%, respectively, while MRA showed 91.67%, 100%, and 97.73%, respectively.
Conclusion: MR arthrography is a potent additional tool facilitating the diagnosis of different pathologic entities affecting the major internal ligaments of the wrist joint and helps to reduce arthroscopic interventions.

B-0911 11:02

Development of a statistical 3D modell of the intact distal radius: preliminary results

J. Binder[1], S.F. Baumbach[1], F. Mück[1], A. Synek[1], Y. Chevalier[1], G. Langs[2], L. Fischer[2]; [1]*Munich/DE*, [2]*Vienna/AT*
(sebastian.baumbach@med.uni-muenchen.de)

Purpose: We are currently lacking detailed knowledge of the morphology and morphometry of the intact distal radius, which would help better understanding fracture patterns and develop novel osteosynthetic materials. The aim of this study was to develop a 3D statistical model of the intact distal radius and conduct a first morphometric analysis.
Methods and Materials: 91 consecutive clinical QCT images of healthy radii were segmented, 3D surface models generated and statistical shape models built. They then were rigidly registered to a common template and reference points were automatically extracted. Three cut planes were defined perpendicular to the main reference axis: just proximal to the articular surface, at the Tuberculum Listerii and in-between those two points. At each cut plane, bone area and central width and depth were derived. Data analysis comprised of general statistics, a Mann-Whitney-U Test, and Bonferroni correction ($p < 0.004$).
Results: Statistical 3D Models based on 46 left and 45 right radii, 43% female, with a mean age of 41 ± 18 years were generated. Analyzing the shape model modes revealed higher shape variance in left radii independent from gender (female/male; left: 15/18, right: 4/5). All assessed plane parameters were significantly greater in male then in female patients ($p \leq 0.001$). No significant side differences could be found.
Conclusion: We herein present the first statistical 3D model of the intact distal radius and a preliminary analysis. Further analysis is needed to describe and analyze inter-radii morphometric dependencies.

B-0912 11:10

Can ultrasound replace MRI in assessment of nerve entrapment in osteofibrous tunnels in the upper extremity

A.M. Abdel Magied, Y.M. Tohamy, T. Taymour, L. Adel; *Cairo/EG*
(asmaa_dr79@hotmail.com)

Purpose: To assess the efficiency of US compared to MRI in assessment and diagnosis of the possible aetiologies of nerve entrapment in the osteofibrous tunnels of the upper extremity.
Methods and Materials: This study included forty patients; 28 females, 12 males with age ranging from 27 to 63 years (mean age 47 years). Thirty-three patients were complaining of chronic refractory unexplained wrist pain, three patients were complaining of medial elbow pain, sensory symptoms in the ring and little fingers, three patients were complaining of pain in the posterior aspect of the shoulder, one patient was complaining of sensory deficits over the ulnar portion of the palm and wasting of the hypothenar eminence. All patients were subjected to electrophysiologic tests, conventional unenhanced MRI and ultrasonographic examination. Surgical relief was done for thirty-two patients while eight patients had medical treatment and physiotherapy.
Results: Ultrasound was overall positive among 82.5% of the studied cases; while 17.5% of the studied cases were negative and border line cases. While positive MRI represents 85% of the studied cases. Comparing the ultrasound results to the MRI, true positive results were present in 77.5% of the cases. Ultrasound shows high positive predictive value 89%, sensitivity 91% and overall accuracy 87.5% but shows low negative predictive value 58% and specificity 67% in diagnosis of nerve entrapment.
Conclusion: High-resolution ultrasonography can be used as an ancillary method to the electrophysiologic tests in diagnosing the patients in whom the median, ulnar or suprascapular nerves are compressed at the osteofibrous tunnels.

B-0913 11:18

Possibilities of magnetic resonance imaging in diagnosis of shoulder joint instability

A. Filimonova, I. Lisachenko, I. Znamenskiy, A. Uchevatkin; *Moscow/RU*
(uchevatkin@mail.ru)

Purpose: To define the diagnostic value of MRI (sensitivity and specificity) in detection of instability of the shoulder Joint.
Methods and Materials: Study population consisted of 60 patients (age 22-65 years; male/female 75%/25%) admitted to the hospital with pain in the shoulder and limited mobility of the shoulder joint. The imaging of the shoulder joint was done with 1.5-T MR scanner. The results of MRI have been correlated with those of arthroscopy.
Results: The capsule joint tears were supposed only in three cases (5%) that set the priority of MR arthrography. 54% articular cartilage lesions were verified with the help of arthroscopy and only 33%, according to MRI results. Sensitivity and specificity of MRI for detection of shoulder joint injuries: full-thickness tears of supraspinatus tendon (ST) - 86% и 84%, partial-thickness tears of ST- 45% и 89%, partial-thickness tears of FL 80% и 64%, full-thickness tears of FL (avulsion) - 90% и 86%, capsule joint tears - 4% и 99%, Hill-Sachs humeral head fractures - 98% и 96%, synovitis - 98.5% и 99%, glenoid articular cartilage - 55% и 78%.
Conclusion: In spite of the submitted variability of diagnostic value, MRI has high sensitivity and specificity in diagnosis of traumatic and degenerative diseases of the shoulder joint. MRI is an effective tool for determination of the future treatment strategy (conservative or operative) and interventions planning (arthroscopy or open surgery). Underestimation of articular cartilage lesions and capsule joint tears are the most frequent reasons of low accuracy of MRI.

B-0914 11:26

High resolution ultrasound in evaluation of bifid median nerve in carpal tunnel syndrome in Indian population

S. Sripathi, D. Bansal, A. Ayachit, R. Kadavigere; *Manipal/IN*
(smitis11@hotmail.com)

Purpose: 1. Evaluate role of ultrasound in patients with bifid median nerve (BMN) in CTS based on difference in cross-sectional area (ΔCSA) of the nerve at carpal tunnel (CSAc) level, and more proximally (CSAp) at pronator quadratus muscle. 2. To compare ΔCSA of BMN in patients with CTS and control population.
Methods and Materials: 139 wrists of 89 patients with symptoms suggestive of CTS were examined who underwent nerve conduction study. 72 wrists of age matched controls were included. Bifid median nerve branches proximal to the distal radio-ulnar junction. The subjects were examined in sitting position with arm extended, wrist resting on a flat surface, forearm supine, and fingers semi-extended. CSA of median nerve was measured with electronic calipers around the margin of the nerve.
Results: Age ranged from 25 to 68 years, male: female ratio was 3:1. There were 20 wrists with BMN out of 139 wrists and 8 of these had persistent median artery (PMA). Amongst the controls, BMN was seen in 5 wrists. Receiver Operator Characteristic Curve showed a statistically significant correlation between ΔCSA and NCS with cut-off value of 2.3 mm2 giving a sensitivity of 76.9 % and specificity of 100%. Independent t-test to compare BMN dimensions at various levels showed higher cross sectional area in cases as compared to controls.
Conclusion: Ultrasound can evaluate anatomic variants like bifid median nerve, which have important surgical implications. As compared to the Caucasian population, our study shows lower cut-off values for bifid median nerve in CTS in Indian population.

B-0915 11:34

Prospective comparative analysis of ultrasound vs arthroscopy in evaluation of impingement syndrome and supraspinatus tear

N. Shetty[1], P.E. Chandy[1], M.D. Mahajan[1], G. K[2], N.P. Hegde[2], M. Shetty[1], A. Shetty[1], V. Ruprela[1]; [1]*Bangalore/IN*, [2]*Mangalore/IN (dr.neerajshetty@gmail.com)*

Purpose: To compare the sensitivity and specificity of ultrasound in evaluation of shoulder impingement with arthroscopy as the gold standard. To assess feasibility and performance of ultrasound in guiding supraspinatus surgery.
Methods and Materials: Prospective study of 40 patients with shoulder impingement was undertaken over a 2 year period. Evaluation of rotator cuff integrity was done by a single radiologist in the standard I and II view according to the modified Wiener and Seitz classification. Arthroscopy was done in patients with persistent symptoms within 4 weeks duration by a single surgeon. The two investigators were blinded to other's result.
Results: Rotator cuff assessment showed Type-1 cuff in 1 (3.4%), Type-2 in 7 (24.1%), Type-3 in 16 (55%), Type-4 in 3 (10%) and Type-5 in 2 (6%) patients. Out of 28 cases, 16 with partial thickness tear (PTT) had type-3 rotator integrity. More than 1.2 mm reduction in cuff thickness was seen in 28 patients (67.5%) -significant for PTT (P-0.0001). Of 32 patients with subacromial bursitis, 24 had PTT and 2 had full thickness tear (P-0.0001). Dynamic evaluation showed grade-2 abnormality in 30 (75%) and grade-1 in 8 (20%) (P-0.0001). Compared to arthroscopy; sensitivity, specificity, positive and negative predictive values for PTT were 85.5%, 75%, 82% and 98%, respectively.
Conclusion: Ultrasound can detect impingement syndrome and partial tear with high sensitivity and specificity, making it most cost-effective and non-invasive modality. Wide availability, comparability between contralateral shoulders and dynamic assessment are added advantages that provides a diagnostic efficiency at par with arthroscopy.

B-0916 11:42

A radiographic union score to assess healing in surgically treated long bone fractures: a feasibility study

V. Perlepe[1], P. Omoumi[2], A. Larbi[1], D. Putineanu[1], J.-E. Dubuc[1], T. Schubert[1], B. Vande Berg[1]; [1]*Brussels/BE*, [2]*Lausanne/CH (vasilikiperlepe@gmail.com)*

Purpose: Our study aimed at evaluating feasibility rate and interobserver agreement of a Radiographic Union Score (RUS) as a tool to quantify fracture healing.
Methods and Materials: Three radiologists and 3 orthopaedic surgeons separately analysed the radiographs of 63 nailed and 77 plated long bone fractures obtained at variable stages of healing. Visibility of the four cortical segments (n=560) of each fracture seen tangentially on the anteroposterior and lateral radiographs was determined. In case of non-visibility, readers specified the cause. In case of visibility, readers scored each cortical segment as follows: 1: bone discontinuity and no callus 2: bone discontinuity and callus 3: bone continuity and callus 4: bone continuity and no callus (RUS score).
Results: Feasibility rate of RUS ranged between 58% and 75% among readers. It was statistically significantly higher in nailed (90-97%) than in plated (31-56%) fractures ($p < 0.001$). Lack of cortical visibility was due to metal hardware superimposition in 79-95% of cases. ICC values for RUS were 0.80, 0.76 and 0.79 among surgeons, radiologists and all readers respectively.
Conclusion: The current study demonstrates variable feasibility rates of the RUS score depending on the type of stabilising hardware. Interobserver agreement when using the RUS score was substantial.

B-0917 11:50

Novel features of metabolic bone diseases in high-resolution imaging: reproducibility and validity of radiologic reading

S. Fussenegger, L. Fischer, M. Weber, F. Kainberger, M. DiFranco, G. Langs, J.M. Patsch; *Vienna/AT (sarah.fussenegger@pmu.ac.at)*

Purpose: High-resolution peripheral quantitative computed tomography (HR-pQCT) is used for skeletal research imaging. However, standardized reading techniques and comprehensive descriptions of microarchitectural features of metabolic bone diseases are missing. We have thus developed and validated a standardized approach for radiologic reading of HR-pQCT images.
Methods and Materials: 69 subjects underwent HR-pQCT (ultradistal radius). 51% had secondary osteopenia/osteoporosis (OP), 49% were controls (Co). We measured bone geometry, density and bone microarchitecture, including cortical porosity. We performed 3D-clustering of trabecular bone microarchitecture. Images were read by two operators assessing the following features: Trabecular defect clusters (TDC), trabecular trajectories (TT), variable cortical thickness (VCT), periosteal reactions (PR), and vascular calcifications (VC). Inter-operator agreement was calculated. We used Mann-Whitney u-tests to determine quantitative differences between cases with/without pre-defined features.
Results: Inter-operator agreement of radiologic features ranged between 85.7% (TDC) and 100% (PR, VC). Overall, 15.9% had TDC. 52.2% showed TT. 36.2% exhibited VCT. 1.4% had PR 4.3% demonstrated VC. In OP subjects, the distribution differed demonstrating 28.6 % TDC, 65.7%TT, 48.6% VCT, 2.9% PR and 8.6% VC. Subjects with TDC had lower trabecular density (-80.3%), greater trabecular spacing (+48.1%), greater heterogeneity (+70.7%) and poorer 3D-texture (low quality cluster +63.6%; all $p < 0.001$). Subjects with VCT demonstrated lower cortical thickness (-13.7%, p=0.006) and higher cortical porosity (+47.2%, p=0.043). Interestingly, cortical density was similar between subjects with and without VCT.
Conclusion: Radiologic reading of HR-pQCT images is feasible and reproducible. It complements quantitative analyses and might be clinically implemented in the radiologic assessment of metabolic bone diseases.

Saturday, March 7

10:30 - 12:00 **Room C**

Breast

SS 1402
Digital breast tomosynthesis: the new mammography

Moderators:
A.M.J. Bluekens; Breda/NL
R. Schulz-Wendtland; Erlangen/DE

K-21 10:30
Keynote lecture
R. Schulz-Wendtland; *Erlangen/DE*

B-0918 10:39
2D mammography dose vs digital breast tomosynthesis: comparison on a large dataset
A. Nitrosi, M. Bertolini, A. Corazza, C. Campari, P. Pattacini, G. Tondelli, V. Ginocchi, L. Ghiddi, M. Iori; *Reggio Emilia/IT (nitrosi.andrea@asmn.re.it)*

Purpose: To present the results obtained on a large sample of dosimetric data collected from 2D mammography (MG) and digital breast tomosynthesis (DBT).
Methods and Materials: Reggio Emilia Diagnostic Imaging Department (REDID) adopted a RIS-PACS integrated dose monitoring system ("Gray Detector") for CT, mammography and angiographic studies. REDID performs about 55,000 mammographic examinations per year on eleven identical mammography units (GE Senographe Essential). Three among these are equipped with DBT modules. MG offers three automatic exposure control modes with increasing dose levels ("dose", "standard" and "contrast"), while DBT uses a single mode. To date Gray Detector collected data on more than 430,000 MG views (CC, MLO) and more than 13,000 DBT ones.
Results: The breast compressed thickness median was 56 mm (mean 55 mm, mode 58 mm), while the median glandularity was 35% (mean 38%, mode 20%). The median values are comparable with the EUREF standard breast definition (45 mm PMMA equivalent).AGD medians were 1.2, 1.5 and 1.9 mGy respectively for AOP "dose", "standard" and "contrast". The median AGD for DBT was 1.6 mGy.
Conclusion: It has been verified that AGD is highly dependent on the compression level for both MG and DBT and on the AOP mode for MG.

B-0919 10:47
Impact on the recall rate of digital breast tomosynthesis (DBT) as an adjunct to digital mammography (DM) in the screening setting
L.A. Carbonaro[1], G. Di Leo[1], N. Verardi[1], R. Trimboli[1], G. Saguatti[2], C. Zuiani[3], M. Bazzocchi[3], F. Sardanelli[1]; [1]*San Donato Milanese/IT*, [2]*Bologna/IT*, [3]*Udine/IT (luca.carbonaro@gmail.com)*

Purpose: To estimate the recall rate of two-view DBT+DM compared with that of DM.
Methods and Materials: We enrolled women aged 40-59 recalled at screening mammography. They underwent two-view DBT. Two independent radiologists (R1,R2) evaluated DM and DM+DBT. They defined whether they would have recalled the patient having had DBT available. istopathological/negative triple assessment was the reference standard. McNemar test and Cohen kappa coefficient were used.
Results: Of 280 enrolled women, 107 (38%) were biopsied [41 (38%) cancers]. With DM, R1 would have not recalled 79 (28%) patients. Considering the remaining 201 (72%), 86 (43%) would have not been recalled with DBT. Diagnostic performance of DM+DBT: sensitivity 93%(38/41); specificity 67%(161/239); accuracy 71%(199/280); PPV 33%(38/116); NPV 98%(161/164). Three false negatives were 2 IDCs and 1 DCIS. With DM, R2 would have not recalled 44 (16%) patients. Considering the remaining 236 (84%) women, 138 (58%) would have not been recalled with DBT. Diagnostic performance of DM+DBT: sensitivity 88%(36/41); specificity 73%(174/239); accuracy 75%(210/280); PPV 36%(34/101); NPV 97%(174/179). Five false negatives were 3 IDC, 1 ILC, and 1 CDIS. With DM, R1+R2 would have not recalled 22 (8%) patients. Considering the remaining 258 (92%) women, 112 (43%) would have not been recalled with DBT. Diagnostic performance of DM+DBT: sensitivity 98%(40/41); specificity 55%(132/239); accuracy 61%(172/280); PPV 27%(40/147); NPV 99%(132/133). The false negative was an IDC. Difference between readers was significant for DM (p=0.001) but not significant for DM+DBT (p=0.500). Inter-reader agreement was fair (κ=0.234) and moderate (κ=0.459), respectively.
Conclusion: The recall rate of DM+DBT may be reduced by up to 40% if compared to DM.

Author Disclosures:
L.A. Carbonaro: Consultant; Im3d SpA.

B-0920 10:55
Comparison of digital breast tomosynthesis vs full field digital mammography for the detection and characterisation of calcifications in the breast
M. Bernathova[1], G. Nagl[2], K. Pinker-Domenig[1], P.A.T. Baltzer[1], P. Kapetas[1], T.H. Helbich[1]; [1]*Vienna/AT*, [2]*Horn/AT (maria.bernathova@meduniwien.ac.at)*

Purpose: To assess the value of digital breast tomosynthesis (DBT) for the detection and characterisation of calcifications in the breast and to compare it to full field digital mammography (FFDM).
Methods and Materials: One hundred and fifty consecutive patients who presented at our institution for assessment were included in this IRB approved prospective multireader multimodal observer performance study. All patients underwent FFDM (Siemens Mammomat Inspiration) and DBT (Siemens Mammomat Inspiration). All imaging data were reviewed by four readers independently. Image analysis included the presence of calcifications, breast density, BI-RADS calcification descriptors (distribution and morphology), visibility in both views, conspicuity of calcifications and assignment of a final BI-RADS assessment category. Additionally duration of assessment was recorded for DBT and FFDM. Sensitivity and specificity of DBT and FFDM and inter-reader agreement was calculated by means of ROC analysis and Kappa Agreement.
Results: Sensitivity of calcification detection of DBT (94.5%) was superior to FFDM (92.5%). There was no significant difference in the area under the curve (AUC) of BI-RADS assessment categories for DBT (0.833) and FFDM (0.829). One reader found a significantly higher visibility for calcifications in DBT (AUC=063, p=0.002). The other readers found that the conspicuity of DBT and FFDM was similar. Inter-reader agreement of DBT and FFDM was 0.356-0.494 for distribution, 0.240-0.383 for morphology and 0.498-0.546 for breast density and comparable for both modalities.
Conclusion: DBT is superior to FFDM for detection and comparable to FFDM for the characterisation of calcifications with similar inter-reader agreement.

B-0921 11:03
False positives (FP) in breast cancer screening with breast tomosynthesis (BT) vs digital mammography (DM)
K. Lang[1], M. Nergården[1], I. Andersson[1], A. Rosso[2], S. Zackrisson[1]; [1]*Malmö/SE*, [2]*Lund/SE (Kristina.Lang@med.lu.se)*

Purpose: To characterise false positives (FP) in breast cancer screening with breast tomosynthesis (BT) vs digital mammography (DM).
Methods and Materials: The Malmö Breast Tomosynthesis Screening Trial (MBTST) is a prospective population-based study designed to compare the efficacy of one-view BT to DM in breast cancer screening. Women could be recalled on BT alone, DM alone or both (BT+DM). This study is based on data from the first half of the MBTST population (n=7500). Besides FP recall rate after arbitration, we investigated whether there was a difference regarding reason for recall (radiographic finding), outcome, content and length of the assessment and FP recall rate over time.
Results: The FP recall rate was 1.7% for BT alone (n=131), 0.9% for DM alone (n=69), and 1.1% for BT+DM (n=81). The major finding leading to a recall on BT alone was an area of stellate distortion that after assessment and follow-up showed no evidence of abnormality. Fewer well-circumscribed lesions were recalled on BT alone (22%) compared to DM alone (28%) and BT+DM (27%). The assessment of BT alone cases needed more examinations but fewer interventions compared to recalls on DM and BT+DM. The FP recall rate over time did not decline.
Conclusion: BT is especially sensitive for detecting areas of stellate distortions, simulating malignancy. With access to prior BT exams, the FP rate can probably be reduced. Also, the characterisation of rounded lesions is improved with BT compared to DM, reducing the number of needle biopsies.

Author Disclosures:
K. Lang: Equipment Support Recipient; Siemens. **Andersson:** Equipment Support Recipient; Siemens. **S. Zackrisson:** Equipment Support Recipient; Siemens.

B-0922 11:11

Value of breast tomosynthesis combined with reconstructed synthetic 2D views versus tomosynthesis alone in a diagnostic set-up

V. Iotti, A. Nitrosi, S. Ravaioli, G. Levrini, C. Coriani, R. Vacondio, C. Mori, R. Sghedoni, P. Pattacini; *Reggio Emilia/IT (iotti.valentina@asmn.re.it)*

Purpose: To evaluate the perceived diagnostic value of reconstructed synthetic two-dimensional (S2D) images when added to digital breast tomosynthesis (DBT).
Methods and Materials: 100 DBT examinations were reviewed in this reading study. 11 had proven breast malignancies. Two independent breast radiologists (20 and 1.5 years of experience) assessed the cases after patient management was completed. To simulate screening and diagnostic situations, the readers were blinded on clinical history for 50 patients and un-blinded for the other 50 (6 malignant). Readings were performed with DBT alone, then with added S2D images. Perceived added diagnostic value of S2D images was rated on 3-step scales: 0 to +2 for the group with truth-unknown and -1 to +1 for cases with truth-known (the latter to determine whether S2D images might be misleading).
Results: The addition of synthetic 2D images to DBT was scored beneficial overall in 40 cases (40%) and 53 cases (53%) by Reader 1 and Reader 2, respectively. Across all readers and subjects, the addition of S2D views was perceived beneficial, with no impact, or negatively versus DBT alone in 41%, 55%, and 4% of cases, respectively. The addition of S2D images was rated particularly useful in the assessment of 79% of distortions and asymmetries (41 cases out of 52). The Wilcoxon signed-rank test (α=0.05) showed the beneficial perception as being statistically significant across all readers and cases ($p < 0.001$).
Conclusion: Synthetic 2D images may bring additional diagnostic value to DBT volumetric image sets alone, in particular for assessing distortions and asymmetries.

B-0923 11:19

Is synthetised Digital Mammography (3D-DM) superior to conventional Digital Mammography (2D-DM)? A retrospective study of 210 patients

P. Martinez-Miravete[1], P. Garcia Barquin[2], M. Millor[2], J. Etxano[2], A. Elizalde[2], L. Pina[2], R. Zalazar[2]; [1]*Zaragoza/ES*, [2]*Pamplona/ES (pgbarquin@unav.es)*

Purpose: The aim of this study was to compare the diagnostic performance of conventional Digital Mammography (2D-DM) and Synthetized Digital Mammography (3D-DM).
Methods and Materials: A retrospective study in an enriched sample with 210 patients was carried out. 57 patients had histologically proven malignant lesions and 153 patients had benign lesions. All patients underwent both techniques 2D-DM and 3D-DM with both CC and 45º MLO views. Informed consent was offered to all patients. One expert breast radiologist, blinded to the clinical information and histological diagnosis, reviewed all the studies. Firstly 2D-DM and four weeks later 3D-DM studies were evaluated. This study was designed as a patient-based study, so additional suspicious lesions were excluded. The reader classified the cases as negative (BI-RADS 1 to 2) or positive (BI-RADS 3 to 5). The differences in sensitivity (SE) and specificity (SP) between 2D-MD and 3D-DM were calculated using PEPI software. The ROC curves were calculated and compared using a z test.
Results: The SE and SP were: 61.4% and 64.05% for 2D-DM; 70.2% and 59.48% for 3D-DM, respectively. Significant differences were found regarding SE between 3D-DM and 2D-DM: OR 0.88, IC (0.78-0.98). No significant differences were found in SP between both techniques: OR 1.08, IC (0.97-1.31).The AUC for 2D-DM was 0.729 and for 3D-DM was 0.747. There were not significant differences between both AUC´s (p=0.54).
Conclusion: 3D-DM demonstrated a higher sensitivity than 2D-DM. Similar SP and AUC values were seen in this enriched sample, so 3D-DM could be used instead of 2D-DM.

B-0924 11:27

Can digital breast tomosynthesis predict the benignity or malignancy of circumscribed masses?

J. Morel, R. Wasan, A. Iqbal, D.R. Evans, C. Peacock, R. Rahim, J. Goligher, K. Satchithananda, M.J. Michell; *London/UK*

Purpose: Circumscribed masses are a common cause of recall for assessment however most are benign. Digital Breast Tomosynthesis (DBT) has been shown to have greater diagnostic accuracy when compared to digital mammography (DM). The aim of this study is to assess if DBT can accurately predict benignity or malignancy in assessment of circumscribed masses and therefore potentially reduce the need for biopsy.
Methods and Materials: Women recalled from breast screening for further evaluation of a mammographic abnormality underwent co-registered DM and DBT. Two experienced breast radiologists evaluated lesions categorised as circumscribed masses on DBT. A consensus was reached on the percentage of the margin that was well defined on DM and DBT. Lesions were categorised as follows: 1 = (0-25%) 2 = (26-50%) 3 = (51-75%) 4 = (76-100%). Change in category for each lesion was noted between DM and DBT.
Results: Of the 120 lesions, 118 were seen on the MLO view and 108 were visible on CC view. Histopathology diagnosed 25 cancers and 95 benign masses. 50% (22/44) of masses categorised as 1 on DBT were malignant compared with 25% (22/88) on DM; Fisher exact test ($p < 0.005$). There were more lesions grouped as 3 and 4 on DBT (49/120) compared with DM (10/120). Of the 95 benign lesions, 48 were categorised as 3 or 4 on DBT and 9 on DM. The difference between the two proportions was significant ($p < 0.0002$).
Conclusion: DBT more accurately predicts benignity or malignancy in the assessment of circumscribed masses.

B-0925 11:35

Invasive Breast Carcinomas (IBCs) that do not look suspicious on Digital Breast Tomosynthesis (DBT): important considerations when integrating DBT into clinical practice

O. Abeyakoon, R. Rahim, J. Morel, R. Wasan, D. Evans, K. Satchithananda, J. Goligher, C. Peacock, M.J. Michell; *London/UK (oshaani@yahoo.co.uk)*

Purpose: To integrate DBT into clinical practice studies have focused on the increase in cancer detection. The purpose of our study was to identify the histopathology and radiologic appearances of cancers that do not look suspicious on DBT.
Methods and Materials: We retrospectively queried our screening/symptomatic databases from 2009-2014 to identify IBCs that were categorized as normal, benign or indeterminate on DBT. Radiological features were correlated with histopathology and molecular profile.
Results: 545 IBCs were diagnosed via the symptomatic service. Six did not reveal suspicious features on DBT (1.1%). The DBT appearances were 3asymmetric-densities (ASDs), 2circumscribed masses (CMs) and 1case of calcification. The histopathology of these lesions were 5-Grade 3-IDC. 1-Grade 2 MucinousCa. 3 were triple negative. 755-IBCs were diagnosed via the screening service. 81 (10.7%) did not reveal suspicious features on DBT. 4 patients were triple negative. Five patients (0.66%) had a normal DBT.The histopathology results were: 1-Grade 1-ILC.1-Grade 2-ILC. 2-Grade-2IDC. 1-Grade 1-IDC. Ten patients (1.3%) had benign features on DBT. The DBT appearances were 7CMs, 2 ASDs and 1 case of calcification. The histopathology results were: 2-Grade-3 IDC. 2-Grade 2-IDC. 4-Grade 1-IDC. 2-Grade 1-TubularCa. Sixty-six patients (8.7%) were classified as indeterminate. The DBT appearances were 35 ASDs, 21CMs, 9calcifications and 1 ASD with calcification. The histopathology of the lesions were 14-Grade 3-IDC. 24-Grade 2-IDC. 12-Grade 1-IDC. 10-Grade 2-ILC. 4-Grade 1-MucinousCa. 2-TubularCa.
Conclusion: IBCs of all histological/molecular subtypes can lack suspicious features on DBT. The most common DBT appearances resulting in false negatives are ASDs and CMs. Multimodality-imaging remains vital for accurate diagnosis.

B-0926 11:43

Additional US or DBT after digital mammography: which one is the best combination?

A. Elizalde, P. Garcia Barquin, M. Millor, J. Etxano, P. Martinez-Miravete, L. Pina, M. Páramo; *Pamplona/ES (pgbarquin@unav.es)*

Purpose: To assess the diagnostic performance of Digital Mammography (DM) and the different combinations of DM+additional DBT, DM+additional US and DM+DBT+US in an enriched sample of patients.
Methods and Materials: Retrospective study in an enriched sample of 1042 patients. Out of them, 84 patients had histologically proven malignant lesions and 258 patients had benign lesions. Finally 700 patients with normal explorations or benign lesions without biopsy confirmation (but stable for at least 12 months) were included. All of them underwent DM, US and DBT examinations, that were retrospectively reviewed by one expert radiologist, blinded to the final diagnoses. The DBT examinations were performed using one single view with wide angle (50º). The reader categorized the cases as benign (BI-RADS 1 or 2) or malignant (BI-RADS 3-5) for DM and the different combination of techniques. The sensitivity (SE) and specificity (SP) were calculated with the PEPI software and the AUC of the different techniques and combinations were calculated by using the SPSS 15.0 software.
Results: The SE and SP of DM were 69.05% and 88.20% respectively. Additional DBT significantly increased the AUC of DM as well as additional US or the combination DM+DBT+US ($p < 0.05$). However there were no significant differences between the AUC of DM+US and DM+DBT (p=0.7).
Conclusion: Additional US, DBT or both, in combination with DM, significantly increased the AUC of DM. However, there were no significant differences between DM+DBT and DM+US.

B-0927 11:51

Whole breast ultrasound after breast tomosynthesis in a screening population

V.N. Aguillar, A.C. Moura, V.S. Ferreira, C.B. Dequi; *Sao Paulo/BR (veraaguillar@uol.com.br)*

Purpose: To determine performance of screening breast ultrasonography (US) during the first two years of implementation of screening breast tomosynthesis (BT), in a private clinic.
Methods and Materials: Prospective study, in a single institution, including 2.155 consecutive women, aged 35 to 80 year-old, who underwent physician-performed handheld screening whole breast ultrasound, subsequent to screening breast tomosynthesis (2 views of digital mammography plus 2 views of BT), from September/2011 to August/2013.
Results: Twenty-five exams were classified as BI-RADS category 4 by US-only (1.2%). All were submitted either to fine needle aspiration (9 cases), percutaneous biopsy (12 cases) or surgical biopsy (3 cases). Only one case was not biopsied and had a normal magnetic resonance and a normal one-year US follow-up. Three cases were invasive carcinomas, all lymphonode negative: two lobular (5 mm and 6 mm) and one ductal (7 mm). All three were in women with dense breast and neither was detected by BT or DM. Cancer detection rate by BT was 7.9/1000 and increased to 9.3/1000 with US screening - incremental detection rate of 1.4/1000 by US-only. PPV3 for US-only lesion detection was 12.5% (3 cancers/24 biopsies), compared to 46% for lesions detected by tomosynthesis (17/ 37) and 33% for BT plus US.
Conclusion: Adding physician-performed handheld US to screening BT increased cancer detection rate in women with dense breast, with an acceptable predictive positive value.

10:30 - 12:00 **Room Z**

Molecular Imaging

SS 1406

Experimental molecular imaging and exploratory clinical studies

Moderators:
N. Lassau; Villejuif/FR
M. Wildgruber; Munich/DE

B-0930 10:30

Making use of the intrinsic Gadolinium quenching effect for cellular imaging

J. Guenoun, G. Koning, G. Kotek, G.P. Krestin, M. Bernsen; *Rotterdam/NL (j.guenoun@erasmusmc.nl)*

Purpose: To understand the relation between (de)quenching of signal intensity (SI) from Gadolinium (Gd) and compartmentalisation in cellular imaging by calculation of the transmembrane exchange rates (κ). The effect of liposomal [Gd], size and compartmentalisation state on SI were assessed.
Methods and Materials: Dependency of SI on intraliposomal [Gd] was assessed comparing three different [Gd] (0.3, 0.6 and 1.0M Gd) in both small (80nm) and large (120 nm) cationic liposomes. In addition, five compartmentalisation states were compared: free Gd, intact Gd-liposomes, ruptured Gd-liposomes, Gd-liposomes in intact cells and Gd-liposomes in ruptured cells (simulating cell death). Since Gd influences not only R1 but also R2, an effect often neglected, both R1 and R2 relaxation rate of a dilution range were measured by T1- and T2-mapping on a 3 T clinical scanner.
Results: Less is more! The unidirectional water efflux rate (outbound across the liposome membrane, κle) being proportional to the surface/volume ratio, smaller liposomes yielded a consistently higher R1 than larger liposomes across the tested dilution range. For equal voxel [Gd] less concentrated liposomes (0.3M Gd) yielded higher R1/R2 ratio partly because of the higher extraliposomal water fraction (vl/ve). Gd exhibits a dualistic behavior: from hypointensity to hyperintensity to hypointensity, with decreasing [Gd]. Regarding compartmentalisation less membrane barriers means a higher R1/R2 ratio.
Conclusion: Gd-liposomes exhibit a dualistic SI curve, dependent on different compartmentalisation states, sizes and different concentrations, as mathematically explained. Understanding the behavior of compartmentalised Gd allows functional tools for cellular imaging (eg to study cell survival).

B-0931 10:38

Optical in vivo imaging of tumour-associated macrophages for evaluation of metastatic capability

N. Grosse Hokamp[1], K. Barczyk-Kahlert[1], A. Becker[1], T.J. Vogl[1], W. Heindel[1], C. Bremer[1], C. Geyer[1], M. Eisenblatter[2]; [1]*Münster/DE*, [2]*London/UK (nils@grossehokamp.de)*

Purpose: Tumour-associated macrophages (TAM) are a substantial part of the tumour microenvironment. TAMs play a key role in metastasis, promoting tumour cell migration and intravasation. Macrophages are the major source of local protease activity and release the pro-inflammatory Ca2+-binding protein S100 A9 upon activation. We assessed whether a combination of protease-specific and S100 A9-targeted optical imaging of TAM activity in tumours is indicative of the individual metastatic capability.
Methods and Materials: Murine (Balb/c) breast cancer cells with a common genetic background but different capability in formation of metastasis (4T1> 168 FAR> 67NR-distant metastasis>local lymph node metastasis>local growth) were orthotopically implanted in female Balb/c mice (n (4T1;168 FAR;67NR)=15;10;7). At a tumour size of 4-6 mm, Cy5.5-labeled anti-S100 A9 and protease-specific ProSense 750EX (PerkinElmer) were injected intravenously (2nmol dye). Fluorescence Reflectance Imaging (FRI) was performed 24h after probe application. Results were validated by flow cytometry (FACS) and immunohistochemistry (IHC) of tumour specimen. Statistics were performed using SPSS applying ANOVA.
Results: S100 A9-driven as well as protease-specific imaging revealed significant differences between the tumour entities. A higher signal reflected a higher metastatic capability (4T1> 168 FAR> 67NR; anti-S100 A9: 388.8> 325.6> 253.2 AU; ProSense: 463.9> 214.9> 165.6 AU; both $p \leq 0.05$). FACS and IHC supported in vivo imaging: FACS proved S100 A9 to be exclusively produced by myeloid cells. In vivo FRI correlates with the relative number of S100 A9-positive myeloid cells in the tumour immune cell infiltrate ($p \leq 0.001$;R2=0.53). IHC for S100 A9, macrophage and myeloid cell markers revealed triple positive cell clusters.
Conclusion: TAM activity is indicative of the metastatic capability in murine breast tumours. Target specific imaging allows for visualisation of TAM abundance and activity.

B-0932 10:46

MRI of antigen-loaded dendritic cell migration in a pancreatic carcinoma model

L. Zheng, A.C. Larson, Z. Zhang; *Chicago, IL/US (zhenglinfeng04@aliyun.com)*

Purpose: To test hypotheses in a murine model of pancreatic cancer: vaccination with antigen-loaded iron-labelled dendritic cells (DCs) reducesT2W signal intensity within peripheral draining lymph nodes (LNs) and T2W signal reductions are associated to tumour size changes following DCs vaccination.
Methods and Materials: Panc-02 cells were implanted into bilateral flanks of C57BL/6 mice. After tumours reached 10 mm; cell viability was evaluated by Trypan blue assay and iron-labelled DCs vaccines were injected into the left-hind footpad. The mice in group one and two was injected with 1-million and 2-million iron-labelled DCs, respectively; the control mice were injected with PBS. T1W and T2W MRI of labelled DCs migration to the draing LNs were acquired before dendritic cell injection and at 6 and 24h following injection. The SNR of the draining LNs was measured.
Results: Trypan blue assays indicated that there was no significant difference in viability indices. Post-injection 35 days, the left and right flank tumour sizes were $112.7 \pm 16.4\ mm^2$, $109 \pm 24.3\ mm^2$ for the 1-million group; $92.2 \pm 9.9\ mm^2$ and $90.4 \pm 12.8\ mm^2$ for the 2-million group; $193.7 \pm 20.9\ mm^2$ and $189.4 \pm 17.8\ mm^2$ for the control group, respectively ($p < 0.01$). There was a correlation between post-injection T2W SNR decreases in the left popliteal LN 24h post-injection and follow-up size changes for tumours in both left and right flanks.
Conclusion: MRI approaches can be used for quantitative measurement of the accumulated iron-labelled dendritic cell-based vaccines in the draining LNs. The amount of dendritic cell-based vaccines in the draining LNs correlates well with the observed protective effects.

Author Disclosures:
A.C. Larson: Grant Recipient; NIH NCI Grants.

B-0933 10:54

MRI-monitored percutaneous injection of iron-oxided labelled Clostridium novyi-NT for bacteriolytic therapy: preclinical studies in xenograft model of pancreatic cancer

L. Zheng[1], Z. Zhang[1], K. Khazaie[2], S. Saha[3], R.J. Lewandowski[1], G. Zhang[4], A.C. Larson[1]; [1]*Chicago, IL/US*, [2]*Rochester, MN/US*, [3]*Kansas City, MO/US*, [4]*Shanghai/CN (zhenglinfeng04@aliyun.com)*

Purpose: To investigate the potential to label *C. novyi*-NT anaerobes with iron-oxide for MRI monitored percutaneous delivery to solid tumours during bacteriolytic therapy.
Methods and Materials: *C. novyi*-NT were labelled with hybrid iron-oxide Texas red nanoparticles. Growth rates of labelled samples were evaluated with optical density measurements. Labelling was confirmed with confocal fluorescence and transmission electron microscopy (TEM) measurements. MRI measurements were performed using a 7T scanner with T2*-weighted sequences. Contrast-to-noise ratio (CNR) were performed for in vitro phantoms as well as in C57BL/6 mice (n=12) with Panc02 xenografts before and after percutaneous injection of labelled *C. novyi*-NT. MRI was repeated 3 and 7 days post-injection.
Results: Iron-oxide labelling had no influence upon *C. novyi*-NT growth rates. The signal intensity (SI) within T2*W images was significantly decreased for iron-oxide labelled *C. novyi*-NT phantoms compared to non-labelled controls. Under confocal fluorescence microscopy, the labelled *C. novyi*-NT exhibited a uniform red fluorescence consistent with observed regions of DAPI staining and overall labeling efficiency was 100%. Within TEM images, a large number iron granules were observed within the labelled *C. novyi*-NT; these were not observed within unlabelled controls. Intra-procedural MRI measurements permitted in vivo visualization of the intra-tumoural distribution of iron-oxide labelled *C. novyi*-NT following percutaneous injection; tumour CNR decreased significantly following intra-tumoural injection of *C. novyi*-NT; these CNR reductions were maintained at 3- and 7-day follow-up intervals. Prussian blue and Gram staining confirmed presence of the labelled anaerobes.
Conclusion: *C. novyi*-NT can be labelled with iron-oxide for MRI visualization of intra-tumoural deposition following percutaneous injection during bacteriolytic therapy.

Author Disclosures:
A.C. Larson: Grant Recipient; NIH NCI Grants. Research/Grant Support; Multiple NIH R01 grant applications pending.

B-0934 11:02

Using 59 Fe labelled triglyceride-rich lipoproteins for visualisation and quantification of brown adipose tissue activity at 7T MRI

C.S.L. Jung, M. Heine, M. Kaul, G. Adam, L. Heeren; *Hamburg/DE*

Purpose: The aim was to determine BAT activity with 7T MRI using radioactively labelled superparamagnetic iron oxide nanoparticles (SPIO) embedded into the lipid core of TRL (59 Fe-SPIO-TRL) for visualisation of BAT metabolism after intravenous (iv) and intraperitoneal (ip) injection.
Methods and Materials: Cold exposed (24h), BAT activated mice (n=10) and thermoneutral mice (n=10) were starved for 4h before 59 Fe-SPIO-TRL application. MRI was performed before, 1 and 24 hours after ip (n=10) and iv (n=10) injection at a 7T ClinScan using a T2*w GRE sequence (TR/first TE 400/2 ms, ETL 12, ES 1 ms, FA 25°). T2* relaxation time, R2* and ΔR2* in liver and BAT were estimated. Ex vivo biodistribution of 59 Fe-SPIO-TRL was analyzed using a large volume Hamburg whole body y counter. The amount of TRL uptake in liver and BAT arrived from activity measurements was correlated with MRI. Uptake of TRL was confirmed by histological and TEM analyses.
Results: Biodistribution after both application approaches were similar with an overall higher uptake after iv application. A significant higher uptake of TRL was detectable in BAT for cold exposed mice with ΔR2* of 104 mmol-1sec-1 after iv and 44 mmol-1sec-1 after ip application (control mice: ΔR2*< 14 mmol-1sec-1). 59 Fe measurements, T2* relaxation time and ΔR2* showed strong correlations for liver tissue ($r > 0.85$) and BAT ($r > 0.85$). Histology and TEM analyses confirmed the uptake of 59 Fe-SPIO-TRL within liver and BAT.
Conclusion: The quantification of ΔR2* using 59 Fe-SPIO-TRL is feasible and may serve as a non-invasive tool for estimation of BAT activity and lipoprotein metabolism.

B-0935 11:10

Treatment response and hypoxia monitoring assessed by molecular imaging of tumour microenvironment using multiparametric 3 T-MRI and ^{18}F-FMISO

P. Georg[1], P. Andrzejewski[2], W. Wadsak[2], A. Sturdza[2], G. Karanikas[2], R. Pötter[2], T.H. Helbich[2], D. Georg[2], K. Pinker-Domenig[2]; [1]*Wiener Neustadt/AT*, [2]*Vienna/AT (petra.georg@medaustron.at)*

Purpose: To monitor changes in tumour microenvironment including hypoxia of cervix cancer patients undergoing chemoradiation with multiparametric positron emission tomography and 3 T-magnetic resonance imaging (MP-PET/MRI) using T2-weighted, T1-weighted, dynamic-contrast-enhanced (DCE) MRI, diffusion-weighted imaging (DWI) and ^{18}F-fluoromisonidazole (^{18}F-FMISO).
Methods and Materials: Seven patients underwent ^{18}F-FMISO-PET/CT and MP-MRI at baseline; 2 and 5 weeks (w) after treatment start and 3 months after treatment end. Data were registered, fused and analyzed using Mirada RTx software (Mirada Medical Ltd, Oxford,UK). Gross tumour volume (GTV) was contoured by an experienced radiation oncologist on PET/MRI data sets. The volume of GTV was analysed for size, EH-kinetics, diffusivity and ^{18}F-FMISO-avidity using SUVmax and SUV normalized to gluteal muscle uptake. At follow-up, cervix was contoured, since all patients showed clinically complete remission.
Results: Median GTV volume was 43.9 cc at baseline, 22.4 cc after 2w (20-25Gy) and 7.7 cc after 5w (40-45Gy). Mean ADC values were 1.02×10^{-3} mm^2/sec increasing to 1.18×10^{-3} mm^2/sec after 2w and to 1.27×10^{-3} mm^2/sec after 5w and were 1.37×10^{-3} mm^2/sec at 3 months. All GTVs showed mean initial-enhancement (IE) followed by a plateau with an increasing IE at 2w and 5w and wash-out at 5w. At follow-up, the mean IE was 120% followed by a persistent enhancement. The mean ^{18}F-FMISO SUV-norm was 3.1 at baseline and decreased to 2.3 at 2w and 2.0 at 5w and follow-up.
Conclusion: There are morphological and functional changes during treatment which can be non-invasively monitored with MP-MRI/PET.

B-0936 11:18

Glycosaminoglycan chemical exchange saturation transfer magnetic resonance imaging of knee joint cartilage at 3 Tesla: baseline values in asymptomatic young adult volunteers

C. Schleich[1], F. Miese[1], C. Zilkens[1], B. Schmitt[2], A. Müller-Lutz[1], M. Sondern[1], G. Antoch[1], R. Krauspe[1], B. Bittersohl[1]; [1]*Düsseldorf/DE*, [2]*Macquarie Park NSW/AU (christoph.schleich@med.uni-duesseldorf.de)*

Purpose: To establish baseline values for glycosaminoglycan chemical exchange saturation transfer (gagCEST) magnetic resonance imaging (MRI) in knee joint cartilage at 3 Tesla (T).
Methods and Materials: Twenty volunteers (8 females, 12 males, mean age: 24.55 ± 2.35, range: 21 - 29 years) with no history or clinical findings indicative of any knee joint pathology underwent MRI at 3 T. The imaging protocol included three-dimensional (3D) double-echo steady-state sequence for morphological cartilage assessment and a prototype 3D CEST pulse sequence to evaluate the CEST effects in six cartilage regions of the knee joint: 1) lateral femoral condyle, 2) medial femoral condyle, 3) lateral tibial plateau, 4) medial tibial plateau, 5) patella, and 6) trochlea. We used the asymmetry of the magnetization transfer ratio (MTRasym) parameter to quantify the gagCEST effects in these regions.
Results: Regional differences were noted, revealing superior MTRasym values in patella (1.62 ± 1.19) and trochlea cartilage (1.17 ± 1.29) and low MTRasym values in medial femoral condyle (0.41 ± 0.58) and lateral tibial plateau (0.52 ± 0.53). Notably, the MTRasym values in the patella and lateral tibial plateau cartilage were not normally distributed.
Conclusion: Regional differences in the gagCEST measures must be considered when conducting gagCEST imaging of knee joint cartilage. GagCEST imaging may be an additional feature in the evaluation of the biochemical composition in knee joint cartilage. However, further studies are needed to substantiate its clinical utility at 3 T

Author Disclosures:
B. Schmitt: Employee; Siemens Healthcare Australia.

B-0937 11:26

Chemical exchange saturation transfer imaging: preliminary experience for characterisation of thoracic nodule and mass based on MR-based molecular information

Y. Ohno[1], M. Yui[2], C. Ouyang[3], M. Miyazaki[3], S. Seki[1], H. Koyama[1], T. Yoshikawa[1], S. Matsumoto[1], K. Sugimura[1]; [1]*Kobe/JP*, [2]*Otawara/JP*, [3]*Vernon Hills, IL/US (yosirad@kobe-u.ac.jp)*

Purpose: Chemical exchange saturation transfer (CEST) imaging using amide proton transfer, which demonstrates the exchange between protons of free tissue water and the protons of amide groups of endogenous proteins and peptides, is considered as one of the MR-based molecular imaging methods. The purpose of this study was to determine the capability of CEST imaging for characterization of thoracic nodule and mass.
Methods and Materials: Twenty consecutive patients underwent CEST imaging at a 3 T MR system and pathological and/or follow-up examinations. According to final diagnoses, all thoracic lesions were divided as follows: malignancy (n=11: 8 lung cancers and 3 other thoracic malignancies) and benign (n=9) groups. To obtain CEST imaging, respiratory-synchronized fast advanced spin-echo images were conducted following a series of magnetization transfer (MT) pulses. Then, magnetization transfer ratio asymmetry (MTRasym) was calculated from z-spectra in each pixel. To evaluate the capability for characterization of thoracic lesion, MTRasyms assessed by ROI measurements were compared between benign and malignant groups, between lung cancers and other thoracic malignancies, and between adenocarcinomas and squamous cell carcinomas by Student's t-test.
Results: MTRasym of malignant group (3.3±2.7 %) was significantly higher than that of benign group (0.3±0.3 %, p=0.03). MTRasym of other thoracic malignancies (8.0±3.9 %) showed significantly higher than that of lung cancer (2.3±1.2 %, p=0.001).
Conclusion: CEST imaging has a potential for non-invasive characterization of thoracic nodule and mass, and play as a new MR-based molecular imaging method in thoracic oncology.

Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems. **M. Yui:** Employee; Toshiba Medical Systems Corporation. **C. Ouyang:** Employee; Toshiba Medical Research Institute USA, Inc. **M. Miyazaki:** Employee; Toshiba Medical Research Institute USA, Inc. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **K. Sugimura:** Research/Grant Support; Toshiba Medical Systems Corporation.

B-0938 11:34

Apoptosis-targeted optical fluorescence imaging for characterisation of regorafenib effects on experimental colon carcinomas validated by perfusion MRI and multiparametric immunohistochemistry

P.M. Kazmierczak, E. Burian, R. Eschbach, M. Moser, L. Havla, H. Hirner, M.F. Reiser, K. Nikolaou, C.C. Cyran; *Munich/DE (Philipp.Kazmierczak@med.uni-muenchen.de)*

Purpose: To investigate apoptosis-targeted optical imaging for monitoring the early effects of multityrosine kinase inhibitor regorafenib on experimental colon carcinomas in rats, validated by perfusion MRI and multiparametric immunohistochemistry.
Methods and Materials: Human colon carcinoma xenografts (HT-29) implanted subcutaneously in athymic rats (n=16) were imaged before (day 0) and after (day 7) a one-week therapy with regorafenib (n=8) or placebo (n=8) using a multimodal imaging protocol including optical fluorescence imaging (OI) with an apoptosis-targeted tracer and multiparametric MRI at 3 Tesla. Optical signal-to-noise ratio (SNR) and MRI tumour perfusion parameters (plasma flow PF, mL/100 mL/min; plasma volume PV, %) were assessed before and after treatment. Subsequent to imaging on day 7, tumours were excised to undergo immunohistochemical analysis for tumour cell apoptosis (TUNEL), proliferation (Ki-67), and microvascular density (CD31).
Results: In the regorafenib-treated group, apoptosis-specific OI demonstrated a tumour-specific tracer accumulation with a significant increase of tumour SNR under therapy (SNR therapy: mean Δ +7.78+-2.95, control: -0.80+-2.48, p=0.021). Correspondingly, MRI detected a significant reduction of tumor perfusion in the therapy group (PF therapy: mean Δ -8.17+-2.32 mL/100 mL/min, control -0.11+-3.36 mL/100 mL/min, p=0.036). Immunohistochemistry showed significantly more apoptotic tumor cells (TUNEL; 11392+-1486 vs. 2921+-334, p=0.001), significantly less proliferating cells (Ki-67; 1754+-184 vs. 2883+-323, p=0.012), and significantly lower microvascular density (CD31; 107+-10 vs. 182+-22, p=0.006) in the therapy group.
Conclusion: Apoptosis-targeted optical imaging allowed for the non-invasive monitoring of early therapy effects of the multityrosine kinase inhibitor regorafenib on experimental colon carcinomas validated by perfusion MRI and multiparametric immunohistochemistry.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 1410

Spine

Moderators:
M.A. Cova; Trieste/IT
C. Giraudo; Vienna/AT

K-22 10:30

Keynote lecture

I.W. McCall; *Devon/UK*

B-0939 10:39

Metal artefacts reduction for spinal fusion implants in computer tomography: usage of gemstone spectral imaging and iterative reconstruction

F. Wang, H. Xue, W. Han, Z. Wu, S. Ma, Y. Zhang, Z. Jin; *Beijing/CN (fengdanw@gmail.com)*

Purpose: To investigate the metal artieact reduction effect of monochromatic imaging combined with adaptive statistical iterative reconstruction (ASIR) for spinal fusion implants, as well as the best ASIR setting.
Methods and Materials: Fifty-one patients (26 men, 25 women) with 318 spinal pedicle screws were prospectively scanned with dual-energy CT by using fast kV-switching GSI between 80 and 140 kV. The monoenergetic images at 110 keV were reconstructed with standard filtered back projection (FBP) and different blending levels of ASIR (30%, 50%, 70% and 100%). For these 5 sets of monoenergetic images, objective image quality was assessed by quantitative artifacts index measurements. Image noise and signal to noise ratio (SNR) were also compared. For subjective assessment, two readers independently evaluated the severity of artifacts, the visualization of implants, peri-implant bones and soft tissues respectively according to a 5-score scale.
Results: During the objective image quality measurement, the artefacts' index remarkably decreased as ASIR increased ($P < 0.001$). Compared with FBP images, the ASIR images also yielded decreased image noise ($P < 0.001$) and increased SNR ($P < 0.001$). For the qualitative image analysis, the inter-reader agreements were good (ICC=0.89-0.99). The scores of metal artifacts were greatly decreased ($P < 0.001$) when ASIR was increased to 70% and 100%. The observation of peri-implant soft tissues was significantly improved ($P > 0.05$).
Conclusion: ASIR combined with monochromatic images at 110 keV could decrease metal artefacts from spinal fusion implants, and improve the visualization of peri-implant soft tissues. The blending levels of at least 70% ASIR were recommended.

B-0940 10:47

Diffusion-weighted MRI of the spine: is it helpful to discriminate between Modic type 1 verterbral endplate changes and infectious spondylodiscitis?

D. Rotzinger, P. Rau, M. Roux, C. Federau, J.-B. Zerlauth, J.-B. Ledoux, P. Omoumi, F. Becce; *Lausanne/CH*

Purpose: To report the diffusion-weighted MRI (DWI) findings in infectious spondylodiscitis and evaluate the potential role of DWI in the differentiation between infectious spondylodiscitis and Modic type 1 vertebral endplate changes.
Methods and Materials: 21 consecutive patients (9 women, mean age 60.3 years) with infectious spondylodiscitis and 20 control subjects (14 women, mean age 63.5 years) with Modic type 1 vertebral changes were prospectively included over a 3-year period. DWI including a reduced-FOV diffusion-weighted echo-planar sequence (b = 0, 300 and 500 s/mm2) was obtained on 3-T systems. Two radiologists independently and blindly measured the apparent diffusion coefficients (ADCs) in normal and abnormal vertebral endplates.
Results: Mean (±SD) ADCs of vertebral endplates affected by infectious spondylodiscitis were 772.3±472.4 and 602±398.1 x 10-6 mm2/s for b = 300 and 500 s/mm2, respectively. Mean ADCs in vertebral endplate affected by Modic type 1 changes were 627.3±66.9 and 569.4±213.3 x 10-6 mm2/s for b = 300 and 500 s/mm2, respectively. No significant differences were found between infectious spondylodiscitis and Modic type 1 vertebral endplate changes (p = 0.255 and 0.750 for b = 300 and 500 s/mm2, respectively). Mean ADCs of abnormal vertebral endplates were significantly higher than in normal vertebral endplates (196.6±142.2 and 157±131.7 x 10-6 mm2/s for b = 300 and 500 s/mm2, respectively) ($p < 0.001$).

Saturday

Conclusion: Although ADCs are significantly higher in abnormal than in normal vertebral endplates, our preliminary results indicate that DWI offers no advantage in discriminating between infectious spondylodiscitis and Modic type 1 vertebral endplate changes.

B-0941 10:55

Prevalence of a lumbosacral transitional vertebra and concomitant edema in the sacral bone in the SPACE (SPondyloArthritis Caught Early) cohort

F. de Bruin[1], S. ter Horst[1], J.L. Bloem[1], R. Landewé[2], K.M. Fagerli[3], M. van Oosterhout[4], D. van der Heijde[1], M. Reijnierse[1]; [1]*Leiden/NL*, [2]*Amsterdam/NL*, [3]*Oslo/NO*, [4]*Gouda/NL (f.de_bruin@lumc.nl)*

Purpose: The lumbosacral transitional vertebra (LSTV) is a congenital enlargement of the transverse process (es) of the last lumbar vertebra and could lead to pseudoarticulation or fusion with the sacrum. Whether LSTV might cause bone marrow edema (BME) and complicate the diagnosis of axial spondyloarthritis (axSpA) is unknown. Therefore, we assessed patients in the SpondyloArthritis Caught Early (SPACE) cohort for LSTV and concomitant BME.
Methods and Materials: Patients from SPACE cohort (backpain≥3 months, ≤2years, onset< 45 years) were used. Two independent readers assessed pelvic radiographs for LSTV (Castellvi classification: type 1 enlargement; 2 pseudoarticulation; 3 fusion; 4 pseudoarticulation and fusion) and coronal-oblique MRI of the sacroiliac joints for BME at the sacral superior border and transverse processes. Fulfilment of Assessment of SpondyloArthritis international Society criteria for axSpA was correlated to LSTV using x2-test.
Results: Of 273 patients (35.1% male, mean age 29.3), 68 (24.9%) patients showed LSTV; type 1 in 35 (12.8%), type 2 in 11 (4.0%), type 3 in 17 (6.2%) and type 4 in 5 (1.8%) patients, without significant difference between patients with/without axSpA (p=0.77). Local sacral BME was absent in patients without LSTV and present in 3/35 (8.6%), 4/11 (36.4%), 1/17 (5.9%), 1/5 (20%) patients with type 1, 2, 3, 4 respectively.
Conclusion: LSTV was found in 24.9% of patients in accordance with literature. Local BME was present in up to one-third of patients with articulating LSTV (type 2 or 4) and was absent in patients without LSTV. Therefore this is of importance in the differential diagnosis of early axSpA on MRI.

B-0942 11:03

T2 mapping of the lumbar intervertebral disc at 3.0 Tesla: does the nucleus pulposus T2 relaxation time predict future low back pain?

M. Raudner, D. Stelzeneder, C. Kronnerwetter, R. Windhager, S. Trattnig; *Vienna/AT (n1042178@students.meduniwien.ac.at)*

Purpose: The aim was to assess if T2-relaxation-times of the lumbar intervertebral disc (IVD) may be a predictive marker for future patient symptoms.
Methods and Materials: This prospective study includes 25 patients with low back pain, without radicular symptoms or previous surgery. All patients underwent a 3.0-Tesla-MRI scan of the lumbar spine, including T2-mapping at baseline, and clinical assessment at 5-year-follow-up. Rectangular regions-of-interest for the annulus fibrosus (AF) were drawn manually anteriorly and posteriorly in the outermost 20% of the disc on two adjacent slices. The space in between was defined as the nucleus pulposus (NP). At the 5 year follow-up visit all patients were scored for their pain using the Roland-Morris-Questionnaire (RMQ). The mean T2-value for the NP and AF per patient (including 5 discs) as well as the "minimum T2-value" (lowest out of five discs) per patient was calculated. For these values Spearman correlation coefficients were calculated with clinical parameters.
Results: There was no correlation of mean T2-values of NP and AF at baseline with patient pain measured via RMQ at 5 year follow-up (r=-0.34, p=0.10 and r=-0.01, p=0.97 respectively). However there was a significant correlation of minimum T2-values of NP (worst disc in each patient) at baseline with RMQ at 5 years (r=-0.47,p=0.02). The minimum AF T2-values did not show a correlation to RMQ (r=-0.08,p=0.72).
Conclusion: Our data suggests that NP T2-values are predictive for future patient symptoms, but AF T2-values are not.

B-0943 11:11

Fat suppression in MRI of the spine at 3 T using a fast T2-weighted two-point mDixon TSE technique: initial clinical experience

P.A. Kupczyk, M. Marinova, J. Gieseke, H.H. Schild, G.M. Kukuk, D.R. Hadizadeh; *Bonn/DE (patrick.kupczyk@ukb.uni-bonn.de)*

Purpose: To compare clinical performance of a fast T2-weighted mDixon TSE technique at 3 T to conventional T2-weighted fast spin echo sequences ± spectral fat suppression (FS).
Methods and Materials: In a prospective, intraindividual comparative study 15 patients underwent MRI of the lumbar and thoracic spine at 3 T. Sagittal T2-weighted TSE ±FS (SPAIR) and sagittal T2-weighted two-point mDixon TSE sequences (total acquisition times: 301s vs.178s) were compared quantitatively and qualitatively. Homogeneity of FS was evaluated by region-of-interest analyses determining variation coefficients of tissue-to-liquor contrast (TLC). Additionally, homogeneity of FS, degree of FS, artifacts, and sharpness were rated according to a 5-point rating scale independently by two blinded readers. Detectability of bone marrow lesions (BML) was evaluated on a lesion-by-lesion analysis. Quantitative results were compared using Student´s t-test, qualitative by determining marginal homogeneities.
Results: Compared to T2-weighted TSE, variation coefficients of TLC were significantly lower for mDixon TSE (0.16±0.07 vs. 0.27±0.10, mean ±SD, p=0.001), and degrees and homogeneities of FS were rated significantly better ($p < 0.01$, respectively). With respect to artifacts and sharpness, T2-weighted mDixon TSE without FS were rated slightly worse (p=0.06; $p < 0.01$), whereas those with FS were rated equivalent (p=0.89; p=0.23). 82.5% of 120 BML were identified with mDixon TSE, whereas 92.8% were identified with conventional T2-weighted TSE ± FS (difference not significant, p=0.091).
Conclusion: T2-weighted two-point mDixon TSE offers more uniform and robust fat suppression in MRI of the spine at 3 T in shorter acquisition times than conventional T2-weighted TSE sequences ± spectral fat suppression with comparable lesion detectability.

Author Disclosures:
P.A. Kupczyk: Speaker; Philips Healthcare. **J. Gieseke:** Employee; Philips Healthcare. **G.M. Kukuk:** Speaker; Philips Healthcare.

B-0944 11:19

Evaluation of artifacts reducing effect of orthopedic metal artifact reduction technique in patients after pedicle screw placement

Y. Wang, Y. Xiao, Y. Jiang, H. Li, S. Liu; *Shanghai/CN (747973340@qq.com)*

Purpose: To prospectively investigate the artifacts reducing effect of orthopedic metal artifact reduction (OMAR, Philips Healthcare) technique in patients after pedicle screw placement.
Methods and Materials: 33 patients (43.2±8.9years, 21 male) after pedicle screw placement underwent CT scans (Ingenuity CT, Philips Healthcare) at 120 kV/250 mAs. Images were reconstructed by filtered back-projection (FBP) only and FBP with OMAR. CT attenuation and standard deviation (SD) were measured at screw level and nearby level without screw. Image quality assessment was performed by 2 independent readers according to the features of artifacts range, clearance of intermuscular space and bony trabecula, image distortion and overall diagnostic confidence (DC) by using a 4-point scale. Student t test and Wilcoxon signed-rank test were used for statistical analysis.
Results: There were significant differences of CT attenuation between non-OMAR and OMAR groups at both screw and non-screw levels (104.5±25.0 HU vs 70.9±12.3 HU; 92.3±21.2 HU vs 68.9±10.1 HU, $p < 0.01$, respectively). Image noise (SD) reduced significantly by OMAR at screw level (132.1±54.2 vs 98.2±50.7, $p < 0.01$), while reduced slightly at non-screw levels (107.2±45.6 vs 93.7±44.7,p=0.058). OMAR significantly improved image quality by reducing artifacts range, enhance clearance of intermuscular space and bony trabecular and improve DC compared to non-OMAR group (2.72±0.63 vs 1.78±0.52; 2.97±0.34 vs 2.11±0.54; 3.09±0.65 vs 2.32±0.53,$p < 0.01$,respectively), while OMAR was scored slightly lower than non-OMR in image distortion (2.69±0.56 vs 2.87±0.43,p=0.066).
Conclusion: OMAR significantly reduced metal artifacts range and image noise which providing much better image quality and diagnostic confidence in patients after pedicle screw placement.

Author Disclosures:
Y. Jiang: Employee; Philips.

B-0945 11:27

Impact of patient positioning during MRI of the Lumbar Spine in patients with stenosis: changes in lordosis and canal dimensions

N. Martins, R.G. Nunes, H. Ferreira, J.P. Figueiredo, L. Barroso, J.D. Mineiro; *Lisbon/PT (pixiesrx@gmail.com)*

Purpose: To investigate the effect of patient positioning on Lumbar Lordosis (LL) and the transversal areas of the lumbar canals, when performing lumbar spine MR exams. To demonstrate that performing lumbar MRI with extended legs allows to more faithfully mimic the upright position evidencing Lumbar Spinal Stenosis (LSS) symptoms, potentially improving evaluation of this pathology.
Methods and Materials: Lumbar MRI exams comprising sagittal and axial T2 Fast Spin Echo sequences were carried out in 13 patients (9 males, ages 29-90 yo) with clinical suspicion of LSS. Images were acquired in the supine position with the lower limbs in flexion and extension. A lateral view extra-long radiography of the spine provided a gold standard LL angular measurement. The following measurements were made: LL angle from Sagittal T2 FSE; for all five lumbar levels from the axial T2 FSE: transversal area and antero-posterior

(AP) and lateral lengths of the lumbar canal. Non-parametric tests were used to compare measurements obtained with different patient positioning (significance set to 0.05).
Results: By placing the lower limbs in extension it was possible to closely reproduce the LL measured in the upright position. In this position, canal areas decreased in all lumbar levels (significantly for L1-L2, L2-L3 and L3-L4 levels). Lumbar spine canal AP lengths were significantly modified (L1-L2 and L3-L4 levels), with no significant changes observed laterally.
Conclusion: In lumbar MRI, the supine position with the lower limbs in extension more closely replicates the vertical position for which patients present more clinical complaints related to LSS.

B-0946 11:35

Differences between supine and orthostatic positions in facet joint (FJ) fluid and spondylolisthesis at lumbar-spine MRI
C. Ottonello[1], A. Giardino[1], P. Giuliani[1], C. Messina[2], G. Di Leo[3], F. Sardanelli[3]; [1]*Rome/IT*, [2]*Milan/IT*, [3]*San Donato Milanese/IT*

Purpose: Spondylolisthesis and FJ degeneration are common findings in patients with low-back pain. In supine position, a gap creates in FJ, where fluid may accumulate. We evaluated differences between orthostatic and supine positions in FJ fluid and spondylolisthesis at MRI.
Methods and Materials: Sixty-three consecutive patients (M/F 32/31;mean age±standard deviation 53±16 years) underwent lumbar-spine MRI for low-back pain. Each examination was performed in both standard supine and orthostatic positions (G-Scan, Esaote, Genoa, Italy). Sagittal T1- and T2-weighted fast spin-echo and axial T2*-weighted gradient-echo sequences (supine) and sagittal T2-weighted fast spin-echo sequences (orthostatic) were performed. For each level, we evaluated the presence of FJ fluid and spondylolisthesis in the two positions. McNemar and $\chi 2$tests were used for comparisons.
Results: At L3/L4, FJ fluid was visible in 32 patients (51%) in supine position and in 23 patients (37%) in orthostatic position (p=0.004); spondylolisthesis was visible in 3 (5%) and in 2 (3%), respectively (p=1.000). At L4/L5, FJ fluid was visible in 26 patients (41%) in supine position and in 18 patients (29%) in orthostatic position (p=0.008); spondylolisthesis was visible in 5 (8%) and in 6 (10%), respectively (p=1.000).At L5/S1, FJ fluid was visible in 9 patients (14%) in supine position and in 2 patients (3%) in orthostatic position (p=0.016); spondylolisthesis was visible in 5 (8%) and in 8 (13%), respectively (p=0.375). No differences between male and female were found (p> 0.359).
Conclusion: FJ fluid in supine position tend to reduce compared to orthostatic position, whereas spondylolisthesis do not show significative changes with position.

B-0947 11:43

Feasibility and reproducibility of T2 mapping of the sacroiliac joints at 3 T
G. Lefebvre, A. Bergère, E. Dodré, V. Pansini, X. Demondion, A. Cotten;
Lille/FR (guillaume.lefebvre59@gmail.com)

Purpose: T2 mapping is a validated MRI method to measure in vivo cartilage composition. Despite of its proved usefulness in pathological and healthy conditions for many different articular locations, no study has focused on sacroiliac joints. The aim of the study was to assess the feasibility and reproducibility of sacroiliac cartilage quantification using T2 mapping.
Methods and Materials: Oblique transverse multi echos T2 slices on a 3 T MRI system were acquired on both sacroiliac joints from 30 healthy adults. Region of interest approach allowed us to obtain T2 values in seventy-two different areas per patient (posterior and anterior parts, sacral, intermediate and iliac parts). Inter observer reproducibility of T2 values between two musculoskeletal radiologists was assessed by intraclass Correlation Coefficient (ICC) (Fleiss 1986).
Results: Mean T2 values was 41.27 ms matching with several studies on cartilage T2 mapping. Inter observer reproducibility values between both observers were calculated for the 72 areas. Overall result was good (0.69); results were excellent (R greater than 0.75) for 17 sites, good (0.6-0.75) for 27 sites, moderate (0.4-0.6) for 22 sites and poor (< 0.4) in only 6 cases, particularly in the posterior regions (5 cases).
Conclusion: Our study demonstrates the feasibility and reproducibility of T2 mapping of the sacroiliac joints at 3 T. Its potential usefulness in pathological conditions such as ankylosing spondylitis has to be demonstrated.

B-0948 11:51

The effect of low back pain on positional changes in the lumbar lordosis: a cross-sectional comparison with healthy controls
B. Hansen, T. Bendix, J. Grindsted, H. Bliddal, P. Hansen, R. Christensen, R. Riis, M. Boesen; *Copenhagen/DK (bjarke.hansen.01@regionh.dk)*

Purpose: To examine influence of Low Back Pain (LBP) on the lumbar-lordosis and supine-to-standing changes in a weight-bearing positional MRI.
Methods and Materials: Patients with LBP over 40 on a 100 mm visual analogue scale (VAS) during activities and rest; and matched control group (1:1; based on sex and age decade) without a history of back pain were sampled and consecutively enrolled to both supine and standing positional MRI in a 0.25 T open MRI (G-Scanner). Blinded for group all participants were evaluated for lumbar degenerative MRI findings and the L2-to-S1 lumbar lordosis angle was measured.
Results: Thirty-eight patients with an average LBP VAS of 58 (±13.8) mm during rest and 75 (±5.0) mm during activities were included. Degenerative MRI findings were common in both groups, whereas, a degenerative sum-score (Pfirrmann) was significant higher in the patients than in controls (mean difference: 1.44, 95%CI: 0.80 to 2.10; P < 0.001). The lordosis angle in the patients was significant less lordotic than the controls in both the supine (-6.4, -11.4 to -1.3; P =0.014) and standing position (-5.6, -10.7 to -0.7; P=0.027). Despite this, the supine-to-standing lordosis changes (ΔLA) were the same in both patients (6.8; ± 6.0) and controls (6.0; ± 5.3), which judged by the confidence interval indicated equivalence between groups (0.8, -1.8 to 3.3; P=0.57).
Conclusion: LBP leads to decreased lumbar lordosis in both the supine and standing position in positional MRI, but the change from supine to standing was the same irrespective of LBP.

Author Disclosures:
B. Hansen: Research/Grant Support; The Oak Foundation, Danish Rheumatism Association. Other; Has received travel support and has given invited lectures sponsored by ESAOTE, Genoa, Italy, Acknowledgement: Unrestricted grant from OAK foundation used buy the WB MRI scanner. **H. Bliddal:** Research/Grant Support; Unrestricted grant from OAK foundation. **P. Hansen:** Research/Grant Support; Research/Grant Support; Unrestricted grant from Oak Foundation Denmark and the Danish Reasearch Council. **R. Christensen:** Research/Grant Support; Research/Grant Support; Unrestricted grant from Oak Foundation Denmark. **R. Riis:** Research/Grant Support; Unrestricted grant from OAK foundation. **M. Boesen:** Other; Has received travel support and has given invited lectures sponsored by ESAOTE, Genoa, Italy, Acknowledgement: Unrestricted grant from OAK foundation used buy the WB MRI scanner.

10:30 - 12:00 **Room E2**

Neuro

SS 1411
Ischaemic stroke (2)

Moderators:
A. Biondi; Besancon/FR
W. van Hecke; Antwerp/BE

B-0950 10:30

CT angiography and CT perfusion improve prediction of infarct occurrence and infarct volume at follow-up
T. van Seeters, L. Kappelle, G. Biessels, Y. van der Graaf, B.K. Velthuis;
Utrecht/NL (T.vanSeeters@umcutrecht.nl)

Purpose: We investigated whether CT angiography (CTA) and CT perfusion (CTP) in the acute stage of suspected ischemic stroke improve prediction of infarct occurrence and infarct volume at follow-up.
Methods and Materials: We analyzed 906 patients with suspected anterior circulation stroke from a prospective multicenter cohort study. All underwent non-contrast CT (NCCT), CTA, and CTP at admission and NCCT or MRI after three days. To predict infarct occurrence, logistic regression analyses were performed including patient characteristics and NCCT, with addition of CTA, CTP, and combined CTA/CTP parameters. Multivariable Tobit regression was used to predict infarct volume.

Results: Infarct was detected in 612 patients (67.5%) at follow-up; median infarct volume was 14.8 mL (IQR 2.8-69.6). For infarct occurrence, the area under the curve (AUC) was 0.82 (95% CI 0.79-0.85) for patient characteristics and NCCT, and was higher after addition of CTA (0.85 (0.82-0.87)), CTP (0.89 (0.87-0.91)), and combined CTA/CTP parameters (0.89 (0.87-0.91); all $p < 0.001$). The AUC for addition of CTP parameters was significantly higher than the AUC for adding CTA parameters ($p < 0.001$) and for patient characteristics and NCCT ($p < 0.001$), but not for addition of combined CTA/CTP parameters (p=0.19). For prediction of infarct volume, adding combined CTA/CTP parameters (R2=0.58) was superior to patient characteristics and NCCT alone (R2=0.44) and to addition of CTA (R2=0.55) or CTP alone (R2=0.54; all $p < 0.001$).
Conclusion: CTA and CTP parameters improve prediction of infarct occurrence at follow-up; CTP more than CTA. For infarct volume, the predictive value is highest for addition of combined CTA and CTP parameters.

Author Disclosures:
B.K. Velthuis: Research/Grant Support; Dutch Heart Foundation (2008T034), NutsOhra Foundation (0903-012).

B-0951 10:38

Multicenter experience and outcomes of acute ischemic stroke (AIS) treated with the intra-arterial multimodal thrombectomy using CTP/CTA for patient selection

E. Puglielli[1], R. Lattanzi[1], M. Fuschi[1], V. Di Mizio[1], V. Di Egidio[2]; [1]*Teramo/IT*, [2]*Pescara/IT (edopug@hotmail.com)*

Purpose: Aim of this work is to report our multicenter experience and outcomes in AIS treatment with multimodal endovascular thrombectomy, using CTP/CTA for patients selection.
Methods and Materials: 142 consecutive patients with AIS (mean age 45.7y, from April 2009 to september 2014), with on-set less than 6 hours for the anterior circulation and 12 for the verbtebrobasilar one, undergoing endovascular therapy using retrievable stents or multimodal treatment approaches including, thromboaspiration, intravenous and/or intra-arterial thrombolysis, pharmacologic and PTA/permanent stent placement. Basal CT, CTP/CTA and DSA were used for the imaging. Clinical outcome and mortality were assessed after treatment. Patient's age, sex, aetiology of occlusion, symptom, median NIHSS score at presentation and modified mRS, recanalization rates evaluated with TICI: grade 0 (no flow) grade 3 (normal flow), and haemorrhagic complications were recorded and correlated using a multiple logistic regression analysis.
Results: Median NIHSS score at presentation was 23 (range3-36). Sites of occlusion before treatment were: M1 64/142 patients (45.07%), intracranial carotid 12/142 patients (8.45%), M2 20/142 (14.08%), tandem occlusion 10/142 (7.04%), extracranial internal carotid isolated occlusion 9/142 (6.33%), P1 12/142 (8.45%), basilar trunk 15/142 (10.56%). Therapeutic interventions: multimodal 41/142 patients (28.87%), pharmacologic cheap with t-PA 19/142 (13.38%), mechanical embolectomy 82/142 (57.74%). Successful recanalization (TICI 3 or 2b) was achieved in all patients (TICI III in 110/142 [77.46%]) $p < 0.005$. Asymptomatic haemorrhagic sufusion occurred in one patient with M1 occlusion that spontaneously resolved.
Conclusion: A multimodal endovascular approach using also the retrievable stents in AIS has high recanalization rates, with very low complications.

B-0952 10:46

Application of multi b-values DWI and ASL in acute ischemia stroke: the relationship between fast-ADC and ASL-CBF

L. Hu, N. Hong; *Beijing/CN (hulibao99@163.com)*

Purpose: To assess the value of bi-exponential apparent diffusion coefficient of multi-factors in acute ischemia stroke.
Methods and Materials: 15 patients (11males, 4females, average age 68.7) of ASL and DWI identified acute ischemia stroke with ischemia penumbra were enrolled, where ischemia penumbra referred to the mismatch areas of ASL and DWI.11 b values of 0, 50, 100, 200, 400, 600, 800, 1000, 2000, 3000, 4000s/mm^2 were applied in the bi-exponential model. Region of interests (ROI) were selected in ischemia penumbras and contralateral normal brain regions. Fast-ADCs, Slow-ADCs and ASL-CBFs were achieved. Paired *t* test was applied to compare ASL-CBF, Fast-ADC and Slow-ADC measurements between ischemia penumbras and contralateral normal brain regions. Linear regression and Pearson's correlation were employed to evaluate the correlations among quantitative results.
Results: Fast-ADCs and ASL-CBFs of ischemia penumbras were statistically significant lower ($p < 0.05$) than those of the contralateral normal brain regions. No statistically significant difference ($p > 0.05$) was observed in Slow-ADCs between ischemia penumbras and contralateral normal brain regions.Compared with contralateral normal brain regions, both CBFs and Fast-ADCs decreased in ischemia penumbras, while Slow-ADCs remained the same. A significant correlation (R=0.416) was detected between Fast-ADC and ASL-CBF. No statistically significant correlation was observed between ASL-CBF and Slow-ADC, nor betweenFast-ADC and Slow-ADC.
Conclusion: The decrease of cerebral blood perfusion reason primarily result in the decrease of Fast-ADC in ischemia penumbras; therefore, Fast-ADC can reflect the perfusion situation of cerebral tissues.

B-0953 10:54

Diagnostic improvement from average intensity projection in acute ischemic stroke

N. Magne, B. Dubourg, E. Tollard, O. Ozkul Wermester, V. Macaigne, J.-N. Dacher, E. Gerardin; *Rouen/FR (nicolas.magne.radio@hotmail.fr)*

Purpose: Perfusion CT is helpful and widely-performed in acute stroke diagnosis, but small or deep ischemic lesions can be missed. Our purpose was to estimate the contribution of average intensity projection (AIP) maps to acute stroke diagnosis in patients undergoing multimodal CT examination, particularly in basal ganglia ischemia.
Methods and Materials: Prospective consecutive single-centre study. All patients had symptoms suggesting an acute (< 6 hours) ischemic stroke and underwent an head and neck multimodal CT, including perfusion CT. CT examinations were interpreted by 2 MRI-blinded neuroradiologists. Two independent interpretations were performed, first blinded of AIP maps, then considering it. Cerebral MRI examinations were performed 3-5 days later.
Results: Seventy-nine of the 98 included patients presented an ischemic stroke on MRI. Multimodal CT without AIP found ischemic stroke in 63 patients (sensitivity = 79.8 %). The addition of AIP maps provided 4 more stroke diagnoses, involving the basal ganglia, that were unnoticed on the other perfusion maps, bringing the total to 67 patients with ischemic lesions on multimodal CT (sensitivity= 84.8 %). Focused on basal ganglia necrosis, AIP maps had a sensitivity of 82.2% and a specificity of 94.3%. Interobserver agreement was good for the diagnosis of basal ganglia necrosis from AIP maps ($\kappa = 0.67$). Finally, relative density thresholds were determined for each of the basal ganglia necrotic lesions.
Conclusion: AIP maps provided from CT perfusion examination increased the sensitivity of multimodal head-and-neck CT regarding acute stroke diagnosis.

B-0954 11:02

Dual-energy CT brain in the evaluation of cerebral infarction

H.S. Teh, M.M.L. Tan, S. Srinivasan, T.W. Choy, K.K. Yeow; *Singapore/SG (cyber_xray@yahoo.com)*

Purpose: To evaluate the role of dual-energy CT brain in the evaluation of cerebral infarction.
Methods and Materials: The study was a retrospective analysis performed in a single institution. Twenty-three patients were evaluated for suspected infarcts with CT scan findings of old or recent infarcts. Dual-source CT scanner was used to acquire images at two different energy levels (80 kVp and 140 kVp) simultaneously. Conspicuity of infarcts were evaluated for 80 kVp, 140 kVp as well as routine blended (mixed) images, using 5 point Likert scale. Image quality was assessed by comparing base of skull related artefact between the dual-energy and single-energy images. The Dose-Length product (mGycm) was recorded, and effective dose (mSv) calculated for each of dual-energy and single-energy techniques.
Results: Detectability and conspicuity of ischaemic changes were significantly better for 140-kVp images compared with routine blended (mixed) images (median score: recent infarct, 4 vs 3; old infarct, 5 vs 4, $P < 0.05$). At 80-kVp, recent infarction showed relatively higher attenuation, whereas chronic infarcts remain low in attenuation (median score: recent infarct, 4; old infarct, 2, $P < 0.05$). Image quality was better in dual-energy CT images, with significant less base of skull related artefact (P 0.05). There were no statistical differences between the radiation doses between dual-energy and single-energy CT brain ($P > 0.05$).
Conclusion: Dual-energy brain imaging allows better detectability of infarcts with improved image quality. It may have a potential application in the assessment of the age of infarction.

B-0955 11:10

Endovascular treatment of acute ischemic stroke. Evolution among 100 consecutive patients in the last 10 years

E. Fandiño, J.C. Méndez, D. Lourido, J. García Poza, J. Sanmillán; *Madrid/ES (fandieduar@hotmail.com)*

Purpose: Endovascular treatment for the acute ischemic stroke has quickly evolved in the last years. Nowadays we can offer high rates of recanalisation. Nonetheless we do not obtain similar rates of functional recovery.
Methods and Materials: We have reviewed 100 consecutive patients treated with endovascular procedures of acute ischemic stroke in the last 10 years. The endovascular treatment included intra-arterial thrombolysis, mechanical disruption or thrombectomy. The first 14 patients, from 2004 to 2009, were treated with intra-arterial thrombolysis and mecanical disruption; the following

86 patients, from 2010 to 2014 were treated with several and modern mechanical retrievers.
Results: The number of patients treated with endovascular procedures has grown in the last 4 years at our institution, with better outcomes in terms of recanalisation and functional recovery. We treated 14 patients in the first 6 years, with a recanalization rate TICI 2b/3 of 50%, obtaining a good functional outcome of 66% (modified Rankin Scale ≤2). These rates were improved on the following 86 patients (recanalisation rate TICI 2b/3 of 79%), but paradoxically obtaining a worse functional outcome (mRS ≤ 2 del 62.7%). We explain these results because almost every case that we have been treating for the last 4 years have been proximal occlusions (carotid, M1 and basilar), while the first 6 years we treated suboclussions and distal segments.
Conclusion: Endovascular treatment of acute ischemic stroke shows a favourable tendency to better rates of recanalisation and clinical outcomes, though we are treating worse and more complex occlusions.

B-0956 11:18

Perfusion CT (pCT) in acute stroke: value of automatically generated colour map in the evaluation of patients with acute stroke
M. Ukmar, R. Pozzi-Mucelli, F. Degrassi, F. Neri, F. Pozzi Mucelli, M.A. Cova; *Trieste/IT (mukmar@sirm.org)*

Purpose: To evaluate the correlation between maps of cerebral blood flow (CBF), cerebral blood volume (CBV), mean transit time (MTT) and colour maps generated automatically by the software "Brain Perfusion" in the definition of core and penumbra in patients with acute stroke.
Methods and Materials: 26 patients with suspect of stroke underwent a direct-CT and a pCT within 4.5h from onset of symptoms. Acquisition of the images was done with a last generation CT (256-slice CT-scanner), and reconstruction of the perfusion maps was done with "Brain Perfusion" software. Sensitivity, specificity, positive and negative predictive value (PPV and NPV) were evaluated based on CT findings at follow-up.
Results: Of the 26 patients, 5 didn't show abnormalities at pCT. 2 patients presented abnormalities at pCT but didn't undergo follow-up. Of the remaining 19 patients representing our study population, all underwent direct-CT scan as follow-up after 24-48h. The study of the colour maps gave 2 true negatives (TN), 3 false negatives (FN) and 14 true positives (TP); with sensitivity of 82.3%, specificity of 100%, TPV of 100% and NPV of 40%. The study of the maps generated by the software found 12 TP, 5 FN and 2 TN, with sensitivity of 70%, specificity of 100%, TPV of 100% and NPV of 28%.
Conclusion: The evaluation of automatically generated colour maps could be helpful in the differentiation of core and penumbra in patients with acute stroke in emergency setting. For a more accurate definition of different areas, the separate evaluation of CBF, CBV and MTT is needed.

B-0957 11:26

False penumbra on CT perfusion studies in acute ischaemic stroke (AIS)
E. Puglielli[1], R. Lattanzi[1], M. Fuschi[1], V. Di Mizio[1], V. Di Egidio[2]; [1]*Teramo/IT*, [2]*Pescara/IT (edopug@hotmail.com)*

Purpose: Thrombectomy in AIS has changed the goals of neuro-imaging and computed tomography Angiography/Perfusion (CTA/CTP) plays a pivotal role in the diagnosis and selection of patients eligible for treatment.
Methods and Materials: 95 consecutive patients with AIS (mean age 53.7y, April 2009-September 2014), undergoing endovascular treatment after CT evaluation were included. The penumbra was accurately measured using automated threshold techniques in real time and CTP, TTP, MTT, CBV was obtained in order to differentiate the ischaemic penumbra. A false delayed peak enhancement or increased MTT in a region with normal or only slightly abnormal CBV was suggestive for ischaemic penumbra (Internal Carotid plaques, Anatomic Abnormality, Benign Oligemia), leading to a false appearance of penumbra. Clinical history and findings at basal and CTA and/or DSA was correlated with PCT data with a regression analysis ($p < 0.005$).
Results: CTA can well define the occlusion site, arterial state, collaterals and characterize atherosclerotic status (89.47% [85/95]), whereas CTP accurately delineates the infarct core and the ischaemic penumbra (96.84% [92/95]). False penumbra, each of which produces a different pattern at imaging were: vascular dysregulation (2.1% [2/95]), upstream flow restriction (3.15% [3/95]), evolution of ischaemic change (2.1% [2/95]), positioning of the patient's head during image acquisition (1.05% [1/95]), and variant anatomy in the circle of Willis (5.26% [5/95]).
Conclusion: CTP imaging may be useful to select patients who will benefit from neuroendovascular reperfusion therapy for ischaemic stroke and appear to be as a strong imaging parameter for predicting clinical outcomes in patients with AIS.

B-0958 11:34

Clinical predictors of diffusion-weighted MR-imaging (DWI) abnormalities in transient ischaemic attack (TIA)
M. Mahmoud, A.F. Christensen, I. Havsteen, H. Christensen; *Copenhagen/DK (hchr0039@bbh.regionh.dk)*

Purpose: Diffusion-weighted MR-imaging (DWI) is very sensitive to acute ischaemic lesions in transient ischemic attack (TIA). A DWI abnormality can thus support the clinical diagnosis of TIA. The purpose of this study was to identify clinical predictors of a DWI abnormality.
Methods and Materials: We studied 1418 consecutive patients admitted to our department with a clinical diagnosis of TIA or minor stroke from February 2010 to February 2014. We included patients presenting with acute focal neurological symptoms and who underwent a DWI scan during hospitalization. The association between specific clinical characteristics and presence of a DWI abnormality was examined by odds ratios (ORs) in a univariate analysis and adjusted ORs in a multivariate analysis.
Results: Age > 60 years (OR=2.06, 95% CI=1.61-2.62), gender (male, OR=2.13, 95% CI=1.67-2.72), symptom duration > 24 hours (OR=2.57, 95% CI=1.78-3.69), ataxia (OR=3.40, 95% CI=2.12-5.48), dysarthria (OR=3.23, 95% CI=2.34-4.47), facial palsy (OR=2.67, 95% CI=1.98-3.62), hemiparesis (OR=2.16, 95% CI=1.65-2.83), monoparesis (OR=1.98, 95% CI=1.47-2.67), and aphasia (OR=1.36, 95% CI=1.02-1.81) were significantly associated with a DWI abnormality. On the contrary, syncope (OR=0.22, 95% CI=0.07-0.73), visual impairments (OR=0.41, 95% CI=0.30-0.56), and sensory symptoms (OR=0.65, 95% CI=0.51-0.82) were found to be significantly associated with no DWI lesion. A multiple logistic regression analysis confirmed the results.
Conclusion: Our findings confirm existing high-risk markers as predictors of a DWI abnormality in TIA. Clinical symptoms less suggestive of TIA predicted no abnormality. These clinical predictors may help differentiate transient neurological symptoms due to cerebral ischemia from symptoms with non-cerebrovascular etiologies.

Author Disclosures:
M. Mahmoud: Research/Grant Support; Supported by the Department of Neurology Bispebjerg research grant.

B-0959 11:42

Benefits and harms of endovascular devices for acute ischaemic stroke in accordance with the cochrane collaboration recommendations
J. Kristensen, C. Gluud, A.F. Christensen, H. Christensen; *Copenhagen/DK (hchr0039@bbh.regionh.dk)*

Purpose: To examine benefits and harms of endovascular devices for acute ischaemic stroke in accordance with The Cochrane Collaboration recommendations and to assess risk of systematic errors with bias domains and risk of random errors with trial sequential analysis (TSA) and quality according to GRADE.
Methods and Materials: All randomised trials evaluating endovascular intervention versus no intervention, sham, or thrombolysis were included. For assessment of adverse events, other study designs were also included. We searched publication databases and trial registries until December 2013. Two review authors individually applied the inclusion criteria, extracted data, and assessed the risks of bias.
Results: 5 trials provided data. All trials had a high risk of bias. 1 trial compared endovascular interventions (n=70) versus no intervention (n=57). At 90 days, no differences were found on modified Rankin Scale score (MRSS) 3-6 (risk ratio (RR) 0.80, 95% CI 0.62-1.01, P=0.06) or on all-cause mortality (RR 0.75, 95% CI 0.37-1.52, P=0.43). 4 trials compared endovascular interventions (n=643) to intravenous thrombolysis (n=436). At 90 days, no differences were found on MRSS 3-6 (RR 0.97, 95% CI 0.84-1.13, P=0.73) or on all-cause mortality (RR 1.02, 95% CI 0.78-1.33, P=0.45). TSA demonstrated paucity of data for all meta-analyses. The quality of evidence was graded low or very low according to GRADE. Based on randomised clinical trials and observational evidence, endovascular devices were associated with a number of adverse events, especially intracerebral haemorrhage.
Conclusion: We did not find beneficial or harmful effects of endovascular interventions versus no intervention or versus thrombolysis.

Author Disclosures:
J. Kristensen: Research/Grant Support; Supported by the Department of Neurology Bispebjerg research grant.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 1416
Prostate cancer imaging

Moderators:
E.C. Pereira Mendes Serrao; Cambridge/UK
G. Petralia; Milan/IT

B-0960 10:30

Apparent diffusion coefficient ratio correlates significantly with prostate cancer Gleason score at final pathology

L. Boesen, E. Chabanova, V. Loegager, I. Balslev, H.S. Thomsen; *Herlev/DK (lars.boesen@dadlnet.dk)*

Purpose: To evaluate the correlation between apparent diffusion coefficient measurements (ADCtumour and ADCratio) calculated from prostate cancer tumour foci and the Gleason score from radical prostatectomy specimens.
Methods and Materials: Seventy-one patients with clinically localized prostate cancer scheduled for radical prostatectomy were prospectively enrolled. Multiparametric MRI (T2W, DWI and DCE) was performed prior to prostatectomy and mean ADC values (calculated from DWI b100 and b800) were measured from both cancerous (ADCtumour) and benign (ADCbenign) tissue to calculate the ADCratio (ADCtumour divided by ADCbenign). The ADC measurements were correlated with the Gleason score from the prostatectomy specimens.
Results: The association between ADC measurements and Gleason score showed a significant negative correlation ($p < 0.001$) with spearman rho for ADCtumour (-0.421) and ADCratio (-0.649), respectively. There was a statistically significant difference between ADC measurements and the Gleason score for all tumours ($p=0.001$). Receiver operating characteristic curve analysis showed an overall AUC of 0.73 (ADCtumour) to 0.80 (ADCratio) in discriminating Gleason 6 from Gleason ≥7 tumours. The AUC changed to 0.72 (ADCtumour) and 0.90 (ADCratio) when discriminating Gleason ≤7 (3+4) from Gleason ≥7 (4+3).
Conclusion: ADC measurements showed a significant correlation with tumour Gleason score at final pathology. The ADCratio demonstrated the best correlation compared to the ADCtumour value and radically improved accuracy in discriminating Gleason ≤7 (3+4) from Gleason ≥7 (4+3) tumours.

B-0961 10:38

The influence of 3.0 T multiparametric prostate magnetic resonance for the identification and localisation of prostatic cancer

D. Cenzi, L. Zantedeschi, A. Borsato, M. Motton, G. Schenal, S. Montemezzi; *Verona/IT (daniela.cenzi@ospedaleuniverona.it)*

Purpose: To evaluate the accuracy of 3.0 Tesla multiparametric magnetic resonance imaging (MP-MRI) for the diagnosis of prostatic cancer compared with histology.
Methods and Materials: From January 2012 to September 2014, 250 patients with suspect of prostatic cancer underwent MRI in our Institute. In all patients, MRI was performed at 3 T using a pelvic phased-array coil and included T2-weighted imaging, diffusion-weighted imaging, dynamic contrast-enhanced imaging and proton MR spectroscopy. Three radiologists in consensus reviewed all cases and give a Likert-like standardized score ranging from one to five based on MRI findings. These interpretations were correlated with findings on histology.
Results: Median age and PSA were 68 years and 13.88 ng/ml, respectively. Among 250 patients, in 101 we could compare the results of MRI with histology. Comparing results with T2 + DWI + DCE (MP-MRI) we obtained SE 82%, SP 76%, VPN 79% and SE 90%, SP 88%, VPN 89% with a statistical significant difference ($p < 0.05$). Furthermore, on a per-lobe basis, MP-MRI reported a significant correlation between Gleason score and tumour detection on MRI (p 0.02).
Conclusion: In our sample, MRI had 90% sensitivity in predicting the presence of tumour in comparison to the Gleason score, suggesting a possible role for MRI in selecting patients with PSA to undergo prostate biopsy, better than results reported with 1.5 T MRI. In patients with a positive MRI result, tissue sampling remains necessary for confirmation of the diagnosis as well as for treatment planning.

B-0962 10:46

Multiparametric MRI of prostate: can it serve as a screening tool for cancer detection? A tertiary care cancer hospital experience from South India

A. Prahladan, K. Kalidos, S. Koshy, R. Krishnankutty Nair; *Thiruvananthapuram/IN (dr.anilp@hotmail.com)*

Purpose: To determine whether mpMRI can be used as a screening tool for prostate cancer detection.
Methods and Materials: A prospective study approved by our institutional review board was done. 54 consecutive patients with suspected carcinoma prostate and referred for mpMRI were included as study subjects. All patients underwent mpMRI (T2WI,DWI and DCEI) at 1.5 T with dedicated endorectal coil (GE Signa HDx). Using ESUR guidelines, individual PI-RADS scores were assigned for eight sectors (6PZ+2TZ) of prostate, following which PI-RADS-S score was calculated. TRUS guided modified sextant biopsy, which included 6 sectors of PZ and in selected cases 2 cores from TZ were done for all patients. Each sector scored, was compared with corresponding histopathological findings cores. Receiver operating characteristics (ROC) analysis done.
Results: In 54 patients (age:67.48±7.6, S.PSA:23.1±24) 274 sectors and corresponding cores were analysed. 76 were malignant and 198 benign. Area under the ROC curves (AUC) of T2WI, DWI, DCEI and PI-RADS-S score were 0.841 (0.792-0.882), 0.897 (0.855-0.931), 0.836 (0.787-0.878) and 0.933 (0.896-0.959) respectively with $p < 0.0001$. The sensitivity and specificity were 88.2%/47% for T2WI, 81.6%/92.4% for DWI and 65.8%/95.4% for DCEI with cut-off of 3. Youden-selected threshold for PI-RADS-S score was 9 with sensitivity, specificity and Youden's index of 79%, 95.5% and 0.744 (0.6395-0.8211) respectively.
Conclusion: mpMRI especially with diffusion weighted imaging can detect prostate cancer with reasonably high sensitivity and specificity. Further studies in this regard may cement the role of MR as a screening modality for detection of prostate cancer.

B-0963 10:54

T2 star relaxation time in the detection and assessment of aggressiveness of peripheral zone cancer in comparison with diffusion-weighted imaging

L.-M. Wu, X.-X. Chen, J.-R. Xu; *Shanghai/CN (wlmssmu@126.com)*

Purpose: To assess the feasibility of T2 star relaxation time for distinguishing benign from malignant regions, as well as tumour aggressiveness, within the peripheral zone of the prostate in comparison with DWI.
Methods and Materials: Fifty-eight patients with prostate cancer underwent 3.0 T MRI by using a multi-echo T2 star and DWI (maximum b value, 2000 sec/mm^2). Parametric maps were obtained for ADC and T2 star value. Two radiologists reviewed these maps and measured ADC and T2 star value in sextants positive for cancer at biopsy. Data were analyzed by using mixed-model analysis of variance and receiver operating characteristic curves.
Results: Ninety-three sextants exhibited a Gleason score of 6; 59 exhibited a Gleason score of 7 or 8. T2 star value was significantly greater in cancerous sextants than in benign PZ (48.69+0.60 vs 74.14+0.56, $P < 0.001$), as well as in cancerous sextants with higher rather than lower Gleason score (52.18+0.55 vs 43.18+0.89, $P < 0.001$). T2 star value showed significantly greater specificity for differentiating cancerous sextants from benign PZ than ADC (93.1% vs 89.7%, $P < .001$), with equal sensitivity (82.8% vs 81.0%, $P > 0.05$).T2 star value exhibited significantly greater sensitivity and specificity for differentiating sextants with low and high-grade cancer than ADC (79.6% vs 64.5% and 81.4% vs 72.9%, respectively; $P < 0.05$).T2 star value had significantly greater area under the curve for differentiating sextants with low- and high-grade cancer than ADC (0.77 vs 0.71, $P < 0.01$).
Conclusion: Preliminary findings suggest increased value for T2 star relaxation time compared with DWI in prostate peripheral zone cancer assessment.

B-0964 11:02

High resolution computed DWI with high b-value for prostate cancer: a preliminary study

Y. Ueno[1], S. Takahashi[1], Y. Ohno[1], M. Yui[2], Y. Kassai[2], Y. Ueda[1], K. Kyotani[1], K. Sugimura[1]; [1]*Kobe/JP*, [2]*Ohtawara/JP (yoshiu@med.kobe-u.ac.jp)*

Purpose: To assess the clinical utility of high resolution computed diffusion weighted imaging (HR-cDWI) for prostate cancer (PCa) detection at 3 T by adding to really acquired DWI.
Methods and Materials: Twenty patients with pathologically-proven PCa (65±5.6y) underwent prostate MRI at 3 T including T2WI (TR/TE 4000/130 ms; 0.7×0.7×3.0 mm), DWI (TR/TE 7000/65 ms; 3.5×2.8×3.0 mm; b-value 0, 2000 s/mm2) and high resolution DWI (TR/TE 7000/65 ms; 2.2×2.2×3.0 mm; b-value 0, 800, 2000 s/mm2). HR-cDWI at b=2000 s/mm2 (HR-cDWI2000) was generated from high resolution DWIs at b=0 and 800 s/mm2 based on the mono-exponential model. For qualitative assessment, the image quality on

each DWI was evaluated by 5-point scoring system. For quantitative assessment, the contrast ratio (CR) between cancerous and non-cancerous lesions on each DWI was evaluated. Each Image quality score and CR was compared by Tukey's test. Four combinations of images; protocol A (T2WI+aDWI2000), protocol B (T2WI+aDWI2000+HR-aDWI800), protocol C (T2WI+aDWI2000+HR-aDWI200) and protocol D (T2WI+aDWI2000+HR-cDWI2000) were assessed for their diagnostic capability for PCa by receiver operating characteristic analyses.
Results: HR-cDWI2000 showed significantly higher image scale than HR-aDWI800, and HR-aDWI2000 (3.6±0.5, 3.1±0.3, 3.2±0.5, $p < 0.05$). CR of HR-cDWI2000 (0.35) was significantly higher than that of other DWIs. Area under the curve (Az) of protocol D (Az=0.75) was significantly larger than that of other protocols (A: Az=0.68, B: Az=0.68, C: Az=0.69, $p < 0.05$).Specificity of protocol D (82.2%) was significantly higher than that of protocol A (56.7%, $p < 0.05$).
Conclusion: HR-cDWI2000 is useful for improving the diagnostic capability for PCa by adding to aDWI2000 due to its good image quality.

Author Disclosures:
Y. Ohno: Grant Recipient; Toshiba Medical Corporation. **M. Yui:** Employee; Toshiba Medical Corporation. **Y. Kassai:** Employee; Toshiba Medical Corporation.

B-0965 11:10

Diffusion tensor imaging in diagnosing prostate cancer: an innovative application of a proven technique
R. Balaji; *Chennai/IN (ravikanthbalaji@gmail.com)*

Purpose: To investigate usefulness of diffusion tensor imaging in diagnosing prostatic malignancy and predicting tumour aggressiveness.
Methods and Materials: MR examination was performed on 43 patients with biopsy proven prostatic malignancy. MR imaging was performed on 1.5 T Philips Achieva scanner (Achieva, Philips Healthcare, Best, the Netherlands). DTI data were acquired using a diffusion weighted single shot echo planar imaging (EPI) sequence with 18 gradient directions and diffusion data was obtained at b values of 0 and 800.Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) values were calculated from the DTI data.
Results: There is moderate correlation between FA and ADC values. Malignant foci show increased FA and decreased ADC values. Tumours with high grade show increased FA and decreased ADC, while tumours with low grade having lower cellularity with randomly arranged cells will show low FA and high ADC values.
Conclusion: DTI not only identifies tumour foci but also provides an indication of aggressiveness of the tumour. The strength of correlations between FA and ADC values is insufficient for immediate diagnostic utility. However, these results warrant further investigation on the potential of DTI to facilitate noninvasive assessment of tumour aggressiveness.

B-0966 11:18

1.5 Tesla MRI of the prostate with 32-channel phase array cardiac coil: is it better than endorectal coil?
A. Discalzi, R. Faletti, C. Guarnaccia, A. Dominguez, D. Righi, P. Fonio, G. Gandini; *Turin/IT (andreadiscalzi@gmail.com)*

Purpose: To compare morphological, functional and perfusion MRI with a 32-channel phase array cardiac coil and pathology and evaluate differences with endorectal coil.
Methods and Materials: We conducted a retrospective study evaluating 109 prostate MRI performed between January 2011 and May 2013 with 1.5 Tesla MRI (Philips Achieve) and 32-channel phase array cardiac coil. It was performed statistical analysis considering a possible correlation between imaging and histological grading of lesions and comparing these data with the literature. We selected patients with progressive increase in PSA values and with negative prostate biopsies before MRI. The multiparametric study protocol included T2-weighted sequences, diffusion-weighted (DWI), from which it is derived the ADC (apparent diffusion coefficient) map, and perfusion study after intravenous infusion of paramagnetic contrast (Gd-BOPTA).
Results: The morphological study and DWI showed low values of specificity and high sensitivity (T2 Sens. 0.80 Spec. 0.63; DWI Sens. 0.94 Spec. 0.52). The multiparametric imaging was more specific than just T2-weighted studies (Spec. 0.83 p0.006). The ADC was found to be inversely correlated to the outcome of the biopsy: one unit increase in the Gleason score is associated with a reduction of the ADC of 0.08 mm2/ s. Therefore, lesions with values less than 0.8 mm2/ s were more frequently malignant (ROC-AUC 0.78, conventionally defined as Good).
Conclusion: In multiparametric studies, MRI with 32-channel phase array cardiac coil is comparable to what is reported in literature with endorectal coil. In our experience there is an inverse correlation between ADC and Gleason score.

B-0967 11:26

MRI findings in men on active surveillance for prostate cancer: does dutasteride make MRI visible lesions less conspicuous? Results from a pilot randomised controlled trial
F. Giganti[1], C.M. Moore[1], N.L. Robertson[1], A. Freeman[1], F. De Cobelli[2], M. Emberton[1], C. Allen[1], A. Kirkham[1]; [1]*London/UK*, [2]*Milan/IT (giganti.francesco@hsr.it)*

Purpose: To investigate changes in the Apparent Diffusion Coefficient (ADC) values using DW-MRI in men on active surveillance for prostate cancer taking dutasteride 0.5 mg or placebo daily for six months.
Methods and Materials: Institutional review board approval and patient informed consent were obtained. 40 men, randomised to 6 months of daily dutasteride 0.5 mg (n=20) or placebo (n=20), underwent 3 T multi-parametric Magnetic Resonance Imaging (mpMRI) scans at baseline, 3 and 6 months. Images were reviewed by 2 radiologists in consensus blind to treatment allocation and clinical information. Minimum and mean ADC of peripheral (PZ), transitional (TZ) and MR-suspicious lesions were compared between the dutasteride and placebo groups at baseline, 3 and 6 months (Mann-Whitney test; $p < 0.05$ significant). Conspicuity was defined as the mean PZ ADC divided by the mean lesion ADC; its change over 6 months was assessed.
Results: At 6-months men in the dutasteride group had significantly lower minimum (1.15 vs 1.51 x 10^{-3} mm^2/s, p =.032) and mean (1.53 vs 1.82 x 10^{-3} mm^2/s, p = 0.01) ADC values in the PZ and, conversely, higher mean ADC in the lesion (1.15 vs 0.93 x 10^{-3} mm^2/s, p = 0.04) and a significant increase of mean lesion ADC (12.5 vs 2.5%, p = 0.01). ADC conspicuity changes between the two groups over 6 months were demonstrated (1.04 vs 0.81, p <.001).
Conclusion: Dutasteride 0.5 mg daily is associated with a significant reduction in the conspicuity of small prostate cancer lesions under active surveillance on DW-MRI.

B-0968 11:34

Prostate cancer staging with extracapsular extension risk scoring using multiparametric MRI: a correlation with histopathology
L. Boesen, E. Chabanova, V. Loegager, I. Balslev, K. Mikines, H.S. Thomsen; *Herlev/DK (lars.boesen@dadlnet.dk)*

Purpose: To evaluate the diagnostic performance of preoperative multiparametric MRI with extracapsular tumour extension (ECE) risk scoring in the assessment of prostate cancer tumour stage (T-stage) and prediction of ECE at final pathology.
Methods and Materials: Eighty-seven patients with clinically localised prostate cancer scheduled for radical prostatectomy were prospectively enrolled. Multiparametric MRI (T2W, DWI and DCE) was performed prior to prostatectomy and evaluated according to the ESUR MR prostate guidelines by two different readers. An MRI clinical T-stage (cTMRI) and an ECE risk score were assigned. Additionally, suspicion of ECE was dichotomized by the readers into either organ-confined disease or ECE based on ECE risk criteria and personal opinion. Histopathological prostatectomy results served as standard reference.
Results: Histopathology and cTMRI showed a spearman rho correlation of 0.658 ($p < 0.001$) and a weighted kappa=0.585 [CI 0.44;0.73](reader A). ECE was present in 31/87 (36%) patients. ECE risk scoring showed an AUC of 0.65-0.86 on ROC-curve for both readers with sensitivity and specificity of 81% and 78% at best cut-off level (reader A), respectively. When ECE criteria were influenced by personal opinion, the sensitivity and specificity for prediction of ECE changed to 61%-74% and 77%-88% for both readers, respectively.
Conclusion: Multiparametric MRI with ECE risk scoring is an accurate diagnostic technique in determining prostate cancer clinical tumour stage and ECE at final pathology.

B-0969 11:42

MR-guided prostatic biopsy at 3 T: the role of PI-RADS-score: a histopahologic-radiologic correlation
A. Malich; *Nordhausen/DE (ansgar.malich@shk-ndh.de)*

Purpose: A correlation of imaging and histopathological outcome was performed at 3 T-based MR-guided prostate biopsies to verify the diagnostic relevance of T2w vs. DWI and dynamic analysis.
Methods and Materials: 189 prostatic lesions were histologicaly verified by MR-guided biopsy (3 T MRI Philips Ingenia) after inconclusive ultrasound guided biopsy according to multiparametric MRI: T2w, dynamic analysis (> 5 min, single scan < 13s, DynaCAD and Confirma-CAD) and DWI-analysis (b-value 1000) and PI-RADS score 4 or 5. PI-RADs-scheme of all single diagnostic features was matched to histopathologic outcome.
Results: 71/189 lesions were proven invasive-malignant and 14/189 lesions ASAP. 39/189 lesions were verified prostatitis, 31/189 hyperplasia, 29/189 atrophic tissue or other benign prostatic pathology. In 5/189 biopsies paraglandular tissue was found. No complication occurred at all. 24% of the histologically verified lesions were located in the central zone. T2w finding was

scored as 4 or 5 in 159 cases (sens: 50.9%; spec: 86.7%); sensitivity and specificity of DWI/ADC-calculation was 60.4%; spec: 63.4% and for dynamic analysis 50.4% and 60.5%, resp.
Conclusion: MR-guided prostate biopsy is a safe and useful intervention especially after inconclusive ultrasound guided biopsy of the prostate gland. PI-RADS-scoring according to T2w-data is more accurate for determination of malignancy, multiparametric analysis is, however essential to improve the diagnostic value especially when analyzing the central zone. CAD-based scoring of contrast uptake of prostatic lesions is less accurate, less specific vs. DWI. Further dynamic parameters, e.g. slope, peak uptake, Kep might be helpful to improve diagnostic potential of dynamic prostate MRI.

B-0970 11:50

Role of 3 T MRI in radiotherapy planning for stereotactic treatment of the prostate with helical tomotherapy

G. Timon, S. Agostinelli, G. Blandino, G. Vidano, S. Barra, R. Corvò; *Genoa/IT (giorgiatimon@gmail.com)*

Purpose: The aim of our study was to evaluate if the target volume in stereotactic radiotherapy (SBRT) in prostate cancer was different using CT or MR scan for the planning.
Methods and Materials: A protocol of SBRT with Tomotherapy for early-stage prostate cancer (36.25 Gy in 5 fractions) has been introduced in our institute. Patients underwent CT and MR examinations in the same position, and the images were co-registered to be used in treatment planning. We performed a comparison between patients with small and large prostate, in terms of target volume and dose to organs at risk (OARs).
Results: We preliminarily evaluated the clinical target volume (CTV) on CT and MR in 5 patients, resulting in a smaller volume if the prostate was contoured on MR. This difference was more relevant for smaller prostate volumes: -46-55% for prostate < 40 cc vs -26-30% for prostate > 60 cc. In the 2 patients we evaluated for dose to OARs, the spare using MR-based treatment planning was particularly significant in penile bulb (-62-89% in maximum dose), but it was observed in rectum and bladder as well (-35-47% and -6-25% respectively).
Conclusion: The target volume was smaller using MR instead of CT for treatment planning. In the 2 patients we evaluated in terms of OARs the use of MR led to a dose reduction, particularly for the penile bulb. This may impact on toxicity, if these data will be confirmed by further studies.

10:30 - 12:00 **Room F2**

GI Tract

SS 1401

Abdominal and vascular imaging

Moderators:
M.M. Maher; Cork/IE
M. Ronot; Clichy/FR

B-0972 10:30

Assessment of bowel wall enhancement for the diagnosis of intestinal ischemia in patients with small bowel obstruction: value of adding unenhanced CT to enhanced CT

A.-M. Chuong, L. Corno, H. Beaussier, G. Chatellier, M. Zins; *Paris/FR (chuong.am@gmail.com)*

Purpose: To evaluate the value of adding unenhanced computed tomography (CT) to enhanced CT to assess decreased bowel-wall enhancement (DBE) for diagnosing intestinal ischemia in a large population with small bowel obstruction (SBO).
Methods and Materials: Two gastro-intestinal radiologists (A and B) performed retrospectively independent blinded reviews of 164 unenhanced and enhanced CT scans of 158 consecutive patients admitted for SBO. The diagnosis of ischemia was established either by the surgical and/or the histopathologic findings (80 cases) or the clinical follow-up (84 cases). DBE was assessed,according to a three-point confidence scale, using first enhanced CT images alone and one month later both unenhanced and enhanced CT images.
Results: In 41 of 164 (25%) CT scans, ischemia was confirmed at surgery and/or histopathologic findings examination. Sensitivity of DBE was improved between the 2 reviews for both readers A (46.3%[19/41] vs 65.8%[27/41], p=0.027) and B (56.1%[23/41] vs 63.4%[26/41], p=0.45). The positive likelihood ratio was increased for both readers A (11.4 vs 13.5) and B (3.6 vs 11.1). The mean confidence score was significantly ($p < 0.001$) increased : 2.27 vs 2.88 and 1.70 vs 2.77 for readers A and B respectively. Inter-observer agreement improved from fair (κ=0.48) to excellent (κ=0.89).
Conclusion: Unenhanced CT in addition to enhanced CT increases the sensitivity, the positive likelihood ratio, the mean confidence score and the inter-observer agreement of the DBE sign for diagnosing intestinal ischemia complicating SBO.

B-0973 10:38

Computed tomography as a diagnostic tool for disseminated histoplasmosis

V.V. Maller, M.O. Afzal, S. Shankar; *Memphis, TN/US (vijethamaller@gmail.com)*

Purpose: Evaluate the efficacy of computed tomography for early diagnosis of disseminated histoplasmosis using CT-scoring system.
Methods and Materials: In our retrospective study we enrolled 40 patients who had confirmed disseminated histoplasmosis based on positive blood cultures and 50 patients who were suspected of having the disease but the blood cultures were eventually negative. Both groups were matched in age (20-50yr's), underlying disease (HIV,AIDS) and received Abelcet. Charts, labs and computed tomography images of all these patients were reviewed. On CT Lymphadenopathy, hepatomegaly, splenomegaly, splenic hypodensities, adrenal nodularity, lymph node calcification were used as marker of disease. Score of 0 and 1 was given for normal and abnormal findings respectively. For lymph nodes scores of 0 - 3 were used, 0 being normal and 3 large necrotic nodes. Net score was calculated using all the postive findings.
Results: In the 40 patients with disseminated histoplasmosis the average CT score was 4.3 while in other group the average score was 1.6. Using 4 as a cut of criteria it had a 74% sensitivity, 89% specificity 80% PPV and 85% NPV. Most striking finding was adrenal nodularity with 88% specificity and 62% sensitivity. Most consistent finding in the disease group was pulmonary and abdominal lymphadenopathy. Least reliable findings were hepatomegaly and splenomegaly.
Conclusion: Computed tomography is an effective diagnostic tool in the setting of disseminated histoplasmosis with good sensitivity and high specificity using the proposed CT-scoring system.

B-0974 10:46

MDCT angiography for suspected acute mesenteric ischemia: diagnostic yield for ischemic and alternative conditions

F.O.O. Henes[1], A. Herzyk[1], G. Adam[1], M. Regier[1], T. Derlin[1], A. Laqmani[1], M. Lubner[2], P. Pickhardt[2], P. Bannas[2]; [1]*Hamburg/DE*, [2]*Madison, WI/US (fhenes@uke.de)*

Purpose: To assess the diagnostic yield of both ischemic and alternative diagnoses at MDCT angiography for the indication of suspected acute mesenteric ischemia.
Methods and Materials: This retrospective bicentric study cohort consisted of 779 consecutive adults (486 male; 293 female; mean age, 64 years; age range, 18-96) referred to MDCT angiography for evaluation of suspected acute mesenteric ischemia from 2006 to 2014 at two academic medical centers. MDCT was performed with 16-, 64- or 256-section multi-detector CT scanners in early arterial and portal venous phases. The prospective radiologist interpretations were correlated with the subsequent clinical course. The ultimate clinical diagnosis for reference standard was based on the combination of all clinical, radiologic, surgical, endoscopic, and pathologic data.
Results: A specific diagnosis at MDCT was made in 467 (59.9%) of 779 patients. Acute mesenteric ischemia was diagnosed in 151 patients (19.4%) and a specific alternative diagnosis was made in 316 patients (40.6%). No significant difference in diagnostic rates was seen between the two centers. The most common broad categories of alternative disease included gastrointestinal (n=163, 20.9%), hepatopancreaticobiliary (n=50, 6.4%), genitourinary (n=17, 2.2%) and gynecologic (n=4, 0.5%) conditions. Other specific diagnoses were made in 82 patients (10.5%).
Conclusion: In 60% of adult patients clinically suspected of having acute mesenteric ischemia, MDCT identifies a specific cause for clinical symptoms, confirming ischemia in one-third and alternative diagnoses in two-thirds of these cases. As such, MDCT evaluation provides for rapid and non-invasive diagnosis in this vital clinical setting, allowing for prompt and appropriate patient management.

B-0976 10:54

Active severe gastrointestinal bleeding (GIB): diagnostic performance of the expanded criteria for positive findings on multi-detector CT angiography (MDCTA)

G. Zhang, H. Sun, X. Li, Z. Jin; *Beijing/CN (zhang_stacey@163.com)*

Purpose: To assess the diagnostic capability of the expanded criteria for positive MDCTA findings in active severe GIB.
Methods and Materials: A total of 115 patients with clinical signs of active severe GIB underwent MDCTA. Images were scored as follows: 1=no GIB source, 2=presence of lesion (s) but no GIB source, 3=presence of focal or

segmental abnormal bowel mucosal enhancement, polyp or diverticulum with abnormal enhancement, 4=presence of a vascular malformation or gastrointestinal tumour, 5=presence of active extravasation of contrast material within bowel lumen. The standard criteria for positive findings was defined as a score of 5 but we proposed to expand the criteria to a score greater than or equal to 3. The standards of reference included digital subtraction angiography, endoscopy, surgery or pathology reports. Sensitivity, specificity, receiver-operating characteristic analysis and the area under the curve (AUC) of the two criteria were evaluated and compared.
Results: Ninety-four patients scored at least 3 and 43 patients scored 5. Active GIB source confirmed by one or more reference standards was identified in 100 patients, of which 93 patients scored at least 3 and 43 patients scored 5. Compared to the standard criteria, the expanded criteria showed an improved diagnostic capability with a significantly increased AUC (0.962±0.017 vs 0.715±0.054, $P < 0.01$) and sensitivity (93.0% vs 43.0%, $P < 0.05$) and a similar specificity (93.3% vs 100%, $P > 0.05$).
Conclusion: The proposed expanded criteria for positive MDCTA findings could be used to diagnose active severe GIB more accurately.

B-0977 11:04

Significance of mesenteric volvulus in patients with bowel obstructive symptom and history of gastric surgery on multidetector CT
J. Nam, J. Lee, Y. Jeong, M. Bang, S. Shin, S. Choi; *Ulsan/KR (0732607@uuh.ulsan.kr)*

Purpose: To evaluate significance of CT features of "mesenteric volvulus" in patients manifested with bowel obstructive symptoms and history of gastric surgery previously.
Methods and Materials: We retrospectively searched radiology information system for patients with previous gastric surgery who had undergone CT between January 2006 to January 2014. We found cases of 30 patients (20 men, 10 women) with mesenteric volvulus and manifested with bowel obstructive symptoms. CT features of mesenteric volvulus, such as mesenteric whirling, compromise of SMV, engorgements of SMV tributaries, compromise of SMA, mesenteric edema, mechanical small bowel ileus, decreased mural enhancement of bowel loops, ascites, and combined whirling of terminal ileum, were reviewed. These findings were compared in order to calculate statistical difference about frequencies of CT findings between two groups performing surgical management and conservative treatment, respectively.
Results: Patients with mesenteric volvulus underwent surgical management in 18 patients, and resolved with conservative treatment in 12 patients, respectively. Two CT features of decreased mural enhancement of small bowel loop and combined whirling of terminal ileum were seen in nine and eight of 18 cases of surgical management group, respectively, and significantly different among two groups. Other CT features did not show significant difference among two groups.
Conclusion: "Mesenteric volvulus" were involved in both groups of surgical management and conservative treatment. Surgical treatment for any patient with mesenteric volvulus on MDCT should be correlated with CT features, especially such as decreased small bowel mural enhancement and combined whirling of terminal ileum, as well as clinical condition.

B-0978 11:12

Comparison between CT and anatomopathologhical findings in gastrointestinal tumours (GIST)
F. Carbonetti, E. Berardi, G. Federici, M. Di Pietropaolo, C. Fantini, S. Caterino, E. Iannicelli, V. David; *Rome/IT (francescocarbonetti799@hotmail.com)*

Purpose: Correlate CT findings with the Miettinen's risk stratification in GIST.
Methods and Materials: Retrospective evaluation of CECT of 46 patients with a pathologically proven diagnosis of GIST was performed. Multiple CT findings were analyzed; we focused our study on localization, size, margins, necrosis, grade and pattern of contrast enhancement of the lesions and we looked for correlation / association between these parameters and the tumours' number of mitoses.
Results: We found two associations: irregular margins were present only in the 14.3% of the lesions with ≤ 5mitoses /50 HPF, and in the 45.5% with > 5mitoses /50 HPF (p value 0.017); the lesions without necrosis had regular margins in the 100% of the cases (p value 0.002). We also found an association (p value 0.017) between the mitoses' number and the size of the tumour, whereas GIST population in our sample had a prevalent gastric origin (70%).No association or correlation were found between the number of mitoses and the grade and pattern of contrast enhancement or the presence of necrosis.
Conclusion: Concerning with the Miettinen's index of progression's risk (location, size and mitosis), location and size are well evaluable on CECT. Our results demonstrate that the CT finding mostly associated with the tumours' number of mitoses is represented by the margins of the lesions. In GIST tumours, the presence of necrosis, the grade and the pattern of enhancement, usually considered as CT malignant features in other tumours, appeared to be independent factors of the tumour aggressiveness.

B-0979 11:20

CT in peritoneal tuberculosis revisited: mystery, myth and reality
M. Khanna, S. Ramanathan, A.M. Abualruz, D. Kumar, S.R. Buddhavarapu, A. Darweesh, J. Khanna; *Doha/QA (mkhanna@hmc.org.qa)*

Purpose: To evaluate the CT findings in peritoneal tuberculosis and compare it to already described findings in the literature.
Methods and Materials: Retrospective review of CT findings in 50 clinically or histopathologically proven cases of peritoneal tuberculosis was performed. The images were reviewed for (1) Peritoneal, omental and mesenteric changes, (2) Type and distribution of ascites and (3) Location, appearance and enhancement patterns of abdominal lymphadenopathy.
Results: Discrete involvement of supradiaphragmatic lymph nodes was seen in 33 patients (85%) as the dominant group and in 17 (43%) cases as the only involved lymph nodes. Discrete and diffusely enhancing lymph nodes were seen in 29 (75%) and 27 (69%) patients respectively. Necrotic lymph nodes were found in only 9 (23%) cases. Ascites was encountered in 45 (90%) cases. The distribution was diffuse in 39 (86%) and loculated in 6 (13%) cases. High density ascites was seen in 31 (69%) cases.
Peritoneal involvement was seen in 42 (84%) cases. Nodules and mass-like peritoneal involvement was seen in 6 (14%) cases. Mesenteric involvement was seen as thickened leaves in 47 (94%) patients. Omental involvement was noted in 47 (94 %) with smudged pattern in 30 (64%) and caking in 16 (34%) cases.
Conclusion: Supradiaphragmatic lymphnode is the commonest group involved in peritoneal tuberculosis, alone or in combination which has not been described so far in the literature. Also the commonest encountered appearance is a discrete enhancing lymph node rather than the matted necrotic appearance as described in previous literature.

B-0980 11:28

Fast MRI-based quantification of visceral adipose tissue in morbidly obese
N. Linder, A. Schaudinn, N. Garnov, M. Blüher, T. Schütz, T. Karlas, A. Dietrich, T. Kahn, H. Busse; *Leipzig/DE (linder@uniklinik-leipzig.de)*

Purpose: Quantification of whole visceral adipose tissue in morbidly obese patients using MRI is laborious. We suggest a novel time-efficient method to predict total visceral adipose tissue from a limited number of MRI slices.
Methods and Materials: 131 morbidly obese patients (94 females, mean BMI 46.5 kg/m^2) patients underwent IRB-approved MRI examination. VAT volumes of the abdominopelvic cavity VVAT-T were quantified by retrospective MRI analysis (active-contour segmentation, visual correction, and histogram analysis). VVAT-T was then correlated with VAT areas determined on 1 or 5 slices defined at seven anatomic landmarks (lumbar intervertebral spaces, umbilicus and femoral heads) and corresponding conversion factors were determined. Statistic measures were coefficients of variation and standard deviations σ1 and σ5 of the difference between predicted and measured VAT volumes (Bland-Altman analysis).
Results: VVAT-T was 8.1 L for males and 4.9 L for females. Analysis of five slices generally agreed better than that of single slices. Best agreements were found at intervertebral spaces L3-L4 for females (σ5/1 = 688/832 ml) and L1-L2 for males (σ5/1 = 846/992 ml).
Conclusion: Gender-specific 5-slice MRI measurements are well suited for fast clinical estimation of whole-abdominal VAT volumes in morbidly obese.

B-0981 11:36

Real-time splenic elastography as a tool for detection and grading of oesophago-gastric varices
V. Venugopal, S.K. Arjun; *New Delhi/IN (vasanthdrv@gmail.com)*

Purpose: To evaluate the role of splenic elasticity ratio measured by real-time elastography (RTE) in predicting the presence of oesophageal varices in patients with portal hypertension. To analyse correlation between the splenic elasticity (SE) score and endoscopic grade of oesophago-gastric varices.
Methods and Materials: This prospective study included 34 patients with CLD being evaluated for PHT and planned for oesophagogastroduodenoscopy (EGD). Initial B-mode and duplex sonographic evaluation was followed by examination of spleen by elastography mode. ROI was simultaneously placed on intrasplenic veins and splenic parenchyma. Elasticity ratio is calculated as the proportion of strain of small veins to that of splenic parenchyma. A higher elastic ratio is indicative of more splenic elasticity. The endoscopic findings were interpreted with reference to the presence of varices, grade of the varices

and presence/absence of signs of active bleeding. The correlation between SE ratio and grade of varices was analysed with the Pearson product-moment correlation coefficient. ROC curves were constructed and AUC was calculated. Sensitivity, specificity, PPV and NPV were calculated using cutoffs obtained from the ROC curves.
Results: Splenic elasticity and variceal grade show significant linear correlation ($R = 0.78$, $P < 0001$).The diagnostic accuracy of cut-off values for SE in predicting the presence of varices was 88% (sensitivity, 92%; specificity, 90%; PPV, 88%; NPV, 97%) with a cut-off value of 7.0.
Conclusion: There is a significant correlation between splenic elasticity and presence, severity of grade and propensity for bleeding of oesophageal varices. Higher is the elasticity score, higher is the chance for severe bleeding.

10:30 - 12:00 **Room D1**

Chest

SS 1404
CT dose reduction and MR indications

Moderators:
J. Broncano; Cordoba/ES
E.J. Stern; Seattle, WA/US

B-0982 10:30

Pulmonary thin-section MRI with ultra-short TE: Comparison of capability for lung and mediastinal radiological finding assessments with thin-section MDCT in patients with various pulmonary diseases
Y. Ohno[1], S. Seki[1], H. Koyama[1], A. Lu[2], M. Yui[3], M. Miyazaki[2], T. Yoshikawa[1], S. Matsumoto[1], K. Sugimura[1]; [1]*Kobe/JP*, [2]*Vernon Hills, IL/US*, [3]*Otawara/JP (yosirad@kobe-u.ac.jp)*

Purpose: To determine the capability of pulmonary thin-section MRI with ultra-short TE (UTE) for lung and mediastinal radiological finding assessment, while comparing with thin-section MDCT (TS-CT) in patients with various pulmonary diseases.
Methods and Materials: 32 consecutive patients with various pulmonary diseases underwent TS-CT and pulmonary MRI with UTE (UTE-MRI). All UTE-MRI examinations were performed by respiratory-gated 3D radial UTE pulse sequence (TR 4.0 ms/ TE 192 μs, flip angle 5 degree, 1x1x1 mm3 voxel size). Then, depictions of pulmonary vasculature from lobar to secondary lobule level, bronchi from trachea to sub-segmental level, ground-glass opacity, honeycomb, traction bronchiectasis, micro-nodule, nodule, bulla and emphysema were visually assessed as lung parenchyma findings by means of a 5-point visual scoring system on a per segment basis on both modalities. Aneurysm, pleural and/ or pericardial effusions, pleural thickening or tumour, lymphadenopathy were also evaluated as mediastinal findings by a 5-point visual score on a per patient or station basis. To compare the capabilities of UTE-MRI for normal lung parenchyma and mediastinum finding evaluations, the agreement of each UTE-MRI finding with that of TS-CT was evaluated by kappa statistics and $\chi 2$ test.
Results: Inter-modality agreements for the lung parenchyma assessment except emphysema ($\kappa=0.42$, $p < 0.0001$) were substantial or almost perfect ($0.78<\kappa< 0.94$, $p < 0.0001$), while those for mediastinum evaluation were almost perfect ($0.81<\kappa< 1.00$, $p < 0.0001$).
Conclusion: Pulmonary thin-section MRI with UTE is able to assess lung and mediastinal findings as well as thin-section MDCT in patients with various pulmonary diseases.

Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems Corporation. **A. Lu:** Employee; Toshiba Medical Research Institute USA, Inc. **M. Yui:** Employee; Toshiba Medical Systems Corporation. **M. Miyazaki:** Employee; Toshiba Medical Research Institute USA, Inc. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **K. Sugimura:** Research/Grant Support; Toshiba Medical Systems Corporation.

B-0983 10:38

Ultra-low dose CT pulmonary angiography for imaging pregnant women: can dose reduction be achieved without affecting image quality?
D. Halpenny, B. Park, J. Alpert, L. Latson, J. Babb, J. Ko; *New York, NY/US (darraghhalpenny@hotmail.com)*

Purpose: To identify any dose reduction or improvement in image quality using low kVp/ low mAs computed tomography pulmonary angiography (CTPE) in pregnant patients.
Methods and Materials: An IRB exemption was granted. The institutional CTPE protocol for pregnancy was changed, decreasing the kVp to 100 from 120, increasing the contrast injection rate from 3 ml/sec to 4 ml/sec, and using shallow rather than deep inspiration. A tube current of 80 mAs was used for all studies. Pregnant patients undergoing CTPE before (SP group) or after (PP group) the protocol change, were identified. Images were qualitatively assessed by 3 chest radiologists and quantitatively assessed by 1 radiologist. CT dose index (CTDIvol), dose length product (DLP) and effective dose were recorded.
Results: 68 patients were included, 23 in the SP group/45 in the PP group. CTDI Vol (3.5 v 5.6 mGy), DLP (69.3 v 118.5 Gy-cm) and effective dose (0.95 v 1.66 mSv) were lower in the PP group ($p < 0.001$). For reader 3, qualitative pulmonary artery opacification was higher in the PP group ($p= 0.041$). For reader 2, qualitative noise was higher in the PP group ($p=0.014$). There was no other difference in qualitative image quality, including no difference in indeterminate scan rates. Quantitive assessment of image noise was significantly higher, and signal to noise ratio significantly lower, in the PP group ($p < 0.001$).
Conclusion: Using an ultra-low dose CTPA protocol tailored for pregnancy significantly reduces dose (43%), without reducing clinical image quality.

B-0984 10:46

Reducing the radiation dose of CT scans to exclude pulmonary embolism by using protocols adapted to patient weight
T. De Bondt, R. Salgado, M. Geldof, F. Deferme, P.M. Parizel; *Antwerp/BE (timo.debondt@uantwerpen.be)*

Purpose: Iterative reconstruction algorithms have proven effective in reducing radiation dose, while maintaining image quality. However, further adaptations of standardized CT-protocols can also have additional significant benefits on delivered dose. The purpose of this study is evaluating dose-lowering effects of individually-tailored pulmonary embolism CT protocols, using the patients' weight as a discriminating factor.
Methods and Materials: Using a dose-monitoring tool, we prospectively obtained data from 2 identical CT-systems in our institution during a 1-year period. In the first 7 months, the standard non-customized CT-protocol was applied in 210 patients. In the last 5 months, separate scanning protocols were used for 3 different patient body weight ranges: 1/ < 60 kg, 2/ 60-90 kg and 3/ > 90 kg. A total of 144 patients were scanned (N=20, 98 and 26 respectively). The iterative reconstruction algorithm factor was kept constant (ASiR 40%).
Results: For all protocols, between-scanner differences in delivered dose were negligible. In range 1, dose length product (DLP) was almost halved (47.7% reduction). In range 2, the reduction was 23.8%. In range 3, the dose remained almost unchanged (1.7% increase). A global reduction for the delivered DLP of 19.2% was achieved. No remarks on decreased image quality were received.
Conclusion: The combination of iterative reconstruction algorithms and an individually-tailored CT protocol for detecting pulmonary embolism based on body-weight can significantly reduce delivered dose, without compromising image quality. The greatest benefit was obtained in patients with a body weight of 90 kg or less, representing 82% of the total number of patients included.

B-0985 10:54

Low-kilovoltage and low-mAs MDCT chest examinations in adults: assessment in terms of feasibility, image quality and radiation dose
A.A. Patil; *Kochi/IN (ashishpatil5184@gmail.com)*

Purpose: To assess the feasibility of low-dose MDCT chest protocols for adults and their effect on image quality and radiation dose.
Methods and Materials: A total of 150 patients were included in study, referred for CECT chest examination. These patients were randomly assigned three protocol group: (1) 80 kv 180 mAs (low kvp), (2) 120 kv 60 mAs (low mAs), (3) 120 kv 240 mAs (standard). Each group had 50 patients. Two experienced radiologists blinded to study parameters evaluated CT images qualitatively for 4 anatomical regions and three subcategories by using 4 - point scale. Effective dose was calculated for each group separately. Statistical analysis was done to assess the difference in image quality and radiation dose by comparing low-kvp and low-mAs protocols with standard protocol.
Results: Overall qualitative score analysis from 2 readers revealed there was no significant difference between low-kvp and standard protocol ($p > 0.05$). But scores between low-mAs and standard protocol showed significant statistical difference ($p=0.002$). Patients in low-kvp protocol and standard protocol sub-categorized according to body mass index (BMI) and image quality scores were compared. Scores were not statistically significant ($p> 0.05$). However, overall increase in BMI showed decrease in subjective image quality. Effective dose calculated for each chest CT examination and compared with standard protocol resulted in significant reduction in radiation dose 60.46% (protocol-1) and 54.8% (protocol-2), respectively.
Conclusion: Use of low-kvp protocol showed significant reduction in radiation dose and comparable image quality with standard protocol and can be routinely performed.

B-0986 11:02

Quantitative measurements in low-dose chest CT with hybrid iterative reconstruction technique

S. Kawanami, T. Kamitani, T. Yamanouchi, Y. Yamasaki, M. Jinnouchi, M. Yonezawa, M. Nagao, H. Yabuuchi, H. Honda; *Fukuoka/JP (kawanami_01@mac.com)*

Purpose: To evaluate the reliability of quantitative measurements in low-dose chest CT with hybrid IR: iterative reconstruction technique.
Methods and Materials: We retrospectively evaluated 3 adjusted-cohorts with normal chest CT findings in individual screening for lung cancer (male, 30-75 yeas old, non-current smoker, and chest CT with fixed tube voltage at 120 kVp); cohort A (n=27): 50 mAs, slice-thickness of 3 mm and 3 different reconstruction techniques (FBP: filter back projection/ iDose3/ iDose7), cohort B (n=26): 30 mAs, 3 mm, and iDose4, and cohort C (n=42): 100 to 300 mAs with REC: real exposure control, 1 mm, and FBP. Quantitative analysis was performed in TLC-CT: total lung capacity, %LAA: low attenuation area, and MLD: mean lung density, comparing prediction formulas for PFT: pulmonary function test.
Results: Error range of TLC-CT was permissible within 10 ml (0.2%) at various reconstruction algorithms. LAA% was extremely affected in low dose setting with or without IR technique. TLC-CT showed a weak, but repeatable correlation to the prediction formula of TLC-PFT (rho=0.31-0.60, $p < 0.05$). The correlations were completely diminished in the prediction formula of RV-PFT: residual volume and FEV-PFT: forced expiratory volume in low dose setting.
Conclusion: TLC was a reliable measurement for chest CT in both standard and low dose settings. MLD should be optimized in each scan setting. %LAA should not be used in low-dose setting with FBP or iDose. Quantitative assessments of chest CT in low-dose setting with hybrid IR should be carefully implemented in clinical practice.

Author Disclosures:
S. Kawanami: Author; Satoshi Kawanami. Research/Grant Support; Philips Electronics Japan, Bayer Healthcare Japan. Speaker; Satoshi Kawanami. **M. Nagao:** Research/Grant Support; Philips Electronics Japan, Bayer Healthcare Japan.

B-0987 11:10

Chest CT radiation dose optimisation: comparison of automatic exposure control strength curves

E. Gyssels[1], P. Bohy[2], A. Cornil[3], A. Van Muylen[4], P.A.A. Gevenois[4], D. Tack[2]; [1]*Sirault/BE*, [2]*Baudour/BE*, [3]*Ath/BE*, [4]*Brussels/BE (elodie.g@hotmail.com)*

Purpose: To compare radiation dose and quality image between the "average" and the "very strong" automatic exposure control (AEC) strength curve.
Methods and Materials: Images and radiation dose data of unenhanced helical chest CT examinations obtained in two hospitals (HA, HB) using the same scanner devices and acquisitions protocols but not the AEC strength curve. The selected AEC strength curve applied to "slim" patients (diameter < 32 cm) was "average" and "very strong" in HA and HB, respectively. Two radiologists with 13 and 24 years of experience respectively scored the image quality of the lung parenchyma and the mediastinum on a five-point scale.The patients' effective diameter, the delivered CTDIvol, and DLP were collected.
Results: 410 patients were included. The average BMI was 24.8 kg/m^2 in hospital B and 23.7 in hospital A. There was no significant difference between hospitals for age, sex ratio, weight, height, BMI, effective diameters and image quality scores foe each radiologist (P ranging from.076 to 1.000). The mean CTDIvol for the entire population was 2.0 mGy, and was significantly lower in HB with the "very strong" AEC curve as compared to HA (-11%, P=.001). The DLP delivered in this 70 kg-weight population was 68 mGy.cm, corresponding to an effective dose of 0.95 mSv.
Conclusion: In chest CT examinations, changing the AEC strength curve from "average" to "very strong" maintains image quality while reducing the delivered radiation dose, enabling to routinely scan at a submillisievert effective dose level.

Author Disclosures:
D. Tack: Board Member; editorial board radiology and journal of thoracic imaging.

B-0988 11:18

Ultra-reduced dose chest CT: comparison between iterative model reconstruction, iDose4 and filtered-back projection

C. de Margerie-Mellon[1], C. de Bazelaire[1], J. Lambert[1], C. Montlahuc[1], A. Martineau[1], E. de Kerviler[1], C. Beigelman[2]; [1]*Paris/FR*, [2]*Lausanne/CH (constancedemm@gmail.com)*

Purpose: Lowering radiation dose delivered by CT without affecting the diagnosis is critical. The aim was to compare performances of two iterative reconstruction algorithms (iDose4 and IMR) to filtered-back projection (FBP) when using chest ultra-reduced dose (URDCT) in patients with known lung diseases.
Methods and Materials: Thirty-six patients (21 males, 15 females; mean age ±SD: 51±20; mean body mass index ±SD: 22±3.3) with haematological malignancies referred for a control chest CT of a known lung disease were prospectively enrolled. Patients underwent standard-of-care scan (140 kV with tube current modulation) reconstructed with iDose4 followed by an URDCT (100 kV, 11 mAs) reconstructed with FBP, iDose4 and IMR (Philips Healthcare). Objective and subjective quality measurements, lesion detectability and evolution diagnosis on URDCT were recorded. Transfer modulation function and noise power spectrum were evaluated with a phantom.
Results: Mean CTDIvol (±SD) and effective doses were respectively 0.43±0 mGy.cm and 0.22±0.03mSv for URDCT and 3.5±0.9 mGy.cm and 1.8±0.4mSv for standard-of-care scan. Noise significantly decreased from FBP to iDose4 and from iDose4 to IMR on URDCT, while lesion visibility and diagnostic confidence increased. Emphysema and micronodules identification was higher with IMR than with FBP and iDose4. Correct evolution diagnosis was obtained in 34/36 cases with FBP and in all cases with iDose4 and IMR. IMR offered an improvement of modulation transfer function while decreasing noise especially in high frequencies.
Conclusion: Both iDose4 and IMR algorithms allowed a correct evolution diagnosis with a 90% dose decrease, but IMR offered better overall lesion detection and diagnostic confidence.

B-0989 11:26

MR diagnosis of diaphragmatic endometriosis

P. Rousset[1], C. Bordonne[2], C. Rousset-Jablonski[1], F. Golfier[1], J. Hugon-Rodin[2], M. Alifano[2], M.-P. Revel[2]; [1]*Pierre Bénite/FR*, [2]*Paris/FR (roussetpascal@gmail.com)*

Purpose: To evaluate MRI findings in patients with thoracic endometriosis syndrome.
Methods and Materials: Over a 28-month period, a diaphragmatic MRI had been performed in 20 patients with basi thoracic chest pain and/or scapular pain and/or catamenial pneumothorax, in two tertiary referral centers for endometriosis. MR protocol included fast spin-echo T2 and 3D gradient-echo T1- weighted sequences, both with fat saturation, performed in the axial and coronal planes. All MR examinations were retrospectively analyzed by an experienced radiologist. Diaphragmatic endometriosis was pathologically confirmed after surgery in 10 patients and confirmed in the remaining 10 patients by clinical follow-up reporting resolution of symptoms under hormonal suppressive treatment.
Results: Eleven (55%) of the 20 patients had diaphragmatic endometrial implants identified on MRI. Eighteen implants were detected on T1-weighted sequences, of which only 13 were detectable on T2-weighted sequences, as nodules of high signal intensity on both T1 and T2-weighted images. All implants were right-sided. Their mean size was 18 (5-50) mm. Relative to the vena caval hiatus, 12 (67%) out of the 18 implants were located in the posterior portion of the right diaphragm, 4 (22%) in the lateral portion and 2 (11%) in the anterior portion.
Conclusion: MRI allows to identify diaphragmatic endometrial implants in half of the patients with thoracic endometriosis syndrome. They show a predominant posterior location.

B-0990 11:34

Magnetic resonance imaging versus chest radiography in the study of lung parenchyma: preliminary results

I. Merli, C. Messina, M. Petrini, F. Secchi, L.M. Sconfienza, F. Sardanelli; *San Donato Milanese/IT (ilaria.merli@gmail.com)*

Purpose: To compare an ultrafast magnetic resonance imaging (MRI) protocol and standard chest x-ray radiography (CXR) in the study of lung parenchyma.
Methods and Materials: All patients undergoing MRI and CXR between October and December 2012 were retrospectively reviewed.All CXR were performed within seven days before MRI. A 1.5-T MR-unit was used to obtain ECG-gated Half-Fourier Acquisition Single-Shot Turbo Spin-Echo images in axial and coronal planes. Two radiologists in consensus analyzed all images in two independent sessions. We considered pleural effusion (PE), pulmonary

consolidation (PC), nodules, and pneumothorax. For each parameter, CXR findings were compared with MR findings using Cohen kappa (k).
Results: A total of 61 patients (36 men; 44±22 years) entered the study. Each MR examination lasted approximately 6 minutes. CXR was negative in 48/61 patients (78.7%); in 9/61 (14.8%) CXR detected at least one nodule, a PE or a PC; in 4/61 (6.6%) CXR was doubtful. MRI was negative in 43/61 patients (70%); in 18/61 (30%) MRI at least one nodule, a PE or a PC; there were no doubtful MRI.Agreement between CXR and MRI for nodules and PE was: k=0.550, 95% confidence interval (CI95%)=0.337-0.763; k=0.554, CI95%=0.334-0.775, respectively. Agreement was poor for PC (k=0.177, CI95%=-0.024-0.378), as in three patients MRI showed a PC undetected at CXR. In one patient, MRI was able to exclude a doubtful PC detected on CXR.
Conclusion: Although on preliminary data, MRI and CXR are reproducible in terms of nodules and PE detection, while MRI demonstrated to be superior in terms of PC.

B-0991 11:42

T2 relaxation and proton density characterisation of pathologically proved nonspecific interstitial pneumonia and usual interstitial pneumonia

M.T.A. Buzan[1], M. Eichinger[2], C. Heussel[2], H.-U. Kauczor[2], M. Kreuter[2], U. Oltmanns[2], A. Warth[2], C.M. Pop[1], J. Dinkel[2]; [1]*Cluj-Napoca/RO*, [2]*Heidelberg/DE (teobuzan@yahoo.com)*

Purpose: Despite the histological differences, the radiological distinction between nonspecific interstitial pneumonia (NSIP) and usual interstitial pneumonia (UIP) remains challenging. The purpose of our study was to assess proton density (PD) and T2 relaxation of NSIP and UIP and to evaluate their utility in differentiating the two patterns.
Methods and Materials: 14 patients with pathologically proved NSIP (n=8) or UIP (n=6) underwent thin-section multislice CT and 1.5 T MRI of the lung. A total of 128 NSIP regions were CT classified into ground-glass opacity (GGO, n=93) and reticulation (RE, n=35). For UIP, there were 82 selected areas classified into GGO (n=11), RE (n=36) and honeycombing (HC, n=35). Based on multi-echo single-shot TSE sequence (TE: 20, 40, 79, 140, 179 ms), entire lung T2 and PD maps were generated from each subject with breath-holding at end-expiration and ECG-triggering. To correct for residual motion mismatch,a non-rigid image registration was applied.
Results: In NSIP, a significant statistical difference in PD was found between GGO, median 206 a.u., and RE, median 178 a.u., p=0.03. In UIP a high difference in T2 relaxation was found among GGO, RE and HC, with a median of 73, 77 and 84 ms, respectively, $p < 0.001$. Overall, NSIP showed lower T2 relaxation, p=0.003, but higher PD, p=0.03, than UIP. A strong positive correlation was found between T2 relaxation and PD (r=0.51) in NSIP pattern; however, no such correlation (r=0.03) was found in UIP pattern.
Conclusion: T2 relaxation and PD maps may provide helpful quantitative information for differentiating NSIP from UIP pattern.

B-0992 11:50

Usefulness of diffusion-weighted (DWI) magnetic resonance for distinguishing different types of thoracic wall sarcoma

T. Milosavljevic, A. Ivkovic; *Nis/RS (tamaradr2009@gmail.com)*

Purpose: To evaluate the usefulness of diffusion-weighted (DWI) magnetic resonance for different types of thoracic wall sarcoma.
Methods and Materials: We enrolled 72 patients with thorax wall sarcoma using ultra sound with colour Doppler, MDCT 16 and 64 with perfusion and MRI 1.5 T with T1W, T3W, 3D troofy, fat suppression and T2W diffusion. Patients were from 12 to 74 years old. Males were 41 (56.94%), females were 31 (43.06%). Fine needle biopsy was performed in 24 patients.
Results: The enrolled patients had 72 solid masses. Although the morphological features and the extent of enhancement on US and CT did not differ significantly between types of sarcoma ($P > 0.05$), sarcoma was distinguishable from solid masses by showing signal suppression on high b-value DW images or high apparent diffusion coefficient (ADC) values. Liposarcoma was in 11 cases with ADC values of 1.56±0.87×10-3 mm2/s ($P < 0.001$). Chondrosarcoma was in 15 cases with ADC values of tuberculoma 2.11±0.87×10-3 mm2/s ($P < 0.001$). Malignant peripheral nerve sheath tumour was in 5 cases with 4.37±0.87×10-3 mm2/s ($P < 0.001$). Soft tissue sarcomas were in 4 cases with 3.44±0.87×10-3 mm2/s ($P < 0.001$). Bone tumours were in 37 cases with 6.24±0.87×10-3 mm2/s ($P < 0.001$). One case was undefined sarcoma with 5.14±0.87×10-3 mm2/s ($P < 0.001$) and 1 with dermatofibrosarcoma protuberance with 2.78±0.87×10-3 mm2/s ($P < 0.001$). According to grade, there were 15 (20.83%) low, 22 (30.56%) intermediate and 35 (48.61%) patients with high-grade sarcoma. According to the age of patient, younger patients had higher-grade sarcomas.
Conclusion: DWI can help differentiate thoracic wall sarcomas, even when US and CT findings are questionable.

10:30 - 12:00 **Room D2**

Interventional Radiology

SS 1409

Radioembolisation and chemoembolisation in liver tumours

Moderators:
R.F. Dondelinger; Liège/BE
T.A. Heusner; Hamm/DE

K-23 10:30

Keynote lecture

P. Haage; *Wuppertal/DE*

B-0993 10:39

Post-SIRT survival in a tertiary referall centre for HCC

P. Lucatelli, G. Vallati, G. Pizzi, F. Portieri, F. Rosella, F. Paradiso; *Rome/IT (pierleone.lucatelli@gmail.com)*

Purpose: To evaluate the main prognostic factors driving survival after SIRT in HCC patients performed in a tertiary referral center.
Methods and Materials: From 2004 to 2012, 380 patients with HCC, received a median activity of 1.6 GBq, predominantly as whole-liver (45.2%) or right-lobe (38.5%) infusions. Patients were predominantly Child-Pugh class A (82.5%), had underlying cirrhosis (78.5%), with ECOG 0-1; 87.7%,but most of them had multinodular disease (75.9%),invading both lobes (53.1%),portal vein occlusion (13.5% branch; 9.8% main).BCLC staging was C in 56.3%.
Results: Median overall survival was 12.8 months (95% confidence interval, 10.9-15.7), varied significantly by disease stage (BCLC A, 24.4 months [95% CI, 18.6-38.1 months]; BCLC B, 16.9 months [95%CI, 12.8-22.8 months]; BCLC C, 10.0 months [95% CI, 7.7-10.9 months]). Survival varied significantly by ECOG status, hepatic function (Child-Pugh class, ascites, and baseline total bilirubin), tumour burden (number of nodules, alpha-fetoprotein), and presence of extrahepatic disease. Independent prognostic factors for survival upon multivariate analysis were:- ECOG status, - tumour burden (nodules > 5), - INR> 1.2, - extrahepatic disease.Grade 3 or higher increases in bilirubin were reported in 5.8% of patients. Mortality was 0.6% and 6.8% at 30 and 90 days.
Conclusion: SIRT leads to clinically relevant survival benefit across different tumour stages including those with advanced disease and few treatment options.

B-0994 10:47

Transarterial chemoembolisation (TACE) in primary liver malignancies: Intraprocedural blood volume measurement using fast C-arm-CT for monitoring response

T.J. Vogl, S. Tietz, S. Zangos, S. Zeuzem; *Frankfurt a. Main/DE (t.vogl@em.uni-frankfurt.de)*

Purpose: To evaluate the response of transarterial chemoembolization (TACE) in primary liver malignancies by measuring parenchymal blood volume (PBV) using C-arm Dyna-CT and correlating changes in PBV after repeated TACE with the MRI findings.
Methods and Materials: In a retrospective study 54 patients with primary liver malignancies received TACE treatment with PBV imaging and MRI in 4-week intervals. Before TACE Dyna-CT was performed using a fast-protocol with timing and infusion of contrast agent as follows: Start of contrast injection at 0s, injector mode with 3.5s X-ray delay with a fill-run at 9s and total scan time of 12s. After examination Dyna-CT scans were processed by software on a research workstation and PBV maps were calculated in the overlapping PBV in correlation with the MRI findings. Statistical analysis was evaluated by software (BiAS, Darmstadt/Germany); survival was analyzed with the Kaplan-Maier-Method and the Log-Rank-Test.
Results: The data demonstrated a significant correlation between PBV and size in MRI with a power of 1-beta=0.80 and a level of significance of alpha=0.05. 54 patients underwent at least one PBV imaging (mean:1.94 Dyna-CTs), 24 patients of whom so far with more than one PBV examination: Initial PBV maps showed a mean parenchymal blood volume of 156 ml/1000 ml. After 2 to 4 TACEs blood volume decreased to 110 ml/1000 ml (decrease of 29.4%), whereas tumour size showed a reduction of 13.7% in diameter.
Conclusion: The current data underline that intraprocedural PBV allows predicting and monitoring early treatment response to TACE. However, data on long-term response need to be acquired.

B-0996 10:55

Utility of intra-procedural cone-beam CT in predicting treatment outcome for drug-eluting bead (DEB) transarterial chemoembolisation (TACE)

B.H. Ge, C.N. Weber, M.M. Watts; *Philadelphia, PA/US*
(benjamin.ge@uphs.upenn.edu)

Purpose: Intra-procedural cone-beam CT can predict short term treatment response during DEB-TACE. We present our experience and describe intra-procedural cone-beam CT features predictive of treatment outcome.
Methods and Materials: A retrospective study was performed on 61 consecutive DEB-TACE patients (mean age 63, range 48 - 82) with 121 treated lesions (mean size 3.2 cm) at a single academic institution. Tumour staining was classified into five patterns: Minimal (less than 25%), Mild (25 to 50%), Moderate (50 to 90%), Robust (over 90%), and Circumferential. Follow-up imaging was assessed for treatment response using mRECIST criteria.
Results: Complete response was seen in 36.4% (n = 44), partial response in 14.9% (n = 18), stable disease in 13.2% (n =16), and progressive disease in 35.5% (n = 43). The DEB-TACE staining patterns included 18% minimal (n = 22), 13% mild (n = 13), 41% moderate (n = 50), 25% robust (n = 30), and 3% circumferential (n = 3). Tumour staining was predictive of improved response with stable disease in 100% of patients with robust (n = 30) and 76% of patients with moderate (n = 38) staining. Robust staining had the highest correlation to complete tumour response (odds ratio 39.2, $p < 0.01$) and a 90% positive predictive value. Tumour size and location did not correlate to treatment response.
Conclusion: Increased tumour staining during DEB-TACE intra-procedural cone-beam CT correlates to improved treatment response. Tumours with submaximal staining are at higher risk for progression and may benefit from additional therapeutic interventions.

B-0997 11:03

Conventional transarterial chemoembolisation versus drug-eluting bead transarterial chemoembolisation for the treatment of hepatocellular carcinoma

R. Kloeckner, F. Prinz, C. Ruckes, A. Weinmann, C. Dueber, M.B. Pitton;
Mainz/DE (roman.kloeckner@googlemail.com)

Purpose: To compare the overall survival of patients with hepatocellular carcinoma (HCC) treated with lipiodol-based conventional transarterial chemoembolization (cTACE) versus drug-eluting bead transarterial chemoembolization (DEB-TACE).
Methods and Materials: An electronic search of our radiology information system revealed 674 patients that received TACE between 11/2002 and 07/2013. 520 received cTACE, and 154 received DEB-TACE. In total, 424 patients were excluded because they had a tumour type other than HCC (n=91), liver transplantation after TACE (n=119), lack of histological grading (n=58), incomplete laboratory values (n=15), other reasons (e.g., previous systemic chemotherapy) (n=114), or were lost to follow-up (n=27). Therefore, 250 patients were finally included for comparative analysis (n=174 cTACE; n=76 DEB-TACE).
Results: The two groups did not differ significantly with regard to sex, overall status (Barcelona Clinic Liver Cancer classification), liver function (Child-Pugh), portal invasion, tumour load, or tumour grading (all $p > 0.05$). The mean number of treatment sessions was 4±3.1 in the cTACE group versus 2.9±1.8 in the DEB-TACE group. Median survival was 409 days (95% CI: 321-488 days) in the cTACE group, compared with 369 days (95% CI: 310-589 days) in the DEB-TACE group (p=0.76). In the subgroup of Child A patients, the survival was 602 days (484-792 days) for cTACE versus 627 days (364-788 days) for DEB-TACE (p=0.39). In Child B/C patients, the survival was considerably lower: 223 days (165-315 days) for cTACE versus 226 days (114-335 days) for DEB-TACE (p=0.53).
Conclusion: The present study revealed no significant difference in survival between cTACE and DEB-TACE.

B-0999 11:11

Parametric response mapping of dynamic CT for longitudinal quantitative assessment of regional tumour vascularisation in TACE treatment for hepatocellular carcinoma

T. Rodt, D. Kaercher, D.B. Hasdemir, T. Kaireit, C. Lutat, A. Vogel, B. Meyer,
F. Wacker, H.-O. Shin; *Hannover/DE (rodt.thomas@mh-hannover.de)*

Purpose: The importance of tumour vascularisation for response assessment and prognosis is well recognized in transarterial chemoembolisation (TACE) of hepatocellular carcinoma (HCC). The feasibility of parametric response mapping (PRM) for longitudinal quantitative assessment of regional vascularisation is demonstrated and results correlated to response and survival.
Methods and Materials: Biphasic CT of 19 patients receiving repetitive conventional TACE treatment for intermediate stage HCC were retrospectively analysed at baseline and 3 follow-up intervals of 12 weeks. Following registration of the arterial and portovenous-phase, the largest lesion was segmented and a voxel-to-voxel matching of the HU-values was performed. A scatter plot showing the frequency distribution of the density pairs was generated. To differentiate between necrotic, hypervascular and non-hypervascular tumour regions and lipiodol/calcification areas thresholds of 30, 100 and 300 Hounsfield units were applied. Density frequency plots of the resulting regions were analysed and correlated to response and survival.
Results: Generation of the scatter plots and calculation of volumes and ratios of the different tumour components was feasible in all cases. All tumour volumes and hypervascular/non-hypervascular-volume ratio showed significant longitudinal decrease ($p < 0.05$). Hypervascular-volume at baseline was inversely correlated to survival (R -0.57, p=0.005). The only predictive parameter to show significant survival difference was the change of the vital/non-vital ratio (p=0.044). Tested response assessment criteria failed to show a significant difference in survival prognosis.
Conclusion: PRM allows a more precise longitudinal quantitative assessment of regional tumour vascularisation compared to conventional response assessment and can be helpful to determine prognosis in TACE treatment for HCC.

B-1000 11:19

Can cone-beam CT-assisted chemoembolisation improve survival of patients with single nodular hepatocellular carcinoma?

J. Lee, J. Choi, H.-C. Kim; *Seoul/KR (lee87jh@gmail.com)*

Purpose: To compare patient survival after chemoembolisation with and without intraprocedural cone-beam CT (CBCT) in patients with single nodular hepatocellular carcinoma (HCC).
Methods and Materials: We retrospectively reviewed the records of 281 patients with single nodular HCC who underwent lipiodol-based chemoembolisation with or without CBCT between January 2006 to December 2011. Inclusion criteria are single nodular tumour, maximal tumour diameter less than 5 cm, newly diagnosed HCC, Child-Pugh class A5 ~ B7, and lipiodol-based chemoembolisation. Exclusion criteria are vascular invasion, infiltrative tumour, biliary invasion, drug-eluting bead chemoembolisation, and previous treatment. Tumour response was assessed by mRECIST at first follow-up enhanced CT/MR and patients' survival was compared by Kaplan-Meier method with log-rank test.
Results: 166 patients were treated without CBCT and 115 treated with CBCT. At first follow-up CT/MR, CBCT group had more complete response of target tumours and overall tumours than non-CBCT group ($p = 0.009$ and $p = 0.089$). Overall survival rates of non-CBCT group were 89.9%, 63.9%, and 50.9% at 1, 3, and 5 years respectively. Overall survival rates of CBCT group were 90.6%, 70.7%, and 66.2% at 1, 3, and 5 years respectively. CBCT group had slightly higher overall survival than non-CBCT group ($p = 0.07$).
Conclusion: CBCT usage during chemoembolisation induces better target tumour response and slightly prolongs survival in patients with single nodular HCC.

B-1001 11:27

Evaluation of quality of life after initial TACE for treatment of HCC

D.B. Hasdemir, M. Nordlohne, K.J. Hartrumpf, N. Schweitzer, A. Vogel,
F. Wacker, B.C. Meyer, T. Rodt; *Hannover/DE*
(hasdemir.davut@mh-hannover.de)

Purpose: Transarterial chemoembolisation (TACE) is a palliative treatment for intermediate-stage hepatocellular carcinoma (HCC) with mixed response and only moderate survival benefit achieved occasionally, highlighting the importance of quality of life (QoL). The aim of this prospective study was to objectively evaluate QoL in patients after initial TACE.
Methods and Materials: QoL was prospectively evaluated with a standardised and validated questionnaire in 79 patients with HCC treated with initial TACE (doxorubicin/cisplatin/mitomycin in combination with lipiodol). The combined questionnaire (QLQ-C30,HCC-18) created by the EORTC consists of 48 questions divided into 24 functional/symptom scales as well as single items. All patients were interviewed before initial TACE and n=62 patients, two weeks after TACE. Tumour response evaluation was performed according to RECIST-,WHO-,mRECIST- and EASL-criteria. Clinical parameters (MELD score, Child-Pugh score, ECOG status) were evaluated prior to initial TACE.
Results: Patients showed a moderate decline in global health status two weeks after initial TACE (median 16.7%). In contrast, functional scales showed a median decrease of 30% in physical functioning. Symptom scales showed a median increase for pain of 16.7% and fatigue of 44.5%. Global health status, physical functioning, pain and fatigue did not correlate with initial tumour load, tumour response or grade of embolisation. Patients with a high MELD-, Child-Pugh-score or ECOG status showed a significant decrease in physical functioning (all $p < 0.05$).

Conclusion: The EORTC questionnaires (QLQ-C30,HCC-18) allow for objective evaluation of QoL in patients with HCC receiving TACE treatment. Objective QoL evaluation has potential to be used as a secondary endpoint for comparison of different treatment regimes and facilitate decision on treatment stratification.

10:30 - 12:00 **Room G**

Genitourinary

SS 1407

Adrenal and kidney imaging

Moderators:
C.D. Alt; Hamburg/DE
O. Nikolic; Novi Sad/RS

B-1003 10:30

Volumetry of adrenal glands: normative data and influence of various parameters

A. Carsin, N. Oubaya, A. Janvier, S. Mulé, B. Delemer, C. Hoeffel; *Reims/FR (certhiel@hotmail.com)*

Purpose: Adrenal gland size is generally assessed in clinical practice using limb measurements on Computed tomography (CT). However, the use of volumetry is emerging, although studies dealing with reproducibility of measurements and advanced semi-automated volumetry of the adrenals are limited so far. We thus aimed to provide robust adrenal gland volume normative data with CT in a large western population of patients and also investigate relationship between adrenal volume and some demographic/morphological parameters or underlying diseases.
Methods and Materials: 154 consecutive patients with abdominal CT scans and without condition or history of hypertension, adrenal-related endocrine disease, chronic steroid use, septic acute condition, cancer, recent surgery, depression, adrenalectomy and without any adrenal nodule above 10 mm were recruited. Linear measurements and semi-automatically volume of adrenal glands were prospectively acquired by two radiologists with dedicated software. Age, gender, body mass index (BMI), adrenal micronodularity, inflammatory disease, diabetes, alcohol abuse and abdominal adipose tissue were recorded.
Results: Interobserver reliability for total adrenal volume (TAV) was excellent (0.97). Mean TAV was 8.4±2.7 cm3. There was a positive correlation between TAV and age (r=0.23,p=0.005), BMI (r=0.42,p < 0.0001), subcutaneous abdominal adipose tissue volume (r=0.29, p=0.0003), visceral abdominal adipose tissue volume (r=0.53, p < 0.0001), gender (p < 0.0001), diabetes (p=0.003), adrenal micronodularity (p=0.001), alcoholic abuse (p=0.04), inflammatory disease (p=0.0001). Generalized linear model showed that only gender, micronodularity, diabetes, age and BMI were independent factors influencing TAV.
Conclusion: Semi-automatically volumetry is a reproducible technique. Age, gender, BMI, micronodularity and diabetes were independent factors influencing TAV.

B-1004 10:38

Contrast-enhanced computed tomography (CT) in intensive care unit patients: impact of hyperattenuating adrenal glands

J. Boos, J. Schek, P. Kröpil, P. Heusch, N. Heinzler, G. Antoch, R.S. Lanzman; *Düsseldorf/DE (Johannes.Boos@med.uni-duesseldorf.de)*

Purpose: To assess the impact of hyperattenuating adrenal glands on contrast enhanced computed tomography (CT) of surgical intensive care unit (ICU) patients with acute clinical deterioration.
Methods and Materials: 96 consecutive ICU patients (mean age 63.8±14.5 years) undergoing CT due to acute clinical deterioration were included in this retrospective analysis. Subjective image analysis for the presence of hyperdense adrenal glands was performed by two blinded radiologists in consensus. Signal intensities (SI) were measured in the adrenal glands and liver parenchyma. Objective hyperattenuation was defined as SI (adrenal glands)>SI (liver parenchyma). Death within 14 days following CT was set as endpoint and acquired from electronic patient data.
Results: : 44 patients (45.8%, group Asubj) exhibited hyperattenuation of the adrenal glands, whereas 52 patients (54.2%, group Bsubj) did not. Concerning the objective analysis, 61 patients (63.5%, group Aobj) exhibited hyperdense adrenal glands, whereas 35 patients (36.5%,group Bobj) did not. Overall 31 of 96 patients (32.3%) died within 14 days following the CT-examination. Lethal outcome was significantly more frequent among patients in group Asubj and group Aobj (21 of 44 patients (47.7%) and 27 of 61 patients (44.3%), respectively) as compared to patients in group Bsubj and group Bobj (10 of 52 patients, (19.2%) and 4 of 35 patients (11.4%), respectively, p < 0.05). Subjective and objective analysis correlated significantly (p < 0.05).
Conclusion: Hyperattenuation of adrenal glands on contrast enhanced CT of ICU patients with acute clinical deterioration is associated with a high mortality and might serve as a prognostic marker for patients´ outcome.

B-1005 10:46

Acute pyelonephritis in kidney transplant patients: role of diffusion-weighted MR imaging

J. Giglio, R. Faletti, C. Guarnaccia, M. Messina, P. Fonio, G. Gandini; *Turin/IT (jacopo.giglio@gmail.com)*

Purpose: Studying the diagnostic capability of diffusion-weighted (DWI) magnetic resonance imaging in detecting acute pyelonephritis (APN) in recently transplanted kidneys, assessing apparent diffusion coefficient (ADC) cut-off values to differentiate among normal renal parenchyma and APN, and evaluating the correlation between ADC values and blood inflammatory markers.
Methods and Materials: Fifty-three MRI examinations in 33 recently transplanted patients with clinical suspicion of APN were retrospectively reviewed. No e.v. contrast agent was used due to the low values of GFR (98%< 40 mL/min). An experienced observer quantified ADC values in normal renal parenchyma (3 areas each transplanted kidney) and in suspected APN areas (52 overall in 28 patients). ADC values, calculated at the healthy parenchyma and APN areas were compared to each other, and correlated with white blood cell (WBC) counts.
Results: The difference between ADC values of the healthy parenchyma (ADC=2.16±0.24 mm2/s) and APN areas (ADC=1.51±0.19 mm2/s) was significant (P < 0.05), with the area under the ROC curve of ADC values assessed at 0.93 (95 % CI), with cut-off value=2 mm2/s. In 12 patients who underwent MRI examinations before and after medical treatment, an inverse linear correlation (Pearson r= -0.56±0.26, with 95%CI (-0.86;-0.02),p=0.06) was found between the difference of ADC values and WBC counts before and after treatment.
Conclusion: Diffusion-weighted imaging appears an important tool in the diagnosis and follow-up of acute pyelonephritis in transplanted kidneys, when e.v. contrast-agents are unsuitable. ADC values correlation with laboratory exams could provide an imaging tool to quantify the response to medical treatment.

B-1006 10:54

Evaluation of chronic kidney disease using blood oxygenation-level dependent magnetic resonance imaging at 3 T

J. Bae, C. Kim, J. Park, B. Park, S. Park; *Seoul/KR*

Purpose: To investigate the feasibility of blood oxygenation level-dependent (BOLD) MRI at 3 T for evaluating non-diabetic patients with advanced chronic kidney disease (CKD).
Methods and Materials: Eleven normal volunteers and 27 patients with advanced CKD were prospectively recruited. All subjects underwent BOLD MRI (multiple fast-field echo sequence with 8 echoes) at 3 T. R2* was measured in cortex and medulla of both kidneys for all subjects and the results were compared. The correlation between R2* and glomerular filtration rate (eGFR) was assessed. For the reproducibility of R2* measurement, five subjects underwent two separate BOLD MRI with one month interval.
Results: The cortical and medullary R2* values were significantly greater in CKD group (19.5 and 32.3 s^{-1}) than in normal group (16.9 and 29.1 s^{-1}, respectively) ($P < 0.01$). The cortical and medullary R2* from stage 3 to 5 showed a trend of increase and decrease, but there was not statistically different with each pairwise comparison ($P > 0.05$). The cortical R2* values revealed very strong correlation with eGFR (correlation coefficient, -0.834; $P < 0.001$) and the medullary R2* values had weak correlation (correlation coefficient, -0.333; $P = 0.04$). The reliability of R2* measurements was excellent in both cortex (ICC= 0.985) and medulla (ICC= 0.860). The mean difference of cortical and medullary R2* measurements was 1.3% and 6.2%, respectively.
Conclusion: BOLD MRI at 3 T, as a feasible and reproducible tool, may have potential to evaluate renal functional state of non-diabetic patients with advanced CKD.

B-1007 11:02

Assessment of intravoxel incoherent motion MR imaging for the differentiation of renal benign tumour and renal malignant tumour

L. Li, H. Ye, H. Wang, Y. Tang, D. Zheng; *Beijing/CN (lilulu301@163.com)*

Purpose: To evaluate the performance of intravoxel incoherent motion (IVIM) diffusion-weighted MR imaging in the differential diagnosis of Angiomyolipoma (AML) ,clear cell renal cell carcinoma (clear cell RCC) and non-clear cell renal cell carcinoma (non-clear cell RCC).
Methods and Materials: Forty-five patients were enrolled and classified into three groups according to the surgical pathology results. There were even amount of subjects (15) in the AML group, clear cell RCC group and non-clear cell RCC group (including 6 Papillary RCC and 9 Chromophobe RCC). ALL the

patients underwent DWI on 3.0 T MR system (GE Discovery) using multi b-values of 0, 20, 50, 100, 150, 200, 400, 600, 800 sec/mm ². Pure molecular-based (D), perfusion-related (D *) and vascular fraction (f) were calculated using a bi-exponential model. Comparisons of derived parameters derived by IVIM-DWI were performed using One-way ANOVA.
Results: D in clear cell RCC was significantly higher than that in AML or non-clear cell RCC (1.8±1.5 vs 0.7±0.3, 1.8±1.5 vs 0.9±0.3×10-3 mm ²/s, $P < 0.05$), while no statistical difference was observed between AML and non-clear cell RCC (P=0.807). D* demonstrated significant difference between AML and non-clear cell RCC (33.3±18.2 vs 17.8±17.2×10^{-3} mm²/s, $P < 0.05$). No observed significant difference in f was revealed between any two groups.
Conclusion: Pure water molecules (true diffusion) and capillary microcirculation (pseudo-diffusion) may result in the observed difference of parameters in these three types of renal tumours. D value can contribute to differentiate the clear cell RCC from AML, and between clear cell and non-clear cell RCC as well. D* value may be applied to differentiate AML from non-clear cell RCC.

B-1009 11:10

Clear cell renal cell carcinoma: associations between CT imaging features and patient survival

A.M. Hötker, C.A. Karlo, J. Zheng, C.S. Moskowitz, P. Russo, H. Hricak, O. Akin; *New York, NY/US (Andreas.Hoetker@uni-mainz.de)*

Purpose: To investigate associations between CT imaging features and survival in patients with clear-cell renal-cell carcinoma (ccRCC).
Methods and Materials: This IRB-approved, HIPAA-compliant study included 763 patients with histopathologically-confirmed ccRCC, who underwent pre-operative contrast-enhanced CT imaging between 1999 and 2011. Qualitative (cystic tumour, necrosis, tumour contact with renal sinus, renal vein invasion, peritumoural stranding, peritumoural neovascularity) and quantitative (maximal tumour diameter, distance of the tumour to the renal sinus) imaging features were evaluated. Uni- and multivariate Cox regression were used to assess associations between imaging features and disease-specific survival (DSS) as well as disease-specific progression-free survival (DSPFS).
Results: Greater tumour size and the presence of renal vein invasion were associated with decreased DSS and DSPFS ($p < 0.032$); the presence of extensive necrosis (> 2/3 of tumour volume) was associated with decreased DSPFS (HR: 1.69, 95%CI 1.03.2.76; p=0.037). In a subgroup analysis stratified by size, only the presence of renal vein invasion resulted in decreased DSS and DSPFS in tumours > 4 cm ($p < 0.036$). No disease-specific death or progression was seen in patients with purely cystic tumours. Greater distance between tumour and renal sinus was not significantly associated with longer survival.
Conclusion: In patients with ccRCC, extensive necrosis on CT was significantly associated with decreased DSPFS, while greater tumour size and the presence of renal vein invasion on CT were significantly associated with decreased DSS and DSPFS. No disease progression was observed in tumours with a cystic appearance. Therefore, selected CT imaging features could aid in pre-operative risk assessment and counseling in patients with ccRCC.

Author Disclosures:
AC.A. Karlo: Grant Recipient; Swiss National Science Foundation. **J. Zheng:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748). **C.S. Moskowitz:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748).

B-1010 11:18

Differentiation of clear cell renal cell carcinoma from other renal cortical tumours using a quantitative multi-parametric MRI Approach

A.M. Hötker, Y. Mazaheri, A. Wibmer, C.A. Karlo, J. Zheng, C.S. Moskowitz, P. Russo, H. Hricak, O. Akin; *New York, NY/US (Andreas.Hoetker@uni-mainz.de)*

Purpose: To develop a quantitative multi-parametric MRI approach to differentiate clear cell RCC from other renal cortical tumours.
Methods and Materials: This IRB-approved, HIPAA-compliant study included 119 patients (85 male, 34 female, mean age 60.7 years) with 124 histopathologically confirmed renal cortical tumours, who underwent pre-operative MRI including chemical-shift, diffusion-weighted and contrast-enhanced sequences before nephrectomy between 2006 and 2013. Two radiologists independently assessed each tumour volumetrically, and apparent diffusion coefficient (ADC) values, parameters from multiphasic contrast-enhanced MRI (Peak Enhancement, UpSlope, DownSlope, Area-under-the-Curve) and chemical-shift indexes were calculated. The intra-class correlation coefficient (ICC) was calculated to assess inter-reader agreement. Univariate and multivariable logistic regressions were performed to identify parameters associated with clear cell RCC; measures of diagnostic accuracy were derived for both readers.
Results: Inter-reader agreement was excellent (ICC: 0.815-0.994). Univariate and multivariable analyses indicated that the parameters ADC (AUC: 0.804/0.807, for the two readers), Peak Enhancement (AUC: 0.629/0.606) and DownSlope (AUC: 0.575/0.561) contributed significantly to the discrimination between clear cell RCC and other renal cortical tumours. The combination of all three parameters further increased diagnostic accuracy (AUC: 0.889/0.907), yielding a sensitivity of 89.7/89.7%, specificity of 73.8/76.2%, positive predictive value of 86.4/87.5% and negative predictive value of 79.5/80% for identification of clear cell RCC by maximizing Youden's index.
Conclusion: Compared with the use of a single MRI parameter, a quantitative multi-parametric approach improves diagnostic performance in differentiating clear cell RCC from other renal cortical tumours.

Author Disclosures:
C.A. Karlo: Grant Recipient; Swiss National Science Foundation. **J. Zheng:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748). **C.S. Moskowitz:** Grant Recipient; MSKCC Biostatistics Core grant (P30 CA008748).

B-1011 11:26

Tubulocystic renal cell carcinomas: a new radiological entity

F. Cornelis[1], O. Hélénon[2], J.-M. Correas[2], L. Lemaitre[3], M. André[4], J.-Y. Meuwly[5], C. Sengel[6], L.E. Derchi[7], N. Grenier[1]; [1]*Bordeaux/FR*, [2]*Paris/FR*, [3]*Lille/FR*, [4]*Marseille/FR*, [5]*Lausanne/CH*, [6]*Grenoble/FR*, [7]*Genoa/IT (nicolas.grenier@chu-bordeaux.fr)*

Purpose: To describe the imaging features of tubulo-cystic renal cell carcinomas (TCRC), a recently identified renal neoplastic entity.
Methods and Materials: IRB approval was obtained for this multi-institutional retrospective study; informed patient consent was not required according to local laws. From 2002 to 2013, imaging of 18 histologically proven TCRC in 17 patients (mean age 55.7 years, 26-76; 15 men, 2 women) were reviewed. These tumours were imaged with ultrasound (n=15), contrast-enhanced ultrasound (n=3), CT-scan (n = 16) and / or MR imaging (n = 9). A review was performed in consensus by two radiologists to identify the imaging characteristics.
Results: The tumour size was 12 to 140 mm (mean: 35). On ultrasound, tumours were all well-circumscribed; hyperechoic in 71.4% of cases (11/15); isoechoic in one; heterogeneous in 3. On CT, 43.7% (7/16) were classified as cystic (type I-IIF in 3 and type IV in 4), 2 were solid and 7 were indeterminate. On MRI, 8 masses (88.9%, 8/9) were considered as cystic (1 type I, 6 type IIF and 1 type IV) and four indeterminate masses on CT were classified as cystic with MRI. Four cases were associated with a papillary carcinoma and one with a transitional cell carcinoma.
Conclusion: Tubulocystic RCC is a new tumour entity with characteristic imaging features associated with small-sized lesions that can provide accurate diagnosis using the combination of US, CT and MR imaging techniques. The most characteristic feature combines a hyperechoic lesion on US and a cystic pattern on CT or MR imaging.

B-1012 11:34

X-ray phase-contrast CT: a novel method for differentiation of low-fat angiomyolipomas from renal cell carcinomas

M. Braunagel[1], L. Birnbacher[2], M. Willner[2], J. Herzen[2], S. Notohamiprodjo[1], T. Saam[1], F. Pfeiffer[2], M.F. Reiser[1], M. Notohamiprodjo[3]; [1]*Munich/DE*, [2]*Garching/DE*, [3]*Tübingen/DE (margarita.braunagel@med.uni-muenchen.de)*

Purpose: We assessed the potential of phase-contrast computed tomography (PC-CT) imaging for visualization and characterization of high-fat and low-fat containing angiomyolipomas (AMLs) versus renal cell carcinomas in comparison to conventional CT and magnetic resonance imaging (MRI).
Methods and Materials: Grating-based x-ray PC-CT was performed using a laboratory x-ray source at 40 kVp on 20 ex-vivo formalin-fixed kidney specimens: 8 clear cell carcinomas (ccRCC), 3 chromophobe RCCs, 3 papillary RCCs, 2 low-fat and 2 high-fat AMLs. Two healthy kidneys were scanned for reference. Quantitative phase-contrast Hounsfield units (HUp) have been calculated from ten manually placed regions of interest, resulted in mean values ± standard deviation. The same specimens were imaged with a clinical CT at 80 and 120 kVp as well as with a 3 T MRI scanner (T1w±fat saturation (FS), T2w±FS, SWI).
Results: PC-CT revealed more structural details, compared to CT and MRI. PC-CT showed a good visual correlation to MR-images. In PC-CT, high-fat AMLs revealed a low phase contrast (-40 ± 3.6 HUp) and low-fat AMLs a high contrast (58 ± 3.6 HUp). High-fat and low-fat AMLs showed a siginifcant difference of HUp-values ($p < 0.05$) to clear cell carcinomas (49 ± 10 HUp) and also to papillary and chromophobe RCCs, which appear with tumour tissues of low phase contrast (39.9 ± 2.7 HUp and 42.9 ± 5.4 HUp, respectively).

Conclusion: Grating-based PC-CT has the potential as a new diagnostic tool for non-invasive differentiation of low-fat AMLs and renal cell carcinomas. The laboratory based approach holds potential for translation as a clinical application.

Author Disclosures:
M.F. Reiser: Other; Editor-in-Chief of European Radiology.

B-1013 11:42

CT perfusion parameters to determine split renal function

M. El-Diasty, G. Gaballa, H. Gad, M.A. Borg, M. Abou El-Ghar, K. Sheir, T.A.E. El-Diasty; *Mansoura/EG (meldiasty@hotmail.com)*

Purpose: To assess feasibility of automatically calculated CT perfusion parameters using two different methods of drawing regions of interest (ROI) to reflect split renal function.
Methods and Materials: 51 potential kidney donors (24 male, 27 female, mean age 39 years) underwent preoperative CT perfusion. Post processing was done twice; one with ROI around renal cortex only and the other around cortex and medulla. Split value for each parameter was calculated and compared with split renal function measured by MAG3 renography using student's T test.
Results: Method 1: perfusion was 125.8 ± 46.4 (ml/100 ml/min) for the right kidney & 126 ±47.4 for the left, peak enhancement intensity (PEI) was 73.7 ± 13.8 HU for the right & 73.5 ±13.9 for the left, blood volume (BV) was 63.6 ±18 ml/100 g for the right and 63.6 ±19 for the left. Method 2: perfusion was 103.8 ± 44.2 for the right & 93.5 ± 53 for the left, PEI was 70.5 ± 13 for the right & 68.2 ± 12.4 for the left, BV was 64.5 ± 20 for the right & 63 ± 19 for the left. Split values of CT parameters showed no significant difference from corresponding renography split function (p value > 0.1) except BV by method 1 and perfusion by method 2 which showed significant difference (p value < 0.05).
Conclusion: Certain CT perfusion parameters can reflect split renal function. Perfusion was more accurate with ROI around the cortex while BV was more accurate with ROI around the whole parenchyma.

10:30 - 12:00 **Room K**

Radiographers

SS 1414

Dose management in medical imaging

Moderators:
H.H. Hjemly; Oslo/NO
C. Loewe; Vienna/AT

B-1014 10:30

Evaluation of beam collimation in paediatric chest radiographs

K. Borg, F. Zarb; *Msida/MT (karl-andrew.borg.10@um.edu.mt)*

Purpose: Collimation is an important aspect in the optimisation of radiographic projections. This study evaluated the use of beam collimation in paediatric chest radiography within a local general hospital in Malta. The research evaluated the relationship of beam collimation on the dose area product (DAP) values as an estimation of radiation dose. The relevance of this project was to instil awareness among radiographers about the importance of beam collimation.
Methods and Materials: The research study was based upon a quantitative, non-experimental, descriptive and retrospective research design. A survey was performed for the year 2013 to obtain an estimate of the number of paediatric chest radiographs carried out on children aged between 0 and 3 years as the target and accessible population. Random samples of chest radiographs were acquired from the accessible population from which the entire collimated area and DAP readings were recorded. The recommended collimated area and DAP was calculated and the excess collimated area and DAP difference were quantified.
Results: Currently used beam collimation area (mean: 56.18 cm^2) and DAP values (mean: 0.20 $Gycm^2$) were significantly ($p < 0.05$) higher than the recommended calculated beam collimation area (29.73 cm^2) and DAP values (mean: 0.09 $Gycm^2$).
Conclusion: The results revealed that poor collimation was being applied implying that the patient was receiving an unnecessary higher radiation dose. The application of improved collimation is suggested within paediatric chest radiography. An awareness campaign on the use of appropriate beam collimation among local radiographers is recommended.

B-1015 10:38

Using BMI-based exposure tables to reduce dose creep and improve image quality in lateral hip radiographs

M.W. Kusk; *Esbjerg/DK (martin.weber.kusk@rsyd.dk)*

Purpose: To examine if patient-reported BMI can be used as a reliable base for selecting optimum exposure parameters, lowering average dose and improving image quality in lateral hip digital radiographs.
Methods and Materials: Patient height and weight data are recorded. DAP, exposure index, collimation, acquisition parameters are harvested from DICOM tags. Average values and standard deviation are calculated. Image quality is evaluated from visual grading analysis and correlated with dose and BMI using Spearmans rho. This is done for at least 100 exposures. Correlation between BMI and hip thickness is done with linear regression from measurements on CT images in a matched patient group and used as basis for exposure tables using Lambert-Beers law. A phantom study is performed to evaluate optimum kVp for standard patients. After implementation analysis of exposures and BMI data is repeated and compared to baseline.
Results: Baseline analysis shows higher than recommended average exposure index with very large variations and correlation between BMI and dose non-existent. kV is routinely increased but seldom decreased regardless of patient size. Negative correlation between VGA-score and dose, indicating overexposure. Linear corellation between hip thickness and BMI is fair to good. Phantom study suggests kVp-reduction for optimum image quality.Results after implementation are pending but will be available at time of presentation
Conclusion: Baseline results suggest difficulties in adjusting parameters to patient size and a tendency to dose creep. Final conclusion awaits evaluation after implementation of exposure tables.

B-1016 10:46

Paediatric chest digital radiography optimisation

P. Freitas, F. Lopes, D. Costa, J. Santos, G. Paulo; *Coimbra/PT (pedrocosta_@hotmail.com)*

Purpose: Establish local Diagnostic Reference Levels (DRLs) for paediatrics chest radiographs in order to optimise the procedures to digital radiology (DR) system.
Methods and Materials: This study was divided into two phases: dose exposure retrospective analysis of chest radiographs available on Picture Archiving and Communication System (PACS) by age groups (0, 5, 10, 15 years old); and exposure parameters adaptation taking into account the age categorisation. Values of Dose Area Product (DAP-Gy.cm2), tube voltage (kV), exposure time (ms), irradiated detector area, collimated area and ionisation chamber, were collected for the 68 chest radiographs.
Results: The obtained local DRL's although similar to those found in the literature, were directly influenced by the collimation. Adjusting the tube voltage and the ionisation chamber selection allowed a mean reduction on dose and exposure time of 9% and 30%, respectively.
Conclusion: Despite the achieved reduction, optimisation of the procedure is possible, considering that exposure time value is slightly higher than the European recommendations.

B-1017 10:54

An investigation into cardiologists' opinion/awareness of radiation risk as part of routine patient consent for cardiac interventional procedures

I. Banerjee[1], J. McNulty[1], D. Catania[2], D. Maccagni[2], L. Masterson[1], J.L. Portelli[3], L.A. Rainford[1]; [1]*Dublin/IE*, [2]*Milan/IT*, [3]*Malta/MT (ipshitabanerjee1@hotmail.co.uk)*

Purpose: Procedural and technology advances in diagnostic imaging have resulted in higher radiation exposure, in particular for interventional cardiovascular examinations. Cumulative exposure of patients to ionising radiation can result in an increased incidence of cancer. This study investigated cardiologists' opinion of radiation risks as part of routine patient consent process for cardiac interventional imaging and the participant's knowledge of doses involved.
Methods and Materials: Cardiology clinicians completed a seven page questionnaire with 28 questions in two national CV centres in Dublin and Milan. Questionnaires were hand delivered upon approval from CV department managers to 18 cardiac practitioners. Institutional ethics was attained. Questions related to paediatric and adult CV examination were included.
Results: Participants (94%) stated, parents of paediatric patients should be informed of potential benefits and risk for all imaging procedures, similarly for adult patients (89%). Despite all participants confirming they had received radiation safety training, 50% had not received training in benefit/risk communication. 80% of participants indicated high confidence levels in successfully explaining risks and/or benefits of cardiac imaging procedures but when asked to estimate effective dose (ED) values for cardiac imaging procedures, less than 50% of the participants marked the correct ED range. All

participants underestimated procedural dose ranges based on recent European data.
Conclusion: Deficits in training for risk /benefit communication was identified and underestimation of radiation dose levels for common procedures noted. The use of agreed effective dose ranges would aid practitioners in communicating risk/benefit of imaging to patients in a harmonised manner.

B-1018 11:02

Dose evaluation releted image quality on paediatric chest examination with dedicated flat-panel

C. Dionisi[1], E. Stefani[1], S. Barbera[2]; [1]*Treviso/IT*, [2]*Biella/IT*
(clizia.dionisi@gmail.com)

Purpose: The aim of the study is to verify if digital imaging system FDR D-EVO allows a significant decrease in radiation dose in paediatric x-ray studies compared with similar digital imaging systems of main Fujifilm competitors.
Methods and Materials: A piggy has been used as anthropomorphic animal phantom because of his morphology. Different x-ray exposures have been taken using standard Fujifilm algorithm "paediatric chest" by the use of FDR D-EVO. After detecting best technical parameters, several x-ray exposures have been taken with the same parameters by the use of GE Dicovery XR656, EIDOS 3000 and DRX Evolution. After that, images quality has been considered.
Results: Since the look up table of the images and the respective pixel values belonged to different scale, a psychometrical valuation of images quality was done by a group of expert radiologists. Only DRX Evolution images were considered good enough to be compared with FDR D-EVO images. Most radiologists noticed that the images obtained by the use of DRX Evolution allowed a better evaluation of lung parenchyma.
Conclusion: The study has shown that there is no significant difference in radiation dose given to paediatric patients by the use of FDR D-EVO respect to DRX Evolution but as compared with GE Discovery XR656 and EIDOS 3000 there is a substantial decrease in radiation dose.

B-1019 11:10

AP vs PA positioning in lumbar spine computed radiography: image quality and individual organ doses

E. Davey, A.E. England; *Manchester/UK (A.England@salford.ac.uk)*

Purpose: It is essential that all aspects of radiological imaging are optimised in order to ensure that the radiation dose is kept as low as reasonably achievable. The aim of this study was to compare anteroposterior (AP) and posteroanterior (PA) projections of the lumbar spine, at various kVps, in order to establish the optimum parameters.
Methods and Materials: An anthropomorphic phantom was imaged in both the AP/PA projections and at various kVps. Acquisitions were undertaken using a Wolverson X-ray unit and processed using CR. The entrance surface dose was recorded and converted to effective and individual organ dose using PCXMC. Five observers were then used to evaluate the images, using a two-alternative force choice approach and a scale based on CEC guidelines.
Results: The PA projection lowered the mean effective dose by 17.6% and also the mean absorbed dose to the stomach (61.0%), small intestine (48.9%), ovaries (26.7%) and testes (60.6%). However, this was at the expense of slightly inferior image quality when compared to the AP projection. Study findings suggested that the optimum kVp was between 95-100 kVp.
Conclusion: Dose optimisation requires the production of an image that is acceptable for the purpose intended. Based on the ALARA principle, and when taking into consideration the significant dose reductions achieved in the PA projection, it may now be time to routinely use this projection when imaging the lumbar spine. The use of a higher kVp should also be considered as an option for dose optimisation when performing lumbar spine radiography.

B-1021 11:18

Uniformisation of the anode heel effect and image quality

A.F.C.L. Abrantes, J. Aleixo, L.P. Ribeiro, S. Rodrigues, P. Sousa, J.P. Pinheiro, R.P.P. Almeida, O. Lesyuk; *Faro/PT*
(oksanalesyuk@gmail.com)

Purpose: Study the anode heel effect behaviour with and without aluminium filters and their influence in image quality.
Methods and Materials: 174 exposures were carried out with and without aluminium filters using an anthropomorphic phantom to simulate a body from one adult patient. The anode heel effect was measured using the Raysafe XI detector and a millimeter scale for accurate measurements. The detector was placed at a spacing of 1 cm between each measurement recorded only in the longitudinal axis (cathode-anode), moving the detector for a total of 20 cm for the cathode and 20 cm for the anode side from the center of the field of exposure (0 point). The procedure was then repeated with the filter 1 and filter 2. Image quality between radiographs with and without filters was compared, and air kerma dose reduction using aluminium filters was studied. Afterwards, to study image quality, radiographs were realized in real patients (volunteers) with and without filters.
Results: We verified an uniformisation of the anode heel effect and radiation dose levels were satisfatory. With filter 1 we obtained a dose reduction between 12 and 39%. With filter 2 we obtained a dose reduction between 32 and 54%. Image quality perception was improved with both filters.
Conclusion: Regarding the image quality, the use of aluminium filters presents significant reasons for the optimization of this parameter. These results indicate that should be considered the use of the filter as good practices to achieve dose reductions.

B-1022 11:26

The effect of lead shielding in pelvis radiography

N. Mekiš, J. Zibert, D. Zontar; *Ljubljana/SI (nejc.mekis@zf.uni-lj.si)*

Purpose: As the use of protective shielding for the patient in conventional radiography varies widely in practice, the study aimed at providing an objective answer regarding the effect of lead rubber sheet shielding in pelvic radiography.
Methods and Materials: Exposure of three radiosensitive organs, colon, lungs and breasts was determined. The dose was measured by electronic dosemeter EDD 30 that was attached to the patient's skin, closest to the primary field or in the centre of the breast. The study was conducted on 110 patients divided into three groups regarding the organ measurements (50 patients for lungs, 50 patients for colon and 10 patients for breast dose measurements). In each group half of the patients were imaged without the use of lead shielding and the other half with the use of lead shielding.
Results: A significant dose reduction from use of shielding was observed in lung (from 16.6±1.4μGy to 6.7±0.6 μGy or 59±4%, $p < 0.0001$) and breast (from 8.0±1.6μGy to 1.2±0.4μGy or 85±6%, p=0.008). On the other hand no statistically significant effect of lead shielding was observed on dose to the colon (from 46±5μGy to 35±2, p=0.118). The non-significant dose reduction to the colon could be explained by the organ position in the body that prevents effective positioning of the shielding.
Conclusion: In pelvic radiography lead shielding was found to reduce dose to the lungs and breasts but no significant reduction in dose to the colon was observed.

B-1023 11:34

Optimising pelvis images of a paediatric phantom by using additional filtration and different combinations of kVp and mAs

V. Harsaker[1], W. Schaake[2], R. Visser[2], C. Bloomfield[3], F. Boavida[4], D. Chabloz[5], E. Crausaz[5], E. Huizinga[2], H. Hustveit[1], H. Knight[3], A. Pereira[4], P.H. Hogg[3]; [1]*Oslo/NO*, [2]*Groningen/NL*, [3]*Salford/UK*, [4]*Lisbon/PT*, [5]*Lausanne/CH*
(vanja.harsaker@hioa.no)

Purpose: Research demonstrates that additional filtration reduces dose considerably. This research investigates whether additional filtration and different combinations of kVp and mAs can reduce effective dose whilst maintaining sufficient diagnostic image quality.
Methods and Materials: 27 images of a 5-year-old paediatric pelvis phantom (ATOM Dosimetry Verification Phantom) were performed with different kVp (50, 60, 70) and mAs (2.2, 3.6, 5.0) values, using copper (Cu) filtration (none, 0.1 mm, 0.2 mm). Ten observers rated image quality against a reference image using 2 alternative forced choice method (2 AFC) with a 5-point Likert-scale. Mathematical measures of image quality included SNR and CNR. PCXMC Monte Carlo simulation software was used to calculate effective dose.
Results: Of the 27 images rated, 13 were of better image quality (2 AFC, SNR, CNR) than the image with lowest acceptable image quality, and a dose lower than the standard parameters image. It is interesting that 11 of the 13 acceptable images were produced with additional copper filtration, and 8 of these had a dose less than 50% of the standard parameter image.
Conclusion: Additional filtration is a method that can be used to lower the dose and still obtain acceptable image quality in pelvis examinations for a 5-year-old phantom.

B-1024 11:42

A European collaborative research study investigating paediatric cardiac interventional radiation dose levels

L.A. Rainford[1], D. Catania[2], M. Pasquato[2], L. Masterson[1], C. McLaren[3], S. Foley[1]; [1]*Dublin/IE*, [2]*Milan/IT*, [3]*London/UK (louise.rainford@ucd.ie)*

Purpose: To compare paediatric cardiac interventional radiography protocols and radiation doses in three European centres.
Methods and Materials: Institutional permission was granted to access imaging records. Retrospective data (n=36 months) was collated in the Irish national centre for paediatric cardiac imaging, performed on a Siemens Bicor unit. Data were age categorised: 0 -1 years, > 1-5 years, > 5-10 years, > 10-15 years, and > 15-18 years. Italian and UK prospective data (n=18 months) were collated for eight matching cardiac interventional examinations performed

using Philips Integris Allura and Siemens Artis equipment, respectively: aortic coarctations; aortic and pulmonary valvuloplasty procedures, ICD and pulmonary PTA studies. Protocol details were recorded: detector specifications, x-ray beam filtration levels and type, magnification factors applied and routine frame rates: fluoroscopy/image capture and total examination dose area product (DAP).
Results: Data from 625 examinations were collated initially and remains ongoing. Comparable additional copper filtration levels (0.2 mmCu) screening rates (25fps) and magnification factors were identified in the Irish and Italian centres. The UK centre typically used lower screening rates and was associated with lower DAP readings. The use of biplane imaging was associated with increased patient doses. Preliminary findings indicate examination times are comparable between centres, across the five age groupings. Across centres procedural DAP increased with patient age.
Conclusion: Initial findings indicate a variety of protocols in use across the European paediatric cardiac centres, with use of lower screening rates and times associated with lower patient doses. Further review of imaging protocols and the completed dose data analysis will be presented.

Sunday, March 8

10:30 - 12:00 **Room C**

Breast

SS 1802
Population-based screening

Moderators:
E.J. Cornford; Nottingham/UK
K. Pinker-Domenig; Vienna/AT

K-24 10:30
Keynote lecture
E.M. Fallenberg; *Berlin/DE*

B-1025 10:39
Performance of grid-less digital mammography acquisition technique for breast screening: analysis of 22,117 examinations
L.B. Larsen[1], A. Fieselmann[2], H. Pfaff[2], T. Mertelmeier[2]; [1]*Odense/DK*, [2]*Erlangen/DE (lisbet.b.larsen@rsyd.dk)*

Purpose: Recently, grid-less digital mammography (DM) with software-based scatter correction (SBSC) has been introduced in the region of Southern Denmark. In this study, performance of this technique in a large screening population was analyzed and compared to conventional grid-based screening.
Methods and Materials: Performance indicators of screening mammography (cancer detection rate as a measure of relative sensitivity, recall rate and specificity) from the Southern Denmark (Syddanmark) region in Denmark were analyzed in a 12-months interval before and in a 5-months interval after complete change from conventional grid-based DM to grid-less DM with SBSC (MAMMOMAT Inspiration PRIME ("PRIME"), Siemens Healthcare). Regular breast screening in this region started in 2007 and population characteristics and breast cancer prevalence rates can be considered to be equivalent in these two intervals.
Results: 22,117 women were screened with PRIME while 50,071 women received grid-based screening. For screening with PRIME vs. grid-based screening, cancer detection rates were 0.55% (0.45-0.64; 95% CI) vs. 0.55% (0.49-0.62), recall rates were 2.44% (2.23-2.64) vs. 2.59% (2.45-2.73) and specificity was 98.11% (97.93-98.29) vs. 97.96% (97.84-98.09). Two-sided equivalence testing (α=0.05) performed on cancer detection rate and specificity showed that the performance measured by these parameters is not statistically significantly different.
Conclusion: Dose reduction of PRIME compared to conventional grid-based DM has been evaluated in previous studies. This study shows that in a large screening population PRIME achieves equivalent screening performance indicators (cancer detection rate and specificity) compared to conventional grid-based screening.

Author Disclosures:
L.B. Larsen: Consultant; Siemens Healthcare. **A. Fieselmann:** Employee; Siemens Healthcare. **H. Pfaff:** Employee; Siemens Healthcare. **T. Mertelmeier:** Employee; Siemens Healthcare.

B-1026 10:47
A six-year study of mammographic compression force: practitioner variability within and between screening sites
C.E. Mercer[1], K. Szczepura[1], J. Kelly[2], S. Millington[2], E. Denton[3], R. Borgen[4], B. Hilton[4], P.H. Hogg[1]; [1]*Manchester/UK*, [2]*Chester/UK*, [3]*Norwich/UK*, [4]*Lancs/UK (claire.mercer@uhsm.nhs.uk)*

Purpose: Application of compression force in mammography is heavily influenced by the practitioner. This can affect client experience, radiation dose and image quality. This research investigates compression force variation over a 6-year screening cycle in 3 screening centres within the United Kingdom. There are no compression force standards for practitioners to follow, other than a maximum value (20daN).
Methods and Materials: Data were collected from 3 consecutive screening events in 3 breast screening centres; 1500 clients. Recorded data included: practitioner code, applied compression force (N), breast thickness (mm), BI-RADS® density. Exclusion criteria included: previous breast surgery, previous/ongoing assessment, breast implants. 975 clients met inclusion criteria across 3 centres. Data analysis assessed practitioner variation of compression force and breast thickness.
Results: Compression force varied significantly between sites. Site 1 had three varying practitioner compressor groups each significantly different to each other. Site 1 and 2 demonstrated no significant difference in mean, first and third quartile compression force and breast thickness values CC ($p > 0.5$), MLO ($p > 0.1$); with site 1 and 3, and site 2 and 3 demonstrating a significant difference ($p < 0.001$).
Conclusion: Practitioners vary in the compression forces they apply to clients over sequential screening. Stabilisation of such compression force variations may have a positive impact on image quality, radiation dose reduction, re-attendance levels and potentially cancer detection. The large variation in compression forces could negatively impact on client experience between the units and within a unit. Further research is required to establish practice guidance and to develop compression focused on pressure rather than force.

B-1027 10:55
Characteristics of BI-RADS 0 lesions at blinded or non-blinded double reading of screening mammograms and impact of arbitration of discrepant BI-RADS 0 recalls by a third reader
E.G. Klompenhouwer[1], R.J.P. Weber[1], A.C. Voogd[2], G.J. Den Heeten[3], L.J.A. Strobbe[4], M.J.M. Broeders[4], L.E.M. Duijm[4]; [1]*Eindhoven/NL*, [2]*Maastricht/NL*, [3]*Amsterdam/NL*, [4]*Nijmegen/NL (elisabethgenevieve@hotmail.com)*

Purpose: To evaluate the characteristics of Breast imaging Reporting and Data System (BI-RADS) category 0 recalls at blinded at non-blinded double reading and determine the potential effect of arbitration of discrepant BI-RADS 0 readings by a third reader.
Methods and Materials: We included a consecutive series of 84,927 digital screening mammograms, double read in a blinded (43,184 screens) or non-blinded (41,743 screens) fashion. Discrepant readings were always recalled for further evaluation. Arbitration of discrepant BI-RADS 0 (i.e., only one radiologist assigned BI-RADS 0) was retrospectively performed by a third screening radiologist. During 2-year follow-up, radiology reports, surgical correspondence and pathology reports were collected of all recalled women.
Results: The positive predictive value (PPV) of BI-RADS 0 recalls was comparable for both reading strategies (7.2% versus 6.8%, p=0.893). Arbitration of discrepant BI-RADS 0 recalls by a third reader would have significantly lowered recall rate (from 3.4% to 2.8% at blinded double reading, $p < 0.001$ and from 2.8% to 2.5% at non-blinded double reading, p=0.008), without a significant change in cancer detection rate (from 7.5‰ to 7.3‰ p=0.751 and from 6.6‰ to 6.5‰, p=0.832, respectively) and program sensitivity (from 83.2% to 81.2% p=0.453 and from 76.0% to 74.6%, p=0.667), respectively). Arbitration would have significantly increased PPV at blinded double reading (from 22.3% to 26.3% p=0.015).
Conclusion: Both at blinded and non-blinded double reading, about 7% of BI-RADS 0 recalls are malignant. Arbitration of discrepant BI-RADS 0 recalls reduces recall rates and improves the PPV of recall at blinded double reading.

B-1028 11:03
Effect of volumetric mammographic density on performance of a breast cancer screening program using full-field digital mammography
J.O.P. Wanders[1], K. Holland[2], W.B. Veldhuis[1], R.M. Mann[2], P.H.M. Peeters[1], C.H. van Gils[1], N. Karssemeijer[2]; [1]*Utrecht/NL*, [2]*Nijmegen/NL (j.o.p.wanders@umcutrecht.nl)*

Purpose: We examined to what extent mammographic density affects screening performance when using full field digital mammography (FFDM).
Methods and Materials: We collected a consecutive series of 69,874 FFDM examinations (2003-2009) from one screening unit of the Dutch biennial screening program (50-75 years). Volumetric mammographic density was automatically assessed with Volpara version 1.5.0 (Matakina, New Zealand). Recall and breast cancer detection information was obtained from the screening registration system. Interval cancers were identified through linkage with the Netherlands Cancer Registry. Within four density categories, comparable to ACR breast density categories, we determined screening performance measures and linear trends with a Chi Square linear trend test.
Results: 19.7% of the examinations was categorised as density category 1 ('almost entirely fatty'), 43.1% as category 2, 29.4% as category 3 and 7.7% as category 4 ('extremely dense'). In total 421 screen-detected and 150 interval tumours were identified. Cancer detection rates were 3.7‰, 6.4‰, 6.6‰ and 6.3‰ in categories 1 to 4 respectively (p=0.005). Interval cancer rates increased with increasing density categories: 0.7‰, 1.9‰, 3.0‰ and 4.5‰, respectively ($p < 0.001$). As a result, the sensitivity (proportion of screen-detected tumours of screen-detected and interval tumours) was lower in higher density categories: 85.0%, 77.6%, 69.0% and 58.6% respectively ($p < 0.001$). The number of false positives was higher in women with dense breasts: 11.4‰, 14.1‰, 18.3‰ and 28.6‰ for categories 1 to 4, respectively ($p < 0.001$).

Conclusion: Also when FFDM is used in breast cancer screening higher interval cancer and false-positive rates are observed in women with mammographically dense breasts.

Author Disclosures:
R.M. Mann: Speaker; Regulary speaker for Bayer healthcare and Siemens medical. **C.H. van Gils:** Research/Grant Support; Bayer financially supports the DENSE trial and Matakina provided the software for the DENSE trial (ClinicalTrials.gov Identifier: NCT01315015). **N. Karssemeijer:** Advisory Board; Matakina Ltd. CEO; ScreenPoint Medical B.V. Consultant; QView Medical Inc. Employee; Radboud University Medical Centre-Nijmegen, Fraunhofer MEVIS-Bremen. Founder; QView Medical Inc., Matakina Ltd., ScreenPoint Medical B.V. Shareholder; QView Medical Inc., Matakina Ltd., ScreenPoint Medical B.V.

B-1029 11:11

Well-defined mass lesions in mammographic screening: determining the rate of cysts and solid lesions

F. Kilburn-Toppin, M. Wallis; *Cambridge/UK (fleurkt@doctors.org.uk)*

Purpose: False-positive assessment of mammographic screen-detected abnormalities is stressful, and may reduce attendance at subsequent screening. We have developed a lesion characterisation tool using spectral mammography to determine the cystic vs solid nature of lesions. To determine the potential significance on recalls from screening, we reviewed our screening data to determine the proportion of well-defined mass lesions and their pathology.
Methods and Materials: Review of R3 (BIRADS 3/4a) solitary well-defined mass lesions was performed for Cambridge, Huntingdon and West Suffolk breast screening service between 1/4/2009 and 31/3/2013. The NHS Breast Screening computer system was used to search the number of women screened and recalled for assessment where the primary mammographic lesion is well defined. Of these lesions, the ultrasound and histopathology results were determined.
Results: The total number of women screened over the 4-year period was 114,945 of which 4,432 (3.9%) were recalled. 911 were classified as R3 lesions (21% of recalls) of which 507 (56%) were simple cysts (4 per 1000 screened) and 26 were malignant (2.9% of all R3 lesions). Of the 26 cancers, 18 were invasive; 13 invasive ductal carcinoma (8 grade 3), 3 papillary carcinoma and 2 mucinous carcinoma.
Conclusion: Over half of all well-defined mass lesions recalled from our screening population were simple cysts, with less than 3% malignant. These data support our work to develop a lesion characterization tool for well-defined lesions in screening to identify cysts and allow a potential important reduction in recall rates, saving time, cost and patient anxiety.

B-1030 11:19

Comparison of the diagnostic workup of women referred at non-blinded or blinded double reading in a population-based screening mammography programme in the south of the Netherlands

E.G. Klompenhouwer[1], R.J.P. Weber[1], A.C. Voogd[1], L.J.A. Strobbe[2], M.J.M. Broeders[1], L.E.M. Duijm[2]; [1]*Eindhoven/NL*, [2]*Nijmegen/NL (elisabethgenevieve@hotmail.com)*

Purpose: To determine whether referred women experience differences in diagnostic workup at non-blinded or blinded double reading of screening mammograms.
Methods and Materials: We included a consecutive series of respectively 42.996 and 44.491 double read screens, either in a non-blinded or in a blinded fashion between July 2009 and July 2011. During 2-year follow-up, we collected the radiology reports, surgical correspondence and pathology reports of all referred women.
Results: A total of 1235 and 1474 women had been referred, respectively at non-blinded and blinded double reading. The overall ultrasound-guided core needle biopsy (CNB) rate and stereotactic core needle biopsy (SCNB) rate per 1000 screens were higher at blinded than at non-blinded reading (respectively 7.5 versus 6.0, p=0.008 and 8.1 versus 6.6, p=0.009). Among women with benign workup (i.e., false positive referrals), these rates were also higher at blinded reading (respectively 2.6 versus 1.4, $p < 0.001$ and 5.9 versus 4.7, p=0.013). A significantly larger proportion received CNB following additional breast imaging procedures at blinded reading (9.9% versus 6.5%, p=0.005). The overall biopsy rate and benign biopsy rate were higher at blinded reading (respectively 17.4 versus 14.3, $p < 0.001$ and 10.1 versus 7.7, $p < 0.001$), whereas the positive predictive value of biopsy (PPV) did not differ significantly (46.3% versus 41.9% at, respectively, non-blinded and blinded reading, p=0.103).
Conclusion: Blinded double reading results in significantly higher overall CNB and SCNB rates than non-blinded double reading, as well as a significantly higher benign biopsy rate. The PPV of biopsy was comparable for both reading strategies.

B-1031 11:27

Characteristics and survival of interval breast cancer subtypes at biennial screen-film and full-field digital screening mammography

R.J.P. Weber[1], E.G. Klompenhouwer[1], J. Nederend[1], M.W. Louwman[1], A.C. Voogd[2], L.J.A. Strobbe[3], F.H. Jansen[1], L.E.M. Duijm[3]; [1]*Eindhoven/NL*, [2]*Maastricht/NL*, [3]*Nijmegen/NL (royweber@gmail.com)*

Purpose: We determined the characteristics and survival of interval breast cancers at full-field digital (FFDM) and screen-film (SFM) screening mammography.
Methods and Materials: We included a consecutive series of 417746 screening mammograms (115047 FFDM screens and 302699 SFM screens), obtained between January 2000 and December 2011. During 2-year follow-up we collected breast imaging reports, surgical reports and pathology results of all women diagnosed with interval breast cancer.
Results: Breast density at the latest screen was more often ACR category 3-4 for interval cancers detected in the first year (early ICs) following a negative SFM or FFDM screen compared to ICs detected in the second year (late ICs) 45.8% versus 36.3%, p=0.008. A larger proportion of early ICs were missed (31.3% versus 19.1%, $p < 0.001$). The two-year survival rate was better for early ICs (97.9% versus 94.5%, p=0.02). The mean invasive cancer size was larger for missed interval cancers (p=0.003), tumour stage was more often T3+ compared to true ICs (16.9% versus 8.5%, p=0.02). A higher portion of true ICs underwent breast conserving treatment (67.2% versus 52.6%, p=0.001). Compared to SFM, more MRIs were performed before surgery at FFDM in early and late ICs ($p < 0.001$).
Conclusion: More interval cancers were missed if detected in the first year. Late ICs showed a decreased two-year survival rate. Missed interval cancers showed different tumour characteristics and histopathological features and underwent more often mastectomy compared to true interval cancer. FFDM leads to increased use of preoperative MRIs in early and late ICs compared to SFM.

B-1032 11:35

Screening outcome and surgical treatment during and after the transition from screen-film to digital screening mammography in the south of the Netherlands

R.J.P. Weber[1], E.G. Klompenhouwer[1], J. Nederend[1], A.C. Voogd[2], L.J.A. Strobbe[3], L.E.M. Duijm[3]; [1]*Eindhoven/NL*, [2]*Maastricht/NL*, [3]*Nijmegen/NL (royweber@gmail.com)*

Purpose: We determined screening outcome of subsequent screens during and after the transition from screen-film mammography (SFM) to full-field digital mammography (FFDM).
Methods and Materials: A consecutive series of 102 863 subsequent SFM screens with a prior SFM screen (SFM-SFM cohort), 91 941 FFDM screens with a prior SFM screen (FFDM-SFM cohort) and 90 407 FFDM screens with a prior FFDM screen (FFDM-FFDM cohort) were obtained between January 2006-July 2013.
Results: The referral rate and cancer detection rate (CDR) per 1000 screens were higher at FFDM-SFM than at SFM-SFM (2.7% versus 1.2% ($p < 0.001$) and 7.0 versus 4.9, $p < 0.001$), at the expense of a lower positive predictive value (PPV) of referral (25.8% versus 39.6%, $p < 0.001$). These parameters were comparable for FFDM-SFM and FFDM-FFDM. DCIS and invasive cancer rates increased during transition and remained stable after transition. DCIS intermediate grade increased during the transition from 0.2 per 1000 screened women at SFM-SFM to 0.6 at FFDM-SFM ($p < 0.001$) and 0.5 at FFDM-FFDM (p=0.001). Compared to SFM-SFM, a significantly higher rate of invasive cancers were stage T1a-b at FFDM-SFM ($p < 0.001$) and FFDM-FFDM ($p < 0.001$). Breast conserving surgery rates increased during transition ($p < 0.001$) and remained stable afterwards.
Conclusion: The CDR and referral rate remained significantly higher at FFDM than at SFM, at the expense of a decreased PPV of referral. During transition, DCIS was more often of intermediate grade and invasive cancers were of smaller size.

B-1033 11:43

Use of computer aided detection in breast cancer screening programmes

E. Tosi[1], S. Teggi[1], G. Dell'Oste[1], M. Zorzi[1], C. Armocida[2], A. Armocida[3], G. Raso[4]; [1]*Padova/IT*, [2]*Modena/IT*, [3]*Ferrara/IT*, [4]*Palermo/IT (elisabetta.tosi@sanita.padova.it)*

Purpose: Aim of this study was to compare the performance of single reading of breast cancer screening mammograms + CAD with traditional double reading.
Methods and Materials: This multicenter study was carried out in three population-based breast cancer screening programmes in the North-East of Italy (Ferrara, Modena and Padova). In the routine practice, 50-69 years old women are invited to undergo a mammogram every two years and mammograms are read by two radiologist independently.

Results: Overall, 37024 women were enrolled in the study, corresponding to 74048 lectures with CAD. Overall, 222 breast cancer were diagnosed, with a DR of 6.0 per 1000 screened women. Double reading + CAD slightly increased RR by about 1.25%. All cancers (in situ + invasive) were detected by double reading, independently of additional positivity to CAD. In other words, no invasive cancer was recognised by CAD alone, therefore the incremental DR was 0. Compared with double-reading, single reading + CAD significantly reduced RR by 24% (from 2.8% to 2.1%), at the cost of a loss of 11.9% cancers (DR from 6.0‰ to 5.3‰).
Conclusion: A screening strategy based on single reading + CAD could be used to reduce the recall rate of screening programs, but it would determine a significant loss of diagnosed cancers.The results of our study may contribute to produce a definitive evidence about the utilisation of CAD systems in the reading of mammograms in population-based screening programmes.

B-1034 11:51

Performance of 3 commercially available CAD-systems applied to ML-views of screening- and nonscreening-selected cases for stereotactic biopsy: comparison to histopathology

R.L. Chelaru, A. Malich; *Nordhausen/DE (ansgar.malich@shk-ndh.de)*

Purpose: The number of screening-based biopsy recommendations with B2-outcome is critically discussed. Study aimed to verify, whether with the usage of CAD-systems the number of unnecessary biopsies could be reduced when applied at preinterventionally obtained ML-images.
Methods and Materials: ML-images of 350 histopathologically verified lesions were evaluated using VuComp3.0.0.3 (CAD1); R2Cenova1.3 (CAD2) and iCADv.7.2 (CAD3). Size distribution of microcalcifications was: n=96< 5 mm;n=102< 10 mm;n=44< 15 mm;n=17< 20 mm;n=18< 30 mm;n=20> 30 mm, distribution for masses/architectural distorsions was: n=21< 10 mm;n=15< 15 mm; n=19< 20 mm; n=15< 30 mm; n=17> 30 mm.132 lesions were proven premalignant/malignant (37.7%).
Results: ML-images were processed in 158 cases (CAD1); 327 cases (CAD2) and 350 cases (CAD3). CAD1-performance was: Sens:82.5%; Spec:26.3; PPV:42.6%; NPV:69.4%. CAD2-performance was: Sens:91.8%; Spec:13.2%; PPV:38.6%; NPV:73.0%. CAD3-performance was: Sens:90.9%; Spec:26.6%; PPV:42.9%; NPV:82.9%. Taking into account screening-selected cases, PPV of CAD1, 2 and 3 was 26.3%; 31.5% and 32.9%, whereas at curative cases it was 69.6%;46.3% and 53.7%,resp. Detection rate varied depending on histopathology: IDC: 81.1%;91.7% and 92.2%, resp.; DCIS: 86.4%;92.9% and 86.4%, resp.; Other malignant: 75%, 87.5%;100% for CAD1, 2 and 3. Related Chi-Square testing was 0.14; 0.50; 0.37. Specificity in the (non)detection of proven benign microcalcifications sent for biopsy by double reading based report of experienced radiologists was: 33.9%/16.4%/33.5% (Fisher exact test p=0.192).
Conclusion: Only CAD3 supported processing of all ML-images. CAD-performance differed among available solutions significantly with most reliable/specific outcome for CAD3, whereas CAD2 was most sensitive and CAD1 with the highest PPV-score at curative cases. The diagnostic quality is still not sufficient to allow a rejection of recommended biopsies according to a negative CAD analysis.

10:30 - 12:00 **Room Z**

Computer Applications

SS 1805

Data sharing and content-based data retrieval

Moderators:
P. Sögner; Feldkirch/AT
C.G. Trumm; Munich/DE

B-1035 10:30

DICOM and DICOM security worldwide: adoption maps and country ratings

O. Pianykh; *Newton Highlands, MA/US (opiany@gmail.com)*

Purpose: The fundamental standards of digital medical data exchange, such as DICOM and HL7, date back to the late 1980s. And although these standards went through countless enhancements, one particular aspect - security -remained virtually untouched. The main purpose of our work was to perform the first comprehensive study of DICOM security worldwide.
Methods and Materials: We used DICOM association establishment protocol to develop a fast, parallel-processing DICOM-probing application. Testing each IP address for its openness to transmit medical data (with no actual data transferred), the application scanned the entire worldwide space of IP addresses in 3 weeks. Geolocation services were used to map each DICOM IP identified. As a result, we compiled a comprehensive map of open radiology archives worldwide, with different levels of security threats.
Results: Our scan discovered 2774 DICOM servers worldwide, out of which 719 were open for medical data communications. DICOM protocol was used to categorize our findings by different levels of security threats, and geolocation data - by countries and regions. As a result, we compiled DICOM security ratings per country, per capita, and per IT infrastructure. We also built the first map of DICOM adoption worldwide.
Conclusion: Medical imaging archives, left wide-open to DICOM threats, is by far the most common security problem, which needs to be addressed with a robust, standardized, and fully implemented solution. Our results demonstrate the full scope of this problem, and the areas where it needs to be solved first.

B-1036 10:38

The RSNA Image Share and the evolving IHE XDS-I environment

D.S. Mendelson[1], C.D. Carr[2], B.J. Erickson[3], E. Siegel[4], D. Avrin[5], R. Arenson[1]; [1]*New York, NY, NY/US*, [2]*Chicago, IL/US*, [3]*Rochester, MN/US*, [4]*Baltimore, MD/US*, [5]*San Francisco, CA/US (david.mendelson@mountsinai.org)*

Purpose: The RSNA Image Share is a project to facilitate and promote Image Exchange through a standards based mechanism, XDS, with the focus on patient engagement.
Methods and Materials: Beginning in 2009 a patient based image exchange solution was developed with the participation of academic sites and vendors under NIH sponsorship. As of October 2014 there have been 14,000 patients enrolled at 8 sites in the RSNA Image Share.
Results: Approximately 30% of patients enrolled have used the Image Enabled Personal Health Record provided to them. We will report their experience, lessons learned and the evolution of the program. The program is actively expanding, engaging with vendors to provide this solution alongside a traditional XDS-I Health Information Exchange approach.
Conclusion: Patients embrace a system in which they take ownership of their images and reports and the ability to exchange them. Patient controlled image exchange is complementary to HIE base exchange and can be based on many of the same standards based technological solutions. A single infrastructure can support both forms of exchange.

Author Disclosures:
D.S. Mendelson: Advisory Board; Vital Images, Nuance, GE. Investigator; RSNA Image Share- NIH. **B.J. Erickson:** Grant Recipient; NIH. **E. Siegel:** Grant Recipient; NIH. **D. Avrin:** Grant Recipient; NIH. **R. Arenson:** Grant Recipient; NIH.

B-1037 10:46

User centered evaluation of the KHRESMOI image search system for radiologists

M. Holzer[1], D. Markonis[2], H. Müller[2], R. Donner[1], G. Langs[1]; [1]*Vienna/AT*, [2]*Sierre/CH (markus.holzer@meduniwien.ac.at)*

Purpose: The KHRESMOI Project has developed two prototype search engines allowing radiologists to search indexed medical knowledge bases using text and image queries, and to find clinically relevant related cases in a hospital PACS based on a query region of interest (ROI) marked in a query case (e.g. a lung CT). We evaluated the search engines regarding their information value, accuracy, and usability by radiologists.
Methods and Materials: The systems were evaluated by 26 radiologists from 4 countries following a specific user-test session design: 1. Introduction to KHRESMOI and short demonstration of the Prototypes; 2. Demographic survey; 3. Tutorial tasks and free use; 4. Guided user tests through defined search scenarios, 5. Survey on the satisfaction with the tools and functionalities. The satisfaction of the users was rated on the Likert Scale of 1 to 5 (where a value of 5 is the best).
Results: The success rate of completing the scenarios is 95% for the Professional and 86% for the Radiology prototype. For the Radiology system the query using a ROI returned results in 4.8 seconds and detailed full volume visualizations of a result was available after 15 seconds. For both systems the response speed was rated with 5 and the result quality with 4. The usability of the systems was rated at 4.25 for the Professional and 4.5 for the Radiologist prototype.
Conclusion: The response of the radiologists indicates that the provided search tools would be beneficial for academic work, research work and during clinical routine.

B-1038 10:54

Development of a shared multisite virtual PACS

P. Rowlands, S. Dyce, N. Pfirsch, S. Lomax; *Liverpool/UK*
(peter.rowlands@rlbuht.nhs.uk)

Purpose: To move from ten individual PACS/RIS systems to a single virtual RIS/PACS in a multi-institution health economy.
Methods and Materials: Our region is a complex health economy with seven acute district hospitals, a paediatric tertiary centre, a regional cancer centre and three small specialist hospitals. Total exams are in excess of 2,000,000 per annum. Patient journeys often involved attendance at multiple institutions, with a very large requirement for image transfer and unnecessary repeat exams. We chose a model of a single virtual PACS, using a single identifier, the NHS number. Single institutional PACS and Vendor neutral archives are linked by a master index and viewing and reporting can be done on any of the sites. System is xds/xdsi compliant.
Results: Installation achieved under budget and within time constraint. High uptime > 99.95%. System allows single regional patient jacket with all prior studies online. Major reduction in image transfer overhead.
System allows multi-disciplinary meetings across all sites with all priors online. We have introduced cross site reporting and specialist opinions. We have rolled out cross site resident on-call cover, enabling compliance with European Working Time Directive and reducing lost training time by 40%.
Conclusion: A single virtual PACS allows a complex health economy to exist as if a single institution. Allows change in workflow to separate acquisition from reporting and allows cross site reporting and out of hours cover. We have added two more district hospitals with other vendor PACS who now appear on the single virtual PACS.

B-1039 11:02

VISCERAL - visual concept extraction challenge in radiology: segmentation challenge - overview, insights and preliminary results

K.M. Grünberg[1], M.-A. Weber[1], O.A. Jimenez del Toro[2], O. Goksel[3], H. Müller[2], G. Langs[4], M. Krenn[4], M. Winterstein[1], A. Hanbury[4]; [1]*Heidelberg/DE*, [2]*Sierre/CH*, [3]*Zurich/CH*, [4]*Vienna/AT*
(katharina.gruenberg@med.uni-heidelberg.de)

Purpose: Since during clinical routine, only a small portion of increasing amounts of medical imaging data are accessible, this project aims to provide the necessary data for research, and to conduct competitions for identifying successful computational strategies.
Methods and Materials: The ongoing VISCERAL project has developed a cloud-based infrastructure for evaluation of large medical image data sets and has organized competitions to exploit and compare multiple state-of-the-art solutions designed for segmentation and landmark localization. The first competition focused on automatic identification, localization and segmentation of organs in images (anatomy benchmark). Therefore, an anatomical reference annotation data base, the gold corpus, was created using 391 CT and MRI data sets with 20 different organs and 40 landmarks annotated.
Results: At the second anatomy benchmark, 4535 structure segmentations and 122 landmark location lists were submitted. Seven participants submitted results for the segmentation tasks in multiple organs using whole-body CT or contrast-enhanced scans. One participant contributed segmentations on whole-body MRI and on contrast-enhanced MR abdomen volumes. Two participants submitted landmark localization results. Evaluation metric results between the heterogeneous benchmark participants will be presented.
Conclusion: Via VISCERAL, different computational algorithms are brought to large medical imaging data sets to support the implementation of novel tools for clinical diagnostic image assessment and workflow. VISCERAL will result in two data bases as an open-access resource, i.e. the gold corpus with expert manual annotations and the silver corpus with data computed by benchmark participants algorithms. Further benchmarks will focus on retrieval of similar cases and lesion detection.

Author Disclosures:
K.M. Grünberg: Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **M. Weber:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **O.A. Jimenez del Toro:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **O. Goksel:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **H. Müller:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **G. Langs:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **M. Krenn:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **M. Winterstein:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,. **A. Hanbury:** Research/Grant Support; Funded by European Union, Seventh Framework Programme,.

B-1040 11:10

Automated liver lesions classification using dictionary Bag-of-Visual-Words (BoVW) model

N. Rozendorn[1], M.M. Amitai[2], E. Klang[2], E. Konen[2], A. Ben Cohen[1], I. Diamant[1], H. Greenspan[1]; [1]*Tel Aviv/IL*, [2]*Ramat Gan/IL (noa.rzn@gmail.com)*

Purpose: To evaluate the accuracy of the Bag-of-Visual-Words (BoVW) algorithm to classify liver lesions in portal-phase CT images.
Methods and Materials: The Bag-of-Visual-Words model (BoVW model) is an algorithm used for image classification, by treating image features as "words in a dictionary". Images are divided to small patches ("words") and a "dictionary" is created. This "dictionary" is used to classify new lesions. In this study, a computer algorithm based on the BoVW model was developed. Portal-phase CT images of 85 liver lesions: 22 cysts, 34 metastasis and 29 haemangiomas were included in the study. Radiologist circumscribed the lesions' margins and provided the diagnosis of each lesion which was established either by biopsy or by clinical follow-up. The sensitivity, specificity, NPV and PPV of the algorithm to identify cysts, metastasis and haemangiomas of the liver were calculated.
Results: The sensitivity for detection of cysts, metastasis and haemangiomas was 90.91%, 88.24%, 82.76%, respectively. The specificity for detection of cysts, metastasis and heamangiomas was 100%, 88.24%, 91.07%, respectively. The PPV for detection of cysts, metastasis and haemangiomas was 100%, 83.3%, 82.76%, respectively. The NPV for detection of cysts, metastasis and haemangiomas was 96.92%, 91.83%, 91.07%, respectively.
Conclusion: The BoVW computer algorithm evaluated in this study showed a high sensitivity, specificity, PPV and NPV for classification of liver cysts, metastasis and haemangiomas.

B-1041 11:18

Evaluation of a computer algorithm for automated detection and measurement of liver metastases

E. Klang[1], A. Ben Cohen[2], I. Diamant[2], N. Rozendorn[2], E. Konen[1], H. Greenspan[2], M.M. Amitai[1]; [1]*Ramat Gan/IL*, [2]*Tel Aviv/IL*
(eyalkla@hotmail.com)

Purpose: To evaluate the performance of a computer algorithm for automated detection and measurement of liver metastases on Follow-up (FU) Computed Tomography (CT) examinations.
Methods and Materials: Included 29 randomized patients with 59 liver metastases with FU CT examinations. Boundaries of liver metastases were marked on the first and on the FU examinations by a radiologist. On the FU examinations, the same metastases were detected, marked and measured automatically by the computer algorithm. The computer markings were compared to the radiologist markings. The results were evaluated by calculating the sensitivity, concordance correlation coefficient and the RECIST criteria of the computer algorithm markings.
Results: The algorithm identified correctly 55/59 (93%) lesions on the FU CT examination. The algorithm's sensitivity for marking pixels was 0.83. The sensitivity was lower in metastases smaller than 2 cm (0.79) and higher in metastases larger than 5 cm (0.91). The concordance correlation coefficient was 0.98. Overall, in 29/32 lesions, the algorithm found the same RECIST criteria as the radiologist.
Conclusion: This computer algorithm for automated detection and measurement of liver metastases in FU CT examinations found the same RECIST criteria in the majority of the metastases and proved to have high identifying capacities and high concordance correlation coefficient. Sensitivity for marking pixels was higher in larger metastases. Automated computer algorithms may play an important tool in radiologists work flow, saving time in measuring liver metastases in consecutive CT examinations.

B-1042 11:26

A breast cancer digital repository for assessing CADx methods on mammography

M. Guevara Lopez[1], N. Gonzalez de Posada[2], D. Cardoso Moura[2], P. Cunha[2], I. Ramos[2], J. Pinheiro Loureiro[2], I. C. Moreira[2], B. Ferreira de Araújo[2]; [1]*Aveiro/PT*, [2]*Porto/PT (mguevaral@ua.pt)*

Purpose: Presents a novel comprehensive annotated Breast Cancer Digital Repository (BCDR - http://bcdr.inegi.up.pt) aimed to support the full lifecycle design of consistent computer-aided diagnosis (CADx) systems on mammography.
Methods and Materials: The BCDR is the first Portuguese wide-ranging annotated repository. BCDR contains 2030 breast cancer patients' cases mammography-based separated in two groups: (1) A Film Mammography (FM) and (2) A Full Field Digital Mammography (DM) including anomalies observed by radiologists, BIRADS classification, outlined biopsy proven lesions, a set of pre-computed image descriptors and clinical data. From BCDR, two benchmarking datasets (benign and malignant classes) representative of masses (200 instances) and microcalcifications (160 instances) were

extracted. Instances are composed by 23 image-based and 4 clinical features. With this, seven machine learning classifiers: Support Vector Machines (SVM), Multilayer Perceptron (MLP), Random Forests (RF), Logistic Model Trees (LMT), K Nearest Neighbours (KNN), Linear Discriminant Analysis (LDA), and Adaboost M1 (AM1) were trained and tested. Three experiments were piloted to: (1) classify masses alone, (2) classify microcalcifications alone and (3) classify all lesions. The classifier's performance was measured based on the area under de curve (AUC).
Results: The performance of classifiers was superior when classifying masses (SVM, LMT and RF reached AUC values above 0.90). Concerning microcalcifications the best results were attained by SVM and LMT (AUC values above 0.80). Related to all lesions classification the best result was attained by RF (AUC above 0.85).
Conclusion: The BCDR demonstrated to be a suitable reference for exploring machine learning classifiers and breast cancer CADx methods.

B-1043 11:34

Real world application of new technologies enhancing teleradiology services in the Waldviertel healthcare region, Austria
A. Bernegger; *Horn/AT (Alexander.Bernegger@horn.lknoe.at)*

Purpose: In 2006 the "ESR white paper on teleradiology" proposed comprehensive best-practice guidelines for teleradiology usage. Waldviertel healthcare region implemented these guidelines to deliver a Cross Enterprise Collaboration in 5 hospitals including 9 associate private outpatient centers. New conceptual approaches were achieved in a real world application.
Methods and Materials: Conceptual inter-operability based on widely enhanced RSNA Radlex Playbook definitions and establishing IHE'S vendor independent protocolling was key to implement smooth workflow integration across collaborating teams. Developing 100% web based RIS/PACS applications, with one of the leading Healthcare companies providing software tools to specialists, enabled radiological and enhanced interdisciplinary services to patients independent of their location.
Results: Defined activities enabled us to archive all "technology-related issues", as proposed in the whitepaper, to integrate teleradiology. A cross enterprise worklist provides access to recent exams across institutions, independent from patient registration location, including referring information. Multisite viewing with streaming technology in one single FDA approved application is improving the ease of accessing relevant prior images building a longitudinal, real-time patient record across hospitals without loss in quality during transmission or display. There is no longer a need for time consuming data push technology. Virtualizing the whole toolbox makes it easy for a remote radiologist to get exactly the same working environment as one would use on site.
Conclusion: The quality of radiological reports and services delivered by teleradiology should be no less than those of local radiologists.

B-1044 11:42

Teleradiology in Italy: results of an online survey
F. Coppola[1], E. Neri[2], D. Regge[3]; [1]*Bologna/IT*, [2]*Pisa/IT*, [3]*Turin/IT*
(francesca_coppola@hotmail.com)

Purpose: This study has the purpose to obtain an overview of the current applications of teleradiology (TR) in Italy and to evaluate the radiologist's current opinion about it and the possible future usage of this technique.
Methods and Materials: A web-based 19 questions survey was sent to all active radiologists working in Italy, in both private and public hospitals, members of Italian Society of Radiology (SIRM).
Results: A total of 1599 radiologists, corresponding at 18% of all Italian radiologists, participated to the online survey. The common opinion of Italian radiologists about TR is generally positive and the large majority of participants believe in a future application of TR (81%). The most common usage of TR is intra-organisational or intra-institutional (80%), while the second one is 'on call' preliminary emergency reading from home during nights and holidays (37%). However, many radiologists have doubts about TR, in particular they thinks that TR is too impersonal with no contact with patient (40%), insufficient integration of patient history and previous studies (39%), and insufficient communication with referring clinicians (39%).
Conclusion: The majority of Italian radiologists are on favour of TR, however they have concerns that it may further reduce communication with referring clinician ad patients.

B-1045 11:50

French and Italian residents' expectations concerning teleradiology: a comparative study
N. Pyatigorskaya[1], F. Coppola[2], D. Regge[3], E. Neri[4]; [1]*Paris/FR*, [2]*Bologna/IT*, [3]*Turin/IT*, [4]*Pisa/IT (nadya.pyatigorskaya@gmail.com)*

Purpose: The goal of this study was assessing the French and Italian residents' practice of teleradiology, their awareness of the legal and practical framework of the French, Italian, and European recommendations, and their expectations about the perspectives of this technique.
Methods and Materials: Radiology residents working in Italy and in France answered the questions of a web-based survey developed using Survey Monkey and Google Documents, respectively. The data were processed using the Survey Monkey Statistical tool and Excel 2010 with global and sub-group analysis.
Results: A total of 120 Italian and 115 French residents replied the survey questions. Positive attitude to teleradiology expressed 58% Italian and 73% French residents and the majority of them believe that this approach will become more widespread in the future. Most commonly, the teleradiology usage is intra-organisational or intra-institutional (82% in Italy and 79% in France). Many Italian residents are doubtful about teleradiology because it is too impersonal (73%) and lacks the integration of a patient's history (39%) or communication with the referring clinicians (59%). In contrast to this, French residents appreciate the access to clinical information (57%), interaction with the referring structure (66%), and improved patient care (27%).
Conclusion: The majority of both Italian and French radiology residents are in favour of teleradiology. While Italian residents are concerned about the risk of reduced communication with referring clinician and patients, French colleagues feel more confident about these issues. It appears important to encourage the residents' reflexion about teleradiology practice, its risks and benefits.

10:30 - 12:00 **Room M**

Abdominal Viscera

SS 1801
HCC diagnosis and treatment

Moderators:
C. Ayuso Colella; Barcelona/ES
A. Furlan; Pittsburgh, PA/US

K-25 10:30

Keynote lecture
C. Ayuso Colella; *Barcelona/ES*

B-1046 10:39

Reporting of hepatocellular carcinoma: comparison of interreader agreement between LI-RADS and standard LIKERT-scale in patients at risk for hepatocellular carcinoma
B.K. Barth, O.F. Donati, M.A. Fischer, E.J. Ulbrich, K.A. Christoph, C.S. Reiner; *Zurich/CH*

Purpose: To compare interreader agreement in reporting hepatocellular carcinoma (HCC) using fixed LI-RADS (Liver Imaging Reporting and Data System) criteria or a standard Likert-scale based on the reader's impression.
Methods and Materials: Eighty-four patients at risk for HCC with Gd-DOTA-enhanced liver MRI between 2005 and 2013 were included in this retrospective study. Two Readers rated the likelihood of HCC for 104 liver observations using standardized LI-RADS (LR1-LR5) criteria and using a 5-point Likert-scale based on Overall impression (LIKERT) in two separate reading sessions. Major features (arterial hyperenhancement, washout-appearance, pseudocapsule, threshold growth) were recorded for each observation. Interreader agreement was assessed with interclass correlation coefficients (scores) and kappa-statistics (major features). Histopathology or imaging follow-up served as reference standard.
Results: Overall interreader agreement was 0.73 [95% CI: 0.63, 0.81] for LI-RADS and 0.71 [95% CI: 0.59, 0.79] for LIKERT. Interreader agreement was higher for LI-RADS as compared to LIKERT in HCC-lesions (0.42 [95%CI: 0.17, 0.62] and 0.34 [95%CI: 0.08, 0.56]) as well as in non-HCC-lesions (0.70 [95%CI: 0.52, 0.82] and 0.60 [95%CI: 0.39, 0.76]). Interreader Agreement was moderate for arterial enhancement (k: 0.50) and washout (k: 0.53) and fair for capsule appearance (k: 0.38) and threshold growth (0.40). Within HCC-lesions, 5% (6/106) were rated LR1 or LR2, whereas 12% (13/106) were assigned Likert-scores 1 and 2. Within non-HCC-lesions, 22% (22/102) were rated LR4 or LR5, whereas 15% (15/102) were assigned Likert-scores 4 and 5.
Conclusion: LI-RADS shows higher interreader agreement than LIKERT and may therefore reduce variability in reporting of HCC.

B-1048 10:47

Clinical application of LI-RADS: preliminary evaluation with Gd-BOPTA MR Imaging

M. Di Martino, M. Bezzi, C. Catalano; *Rome/IT (dimase81_6@hotmail.com)*

Purpose: To evaluate clinical impact of the new standardized algorithm in reporting focal liver lesion (LI-RADS) in cirrhotic patients.
Methods and Materials: Sixty-six consecutive cirrhotic patients (39 male; 27 female) with 145 focal liver lesions (63 HCCs) were prospectively enrolled. MR imaging examination was acquired using a 1.5 T magnet with the following sequences: breath-hold T1- and T2-weighted pre-contrast images with and without fat saturation and volumetric three-dimensional Gd-BOPTA-enhanced T1-weighted GRE MR sequences acquired in the arterial (25s), portal-venous (60s), equilibrium (180s), and hepatobiliary phase (75 min). Two blinded readers with different experience in liver imaging (5 and 10 years respectively) reviewed the MR images: the youngest according to the LI-RADS classification bythe oldest of focal liver lesion but expert radiologist was given the freedom to diagnose lesions with atypical features. Inter-rater agreement was calculates between readers. Diagnostic Accuracy, Sensitivity, specificity, and positive and negative predictive values with corresponding 95% confidence intervals (CIs) were determined and compared each other.
Results: Good agreement was found (κ 0.70). The expert reader reported a significantly better sensitivity (81% vs 57% p.03) the young radiologist reported a specificity of 100%. Comparison of diagnostic accuracy of the two reading session reported a significantly better value for expert reader (0.881 vs 0.779; p.005).
Conclusion: LI-RADS system in reporting focal liver lesions in cirrhotic patients guarantee an optimal specificity but suffer from low sensitivity.

B-1049 10:55

A prospective study to compare the diagnostic performance of gadoxetic acid-enhanced MRI and US for surveillance of HCC in high risk patients with liver cirrhosis

S. Kim, Y.-S. Lim, J. Byun, H. Won, S. Lee, S. Han, J. An, H. Lee, Y. Lee; *Seoul/KR (sykim.radiology@gmail.com)*

Purpose: To determine if gadoxetic acid-enhanced MRI could provide better diagnostic performance than US for surveillance of hepatocellular carcinoma (HCC) in high-risk patients with live cirrhosis.
Methods and Materials: We conducted a prospective intra-individual comparative cohort study of 407 patients with cirrhosis, with an estimated annual risk of HCC > 5%, and without current or previous HCC. The patients were screened every six months with three rounds of gadoxetic acid-enhanced MRI and US. One of three radiologists interpreted US and the other of them analyzed MRI. An independent research coordinator allocated each image interpretation to one of the three radiologists blinded to results of the other imaging modality taken at any round. Pathology and follow-up CT examinations were served as the reference standard. The primary endpoint was a per-patient sensitivity for early stage of HCC (Barcelona Clinic Liver Cancer (BCLC) stages 0 or A). Per-patient specificity was evaluated as the secondary endpoint.
Results: There were 40 HCC nodules diagnosed in 35 patients (annual incidence, 6.3%). Median size of the HCC nodules was 1.5 cm (0.9-4.8 cm). BCLC stages were 0, A, and C in 26, 8 and 1 patients, respectively. The per-patient sensitivity of gadoxetic acid-enhanced MRI (97.1%, 33/34) was significantly higher compared with US (41.2%, 14/34; $P < 0.001$). The per-patient specificity of gadoxetic acid-enhanced MRI (93.8%, 349/372) was significantly higher than that of US (89.8%, 334/372; P=0.049).
Conclusion: For surveillance of early stage of HCC in high-risk patients with live cirrhosis, gadoxetic acid-enhanced MRI provides better diagnostic performance than US.

Author Disclosures:
Y. Lim: Grant Recipient; Bayer Schering Pharma.

B-1050 11:03

Hypointense nodules on hepatobiliary phase Gadoxetic acid-enhanced MR images: imaging features, evolution and the role of diffusion-weighted imaging

C. Briani, M. Di Pietropaolo, G.F. Federici, F. Carbonetti, M. Marignani, P. Begini, E. Iannicelli; *Rome/IT (chiarabriani@hotmail.com)*

Purpose: To evaluate the imaging features and the evolution of hypovascular nodules, hypointense on hepatobiliary phase Gadoxetic Acid-enhanced MR images (Gd-EOB-DTPA enhanced MRI), focusing on the diagnostic value of Diffusion Weighted Imaging (DWI).
Methods and Materials: Thirty-one patients with 42 nodules were included in this study. Two radiologists, in consensus, retrospectively analysed number, size, signal intensity on Gd-EOB-DTPA enhanced MRI including DWI. Fisher's exact test and Mann-Whitney test were performed to compare proportions.
Results: Ten/42 (23.8%) nodules showed hyperintensity on DWI. On follow-up period 18/42 lesions (42.8%-mean size 14.7 mm), became hypervascular HCC. Seven/10 nodules, hyperintense on DWI at first exam, showed malignant evolution. The mean ADC value of the nodules not showing hypervascularization ($1.29x10^{-3}$ $m^2/s \pm 0.33$) was relative higher than the nodules that showed malignant transformation ($1.03x10^{-3}$ $m^2/s \pm 0.28$). The mean size at first exam of the lesions showing hypervascular transformation was significantly higher than those without evolution (p=0.002). The risk increased for the nodules > 10 mm (p=0.02). The overall 6- and 12-month cumulative risk of nodule hypervascularization were 54.8% and 45.1%.
Conclusion: Our study highlights the high risk of hypointense nodules on hepatobiliary phases of malignant transformation. Hypovascular lesions > 10 mm and those that appeared hyperintense in DWI, were associated with progression to hypervascular HCC; therefore, in these cases, a close follow-up or an invasive approach for diagnosis is recommended.

B-1051 11:11

Non-hypervascular hepatobiliary phase hypointense nodules on gadoxetic acid-enhanced MRI: risk of HCC recurrence after radiofrequency ablation

D. Lee, J. Lee; *Seoul/KR (dhlee.rad@gmail.com)*

Purpose: Hepatobiliary phase images (HBPI) of gadoxetic acid-enhanced MRI depict borderline hepatocellular nodules, which have potential to progress into hypervascular hepatocellular carcinomas (HCCs), as non-hypervascular hypointense nodules. We evaluated retrospectively impact of the presence of non-hypervascular hypointesene nodules on HBPI of gadoxetic acid-enhanced MRI on the patient's prognosis after radiofrequency ablation (RFA) for early stage HCC.
Methods and Materials: A total of 139 patients who underwent pre-procedural gadoxetic acid-enhanced MRI followed by RFA was included. After a mean follow-up of 44.6 ± 13.2 months, we compared results of tumour recurrence as well as overall and recurrence-free survival (RFS) according to the presence of non-hypervascular hypointesene nodules.
Results: The presence of non-hypervascular hypointense nodules did not significantly affect overall survival (P=0.136). However, the estimated 5-year RFS rate was 71.3% in 29 patients without non-hypervacular hypointense nodules compared to 27.9% in 110 patients with non-hypervacular hypointense nodules, indicating a statistically significant difference (hazard ratio=2.84 [1.39-5.98], P=0.006). When we classified recurrence into three types, i.e., local tumour progression [LTP], intrahepatic distant recurrence [IDR], and extrahepatic metastasis [EM], five-year cumulative incidences (CI) of IDR in patients with non-hypervascular hypointense nodules was significantly higher than that in patients without non-hypervascular hypointense nodules (17.9% vs. 67.5%, P=0.001). Five-year CIs of LTP and EM showed no significant difference.
Conclusion: The presence of non-hypervascular hypointense hepatocellular nodules on HBPI of gadoxetic acid-enhanced MR imaging taken prior to RFA is a significant predictive factor of recurrence after RFA of early stage HCCs, particularly IDR.

B-1052 11:19

Role of DWI, ADC and correlation with hepatobiliary phase (DPI, delayed phase imaging) findings in the differentiation of hepatocellular carcinoma (HCC) from dysplastic nodules (DNs) in liver cirrhosis

D. Curione, R. Inchingolo, A. De Gaetano, M. Ciresa, L. Bonomo; *Rome/IT*

Purpose: To investigate the utility of DWI, ADC and the correlation with DPI in the differentiation of HCC from DNs in liver cirrhosis.
Methods and Materials: Forty-three cirrhotic patients with 53 pathology-proven nodules, who underwent liver MRI with DWI (b values 0-800s/mm2) and DPI sequences, were retrospectively reviewed. The nodules (mean size 2.17 cm; range 1-4 cm) included 29 HCCs and 24 DNs, of which 13 were high grade (HGDNs) and 11 were low grade (LGDNs). The lesions were classified as hypointense, isointense or hyperintense relative to the adjacent liver parenchyma. ADC of each nodule, of the surrounding parenchyma and lesion-to-liver ratio were calculated.
Results: Hyperintensity vs iso/hypointensity on DWI, hypointensity vs iso/hyperintensity on DPI and the mean lesion-to-liver ratio showed a statistically significant difference both between HCCs vs DNs ($p < 0.05$) and between HCCs+HGDNs vs LGDNs ($p < 0.001$). Sensitivity, specificity and accuracy were: HCCs vs DNs: 96.55%, 70.83% and 84.91%, respectively, for nodule hyperintensity on DWI; 100%, 57.14% and 84.21, respectively, for the combination of hyperintensity on DWI and hypointensity on DPI; and 75%, 75.86%, and 83.69%, respectively, when lesion-to-liver ratio was < 0.92. HCCs+HGDNs vs LGDNs: 83.33%, 100% and 86.79%, respectively, for nodule hyperintensity on DWI; 96.8%, 100% and 97.2%, respectively, for the combination of hyperintensity on DWI and hypointensity on DPI; and 90.9%, 81.0% and 83.6%, respectively, when lesion-to-liver ratio was < 0.95.

Sunday

Conclusion: The distinction of HCC from DNs is crucial in the management of cirrhotic patients, but their dynamic imaging features often overlap: DWI, especially in association with DPI, and ADC may be helpful.

B-1053 11:27

Added value of functional dynamic CT-perfusion in assessment of neoangiogenesis tumour-related phenomenon in diagnosis and treatment evaluation of HCC patients

D. Ippolito, D. Fior, P.A. Bonaffini, C. Talei Franzesi, R. Corso, S. Sironi; *Monza/IT (davide.atena@tiscalinet.it)*

Purpose: To determine the value of perfusion computed tomography (CT-p) technique in quantitative assessment of blood flow changes, related to tumour neoangiogenesis, for evaluation of diagnosis and treatment response of HCC lesions.
Methods and Materials: Fifty-eight CT-p study were performed in cirrhotic patients by analyzing 33 biopsy proven HCC lesions before and after treatment with TACE or RFA. Dynamic study was performed on 256 multidetector CT by acquiring 16 dynamic slices/scan for a total of 40 scans, at a fixed table position, during injection of 50 ml of non-ionic contrast agent at flow rate of 5 ml/sec. HCC lesions, treated lesions and surrounding liver parenchyma were evaluated by using a dedicated perfusion software and following perfusion parameters were considered: hepatic perfusion (P), arterial perfusion (AP), blood volume (BV), hepatic perfusion index (HPI), time to peak (TTP). Univariate paired Wilcoxon signed ranked test was used for statistical analysis.
Results: In HCCs lesions evaluated, the following quantitative data were obtained: P (ml/sec/100 gr) 47.0; BV (ml/100 mg) 22.5; AP (ml/min) 42.9; HPI (%) 75.3; TTP (sec) 18.7. Perfusion values calculated in correctly treated lesion were: P 13.6±5.6; BV 6.8±4.8; HPI 13.6±9.2 e TTP 29±16.1; while in partially treated lesions were: P 32.7±15 ml/100 gr/sec; BV 17.6±9.5 ml/100 gr; TTP 19±5.7sec; HPI 61.3±32.7%. A statistical difference ($p < 0.001$) was obtained for all perfusion parameters evaluated with a significant higher values in viable HCC tissue than in correctly treated lesion or in surrounding parenchyma, due to the presence of arterial structures that develop in neoplastic tissue,sustaining tumour growth.
Conclusion: CT-p technique can help in non-invasive quantification of tumour blood supply, related to the formation of new arterial structures, essential for tumour growth, allowing also the assessment of therapeutic response.

B-1054 11:35

Radiological response of hepatocellular carcinoma (HCC) treated with transarterial chemoembolisation (TACE) before liver transplant (LT): correlation with histopathology and recurrence free survival

A. Agostini, D. Nicolini, C. Mincarelli, G. Svegliati Baroni, A. Mandolesi, A. Lorenzoni, R. Candelari, M. Vivarelli, A. Giovagnoni; *Ancona/IT (andrea.agostini84@yahoo.it)*

Purpose: To evaluate the correlation between EASL and mRECIST response criteria of HCC to TACE and histological necrosis in explanted livers, and the impact of pre-operative risk factors on recurrence after LT.
Methods and Materials: In patients who underwent to at least a TACE for HCC before LT, we retrospectively evaluated mRECIST and EASL response, as complete (CR), partial response (PR), stable (SD) and progressive disease (PD). In explanted livers, tumour necrosis was defined as a percentage of cumulative tumour area and classified as complete (100%), partial (50-99%) and inadequate (< 50%). Correlation between radiological response and tumour necrosis, and recurrence-free survival analysis after LT were performed.
Results: From August 2005 to March 2014, 61 patients (M/F = 54/7; mean age 56±6.5 years) performed doxorubicin eluting beads (DEB)-TACE (n=45) or conventional (C)- TACE (n=16). 11 patients were beyond San Francisco Criteria (UCSF) before TACE. We found 137 nodules in 61 explanted livers (2.2±1.5 nodules per patient), with complete histological necrosis in 12 patients and partial in 24 patients. Agreement between radiological and histological criteria was 75.4% for mRECIST and 70.5% for EASL criteria. Histological necrosis differed significantly between patients classified as CR, PR or SD/PD according with both radiological criteria. We evaluated Neutrophil-to-Lymphocyte Ratio (NLR) (mean 3±1.7) and alpha fetoprotein (aFP, mean 299 ng/ml) before LT. Independent risk factors on recurrence were mRECIST SD/PD, UCSF out before TACE, cTACE, NLR> 4.
Conclusion: Radiological response and biological parameters are predictors of HCC recurrence after LT.

B-1055 11:43

The impact of transarterial chemoembolisation (TACE) on uninvolved liver parenchymal perfusion in patients with hepatocellular carcinoma undergoing TACE

M. Horger, K. Nikolaou, S. Kaufmann; *Tübingen/DE (Marius.Horger@med.uni-tuebingen.de)*

Purpose: To analyse the impact of selective transarterial chemoembolization (TACE) on uninvolved liver parenchymal perfusion in patients with hepatocellular carcinoma undergoing TACE using different particles sizes and to document their temporal evolution.
Methods and Materials: Institutional review board approval was obtained for this prospective study. Volume perfusion-CT (VPCT) was performed in the baseline and post-interventional (FU1) setting (24h later) and again at follow-up (FU2; median 81 days) in 45 consecutive patients. 100-300µm (n=17) and 300-700µm (n=28) drug eluded beads (DEB) in a dose of (25 mg) were used. VPCT was performed for 40-sec covering the involved liver (80 kV, 100/120 mAs) using 64x0.6 mm collimation, 26 consecutive volume measurements, IV injection of 50 mL of iodinated contrast, flow rate of 5 mL/s. Arterial liver perfusion (ALP), portal-venous perfusion (PVP) and the hepatic perfusion index (HPI) were registered in the non-involved liver parenchyma in two large VOIs (left and right). Results were compared with those at FU1 and FU2.
Results: In the liver parenchyma there was a significant increase of ALP and HPI between baseline (11.6 mL/100 g tissue/' and 19.1%) and FU1 (14.8 mL/100 g tissue/' and 26%) coupled by a significant decrease (normalisation) of ALP and HPI between FU1 and FU2 (10.2 mL/100 g tissue/' and 16.9%). At the same time, PVP did not significantly change. There was no persisting hepatic parenchymal perfusion deficit.
Conclusion: VPCT accurately measures impact of TACE on dual hepatic parenchymal perfusion showing temporarily increases in ALP and HPI presumably caused by redirection of arterial flow which normalize with time and are independent on the particle size.

10:30 - 12:00 **Studio 2015**

Cardiac

SS 1803

Biomarkers in cardiac imaging

Moderators:
A. Kallifatidis; Thessaloniki/GR
T. Leiner; Utrecht/NL

B-1056 10:30

MRI-proven cardiac pathologies in female carriers of Duchenne muscular dystrophy

J. Schelhorn, A. Schoenecker, U. Neudorf, K. Nassenstein, U. Schara, T. Schlosser; *Essen/DE (juliane.schelhorn@uk-essen.de)*

Purpose: Duchenne muscular dystrophy (DMD) is the most common and severe dystrophinopathy. Affected males develop distinct general muscle weakness. The myocardium is often involved and dilated cardiomyopathy presents as one leading cause of death among these patients. In contrast, DMD carriers rarely present with clinical symptoms but may suffer from cardiac involvement. Because echocardiographic findings are inconsistent and cardiac magnetic resonance imaging (CMRI) data is limited in DMD carriers this study aimed to investigate asymptomatic carriers by CMRI for cardiac abnormalities.
Methods and Materials: 15 genetically confirmed DMD carriers (mean age 32.3±10.2 years) were prospectively examined on a 1.5 T MR scanner. Cine, T2 and delayed gadolinium enhancement (LGE) images were acquired. CMRI studies were evaluated by two experienced readers in consensus. Left ventricular (LV) parameters were analyzed semi-automatically and normalized to BSA.
Results: Normalized LV end-diastolic volume was increased in 27% of cases (mean: 73.7±16.8 ml/m², range: 48-116 ml/m²) and normalized LV end-systolic volume in 87% (mean: 31.5±13.3 ml/m², range: 15-74 ml/m²). Ejection fraction was reduced in 33% (mean: 58.4±7.6%, range: 37-69%), whereas the normalized LV myocardial mass was reduced in all subjects (mean: 40.5±6.8 g/m², range: 31-55 g/m²). In 80% regional myocardial thinning in more than one segment was detected. In 13% of cases apicolateral accented LV-noncompaction was present. LGE was found in 60% and was accented midmyocardial inferolateral.
Conclusion: Due to the high frequency of cardiac pathologies detected by CMRI a regular cardiac risk assessment seems advisable in DMD carriers. Beside clinical examination CMRI proved an excellent tool for this purpose.

B-1057 10:38

Correlation of thoracic aortic distensibility with aortic and coronary atherosclerotic plaques

M.A. Karimi, A. Arjmand Shabestari, M. Shahnazi, T. Faghihi Langroudi, H. Pouraliakbar, M. Tehrai; *Tehran/IR (mkarimidr@yahoo.com)*

Purpose: To determine the relationship between aortic distensibility and the presence, extent and composition of thoracic aortic plaques (TAP).
Methods and Materials: With institutional review board approval, retrospective ECG-gated coronary multi-slice CT was performed for 150 subjects (75 with and 75 without TAP; mean age: 59.0 ± 13.5 years; 54.7% female) using two 64-slice and a dual-source 256-slice scanners. Aortic distensibility index (ADI) [(end-systolic minus end-diastolic (ED) lumen)/(lumen in ED × pulse pressure)× 103] was measured at local TAP (L-ADI) and predefined locations including ascending aorta (A-ADI), proximal (PD-ADI) and distal descending aorta (DD-ADI). Total ADI (T-ADI) was the mean of predefined locations. TAP was categorized as either calcified or non-calcified plaques.
Results: All ADIs of the patients with calcified TAP were significantly lower than patients with non-calcified or without TAP ($p < 0.0001$). All ADIs, except for L-ADI, of the patients with coronary plaque were significantly lower than those without coronary plaque ($p < 0.0001$). T-ADI was positively correlated with A-ADI, PD-ADI, DD-ADI (r=0.82, 0.64, 0.83, respectively, $p < 0.0001$), and negatively correlated with age (r=-0.61, $p < 0.0001$), systolic blood pressure (r=-0.35, p=0.001), aortic calcium score and plaque burden (r=-0.57, $p < 0.0001$; r=-0.6, p=0.001, respectively). In the multivariate analysis adjusted for age, gender, diabetes mellitus, hypercholesterolemia, hypertension and cigarette smoking, presence of TAP, particularly calcified TAP, was independently correlated with ADI.
Conclusion: A less-distensible thoracic aorta is associated with calcified aortic and coronary plaques. Aortic plaque is an independent predictor of the stiffer aorta.

B-1058 10:46

Cardiac computed tomography is an accurate method to differentiate left atrial appendage thrombi from spontaneous echo contrast in acute stroke patients

M. Taina, R. Vanninen, P. Sipola, A. Muuronen, P. Jäkälä, M. Hedman; *Kuopio/FI (Mikko.Taina@kuh.fi)*

Purpose: Left atrial appendage (LAA) is the most typical origin for cardioembolic thrombus as stroke aetiology. Transesophageal echocardiography (TEE) is widely used but uncertain to differentiate solid thrombus from spontaneous echo contrast (SEC). We assessed whether cardiac CT (cCT) can detect LAA thrombi more accurately.
Methods and Materials: Altogether 102 patients with suspected acute cardioembolic stroke/TIA without chronic atrial fibrillation underwent arterial and venous phase cCT and TEE. A cardioradiologist and cardiologist evaluated TEE and cCT in consensus to define LAA thrombus while TEE alone defined SEC. The LAA/aorta Houndsfield unit (HU) ratio was measured independently and blinded to prior visual readings. The optimal LAA/aorta HU-ratio cut-off value for differentiating thrombi and SEC was defined.
Results: TEE indicated 10 SECs and three thrombi. Consensus reading of cCT and TEE exposed all thrombi in TEE as false positive, but revealed three actual thrombi missed in TEE. For detection of thrombi, the best trade-off for LAA/aorta HU-ratio was < 0.245 in both arterial and venous phases. Sensitivity, specificity, positive and negative predictive value and accuracy for detection of thrombi were 100% for cCT in both phases. SEC was characterized with HU-ratios of > 0.245 and < 0.577 in arterial phase and > 0.245 and < 0.824 in venous phase. LAA/aorta HU-ratio correlated significantly with presence of thrombi in both phases ($P < 0.001$) and with presence of SEC both in arterial (P=0.019) and venous phase (P=0.024).
Conclusion: cCT is more accurate than TEE in the detection of LAA thrombi especially when combined with the measurement of LAA/aorta HU-ratio.

B-1059 10:54

Impact of implementing cardiac CT in evaluating patients suspected of cardioembolic stroke

A.M. Ajlan, R.R. Bagdadi; *Jeddah/SA (amrajlan@yahoo.com)*

Purpose: Echocardiography is considered the practical choice in the cardiac evaluation of patients suspected of cardioembolic stroke. Cardiac CT has been recently introduced as a noninvasive modality that has the ability to detect various embolic causes. Our aim is to assess the yield of implementing cardiac CT in the workup of patients suspected of cardioembolic stroke in daily practice.
Methods and Materials: Out of 356 patients who underwent cardiac CT at our tertiary care center, 47 patients were retrospectively identified as suspected cardioembolic stroke referrals. Clinical reports of our three experienced cardiac CT radiologists were evaluated. The ability of cardiac CT was assessed in detecting findings of major embolic potential, stroke-unrelated clinically significant findings, coronary arterial disease (CAD) and incidental findings. The CT findings were correlated with the patients' clinical profile and echocardiographic results.
Results: Cardiac CT showed findings of major embolic potential in 10 (21%) patients (2 cases of left atrial thrombi, 2 cases of vasculitis, 1 case of repaired mitral valve clot, 1 case of left ventricular thrombi, 1 case of proximal aortic thrombus, 1 case of metastasis invading the left superior pulmonary artery, 1 cases of myocardial infarction, and 1 case of multiple pulmonary arteriovenous malformations). Echocardiography was unable to offer the explanation of stroke in 9 out of these 10 cases (19% of the 47 patients). 2 (4%) cases with findings of major embolic potential where identified on echocardiography but not on CT (1 case of left atrial appendage thrombus and 1 case of mitral valve vegetation). CT of 10 (21%) patients showed additional stroke-unrelated yet clinically significant findings (3 cases of pulmonary emboli, 2 case of aspiration pneumonia, 1 case of thoracic lymphadenopathy, 1 case of cavitary pneumonia, 1 case of septic emboli and malpositioned endotracheal tube, 1 case of thymic mass, and 1 case of malpositioned enteric feeding tube and chest tube-induced lung laceration). 23 (49%) patients had unexpected CAD on CT, out of which 52% were obstructive (> 50% stenosis). 4 (65) cases of incidental findings were also noted (2 cases of lung nodules, 1 case of ankylosing spondylitis and 1 case of hiatus hernia with lower esophageal thickening).
Conclusion: In daily practice, implementing cardiac CT in assessing patients suspected of cardioembolic stroke adds value to echocardiographic evaluation. In certain cases, cardiac CT revealed other unrelated clinically significant findings, obstructive coronary arterial disease (CAD) or incidental findings that were undetected by echocardiography.

B-1060 11:02

Geometrical differences of the coronary arteries during the cardiac cycle on 4D CT angiography

J.K. van Zandwijk[1], V. Tuncay[1], C.H. Slump[2], M. Oudkerk[1], R. Vliegenthart[1], P.M.A. van Ooijen[1]; [1]*Groningen/NL*, [2]*Enschede/NL* *(jordyvanzandwijk@gmail.com)*

Purpose: To quantify geometric differences of the coronary arteries in end-systolic (ES) and end-diastolic (ED) phase using 4D dual-source computed tomography (CT).
Methods and Materials: Patients from studies including coronary CT imaging in our clinic were included (n=71, 62 men, mean age 62.2±9.9 years). All underwent dual-source CT with retrospective electrocardiographic-gating. The entire cardiac cycle was imaged. Reconstructions were made at every 10% of the cardiac cycle. ES and ED phases were automatically determined by the software. Centerlines were extracted for the right (RCA) and left coronary artery (LAD and LCx). On artery and segment level, the path length, curvature, and tortuosity, and the number of inflection points were analysed. Paired sample T-tests and Wilcoxon signed-rank tests were calculated.
Results: In total, 213 arteries and 639 segments were included. Of these, 137 arteries (64.3%) and 456 segments (71.4%) could be assessed, including 53 RCAs (38.7%), 45 LAD (32.8%), and 39 LCx arteries (28.5%). No significant differences in path length were found between end-systole and end-diastole. Curvature and tortuosity were significantly higher in ES than in ED phase for arteries (respectively 10.5% and 2.8%) and segments (8.9% and 1.6%), with p-values < 0.0001. The number of inflection points was also significantly higher in ES on both artery and segment level ($p < 0.001$).
Conclusion: A robust method was established for quantifying the geometrical changes of the coronary arteries during the cardiac cycle with 4D dual-source CT. Further studies are needed to investigate whether dynamic changes are related to plaque development.

B-1061 11:10

Heritability of coronary geometry: initial experience

M. Kolossváry[1], Z.D. Drobni[1], G. Závodszky[1], I. Kolossváry[1], P. Kitslaar[2], B. Merkely[1], P. Maurovich-Horvat[1]; [1]*Budapest/HU*, [2]*Leiden/NL*

Purpose: Increased arterial tortuosity is a result of aging, hypertension and numerous pathological processes. Coronary tortuosity may initiate and propagate atherosclerosis due to its influence on local hemodynamic conditions. Yet, it is unknown to what extent environmental and genetic factors contribute to the geometry of the coronaries. Therefore, we investigated the feasibility of comparing coronary geometry between healthy twins.
Methods and Materials: In total, 28 twins 8 monozygotic (MZ), 6 dizygotic (DZ), underwent 256-slice coronary CT angiography. The coronary trees were segmented and the inner-lumen meshes were extracted using QAngioCT software. Vessel centerline coordinates were calculated with 0.5 mm increments. Twins' centerline data points were superimposed on each other using rigid body transformations (translation, rotation) with the Kabsch algorithm. Root mean square error (RMSE) was calculated between the distances of the corresponding data points after superimposition. Mann-Whitney U test was used for statistical comparison of RMSE values between MZ and DZ twins using Matlab 2012b.

Results: Analysis of the coronary trees showed that MZ twins RMSE values showed no significant difference compared to the DZ twins values (Median: 14.57 mm IQR: 11.71 - 21.75 mm; 19.99 mm IQR: 12.15 - 20.61 mm respectively, p=0.57). No significant difference was seen on a segmental basis either.
Conclusion: Our initial results suggest that, coronary geometry is similar between MZ and DZ twins, which indicate that environmental factors play an important role in the development of coronary anatomy. We intend to evaluate our results in the full cohort (105 twin pairs) with the application of more in-depth twin statistics.

B-1062 11:18

Heritability of coronary calcification and plaque burden: a classical twin study

P. Maurovich-Horvat[1], Z.D. Drobni[1], T. Horvath[1], A.L. Jermendy[1], M. Karoly[1], M. Kolossvary[1], A.D. Tarnoki[1], S. Voros[2], B. Merkely[1]; [1]*Budapest/HU*, [2]*Richmond, VA/US (maurovich.horvat@gmail.com)*

Purpose: Through the comparison of monozygotic (MZ) and dizygotic (DZ) twins phenotypic similarities can be quantified, genetic and environmental factors can be determined in an uniqe way. Our goal was to determine the magnitue of genetic and environmental impact on coronary calcification and plaque burden.
Methods and Materials: Coronary CT-angiography was performed in 208 twin subjects, of whom 62 were MZ pairs and 42 were DZ pairs (mean age: 58.1±8.7 vs. 55.8±9.8, p=0.218, respectively). Calcification was assessed by Agatston-score measurement. Plaque burden was assessed by the segment involvement score (SIS: total number of segments with plaque) and segment stenosis score (SSS: sum of all stenoses, minimal=1, mild=2, moderate=3, severe=4). SSS index (SSSi) is the SSS/total segment number, whereas SIS index (SISi) is the SIS/total segment number. Concordance between MZ and DZ pairs were assessed by non-parametric correlations. Rough heritability was calculated according to the Falconer-method.
Results: Ca-score was measured in 208 subjects, whereas plaque burden scores were assessed in 104 subjects. Ca-score was more than 0 in 39.4% (82/208) of twins with a median Agatston score of 114.6 (IQR:285.3). SSSi and SISi were positive in 59.6% (62/104) of twins. In the positive cases the median of the SISi was 0.24 (IQR:0.31) and the median of SSSi was 0.29 (IQR:0.49). Relatively strong heritability was found regarding Ca-score (0.89), while the plaque burden showed a weaker genetic dependency (SSSi:0.28 and SISi:0.27).
Conclusion: This classical twin study shows that coronary calcification has a relatively strong heritability, while plaque burden is more determined by environmental factors.

B-1063 11:26

Measuring athlete's risk of cardiovascular events (MARC) study: the role of coronary CT in the cardiovascular evaluation of middle-aged sportsmen

T. Braber, B.K. Velthuis; *Utrecht/NL (thijsbraber@gmail.com)*

Purpose: Over 90% of exercise-related cardiac arrests occur in men, predominantly those aged > 45 years with coronary artery disease (CAD) as main cause. The current sports medical evaluation (SME) of middle-aged athletes consists of a medical history, physical examination, resting- and exercise-electrocardiography. Coronary CT (CCT) provides a minimally invasive low-radiation-dose opportunity to image the coronaries. We investigated the added value of CCT (non-enhanced CT for coronary calcium scoring (CACS) and contrast-enhanced CT for coronary angiography (cCTA)) in male recreational athletes free of known cardiovascular disease aged ≥ 45 years who underwent a SME.
Methods and Materials: : A total of 314 participants underwent prospective ECG-triggered CCT using a 256-slice CT scanner. The presence of relevant CAD was defined as a CACS ≥100 Agatston Units (AU) or obstructive (≥50%) luminal stenosis on CCTA. The number needed to screen (NNS) to prevent one (cardiovascular) event in the next 5 years conditional on adequate treatment was estimated.
Results: 51 (16%,95%CI=12-20%) of 314 participants had a CACS ≥100 AU. Adding cCTA identified 8 participants with luminal narrowing ≥ 50%. Taken together CCT identified CAD in 59 (19%, 95%CI=15-24%) of 314 participants. The estimated NNS for CACS to prevent one CV-event in the next five years conditional on adequate treatment was 118 and 101 when combined with cCTA.
Conclusion: Minimally invasive CCT detects relevant CAD in one of five asymptomatic male athletes ≥45 years after a normal SME. The NNS to prevent one cv-event compares favorably to that of other screening tests.

B-1064 11:34

Athletes' normal left ventricular magnetic resonance parameters modified by trabeculae measurement

H. Vago, A. Toth, C. Czimbalmos, F. Suhai, I. Csecs, K. Kecskes, B. Merkely; *Budapest/HU (vagoha@gmail.com)*

Purpose: Our goal was to determine left ventricular magnetic resonance (MR) parameters for athletes and to examine how these parameters change with trabeculae measurement method.
Methods and Materials: Cardiac MR examination was performed on 128 top athletes (108 male, 20 female) and on 54 healthy volunteers (40 male, 14 female). The athletes were canoe and kayak paddlers (n=40), rowers (n=10), water-polo players (n=24), cyclists (n=7), football players (n=7), kick-boxers (n=8), handball players (n=6) and ultra-marathon runners (n=6). Left ventricular parameters were determined by using Medis QMass MR 7.6 quantification software. Left ventricular trabeculation was also analyzed quantitatively.
Results: Left ventricular volumes and myocardial mass indices (LVMi) were higher in athletes than in the control group both with and without quantifying the trabeculae mass (TrM). When TrM is included in the measurement, myocardial mass indices were higher and the volumes were lower both in athletes and in control group. Compared to the male control volunteers, TrM was higher in male athletes (43.4±10 vs 38±8 g, p=0.001). However, TrM% (trabeculae (g)/LVM (g)*100) was higher in the control group (21.1±4% vs 18.9±4%, p=0.001). This suggests a more pronounced hypertrophy in the compact myocardium caused by extensive physical training. LVMi corrected with TrM was higher in canoe and kayak paddlers (122.7±15 g/m2) compared to water-polo players (108.7±16 g/m2), ultra-marathon runners (100.7±10 g/m2), kick-boxers (89.9±12 g/m2) and football players (104.4±11 g/m2)($p < 0.05$). Moreover, canoe and kayak paddlers had higher end-diastolic (105.2±14 ml/m2) and stroke volume indices (68.3±8 ml/m2) than kick-boxers (88.6±13 ml/m2; 58±7 ml/m2)($p < 0.05$).
Conclusion: Quantification of myocardial trabeculae could significantly modify normal left ventricular parameters

B-1065 11:42

Cardiac MRI in athletes can be a final step in the eligibility for competitive sport after suspicious ultrasonography or stress ECG?

L. Patriarca, F. Bruno, A. Mancini, F. Smaldone, E. Di Cesare, C. Masciocchi; *L'Aquila/IT (lu.patriarca@gmail.com)*

Purpose: To evaluate usefulness and efficacy of CMR in young athletes with suspicious or inconclusive ultrasonography or stress ECG referring for their eligibility to competitive sport.
Methods and Materials: 39 athletes (italian football players, rugby players, volley players, athletics; age 26±4; 33/6 men/women) were examined in 7 years. All athletes had suspicions to cardiac abnormalities according to the results of echocardiography, ECG and functional examination. CMR was performed with 1.5 T-scanner to detect/rule out LV hypertrophy, arrhythmogenic cardiomyopathy, myocarditis or congenital heart diseases.
Results: MR didn't confirm cardiac pathology or found minor non-significant abnormalities in 28 cases (71.7%). In 4 cases (10.2%) CMR demonstrated the presence of bicuspid aortic valve with non-significant regurgitation. In 6 cases (15.4%) athletes had deep myocardial trabeculations without criteria of non-compaction cardiomyopathy. These athletes kept on doing competitive sports under the care of cardiologists. In 3 cases (7.6%) CMR revealed LV hypertrophy, which exceeded criteria established for the "athlete's heart". In 1 case of eccentric LV hypertrophy with focus of late-enhancement was found. These athletes were recommended to discontinue professional sport activities. 2 sportsmen (5.1%) were referred to cardiac surgeon: the first one had patent ductus arteriosus, the second one - the complex cardiac pathology - non-compacted myocardium, ventricular septal and inferior wall aneurism, atrial septal defect.
Conclusion: CMR provides significant contribution for medical decision-making in athletes eligibility for professional sport due to its possibilities in the assessment of ischemia, evaluation of non-ischemic cardiomyopathies, myocarditis, pericardial disease, congenital heart disease and cardiac masses.

B-1066 11:50

Can pericardial fat volume be a marker of metabolic syndrome in adult patients? A preliminary study

H. Chen[1], J. Yu[1], X. Zhang[2]; [1]*Chengdu/CN*, [2]*Shanghai/CN (chenhui19870706@126.com)*

Purpose: This study aimed to assess the relationship between pericardial fat volume (PT) measured by dual source computed tomography (DSCT) (Somatom Definition Flash, Siemens Healthcare) and the presence of variable metabolic syndrome (MS).

Methods and Materials: A total of 322 patients (female, medial age 61Y) who underwent DSCT for suspected coronary artery diseases were retrospectively analyzed, in which 55 normal patients,77 only calcified plaques, 53 soft plaques only, 137 fibrillation atrial. PT of every patient was measured from CT images using a prototype software from Siemens. Presences of metabolic syndrome (MS) were also recorded, such as fasting plasma glucose, blood uric acid, smoking, alcohol drinking, triglyceride, cholesterol ,high density lipoproteins, low density lipoprotein. Analysis of variance (ANOVA) and linear regression were used to analyze the relationship between PT and MS presences.
Results: PT was statistically significantly higher in patients with MS compared to those without MS (173±1.43 mm3 vs 125±2.10 mm3, $p < 0.001$). Simple regression analysis results revealed that the presence of smoking, alcohol drinking, abnormal triglyceride, calcified plaque and abnormal blood uric acid were correlated with PT volume (r=0.398, 0.376, 0.371, 0.121, 0.119, respectively, $p < 0.001$).
Conclusion: This study indicated that PT volume were associated with MS indexes like smoking, alcohol drinking, triglyceride, calcified plaque and blood uric acid, but not with fasting plasma glucose, fibrillation atrial, soft plaque, cholesterol, high density lipoproteins, low density lipoprotein and age. These findings implicated the potentiality of PT to be a novel indicator for specific MS.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 1810
Arthritis

Moderators:
A. Cotten; Lille/FR
S. Weckbach; Heidelberg/DE

K-26 10:30
Keynote lecture
I. Boric; *Zabok/HR*

B-1067 10:39
A comparison between x-ray, CT and DECT in detection of tophi in gouty arthritis: first clinical experience with single source DECT in volume scan mode
T. Diekhoff, T. Kiefer, K.-G.A. Hermann; *Berlin/DE (torsten.diekhoff@charite.de)*

Purpose: So far dual energy CT (DECT) is restricted to dual source scanners. However, transferring the possibilities of DECT to conventional single source CTs provides its benefits to a larger number of patients. The aim of this study was to compare the detection of gouty tophi in X-ray, CT and single source DECT.
Methods and Materials: 47 patients with acute arthralgia of the feet joints and suspicion of gout were investigated with single source DECT. Standard X-rays were performed as well as DECT using a 320-rows CT (Toshiba Aquillion One, Toshiba medical systems, Japan) and two consecutive volume scans with 16 cm z-axis coverage (135 kV and 25 mA following 80 kV and 140 mA). Presence of tophi was scored by three blinded readers per joint in X-ray, conventional CT (135 kV) and color-coded DECT. Statistical Analysis was done using Wilcoxon matched-pairs signed rank test, Bland-Altman plot and Spearman-test.
Results: Using X-ray 1.8% of all investigated joints were positive. This number raised to 6.2% using CT and 7.7% using DECT ($p < 0.0001$). However, the Bland-Altman and Spearman test proved a good correlation between CT and DECT ($r = 0.69$, $p < 0.0001$), whereas X-ray showed an inferior correlation to CT ($r = 0.25$, $p < 0.0001$) and DECT ($r = 0.19$, $p < 0.0001$).
Conclusion: Single source DECT of the extremities depicts more clearly uric acid depositions in the soft tissue than X-ray and conventional CT and is not restricted to dual source systems.

B-1068 10:47
Evaluation of a simplified version of the rheumatoid arthritis magnetic resonance imaging score (RAMRIS) comprising 5 joints (RAMRIS5)
C. Schleich, C. Buchbender, P. Sewerin, B. Ostendorf, C. Rubbert, G. Antoch, F. Miese; *Düsseldorf/DE (christoph.schleich@med.uni-duesseldorf.de)*

Purpose: The objective of this study was to evaluate a simplified version of the Rheumatoid Arthritis Magnetic Resonance Imaging Score (RAMRIS) reduced to five joints of the hand (RAMRIS5).
Methods and Materials: 94 patients with rheumatoid arthritis (62 female; age 59±12 years, range 25-83 years; disease duration 60±90 months (median:22 months, first quartile:7 months, third quartile: 66 months) from the REMISSION PLUS study cohort who had complete files on C-reactive protein (CRP) levels and Disease Activity Score of 28 joints (DAS28) and complete MRI of the clinical dominant hand at baseline and after one year under anti-rheumatic therapy (follow-up time 12.5 ± 1.1 months) in a dedicated extremity MRI scanner at 0.2 T were included in this retrospective study.
Results: There was a strong correlation between RAMRIS5 and the RAMRIS sum-score for all patients ($r= 0.87$, $p < 0.001$) at baseline and follow-up ($r= 0.87$, $p < 0.001$). Among the subscores there was a significant correlation between RAMRIS5 and RAMRISMCP (baseline: $r= 0.66$, $p < 0.001$; follow-up: $r= 0.74$, $p < 0.001$) as well as between RAMRIS5 and RAMRISwrist (baseline: $r= 0.72$, $p < 0.001$, follow-up: $r= 0.69$, $p < 0.001$) at baseline and follow-up.
Conclusion: RAMRIS5, a modified shorter RAMRIS score based on five joints of the hand is a viable tool for semi-quantitative assessment and monitoring of joint damage in RA. This abbreviated score might reduce the time needed for image analysis in MRI-controlled studies in RA and facilitate the use of MRI in studies on therapy response assessment in RA

B-1069 10:55
Increased risk for incident radiographic osteoarthritis and cartilage loss in knees undergoing meniscal surgery in the previous year
F.W. Roemer[1], C. Kwoh[2], M. Hannon[3], J. Grago[3], D.J. Hunter[4], F. Eckstein[5], A. Guermazi[6]; [1]*Erlangen/DE*, [2]*Tucson, AZ/US*, [3]*Pittsburgh, PA/US*, [4]*Sydney/AU*, [5]*Salzburg/AT*, [6]*Boston, MA/US (frank.roemer@klinikum-augsburg.de)*

Purpose: To assess if meniscal surgery increases risk for incident radiographic osteoarthritis (ROA) and cartilage loss in the following year.
Methods and Materials: Participants were drawn from the Osteoarthritis Initiative. We studied 328 knees that developed incident ROA before the OAI 48 month visit that were each matched with a control knee that did not develop incident ROA. Matching was done by gender and age within 5 years. MR images were acquired using Siemens Trio 3 T scanners. MRIs were read for meniscal and for cartilage morphology at the time point prior and at the case defining visit. Conditional logistic regression was applied to assess risk of incident ROA and cartilage loss during the following year.
Results: 31 (4.4%) knees underwent meniscal surgery during the year prior the case defining visit. 238 (34.9%) knees had prevalent meniscal tears and 42 (6.2%) knees showed any meniscal maceration at the time point prior the case-defining visit not including the knees that had surgery. (100%) knees that had meniscal surgery 58.9% of the knees with prevalent meniscal damage developed incident ROA. Risk of cartilage loss was significantly increased for knees exhibiting any prevalent meniscal damage (OR=1.5 95% confidence interval [CI] [1.1.2.2]) but markedly further increased for knees that had surgery (OR=13.1 95% confidence interval [CI] [4.7.36.3]).
Conclusion: All knees undergoing meniscal surgery developed incident ROA. Risk for cartilage loss is much higher for knees undergoing surgery compared to knees with prevalent meniscal damage.

Author Disclosures:
F.W. Roemer: Shareholder; Boston Imaging Core Lab (BICL), LLC. **C. Kwoh:** Consultant; Novartis. **D.J. Hunter:** Consultant; DJO. **F. Eckstein:** Consultant; MerckSerono, Novartis, and Sanofi-Aventis. Research/Grant Support; Pfizer, Eli Lilly, MerckSerono, Glaxo-Smith-Kline, Centocor R&D, Wyeth, Novartis, and Stryker. Speaker; Merck, Glaxo-Smith-Kline, Genzyme, Medtronic, and Synthes. **A. Guermazi:** Consultant; OrthoTrophix, Genzyme, MerckSerono and TissueGene. Shareholder; Boston Imaging Core Lab (BICL), LLC.

B-1070 11:03
Comparison of optimised high-resolution MR imaging of the temporomandibular joint at 1.5 T and 3.0 T using an optimised high-resolution protocol
A. Manoliu, G. Spinner, M. Wyss, S. Erni, D. Ettlin, D. Nanz, E.J. Ulbrich, L.M. Gallo, G. Andreisek; *Zurich/CH (a.manoliu@googlemail.com)*

Purpose: Current literature describes MR imaging of the temporomandibular joint (TMJ) at 1.5 T as standard, and, still, little is known about 3.0 T imaging. Purpose was to quantitatively and qualitatively compare TMJ imaging at 1.5 T and 3.0 T using an optimized high-resolution protocol.
Methods and Materials: IRB approved study with written informed consent. A spherical phantom and 12 asymptomatic volunteers underwent MR imaging of the TMJ at 1.5 T and 3.0 T (Achieva 1.5 T/ Ingenia 3.0 T, Philips) using identical 2-channel surface coils (SENSE FlexS, Philips). Image protocol included sagittal and coronal fast spin echo sequences. Acquisition parameters at both field strength were kept identical with except for a higher spatial resolution at 3.0 T (0.375x0.375x2.0 mm versus 0.25x0.25x2.0 mm). For quantitative analysis, pixel-by-pixel signal-to-noise ratio (SNR) maps were calculated using Matlab routines (Natick, USA). For qualitative analysis, images were evaluated by two independent readers using 5-point Likert scales. 1.5 T and 3.0 T were compared using t-tests.

Results: The quantitative analysis revealed significantly increased SNR for 3.0 T compared to 1.5 T (1.5 T: mean±SD, 64.29±30.63; 3.0 T: 102.45±43.63; $p < 0.001$). For the qualitative analysis, inter-rater reliability ranged from "substantial" to "almost perfect" (Kappa, 0.84-0.97).The qualitative analysis showed significantly better image quality and visibility of clinically relevant anatomic structures (4 different regions of the disc, posterior attachment, mandibular condyle at 3.0 T compared to 1.5 T ($p < 0.05$ and $p < 0.001$, respectively; corrected for multiple comparisons).
Conclusion: MR imaging of the temporomandibular joint at 3.0 T using sequences optimized for high-resolution yields increased SNR, better image quality and visibility of clinically relevant anatomic structures compared to 1.5 T.

B-1071 11:11

Increased risk for radiographic osteoarthritis features in young active athletes: a cross-sectional matched case-control study

F.W. Roemer[1], M. Jarraya[2], J. Niu[2], J.-R. Silva Jr.[2], R. Frobell[3], A. Guermazi[1]; [1]*Doha/QA*, [2]*Boston, MA/US*, [3]*Lund/SE (frank.roemer@aspetar.com)*

Purpose: Prevalence data on radiographic osteoarthritis (ROA) in young active athletes is sparse. Aim was to assess in a matched case-control design the frequency of ROA in an athlete population and whether athlete status, gender, previous ACL surgery and age increase the odds for ROA.
Methods and Materials: 135 consecutive athletes (82% soccer players) 18 to 36 years old and 550 non-athletes aged-matched controls had knee radiography (Lyon-Schuss protocol) for assessment of subacute or chronic knee complaints. Patients with acute trauma or fractures were excluded. Radiographs were graded according to the Kellgren-Lawrence and OARSI grading schemes. In addition, medial and lateral intercondylar notch osteophytes were scored. The odds of ROA and specific OA features were assessed using logistic regression models taking into account athlete status, prior ACL surgery, gender and age including adjustment for confounders.
Results: 19.4% of patients were 18-22 years old, 26.4% were 23-27, 22.6% were 28-32, and 31.5% were 33-36. 18.7% were female and 8.8% had previous ACL surgery. 8.5% had ROA and 6.0% had evidence of JSN. The adjusted odds ratios (aOR) for ROA were 2.8 (1.4, 5.5) for athletes, 7.0 (3.5, 13.9) for previous ACL surgery and 3.3 (1.2, 9.0) for age range 32-36. Athlete status significantly increased odds for grade 1, grade 2, and grade 3 tibiofemoral osteophytes (aORs 2.9 to 4.8) and comparably for notch osteophytes.
Conclusion: Athlete status and higher age increase risk of ROA with previous ACL surgery being the strongest risk factor while female gender was associated with lower odds.

Author Disclosures:
F.W. Roemer: Shareholder; Boston Imaging Core Lab (BICL), LLC. **A. Guermazi:** Consultant; OrthoTrophix, Genzyme, MerckSerono and TissueGene. Shareholder; Boston Imaging Core Lab (BICL), LLC.

B-1072 11:19

Use MRI T1rho monitor the curative effective treatment of epimedium on early osteoarthritis

S. Liu, J. Zhang, S. Shen, F. Wang, L. Qiu, M. Chen, C. Zhang; *Guangzhou/CN (tlsr@jnu.edu.cn)*

Purpose: Using T1rho monitoring the effective treatment of osteoarthritis of epimedium.
Methods and Materials: 28 New Zealand rabbits were randomly divided into three groups (A,B,C,11.11,6) 0.5 ml 1.6% papain and equivalent dilution was respectively injected into the right, left knee joint cavity of both group A and B for three times (1, 4, 7 days). After 3 weeks, give group A epimedium 1 g (kg. D)-1 to lavage, Group B take equivalent sterile saline,continuous dosing for 2 month. All of them take T2WI, 3D FSSPGR, and T1rho for pre-intervention and post-intervention (T = 0, 1, 2 mon). Analyzing T1rho values and cartilage thickness in bilateral femoral condyle cartilage. all femurs were examined pathologically.
Results: 1, Papain post-induced, A+B group: right side T1rho values is (67.26±9.19 ms) higher than the left side (41.44±4.85 ms), difference was statistically significant (t = 10.294, P = 0.000); Compared right side cartilage thickness value (0.773 ±0.053 mm) with control lateral thickness (0.781±0.059 mm), difference has no significance (t = 1.122, P = 1.122)Intervention in group A and group B at the different time phase, Group A T1rho values change over time is linear downward trend, the second month is more obvious than the first month; Group B T1rho values change with time is not obvious.
Conclusion: Epimedium is effective for early stages osteoarthritis, Mid-term efficacy significantly. T1rho mainly reflects loss of matrix proteoglycan content in early stages and interaction between collagen and water in progressive stages OA.

B-1073 11:27

Is it worth to include MRI of the spine in the ASAS classification criteria for axial spondyloarthritis: data from the DESIR-cohort

M. de Hooge, J.-B. Pialat, A. Feydy, M. Reijnierse, M. Dougados, D. van der Heijde; *Paris/FR (antoine.feydy@cch.aphp.fr)*

Purpose: Spinal MRI lesions suggestive of axial Spondyloarthritis (axSpA) are not included in the ASAS definition of a positive MRI. The objective of this study was to investigate the prevalence of a positive MRI-spine in patients with short symptom duration and a negative MRI-SIJ.
Methods and Materials: French patients aged 18-50 with inflammatory back pain (IBP) (≥3 months, ≤3 years) were included in the DESIR-cohort (n=708). MRIs-SIJ were scored according to the ASAS definition. Inflammatory lesions on MRI-spine suggestive of spondylitis were scored when visible on ≥2 consecutive slices and according to the ASAS consensus definition (≥3 lesions).
Results: All patients with MRI-spine and MRI-SIJ (n=650) were included in the analyses. There were 231 patients (35.5%) with a positive MRI-SIJ and 102 patients (15.7%) with a positive MRI-spine; 67 patients (10.3%) were positive for both MRI-SIJ and MRI-spine, 384 (59.1%) were negative for both; and 35 patients (5.4%) had a positive MRI-spine but a negative MRI-SI. If the MRI-spine would be considered to count for imaging for the ASAS criteria, 6 additional patients would have been classified and 16 patients would have fulfilled both the imaging and clinical arm. Overall, only 25 patients (3.8%) had a positive MRI-spine without sacroiliitis on MRI or radiographs.
Conclusion: In 3.8% of IBP patients aged 18-50, ≥3 spinal inflammatory lesions suggestive of axSpA are found in absence of sacroiliitis on MRI or radiograph. Therefore the yield of including MRI-spine as additional imaging criterion in the ASAS axSpA classification criteria is considered unacceptably low.

B-1074 11:35

Gouty arthritis: effect of dual-energy CT on diagnostic thinking and therapeutic decision making

T. Finkenstaedt, A. Manoliou, M. Toniolo, T. Frauenfelder, G. Andreisek, B. Michel, R. Guggenberger, H. Alkadhi; *Zurich/CH (tim.finkenstaedt@usz.ch)*

Purpose: To determine the effect of dual-energy computed tomography (DECT) imaging results on diagnostic thinking and therapeutic decision making by clinicians in cases of known or suspected gout.
Methods and Materials: This retrospective study included 89 patients (29 female, mean age 61±14ys) with known (n=28) or suspected (n=61) gout who underwent clinically indicated DECT of the extremities (n=85) or spine (n=4). Two readers blinded to clinical data independently evaluated DECT images for presence of soft tissue and subsequently urate crystal deposits. Clinical diagnosis (gout, differential diagnosis), suspected location of urate crystal deposits and therapeutic decisions were noted before and after DECT by another reader blinded to the DECT data analyses.
Results: Interreader agreement for detection of soft tissue and urate crystal deposits with DECT were excellent ($\kappa = 1.0$ and 0.94, respectively). Thirty-nine of the 89 patients (44%) showed periarticular soft tissue deposits. Twenty-four of these 39 patients (62%) had urate crystal deposits according to DECT. After DECT, the clinical diagnosis of gouty arthritis was withdrawn in 15 of 39 (38%) patients. In 15/39 patients (38%) DECT resulted in maintaining the diagnosis. In 4/39 (10%) patients DECT revealed urate crystal deposits at another, clinically not suspected location, and in 5/39 patients (13%) in the clinically suspected and in an additional location. In 22/39 (56%) of patients, a change in treatment plan resulted after DECT.
Conclusion: In patients with known or suspected gout, DECT has a remarkable effect on diagnostic thinking and therapeutic decision making by clinicians.

B-1075 11:43

Prevalence of MRI spinal lesions typical for axial Spondyloarthritis in patients with inflammatory back pain

M. De Hooge[1], J.-B. Pialat[2], A. Feydy[3], M. Reijnierse[1], P. Claudepierre[4], A. Saraux[5], M. Dougados[3], D. van der Heijde[1]; [1]*Leiden/NL*, [2]*Lyon/FR*, [3]*Paris/FR*, [4]*Créteil/FR*, [5]*Brest/FR (antoine.feydy@cch.aphp.fr)*

Purpose: The aim was to determine the prevalence of inflammatory (BME) and fatty lesions on MRI-spine in patients (pts) with and without axSpA.
Methods and Materials: French patients with inflammatory back pain (≥3 months, ≤3 years) were included in the DESIR-cohort (n=708). All available baseline MRIs were independently scored by 2 well-calibrated readers, blinded to any other data. BME and fatty lesions typical for axSpA were scored when visible on ≥2 consecutive slices.
Results: All patients with symptom onset < 45 yrs with MRI-spine (n=549) were included. Pts fulfilling the ASAS criteria could either fulfill both arms, only the imaging arm or only the clinical arm. The prevalence in no SpA group is only 6.1%. With a cut-off ≥2 BME lesions false positives drop below 5% while

the prevalence in the ASAS axSpA groups is still reasonable. Especially prevalence in pts with mNY+ & MRI+ is very high; 61.9% (both arms positive) and 43.8% (imaging arm only positive). Fatty lesions are seen slightly less often seen in all patient groups. However the same trend is seen as with BME lesions; Even with cut-off ≥1 the prevalence in no SpA group is low (5.5%), with cut-off ≥2 false positives drop below 5% and again pts with mNY+ & MRI+ have the highest percentage of spinal fatty lesions.
Conclusion: In a low percentage of pts without axSpA BME and fatty lesions are found indicating that these lesions are specific for axSpA. These spinal lesions are especially prevalent in pts with sacroiliitis on imaging.

B-1076 11:51

Scoring of spinal lesions compatible with axial spondyloarthritis on MRI in clinical practice by local radiologist or rheumatologist in DESIR: comparison with central reading

M. de Hooge[1], J.-B. Pialat[2], M. Reijnierse[1], D. van der Heijde[1], M. Dougados[3], A. Feydy[3]; [1]*Leiden/NL*, [2]*Lyon/FR*, [3]*Paris/FR (antoine.feydy@cch.aphp.fr)*

Purpose: In clinical practice radiologists and rheumatologists assess whether lesions compatible with axial SpondyloArthritis (axSpA) are present on spinal MRI. The objective was to compare the results of local readings (LocR) to centralized reading (CentR) as external standard of BME and structural lesions on MRI-spine, in patients (pts) with inflammatory back pain (IBP).
Methods and Materials: French patients aged 18-50 with recent IBP (≥3 months, ≤3 years) were included in the DESIR-cohort (n=708). All available baseline MRIs-spine were scored on BME and structural lesions as present, absent or doubtful by the local radiologist/rheumatologist who might have access to clinical data. In addition, 2 well-calibrated centralized readers independently scored the same MRIs. Agreement between CentR and LocR was calculated excluding the cases assessed as doubtful by LocR (kappa κ).
Results: The k agreement between LocR and CentR was 0.27 for BME lesions and 0.13 for structural lesions. For radiologists, κ=0.36 for BME, and κ=0.15 for structural lesions. For rheumatologists κ=0.006 for BME and κ=0.12 for structural lesions. Overall, local specialists are highly overrating positive findings: 42.3% and 85.7% of the positive MRIs for BME are scored negative by the central read (radiologists and rheumatologist respectively). Similarly findings for structural lesions: 48.4% and 70% of MRIs positive for structural lesions are scored normal by central reading.
Conclusion: Local readers, especially rheumatologists overrate the presence of BME and structural lesions on MRI of the spine compared to trained central readers.

10:30 - 12:00 **Room E2**

Neuro

SS 1811

Brain epilepsy and inflammation

Moderators:
T. Kau; Klagenfurt/AT
M. Mantatzis; Alexandroupolis/GR

B-1077 10:30

Widespread white matter maldevelopment in children with specific language impairment

I.L. Štepán-Buksakowska[1], N. Szabó[2], R. Vydrová[1], T.Z. Kincses[2], J. Šanda[1], M. Kynčl[1], D. Hořínek[2], M. Roček[1], V. Komárek[1]; [1]*Prague/CZ*, [2]*Brno/CZ (irena.buksakowska@gmail.com)*

Purpose: Children with specific language impairment (SLI) have difficulties in acquiring their native language, although they do not show any obvious physical or mental deficits. Underlying pathophysiological mechanisms involve impaired central processing of the language. Whereas most studies evaluated alterations in related specific white matter (WM) tracts, our aim was to investigate global WM microstructure in patients with SLI.
Methods and Materials: We obtained diffusion tensor imaging data from 14 patients (mean age: 97months, SD=16) and 15 controls (97months, SD=12; age/sex/handedness matched). WM integrity was quantified with fractional anisotropy (FA), mean, longitudinal and radial diffusivity (MD/LD/RD). Diffusion parameters were compared between the groups with the use of linear/non-linear registration steps and nonparametric-permutation tests as implemented in Tract-Based Spatial Statistics.
Results: Reduced FA ($p < 0.0002$) and LD ($p < 0.0002$) were found bilaterally in widespread WM regions in patients, when compared to controls. Specifically, region of interest analysis showed increased MD ($p < 0.017$) and RD ($p < 0.000002$) in these affected pathways. However, in a whole brain analysis, neither MD nor the RD showed any significant difference between groups.
Conclusion: In our study we found decreased integrity of multiple tracts in patients with SLI, as indicated in group-level differences in diffusion parameters. Due to the diffuse pattern of changes, our results may reflect an underlying altered development of complex brain networks in SLI, rather than isolated changes in specific language-related pathways. This hypothesis could be strengthen by showing other, non-language related cognitive dysfunctions in SLI children.

Author Disclosures:
I.L. Štepán-Buksakowska: Research/Grant Support; Supported by the project FNUSA-ICRC (no. CZ.1.05/1.1.00/02.0123) from the European Regional Development Fund / IGA MZ ČR grant NT 11 443 and MH CZ–DRO, University Hospital Motol, Prague. **N. Szabó:** Research/Grant Support; Supported by the project FNUSA-ICRC (no. CZ.1.05/1.1.00/02.0123) from the European Regional Development Fund. **R. Vydrová:** Research/Grant Support; Supported by IGA MZ ČR grant NT 11 443 and MH CZ–DRO, University Hospital Motol, Prague, Czech Republic. **T.Z. Kincses:** Research/Grant Support; Supported by the project FNUSA-ICRC (no. CZ.1.05/1.1.00/02.0123) from the European Regional Development Fund. **J. Šanda:** Research/Grant Support; Supported by IGA MZ ČR grant NT 11 443 and MH CZ DRO, University Hospital Motol, Prague, Czech Republic. **M. Kynčl:** Research/Grant Support; Supported by IGA MZ ČR grant NT 11 443 and MH CZ DRO, University Hospital Motol, Prague, Czech Republic. **D. Hořínek:** Research/Grant Support; Supported by the project FNUSA-ICRC (no. CZ.1.05/1.1.00/02.0123) from the European Regional Development Fund. **V. Komárek:** Research/Grant Support; Supported by IGA MZ ČR grant NT 11 443 and MH CZ–DRO, University Hospital Motol, Prague, Czech Republic.

B-1078 10:38

Acute necrotising encephalopathy of childhood: correlation of MRI findings and clinical outcome

M.D. Mahajan, V. Ruprela, B. Banerjee, P.E. Chandy, R. Ananthasivan, U. Patil, S. Kumar GG, N. Shetty, P. Reddy; *Bangalore/IN (dr.muktamahajan@gmail.com)*

Purpose: To correlate MRI findings of Acute necrotizing encephalopathy of childhood (ANEC) with the clinical outcome.
Methods and Materials: Eight patients of acute encephalopathy with bilateral thalamic involvement were retrospectively analyzed since 2010. Age, presence of shock, platelet count, CSF analysis, hepatic enzymes, duration of hospitalization were used to grade severity of illness. Clinical outcome categories were based on residual neurological impairment on follow-up. MRI findings were stratified depending on associated involvement of brain stem, cerebral and cerebellar white matter, presence of hemorrhage, cavitation, hydrocephalus and cerebral edema. Spearman rank test was used for correlation where MRI findings were considered as independent variable and clinical outcome as dependent variable.
Results: All 8 patients presented with acute encephalopathy with seizures, irritability and vomiting. Average hospitalization was 21 days. Clinical outcome was graded as mild (62.5%), moderate (12.5%), severe (12.5%) impairment and, fatal (12.5%). Two patients tested positive for dengue and influenza. MRI findings of extensive symmetrical cerebral white matter involvement (25%) and large bi-thalamic cavitation (25%) were correlated with poor prognosis. Extensive brain stem (25%) and cerebellar (37.5%) involvement, hydrocephalus (25%), and cerebral edema (37.5%) were inconsistently present; and did not correlate well with the outcome.
Conclusion: Statistically significant correlation was observed between MRI findings and clinical outcome of ANEC. In addition to hemorrhage and cavitation, in our study population, presence of bilateral symmetrical cerebral white matter involvement was associated with poor prognosis. Thus, MR imaging has a potential to predict severity and outcome of this rare and fulminant encephalopathy.

B-1079 10:46

Abnormal brain development in neonates with congenital heart disease: evaluation with quantitative magnetic resonance spectroscopy

R.A. Elshafey, M. Awny, A. Elmashad, M. Nassar; *Tanta/EG (drrashaelshafey@yahoo.co.uk)*

Purpose: To assess brain maturity and brain injury in newborns with congenital heart disease (CHD) using proton magnetic resonance spectroscopy (MRS).
Methods and Materials: This prospective study on 40 full-term neonates suffering from CHD (cyanotic HD (n=20), acyanotic HD (n=20)), who were attendants of the Neonatology Unit of Paediatric Department and radiodiagnosis department of Tanta University Hospital. MR spectroscopy was done and spectra were analysed with voxels centered bilaterally on white matter and gray matter (basal ganglia and thalamus).
Results: MRS reveal decrease NAA/choline ratio and increase lactate/choline ratio, compared with controls, the changes more obvious at the cyanotic group. MRS changes were correlated with increased risk of neurodevelopmental impairment.

Conclusion: Newborn infants with cyanotic and acyanotic CHD are at high risk of cerebral white-matter injury together with poor brain maturity. MRS provides a marker for early detection of such brain abnormalities and identify infants at risk and so permits the initiation of early intervention programs to enhance the outcome of survivors.

B-1080 10:54

The value of resting-state fMRI for detecting epileptogenic zone in patients with focal epilepsy

J. Yin[1], B. Zhao[1], P. Zuo[2], H. Ni[1], W. Shen[1]; [1]*Tianjin/CN*, [2]*Beijing/CN*
(jianzhong.yin@gmail.com)

Purpose: To evaluate the value of resting-state fMRI (RS-fMRI) based on local analysis methods, regional homogeneity (ReHo), amplitude of low-frequency fluctuation (ALFF) and fractional of ALFF (fALFF) for detecting epileptogenic zone (EZ).
Methods and Materials: Forty-two patients with focal epilepsy were consecutively included. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of EZ localization in RS-fMRI, MRI, MRS, video electroencephalogram (VEEG), and PET-CT were calculated and compared to assess the diagnostic ability. Those of ReHo, ALFF and fALFF were also assessed.
Results: RS-fMRI shows a comparable diagnostic sensitivity to PET (83.3%) but specificity to VEEG (66.7%) for localizing EZ in patients with focal epilepsy. There was no significant difference between RS-fMRI and other localization techniques in sensitivity, specificity, PPV, and NPV for localizing EZ ($P > 0.05$). The sensitivity of ReHo, ALFF and fALFF was 69.4%, 52.8% and 38.9%, respectively; and the specificity was 66.7%, 83.3% and 66.7%, respectively. The comparison of ReHo, ALFF and fALFF showed no statistically significant difference ($P > 0.05$); but the ReHo was more sensitive, at least in our cohort study, than fALFF ($\chi 2=6.77$, $P=0.0093$).
Conclusion: RS-fMRI could be an efficient tool for detecting EZ in epilepsy.

B-1081 11:02

fMRI resting-state in temporal lobe epilepsy

N. Ananyeva, L. Shmeleva, R. Ezhova; *St. Petersburg/RU*
(ananieva_n@mail.ru)

Purpose: Investigation of functional connectivity (FC) in resting-state networks (RSNs) in TLE patients with affective disorders.
Methods and Materials: Investigation of functional connectivity (FC) in resting-state networks (RSNs) in TLE patients with affective disorders. 54 patients with TLE without significant brain damage and history of other psychiatric disorders. All patients underwent Beck Depression Inventory, Hospital Anxiety Depressive Scale, Hamilton Anxiety Scale and Montgomery-Åsberg Depressive Rating Scale. All subjects underwent 9-min resting-state fMRI on Toshiba Exelart Vantage 1.5 Tesla. The data was processed and analyzed using SPM8 and 'GIFT' toolbox. Independent component analysis (ICA) was used to isolate RSNs. The resulted maps were compared in groups using one-way ANOVA and two-sample t-test. The results were considered as statistically significant according to threshold of $p < 0.005$ with a 10-voxel cluster size.
Results: Patients were divided into three groups using clinical examination and EEG: patients with current affective disorders and left sided epileptic focus localization [left-sided 'affective' group (LSAG), n=18], patients with affective disorders and right-sided focus localization [right-sided 'affective' group (RSAG), n=18], and patients without affective disorders [non-affective group (NAG), n=18]. In both groups with affective symptoms, a moderate Level of depressive and anxiety symptoms (HAMA: 25.4±2.6; MADRS: 20.1±2.6) was found. The main interest of this study was to identify FC features of DMN.
Conclusion: Significantly increased FC was identified in the left insula, superior parietal cortex, left frontal cortex, right precuneus, right parahippocampal gyrus, right frontal cortex in patient's groups with affective symptoms in comparison to patients with NAG.

B-1082 11:10

Relative contributory role of Interictal/Ictal SPECT, interictal PET, MR spectroscopy and T2 relaxometry in localisation of seizure focus in temporal lobe epilepsies: a metaanalysis and systematic review

V. Venugopal, I. Afshan, S.K. Arjun; *New Delhi/IN (vasanthdrv@gmail.com)*

Purpose: To perform a meta-analysis to quantitatively assess the seizure localisation potential of SPECT, PET, MR spectroscopy (MRS) and T2 relaxometry (T2R)in patients with temporal lobe epilepsy (TLE).
Methods and Materials: A structured search strategy of PubMed, EMBASE,Cochrane Central Register and other databases was used to English language studies in which the diagnostic potential of FDG-PET, SPECT, MRS and T2R were assessed in patients with TLE. Studies were selected independently by three radiologists.Quality Assessment of Diagnostic Accuracy Studies tool was employed to assess the quality of the studies. Meta-Disc version 1.4 was used to describe and calculate sensitivity, specificity, summary receiver operating characteristic (SROC)curves and area under the curve (AUC) for these modalities. The meta-analysis was performed in accordance with the PRISMA guidelines.
Results: we noted gross heterogeneity among the studies regarding study design, methodology and interpretation criteria. 54 studies met the inclusion criteria. For ictal SPECT, interictal PET and interictal SPECT pooled sensitivity was 83 (95% CI 80-85) ,80 (95% CI 78-82) and 58%(95% CI 50-62), respectively. For MRS and T2R, pooled sensitivity was 76 (95% CI 74-78) and 79% (95 CI 76-81), respectively. Thus ictal SPECT had a slightly better sensivity,specificity and odds ratio. However, SROC analysis showed the diagnostic value of ictal SPECT in TLE has no significant difference compared with PET, MRS or T2R.
Conclusion: Although interictal SPECT is found to have a slightly better diagnostic value in this study, no statistically significant difference is seen in the diagnostic potential compared with other modalities

B-1083 11:18

Application of "Zero" Time-of-Echo (ZTE) MRI sequence for "Silent" T1-weighted imaging at 7.0 Tesla

M. Costagli[1], M.R. Symms[1], L. Angeli[1], D.A.C. Kelley[2], L. Biagi[1], C.H.S. Rua[1], G. Tiberi[1], M. Tosetti[1], M. Cosottini[1]; [1]*Pisa/IT*, [2]*San Francisco, CA/US*
(me@maurocostagli.info)

Purpose: One of the most prominent drawbacks of MR systems operating in quadrature at ≥7.0 Tesla is the increased radiofrequency field inhomogeneity that limits image quality, and in particular tissue contrast. A prototype "Zero" Time-of-Echo (ZTE) sequence was optimized to outperform standard T1w Fast-SPoiled-GRadient-echo (FSPGR) sequences at 7.0T.
Methods and Materials: 3D images obtained in 10 subjects with the optimized ZTE radial sampling sequence "Silent" (TR=525 ms, TE=16us, TI=600 ms, TD=2000 ms, FA=4deg, resolution=1x1x1 mm) were compared to those acquired with an FSPGR sequence routinely used for T1w structural imaging on a GE MR950 7.0T whole-body scanner in quadrature transmission. Different measures of signal-to-noise ratio (SNR), gray/white matter contrast and spatial homogeneity in Silent and FSPGR were computed and compared. Automated segmentation of white matter and gray matter was performed with FreeSurfer software.
Results: "Silent" provided significantly better contrast than FSPGR (mean gray/white matter intensity ratios = 0.79 in FSPGR and 0.56 in "Silent"; t-test $p < 0.0001$; ratio=1 means no contrast, and smaller ratios indicate better contrast), in particular in the posterior regions (ratio=0.84 in FSPGR and 0.6 in "Silent") and most superior slices (ratio=0.82 in FSPGR and 0.57 in "Silent"). SNR was approximately three times lower in Silent than in FSPGR. Radiological inspection of the output of automated segmentation software assessed that segmentation obtained from "Silent" was more accurate.
Conclusion: Optimized ZTE "Silent" sequence for T1w imaging is feasible at 7.0T and, despite its lower SNR, it improves the limited performance of FSPGR in terms of image inhomogeneity and tissue contrast.

Author Disclosures:
M.R. Symms: Employee; General Electric Healthcare. **D.A.C. Kelley:** Employee; General Electric Healthcare.

B-1084 11:26

Globe flattening: conventional two-dimensional vs three-dimensional T2-weighted imaging

J. Ann, E. Kim; *Incheon/KR (neuroradkim@gmail.com)*

Purpose: The sensitivity of posterior globe flattening is not as high as its specificity, which may be attributable to partial-volume effect on thicker imaging. We aimed to compare the frequency of posterior globe flattening between two-dimensional T2-weighted imaging (2D T2WI) and three-dimensional (3D) T2WI.
Methods and Materials: We enrolled 69 patients who had undergone both 5-mm axial T2WI and sagittal 1-mm isovoxel 3D T2WI of the whole brain for evaluation of increase intracranial pressure (IICP). Two radiologists independently reviewed both imaging sets at a separate session. Axial T2WI and multi-planar imaging using 3D T2WI were visually assessed for the presence of globe flattening. The optic nerve sheath diameter (ONSD) was measured at a location 4 mm posterior to each globe on oblique coronal imaging reformatted from 3D T2WI.
Results: There were significantly more globes showing posterior flattening on 3D T2WI (105/138 [76.1%]) than on 2D T2WI (27/138 [19.6%], $P=0.001$). Interobserver agreement was excellent for both 2D T2WI and 3D T2WI ($k=0.928$ and 0.962, respectively). Intraclass correlation coefficient for the ONSD was almost perfect (0.839). The ONSD with posterior globe flattening was significantly larger than that without flattening on both 2D and 3D T2WI ($P < 0.001$; 6.14 mm [mean]±0.44 [standard deviation] vs 5.74 mm±0.44 on 2D T2WI; 5.90 mm±0.47 vs 5.56 mm±0.34 on 3D T2WI).

Conclusion: Posterior globe flattening is significantly more frequently observed on 3D T2WI than on 2D T2WI in patients suspected of having IICP. The ONSD is significantly larger in the globes with posterior flattening than in those without.

B-1085 11:34

Decreased auditory GABA+ concentrations in presbycusis demonstrated by edited magnetic resonance spectroscopy

F. Gao[1], B. Zhao[1], G. Wang[1], F. Ren[1], R.A.E. Edden[2]; [1]*Jinan/CN*, [2]*Baltimore, MD/US (feigao6262@gmail.com)*

Purpose: Gamma-aminobutyric acid (GABA) is the main inhibitory neurotransmitter in the central auditory system. Altered GABAergic neurotransmission has been found in the auditory cortex in animal models of presbycusis. In this study, J-difference edited MRS was used to investigate GABA concentrations in the auditory region of patients with presbycusis and healthy controls and their relationship to audiological outcomes.
Methods and Materials: Sixteen patients with presbycusis (5 males/11 females, mean age 63.1 ± 2.6 years) and twenty healthy controls (6 males/14 females, mean age 62.5 ± 2.3 years) underwent audiological and MRS examinations. Pure tone audiometry from 0.125 to 8 KHz and tympanometry were used to assess the hearing abilities of all subjects. The pure tone average (PTA; the average of hearing thresholds at 0.5, 1, 2, and 4 kHz) was calculated. The MEGA-PRESS sequence was used to measure GABA+ concentrations in 4 x 3 x 3 cm3 volumes centered on the left and right Heschl's gyri.
Results: GABA+ concentrations were significantly lower in the presbycusis group compared to the control group (left auditory regions: $p = 0.002$, right auditory regions: $p = 0.008$). Significant negative correlations were observed between PTA and GABA+ concentrations in the presbycusis group ($r = -0.57$, $p = 0.02$), while a similar trend was found in the control group ($r = -0.40$, $p = 0.08$).
Conclusion: These results are consistent with a hypothesis of dysfunctional GABAergic neurotransmission in the central auditory system in presbycusis, and suggest a potential treatment target for presbycusis.

B-1086 11:42

Diffusion tensor imaging of cervical spine in subjects presenting successful aging: preliminary report

J. Ciescinski, E. Zawada, B. Augustynska, K. Porzych, Z. Serafin; *Bydgoszcz/PL (ciescinski@mp.pl)*

Purpose: Successful aging is defined as freedom chronic disease and disability, along with physical and social cognitive functioning and social engagement. However, successful aging does not exclude some subclinical morphological and functional changes that can be found with imaging. Diffusion tensor imaging (DTI) of the spinal cord has a potential to detect subtle alterations of the white matter integrity in elderly. The aim of this study was to evaluate conventional cervical spine MRI morphology and DTI parameters in subjects presenting successful aging.
Methods and Materials: Twenty subjects aged 60-81 years (mean age 68.5 years), who fulfilled criteria of successful aging, underwent cervical spinal cord MRI examinations. All subjects were free of any neurological symptoms that could be related to cervical spine pathologies. Conventional morphological images were assessed along with DTI cross sections at the level of the most significant disc prolapse and the healthiest segment. Apparent diffusion coefficient (ADC), fractional anisotropy (FA), expotential attenuation (EA), and anisotropy index (AI) were measured.
Results: All of the studied subjects presented spinal degenerative changes and only two of them did not have any posterior prolapse of the intervertebral disc. Comparison of intervertebral segments with and without disc prolapse shoved significant differences in FA (0.50 and 0.54, respectively, $P < 0.02$) and EA (0.32 and 0.35, respectively, $P < 0.02$).
Conclusion: Patients presenting successful aging without neurological manifestation of spinal degenerative disease tend to demonstrate significant subclinical morphological and functional changes that can be assessed with MRI.

B-1087 11:50

Multiple sclerosis deep grey matter: the relation between demyelination, neurodegeneration, inflammation and iron

L. Haider[1], C. Simeonidou[2], G. Steinberger[1], S. Hametner[1], N. Grigoriadis[2], H. Lassmann[1], J. Frischer[1]; [1]*Vienna/AT*, [2]*Thessaloniki/GR (lukas.haider@meduniwien.ac.at)*

Purpose: In multiple sclerosis (MS), MRI revealed degenerative processes in the deep grey matter (DGM). These findings have been associated with clinical disabilities but their origins remained unclear.
Methods and Materials: We performed a histological study in MS with a focus on the incidence and topographical distribution of DGM lesions in relation to white matter and cortex in a sample of 75 MS autopsy patients and 12 controls. In addition, analyses of inflammation, acute axonal injury, iron deposition and oxidative stress were performed.
Results: MS DGM was affected by two different processes: formation of focal demyelinating lesions and diffuse neurodegeneration. DGM demyelination was most prominent in the caudate nucleus and hypothalamus and could already be seen in early MS stages. Lesions developed on the background of inflammation. DGM inflammation was intermediate between low-inflammatory cortical lesions and active white matter lesions. Demyelination and neurodegeneration were associated with oxidative injury. Iron was stored primarily within oligodendrocytes and myelin fibres and released upon demyelination. In addition to focal demyelinated plaques, the MS deep grey matter also showed diffuse neurodegeneration. This was reflected by a global reduction of neuronal density, presence of acutely injured axons, and accumulation of oxidised phospholipids and DNA in neurons, oligodendrocytes and axons. Neurodegeneration was associated with T-cell infiltration, expression of inducible nitric oxide synthase in microglia and profound accumulation of iron.
Conclusion: Thus, both focal lesions as well as diffuse neurodegeneration in the DGM appeared to contribute to the neurological disabilities of MS patients.

Author Disclosures:
H. Lassmann: Consultant; Baxter Innovations. Speaker; TEVA, Novartis.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 1816

Response assessment: new concepts

Moderators:
B. Banko; Belgrade/RS
A. Sohaib; London/UK

K-27 10:30

Keynote lecture

H. Hricak; *New York, NY/US*

B-1088 10:39

Predicting non-response to NAC in patients with breast cancer using 3D texture analysis

N. Michoux[1], L. Bollondi[2], A. Depeursinge[3], A. Geissbühler[2], L. Fellah[1], H. Müller[3], I. Leconte[1]; [1]*Brussels/BE*, [2]*Geneva/CH*, [3]*Sierre/CH (nicolas.michoux@uclouvain.be)*

Purpose: Neoadjuvant chemotherapy (NAC) has a major role in the treatment of breast cancer. However, the rate of response to NAC is limited and dependent on the subtype of cancer. Identifying non-responders is important, as it may allow considering alternative therapeutic options. This study evaluates the performance of a predictive model of non-response to NAC based on 3D texture analysis of baseline dynamic MRI.
Methods and Materials: Seventy patients with invasive ductal carcinoma who underwent baseline breast MRI were studied. Patients were imaged at 1.5 T with a 3D axial T1W-GRE fat-suppressed sequence followed by a dynamic study. Histopathology, immunohistochemistry and BI-RADS classification were performed. Pathological complete response (CR: absence of invasive and in situ cancer in breast and nodes), partial response (PR: decrease of invasive cancer exceeding 30%), and non-response (NR: decrease of invasive cancer lower than 30%) were determined. Lesions were segmented by two experienced radiologists. Intra-lesional textons were estimated from the gray level co-occurrence matrix (COM), run length matrix (RLM) and Riesz transform (RT). Two predictive models (logistic regression, support vector machine) were tested. Performance was assessed from ROC analysis and leave-one-out cross-validation.
Results: At histology, patients were classified as CR=27/PR=24/NR=19. The best predictive model was based on logistic regression, 5 textons (1RLM+4RT), and predicted non-response to NAC with Se=89%/Sp=71%. 3D analysis including Riesz transform improved the classification accuracy compared to 2D analysis based on COM and RLM only.
Conclusion: Pre-NAC 3D textons measured from dynamic MRI coupled with a decision-aided tool help predicting the non-benefit to NAC.

B-1089 10:47

Tumour heterogeneity quantified by texture analysis on contrast-enhanced CT predicts prognosis in patients affected by colorectal cancer liver metastases treated with bevacizumab-containing chemotherapy

M. Ravanelli, D. Ngo Ikeng, A. Rossi, A. Berruti, R. Maroldi; *Brescia/IT (marcoravanelli@hotmail.it)*

Purpose: To assess the role of texture analysis (TA) on contrast-enhanced CT (CECT) studies as predictive and prognostic biomarker in patients with colorectal cancer liver metastases (CRC-LM) treated with bevacizumab-containing therapy.
Methods and Materials: 43 patients with unresectable CRC-LM were enrolled; 23 of them received bevacizumab-containing chemotherapy (group A), 20 received standard chemotherapy (group B). TA was performed on portal-phase CECT using a filtration-histogram method producing the parameter Uniformity (U), ranging from 0 to 1. Objective response (OR) was classified on post-treatment CECT according to RECIST 1.1. Overall survival (OS) and progression-free survival (PFS) were used as prognostic indicators. Multivariate logistic regression and survival analysis were used to assess predictive and prognostic value of texture and clinical parameters.
Results: There was no significant difference in OR rate, PFS and OS between group A and B. In group A, but not in group B, U was lower in responders compared to non-responders ($p < 0.0001$). At multivariate analysis, in group A, U was the unique variable independently correlated with OR, value < 0.42 leading to 20-fold higher response probability (p0.01) than value ≥0.42. No variable correlated with OR in group B. At survival analysis, in group A, U was independently correlated with OS and PFS, with hazard-ratio of 6.9 (p=0.005) and 5.2 (p=0.003), respectively. In group B, none of the independent variables showed a prognostic value.
Conclusion: Tumour heterogeneity quantified by TA on CECT predicted response and prognosis in patients with CRC-LM treated with bevacizumab-containing therapy. This result was specific for bevacizumab group.

B-1090 10:55

Tumoural response assessment after chemoembolisation of hypervascular liver lesions

M.-A. Jegonday, A. Fohlen, V. Le Pennec, K. Bouhier-Leporrier, I. Ollivier-Hourmand, J.-J. Parienti, J.-P. Pelage; *Caen/FR*

Purpose: To evaluate tumour response after transarterial chemoembolization (TACE) for hypervascular liver lesions (HLL) by comparing morphologic criteria, and to evaluate the added value of volumetric analysis of target nodules.
Methods and Materials: Thirty consecutive patients who underwent TACE for hepatocellular carcinoma (HCC) or endocrine liver metastases (ELM) were included in this retrospective study. Patients were divided in 2 groups according to their underlying condition. Tumour response was assessed using WHO, RECIST, EASL and mRECIST criteria. The mean percentage of each component (densities) was evaluated before and after TACE and compared to the response status defined using WHO and RECIST.
Results: A total of 87% of ELM and HCC patients had a non progressive disease (NPD) using WHO and RECIST criteria. Between 60% and 80% of ELM patients and 94% and 93% of HCC patients had an objective response according to mRECIST and EASL criteria, respectively. An excellent concordance was found between EASL and mRECIST criteria (kappa = 1.00). There was a highly significant decrease in amount of viable tissue ($p < 0.0001$) and increase in amount of calcification/Lipiodol ($p < 0.0001$) within target lesions after TACE. There was a trend towards reduced viable tissue and higher percentage of calcification, Lipiodol and necrosis in NPD patients compared to those with disease progression, using RECIST critera.
Conclusion: TACE is effective to treat HCC and ELM. In the assessment of HLL after TACE, EASL and mRECIST are highly correlated and we suggest a potential role for precise analysis of the different densities within target liver lesions.

Author Disclosures:
A. Fohlen: Consultant; Cook. **V. Le Pennec:** Consultant; Cook. **I. Ollivier-Hourmand:** Grant Recipient; Bayer, Gilead, Roche, MSD. Research/Grant Support; Novartis Pharma, Bayer. Speaker; Gilead, Roche, MSD. **J.-P. Pelage:** Consultant; Merit Medical, Keocyt, Cook, Terumo. Research/Grant Support; Merit Medical, Keocyt, Cook, Terumo.

B-1091 11:03

Prognostic value of dynamic contrast-enhanced CT with perfusion imaging in assessing the response to anti-angiogenic therapy in patients with advanced hepatocellular carcinoma: preliminary results

G. Querques, D. Ippolito, P.A. Bonaffini, C. Talei Franzesi, A. Nasatti, S. Sironi; *Monza/IT (giulia.querques@hotmail.it)*

Purpose: To investigate the feasibility of quantitative perfusion-CT (CTp) values, as surrogate biomarkers of angiogenesis, in predicting the response to anti-angiogenic therapy (Sorafenib) in patients with advanced hepatocellular carcinoma (HCC).
Methods and Materials: A total of 60 CTp study were performed in 23 cirrhotic patients with biopsy proven HCC, before Sorafenib administration and after 3 months; dynamic scan was performed on a 256-slice scanner after bolus injection of contrast agent. Dedicated perfusion software, which generated a quantitative map of liver vascularization, was employed. Hepatic perfusion (HP), blood volume (BV), arterial perfusion (AP), hepatic perfusion index (HPI), and time-to-peak (TTP) were compared between patients with partial response (PR), stable (SD) and progressive disease (PD), according to mRECIST.
Results: At baseline, in PR (n=11) median perfusion values were higher (HP 51.8; BV 14.1; AP 51.2) compared to SD (n=5;HP 40.2;BV 12.8;AP 33.7) and PD (n=3;HP 50.5;BV 13.3;AP 48.8); TTP was lower (16.1 vs 17.2 and 18.4, respectively). At 3-months, CTp showed a significant decrease ($p < 0.04$) of all perfusion values, except for TTP, in PR (HP 15.9;BV 6.0;AP 17.6;HPI 25;TTP 21.8) compared to SD (HP 36.8;BV 18.5;AP 33.7;HPI 100.0;TTP 17.3;$p < 0.02$) or PD (HP 73.5;BV 14.9;AP 62.5;HPI 100.0;TTP 13.8).
Conclusion: Higher perfusion values in HCC might be considered an important prognostic indicator of response to treatment, conversely to lesions with lower perfusion, characterized by progressive disease. Therefore, the non-invasive assessment of tumour vascularization with CTp might represent a complementary tool in stratifying patients according to prognosis and in predicting response to anti-angiogenic therapy.

B-1092 11:11

Prediction of tumouru response to neoadjuvant concurrent chemoradiotherapy for borderline resectable pancreatic cancer by diffusion-weighted MRI and 18 F-FDG PET/CT

I. Joo, J. Lee, J. Han, B. Choi; *Seoul/KR*

Purpose: To evaluate the value of diffusion-weighted MRI (DWI) and 18 F-FDG PET/CT in the prediction of tumour response to neoadjuvant concurrent chemoradiotherapy (CCRT) in patients with borderline resectable pancreas cancer.
Methods and Materials: This ongoing prospective study was approved by our institutional review board. Fifteen patients with borderline resectable pancreatic cancer who were planned to undergo neoadjuvant CCRT were enrolled in this study. All patients underwent pre- and post-CCRT MR imaging with DWI (b values, 0 to 800 sec/mm^2) and 18 F-FDG PET/CT, and subsequent surgery was performed in 14 patients. Mean apparent diffusion coefficient (ADC) and maximum standardized uptake values (SUVmax) in PET/CT of pancreatic cancers were compared between before and after CCRT. Pre-CCRT and interval percentage change in ADC and SUVmax were compared between responders and non-responders according to Response Evaluation Criteria in Solid Tumours; and between patients achieving R0 resection and R1/R2 resection.
Results: After neoadjuvant CCRT, ADC of pancreatic cancers significantly increased and SUVmax significantly decreased (P <.05). In responders (n=6), pre-CCRT ADC was significantly lower and SUVmax was significantly higher compared with non-responders (n=9) (ADC, medians of 1.20 x 10^{-3} and 1.39 x 10^{-3} mm^2/s; SUVmax, medians of 11.3 and 4.8, respectively) (all P.05).
Conclusion: In patients with borderline resectable pancreatic cancer, pretreatment ADC and SUVmax may be helpful for prediction of tumour response to neoadjuvant CCRT.

B-1093 11:19

DCE-MRI-derived parameters as predictors of response to neo-adjuvant chemoradiation treatment of rectal carcinoma

S. Phongkitkarun, U. Tohmad, N. Larbcharoensub, K. Sumbunnanondha, T. Sawangsilpa, E. Sirachainan; *Bangkok/TH (sith.pho@mahidol.ac.th)*

Purpose: To evaluate the use of DCE-MRI parameters to predict the treatment response of patients with rectal cancer.
Methods and Materials: Nineteen patients who had histologically proven rectal adenocarcinoma, T3 or T4 stage, who were candidates for neo-adjuvant chemoradiation (CRT), were prospectively included. All patients were examined by conventional and DCE-MRI at three points including pre-, during- and post-CRT. Definitive surgical resection was performed. The pathologic response rate and Dworak regression grade were applied for evaluation of the response. All data were blindly analyzed.

Results: The median of the pathologic response rate in all patients was 40%. Dworak regression grades of 0, 1, 2, 3 and 4 were found in 0.0%, 21.1%, 42.1%, 26.3% and 10.5% of patients, respectively. The tumour thickness and length was 30% and 32.9% lower during CRT and 40.6% and 44.7% lower post-CRT, and had moderate and fair negative correlation with the pathologic response rate and Dworak regression rate. Among DCE-MRI parameters, only a change in the time to peak between pre- and during-CRT was correlated with the Dworak regression grade (P = 0.01). The percentage change in the time to peak in patients with poor regression (grades 0 and 1) was significantly greater than that in those with intermediate/complete regression (grade 2 to 4) [139.25% vs. 6.13%].
Conclusion: The changes in the tumour thickness and length of the rectal cancer and in the time to peak evaluated by DCE-MRI during CRT may be useful for predicting the treatment response.

B-1094 11:27

Automated and semi-automated diffusion-weighted MRI volumetry to assess response after neoadjuvant therapy in rectal cancer

M.M. van Heeswijk[1], D.M.J. Lambregts[1], S. Oei[1], N. Papanikolaou[2], S.-X. Rao[1], G.L. Beets[1], R.F.A. Vliegen[3], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Iraklion/GR*, [3]*Heerlen/NL (d.lambregts@mumc.nl)*

Purpose: DWI tumour volumetry using manual tumour delineation is promising to assess tumour response to chemoradiotherapy (CRT). Manual delineation is, however, very time consuming and thus unpractical in clinics. Aim was to assess the validity and reproducibility of automated and semi-automated DWI tumour volumetry compared to manual tumour volumetry.
Methods and Materials: Thirty-five patients (two centers) underwent pre- and post-CRT DWI at 1.5 T (highest b-value b1000-1100). Volumes were measured in three-fold: [1] manual delineation (2 observers), [2] automated using a "region growing" model, [3] semi-automated by manual adjustment of method 2 (2 observers). Volumes (+ time required to complete measurements) were compared between the 3 techniques and different observers.
Results: Mean volumes (+ measurement time) pre-CRT were: [1] 27.4 cm3 (220 sec) for manual delineation, [2] 23.0 cm3 (63 sec) for automated measurements and [3] 25.6 cm3 (96 sec) for semi-automated measurements. After CRT, numbers were [1] 3.5 cm3 (96 sec), 4.1 cm3 (67 sec) and [3] 4.7 cm3 (94 sec). Compared to manual delineation, intraclass correlation coefficient (ICC) for the automated method was 0.94 pre-CRT and 0.54 post-CRT. For the semi-automated method ICCs (compared to manual delineation) were 0.97 pre-CRT and 0.70 post-CRT. ICC between the two observers was 0.81 (pre-CRT) and 0.72 (post-CRT) for manual delineation, versus 0.97 (pre-CRT) and 0.50 (post-CRT) for semi-automated measurements.
Conclusion: Taken into account measurement time and reproducibility (compared to manual delineation and between observers), semi-automated tumour volumetry is a promising and time-efficient method for DWI tumour volumetry in rectal cancer.

B-1095 11:35

Early monitoring of tumour response to photothermal/photodynamic therapy delivered by nano-graphene oxide using diffusion-weighted and BOLD-contrast MRI

F. Zhang, J. Cao, G. Fu, G. Fu; *Xiamen/CN (sailfmri@hotmail.com)*

Purpose: Nanoparticles-based agents have been used widely for photothermal therapy (PTT), photodynamic therapy (PDT) and synergistic PTT /PDT. Since treatment efficacy is determined by several parameters, it is valuable if a technique can be used to monitor the tumour response to predict treatment efficacy at an early time; thereby, adjuvant treatment can be considerate early. In present study, we evaluate the capability of DW-MRI and BOLD-contrast MRI for early detection of tumour response to PTT, PDT or combinational treatments of PTT /PDT by photosensitizer chlorin e6 loaded nano-graphene oxide in an animal model.
Methods and Materials: 4T1 cells (2×106 cells/each mouse) were subcutaneously transplanted into the right hip of female BALB/C mice. When the tumours reached a size of 100 mm3, various formulations including PBS, free Ce6, and GO-PEG-Ce6 were injected intravenously into the mice. Subsequently, the tumours suffered from various photoirradiation treatments. Treatment efficacy is assessed by DW-MRI and BOLD-contrast MRI.
Results: Compared with free Ce6, photothermal therapy only using GO-PEG-Ce6 or photodynamic therapy only using GO-PEG-Ce6, the combination of photothermal and photodynamic therapy dramatically improved cancer killing efficacy. Apparent diffusion coefficients (ADC) showed significantly positive correlation with cancer killing efficacy. Tumour R2* values showed significantly negative correlation with cancer killing efficacy. These results were validated by immunohistochemistry and H&E staining.
Conclusion: DW-MRI and BOLD-contrast MRI have potential use for the early detection of tumour response to photothermal/photodynamic therapy delivered by nano-graphene oxide and for predicting treatment outcome.

B-1096 11:43

Tumour volume as a quantitative imaging biomarker on computed tomography: toward adaptive criteria

H. Beaumont[1], S. Egels[2], S. Zaim[1], A. Iannessi[3], O. Lucidarme[2]; [1]*Valbonne/FR*, [2]*Paris/FR*, [3]*Nice/FR (hubert.beaumont@mediantechnologies.com)*

Purpose: The Response Evaluation Criteria in Solid Tumours (RECIST) uses the Longest Axial Diameter while a growing community reports best benefits of using tumour volumetry (TV). Some aspects are incompletely documented by RECIST as considering equivalently the different sites of disease (SoD) and applying the same rule for different cancers. We report lessons learned in assessing the reliability of TV on computed tomography (CT) in different contexts.
Methods and Materials: We participated in two public challenges organized by the RSNA's Quantitative Imaging Biomarker Alliance to measure the reliability of pulmonary TV. These challenges involved 408 synthetic nodules and 31 clinical test-retest patients. We evaluated inter-reader response agreement between 6 experienced readers who evaluated 10 patients with advanced lung disease with an average of 7 time points. We involved 3 experienced radiologists that reproduced measurements of 125 hepatic lesions to test the association between reliability of TV and lesion phenotype, contexts and disease.
Results: We confirmed a standard deviation (SD) of 15% when measuring advanced pulmonary disease. We also found that a non-negligible proportion of lung tumour measurements have significant higher variability due to their phenotype or location. TV of hepatic metastasis featured a SD in the range of 25% that was significantly higher for hepatocellular carcinoma (p=0.014). Part of the hepatic dataset was too complex to be measured.
Conclusion: Not all lesions can be reliably quantified and TV in different SoD would have specific features. A TV-based criteria would gain value in addressing specifically the different SoD and clinical contexts.

Author Disclosures:
H. Beaumont: Employee; MEDIAN Technologies. **S. ZAim:** Employee; MEDIAN Technologies.

B-1097 11:51

Does DWI improve therapy response evaluation by Gd-EOB-DTPA MRI in patients with HCC after radioembolisation?

J. Schelhorn[1], J. Best[1], M.P. Reinboldt[1], G. Gerken[1], M. Ruhlmann[1], T.C. Lauenstein[1], G. Antoch[2], S. Kinner[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE (juliane.schelhorn@uk-essen.de)*

Purpose: To investigate whether additional diffusion-weighted imaging (DWI) improves therapy response evaluation by Gd-EOB MRI in HCC after radioembolization.
Methods and Materials: 50 patients with radioembolization for HCC underwent gadobutrol and Gd-EOB MRI with DWI prior to and, 30, 90, and 180 days after radioembolization. Gadobutrol MRIs were interpreted by two radiologists in consensus as routine clinical follow-up and served in combination with alpha-foetoprotein as reference standard. Two radiologists reviewed Gd-EOB alone (Gd-EOB), DWI alone (DWI), and the combination of both (Gd-EOB+DWI) in consensus using a 4-point-scale: 1=definitely no tumour progression (TP), 2=probably no TP, 3=probably TP, 4=definitely TP. ROC analysis was performed.
Results: 30 days after radioembolization three out of 38 patients showed TP which was missed by DWI in one case. Area under the curve (AUC)/sensitivity/specificity were 1.0 (p=0.004)/1.0/1.0 in Gd-EOB, 0.881 (p=0.030)/0.665/1.0 in DWI, and 1.0 (p=0.004)/1.0/1.0 in Gd-EOB+DWI. 90 days after radioembolization four out of 28 patients showed TP which was detected in all data sets. One case was rated as TP by DWI and Gd-EOB+DWI, but not by the reference standard or by Gd-EOB, but this TP was proven in follow-up. AUC/sensitivity/specificity were 0.979 (p=0.003)/1.0/0.917 in Gd-EOB, 0.958 (p=0.004)/1.0/0.875 in DWI, and 0.958 (p= 0.004)/1.0/0.917 in Gd-EOB+DWI. 180 days after radioembolization four out of 13 patients showed TP which was detected in all data sets. AUC/sensitivity/specificity were 1.0 (p=0.005)/1.0/0.889 in Gd-EOB and 1.0 (p=0.005)/1.0/1.0 in DWI and in Gd-EOB+DWI.
Conclusion: Additional DWI improves therapy response evaluation by Gd-EOB MRI in HCC after radioembolization.

10:30 - 12:00 **Room F2**

Physics in Radiology

SS 1813

Novel digital imaging techniques

Moderators:
M. Brink; Nijmegen/NL
N. Kalyvas; Athens/GR

B-1098 10:30

Dual spectrum single pass digital breast tomosynthesis imaging

I. Sechopoulos, S.S.J. Feng, L. Merchan, J.G. Nagy; *Atlanta, GA/US (isechop@emory.edu)*

Purpose: To determine the feasibility of using a spectral reconstruction algorithm to perform digital breast tomosynthesis (DBT) with substantially reduced dose or improved image quality with tube voltage switching.
Methods and Materials: A 5 cm thick breast phantom was imaged with a clinical DBT system with the auto-selected 31 kVp spectrum and with a higher energy spectrum (49 kVp + 0.254 mm Cu filter). A combined set of alternating projections was constructed from the standard projection and high energy sets, thus simulating a dual spectrum (DS) acquisition involving tube voltage switching. A previously developed spectral reconstruction algorithm that accounts for the spectral nature of the x-ray beam was used to reconstruct the DBT images. Image quality was assessed using the signal difference-to-noise ratio (SDNR) of targets of differing glandular fractions. Monte Carlo simulations were performed to determine the mean glandular dose (MGD) of each acquisition.
Results: The image quality of the DS reconstructions is slightly lower than that of the standard acquisition, with an average non-significant change in SDNR of -16.0 ± 9.25% ($p > 0.08$). However, the MGD of the standard acquisition is 1.12 mGy, while that of the simulated DS acquisition would be 0.580 mGy, a 48% reduction.
Conclusion: Our spectral reconstruction algorithm exhibits the potential to allow for dual spectrum imaging in DBT with minimal impact to image quality but with a drastic reduction in dose. Further investigation with detectors with a higher quantum efficiency at high energies and optimization of the spectra remains to be performed.

Author Disclosures:
I. Sechopoulos: Consultant; Fujifilm Medical Systems USA. Research/Grant Support; Hologic, Inc., Barco. **S.S.J. Feng:** Employee; Northrop Grumman.

B-1099 10:38

A new anthropomorphic, physical phantom for DBT performance evaluation

N. Oberhofer[1], L. Ikejimba[2], Y. Chen[3], J. Lo[2], E. Samei[2]; [1]*Bolzano/IT*, [2]*Durham, NC/US*, [3]*Beijing/CN (nadia.oberhofer@asbz.it)*

Purpose: Existing phantoms for performance evaluation of digital breast tomosynthesis (DBT) are either too simplistic, without anatomical background, or require human evaluation. A new anthropomorphic, physical tissue-equivalent phantom and new metrics for objective, observer independent evaluation are presented.
Methods and Materials: Starting from a real breast CT dataset, a voxelized breast model was developed and 3D-printed with 2 photopolymers mixed on the fly in different proportions into 4 density classes, to produce a ‚graded" phantom with 13% dynamic range (74% - 61% glandularity). Phantom acquisitions were carried out on commercial DBT-systems from all 5 vendors available on the market in automatic exposure control (AEC) mode and at fixed 1.5 mGy average glandular dose (AGD). Reconstructed planes were evalutated with newly defined contrast index (CI, signal difference between adipose vs. Fibroglandular tissue within a ROI) and heterogeity index (HI, variance of ROIs, accounting for both noise and intra/inter-plane anatomical artifacts).
Results: CI and HI showed large variabilty between different systems. CI decreased with increasing ROI size and converged to overall image contrast, showing dose dependence. Images perceived as ‚high contrast" had CI higher by a factor of 2 on all range. HI decreases with increasing ROI, too. HI exhibited also different behavier in low and high frequency range, suggesting more or less aggressive noise filtering.
Conclusion: In preliminary results both CI and HI were able to depict differences among diverse acquisition/reconstruction strategies of different vendors and demonstrated sensitivity to variations in acquistion conditions. CI and HI results confirmed visual perception.

Author Disclosures:
J. Lo: Grant Recipient; Siemens.

B-1100 10:46

A structured phantom for comparative detectability evaluation in 2D digital mammography and breast tomosynthesis

L. Cockmartin, N.W. Marshall, G. Zhang, E. Shaheen, H. Bosmans; *Leuven/BE (lesley.cockmartin@uzleuven.be)*

Purpose: To apply a new structured phantom for comparative detectability studies in digital mammography (DM) and breast tomosynthesis (DBT).
Methods and Materials: A breast-shaped acrylic container of thickness 48 mm was filled with water and acrylic spheres of different diameters. Spiculated and non-spiculated 3D printed masses covering diameters 1.6 mm to 8.2 mm together with microcalcifications of diameter 90µm to 250µm were added as targets. Images were acquired on a Siemens Inspiration Tomosynthesis system in DM and DBT modes under automatic exposure control (AEC) and at half and double AEC dose. For each condition, 10 images/scans were acquired, giving 60 in total. A four-alternative forced-choice study with five readers evaluated target detectability. Detection data were compared using the Wilcoxon test. A 75% probability of correct response was defined as threshold detectability.
Results: At AEC levels, microcalcification detection was equal between DM and DBT ($p=0.92$) while detection of masses was better in DBT ($p < 0.0001$ and $p=0.012$ for non-spiculated and spiculated masses respectively). DM required target sizes of 160µm, 5.8 mm and 4.1 mm to exceed threshold detectability for microcalcifications, non-spiculated and spiculated masses respectively, compared to 160µm, 2.5 mm and 2.5 mm for DBT (both at AEC dose). For DBT compared against DM at equal dose, microcalcification detection became worse ($p=0.044$)), non-spiculated mass detection remained better ($p=0.001$) while spiculated mass detection became equal ($p=0.098$).
Conclusion: The proposed phantom allows evaluation of detection thresholds for both DM and DBT and showed DBT to outperform DM at current system AEC settings.

Author Disclosures:
H. Bosmans: Founder; Co-founder Qaelum NV. Research/Grant Support; Research Grant Siemens AG.

B-1101 10:54

In vivo proof of principle: x-ray dark-field radiography for diagnosis of lung fibrosis

K. Hellbach[1], A. Yaroshenko[2], O. Eickelberg[3], F.G. Meinel[1], M. Bech[4], T. Conlon[3], M.F. Reiser[1], A. Yildirim[3], F. Pfeiffer[2]; [1]*Munich/DE*, [2]*Garching/DE*, [3]*Neuherberg/DE*, [4]*Lund/SE (katharina.hellbach@med.uni-muenchen.de)*

Purpose: The aim of this study was to evaluate whether it is possible to visualize pulmonary fibrosis in vivo using X-ray dark-field imaging and whether dark-field radiography has incremental diagnostic value in diagnosing fibrosis compared to conventional transmission images.
Methods and Materials: Female C57Bl/6N mice were used for the experiments. Pulmonary fibrosis was induced by orotracheal injection of bleomycin. Control mice received orotracheal injection of PBS. All mice were examined 14 days after application of bleomycin or PBS. A prototype grating-based small animal scanner was used for image acquisition. Images were processed using Fourier decomposition thus generating transmission as well as dark-field radiographs. Lungs were obtained for further histopathological analysis (e.g. tissue ratio).
Results: As confirmed by histopathological analysis and pulmonary function tests mice in the bleomycin group had developed fibrosis: Tissue ratio was significantly higher for fibrotic (51.8% ± 9.6) than for control lungs (37.7% ± 1.7; $p < 0.05$). Fibrotic areas within the lungs resulted in a strong decrease in dark-field signal intensity, which correlated significantly better with histology ($r = 0.9$) than changes in transmission signal intensity ($r = -0.52$). Moreover, alterations in signal intensity were easier to detect in dark-field than in transmission images.
Conclusion: With this study we were able to show for the first time that in-vivo visualization of pulmonary fibrosis is feasible using dark-field radiography. Furthermore, dark-field signal intensity correlates better with histology than transmission signal intensity. Additionally, changes in signal intensity can be detected more easily in dark-field than in transmission images.

B-1102 11:02

Improved imaging performance with Cs-halide needle phosphor based detectors over powder phosphor CR detectors: application in neonatal imaging

N. Marshall, M. Hofmans, M. Smet, H. Pauwels, H. Bosmans; *Leuven/BE (nicholas.marshall@uz.kuleuven.ac.be)*

Purpose: To characterize the technical imaging performance of a CsBr needle phosphor based computed radiography (CR) detector for neonatal imaging and to compare against two other x-ray detectors.

Methods and Materials: Three detectors from Agfa HealthCare were assessed: a CR needle crystal based phosphor (HD5.0/DX-M, using a CsBr phosphor), a CR powder phosphor (MD4.0/DX-M, BaFBr phosphor), and a needle crystal digital radiography (DR) detector (DX-D35C, CsI phosphor). Beam qualities used were IEC RQA3 (52 kV; 10 mm Al added; approx. 41.4 keV) and RQA5 (74 kV; 21 mm Al added; approx. 55.0 keV) and source-detector-distance was 200 cm. Modulation transfer function (MTF) was measured with the edge method; detective quantum efficiency (DQE) was established at detector air kerma values of 0.7µGy, 2.5µGy and 7.8 µGy.
Results: Sharpness was similar between the detectors: MTF at 2.5 mm-1 averaged for all detectors was 0.20±0.01 and 0.21±0.02 at RQA3 and RQA5, respectively. At RQA5, the DR detector had the highest DQE (at 2.5µGy, 0.5 mm-1) of 0.49, although the needle CR detector was close at 0.45, while 0.19 was found for the powder CR detector. At RQA3, a beam quality appropriate to neonatal imaging, DQE (at 2.5µGy, 0.5 mm-1) for the needle CR detector was 0.54 compared to 0.53, 0.24 for the DR and powder detectors, respectively. At RQA3 and 0.7µGy, the needle CR detector gave the highest DQE curve.
Conclusion: At the energies and low detector exposures used for neonatal imaging, the needle CR detector matches DR detector performance and easily surpasses powder CR image quality.

Author Disclosures:
H. Bosmans: Founder; Qaelum NV. Research/Grant Support; Siemens AG.

B-1103 11:10

RIS-integrated dose monitoring systems: dose quality ratio optimisation by iterative acquisition settings standardisation. First results for a large breast screening programme

A. Nitrosi, M. Bertolini, A. Corazza, R. Sghedoni, C. Campari, P. Pattacini, C. Mori, P. Notari, M. Iori; *Reggio Emilia/IT (nitrosi.andrea@asmn.re.it)*

Purpose: To show how a RIS-integrated dose monitoring systems can help reduce variability of acquisition settings adopted by radiographers/physicians, and, if iteratively applied, optimise dose-image quality ratio especially for large groups of examinations, like a breast screening program (BSP).
Methods and Materials: Reggio Emilia Diagnostic Imaging Department (REDID) adopted a RIS-PACS integrated dose monitoring system ("Gray Detector"). It records data from CT, mammography and angiographic examinations. For mammography, the average glandular dose (AGD), compression level, breast thickness and glandularity, as well as the selected automatic exposure control (AOP) mode (one among three with increasing dose levels labelled as "dose", "standard" and "contrast") are registered. The REDID BSP monitors about 55,000 examinations/year from eleven mammography units (GE Senographe Essential) equally configured. To date, "Gray Detector" collected data from more than 430,000 mammographic exposures. AGD dependency on the compression force and the selected AOP has been verified. The compression force (at least 100N) and the AOP selection ("dose" mode) were standardised among the radiographers. Results compare five months before and after this standardisation.
Results: After standardisation the AGD variability decreased from 60% to 28% and the median AGD decreased from 1.36 to 1.19 mGy, while the recall rate did not change significantly (from 3.9% to 4.0%). Detection rate as well false negative evaluation is ongoing.
Conclusion: The iterative application of these monitoring processes and integration with information systems like RIS for the qualification of image quality-dose ratio, may improve clinical quality performance in diagnostic imaging.

B-1104 11:18

Comparison of mDIXON and proton density liver fat fraction maps in patients suspected of NAFLD/NASH with ^{1}H-MRS as reference

J.H. Runge, A.J. Nederveen, J. Verheij, U.H. Beuers, J. Stoker; *Amsterdam/NL (j.h.runge@amc.uva.nl)*

Purpose: Liver fat fractions (FF) can be accurately measured with MR and used for the detection of hepatic steatosis. The recently introduced mDIXON-protocol delivers high-resolution isotropic water (W) and fat (F) images in a single breath hold. However, its reconstruction uses a single fat-peak model, potentially introducing bias in its derived FF. While the proton density fat fraction (PDFF) maps have lower spatial resolution, they apply a multipeak model and R2*-corrections. We compared mDIXON and PDFF FF-map values with 1H-MRS determined FF in NAFLD/NASH patients.
Methods and Materials: Data from 29 NAFLD/NASH patients enrolled in a review board approved study were used. All gave written informed consent. mDIXON images were obtained with FA=10,TR=5.4 ms, TE1/ΔTE=2.11/1.1 ms and 3 echoes, PDFF source images with FA=10, TR=200 ms, TE1/ΔTE=1.15/1.15 ms and 6 echoes. mDIXON images were converted to FF-maps by voxel-wise F/F+W division. PDFF-maps were generated using the Lipoquant plug-in for OsiriX. Multi-echo STEAM 1H-MRS was performed in liver segments V/VIII to obtain 1H-MRS FF. Bland-Altman and Spearman's correlation analysis was performed.
Results: Median (IQR) FF values were 9.9 (3.8—18.1), 14.5 (5.9—22.6) and 11.1 (2.3—19.6) for 1H-MRS, mDIXON and PDFF. mDIXON values were significantly higher ($P < 0.001$). Correlations between 1H-MRS and mDIXON and PDFF were near-perfect at 0.97 and 0.99. Mean paired differences between 1H-MRS and mDIXON and PDFF values were 3.7 (-1.5—8.8) and 0.38 (-4.6—5.3).
Conclusion: mDIXON and PDFF showed-near perfect correlation with 1H-MRS but mDIXON values were significantly higher than 1H-MRS. Bland-Altman analysis revealed excellent agreement of only PDFF with 1H-MRS values. PDFF is preferred over mDIXON for FF-mapping.

B-1106 11:26

In vivo study of microcirculation in a murine model of pseudomyxoma peritonei using the IVIM method for the assessment of antiangiogenic drugs

A. Dohan[1], C. Eveno[1], C. Pimpie[1], F. Duchat[2], P. Bonnin[1], M. Pocard[1], P. Soyer[1]; [1]*Paris/FR*, [2]*Dijon/FR (anthony.dohan@lrb.aphp.fr)*

Purpose: Pseudomyxoma peritonei (PMP) is a rare peritoneal malignancy, which is characterised by mucinous ascites confined to the peritoneal cavity. The aim of this study was to monitor an antiangiogenic treatment in a murine model with the intravoxel incoherent motion (IVIM)-derived parameters obtained by MRI at 1.5 T.
Methods and Materials: Twenty nude mice orthotopically xenografted with human PMP had MRI 8 weeks after the graft. All mice underwent diffusion-weighted images with 13 b-values to fit the IVIM-derived parameters, namely, the pure-diffusion coefficient, perfusion-related diffusionand perfusion fraction. Fitting was obtained using an automated MATLAB program.Ten mice were treated with daily administration of Sorafenib (60 mg/kg), and ten untreated mice were used as controls. MRI acquisitions were repeated one week and 4 weeks after the beginning of the treatment. After the last MRI examination mice were sacrificed and tumour angiogenesis was quantified with blood analysis of (VEGF, PlGF and TGF-β), and histological markers (CD31, VEcadherin, isolectin).
Results: The pure-diffusion coefficient and the perfusion fraction were not different between the 2 groups at the different times ($p < 0.05$). Perfusion-related diffusion coefficient decreased non significantly at the first week in the treated group ($p=0.5$) and became significantly lower at the 4th week ($p < 0.05$). It remained stable in the control group. Histological markers confirmed a greater vessel density in the tumour compared to treated group ($p < 0.05$). Serum levels of markers were lower in the treated group ($p < 0.01$).
Conclusion: IVIM parameters are useful to monitor the effect of an antiangiogenic drug in a murin model of PMP.

B-1107 11:34

Improved receiver coil arrays for real-time contrast-enhanced MRA of the peripheral vasculature

S. Riederer, P.T. Weavers; *Rochester, MN/US (riederer@mayo.edu)*

Purpose: Describe how modifications of receiver coil arrays can provide marked improvement in the spatiotemporal resolution necessary for real-time contrast-enhanced MRA (CE-MRA) of the peripheral vasculature.
Methods and Materials: Fluoroscopic tracking is a method providing real time imaging of the advancing contrast bolus in peripheral CE-MRA, enabling the operator to interactively advance the table based on the patient-specific bolus transit speed. Initial implementation had 2.5 sec frame times, and while fast, did not always provide adequate temporal resolution for accurate table advance. In this work we adapted the multiple receiver coil elements at all three
stations to provide either better retention of signal-to-noise ratio (SNR) (pelvis station) or lower frame times for equivalent spatial resolution (thighs, calves) to better match bolus transit. Design characteristics included narrower coil elements (pelvis), tapered coil elements to match body habitus (thighs), and a 16-element array for high acceleration (R = 12; calves). The new coil assemblies were evaluated in volunteer CE-MRA studies.
Results: The new coils provide improved performance as desired: (i) improved SNR at the given acceleration (pelvis); (ii) higher acceleration (R = 10 vs. 8) with very low frame time (2.1 sec), at 1.5 mm isotropic resolution (thighs); (iii) higher acceleration (R = 12 vs. 8) and low 4.0 sec frame time at 1.0 mm isotropic resolution for venous-free imaging of small vessels (calves).
Conclusion: High count coil arrays when configured effectively can allow high acceleration
factors in peripheral CE-MRA, permitting accurate real-time tracking of the advancing contrast bolus.

B-1108 11:42

Anatomical noise and impact on lung nodule conspicuity: comparing digital radiography, dual-energy x-ray, and digital angular tomosynthesis

S. Richard[1], S. Sajja[2], X. Wang[1], L. Vogelsang[1], N.S. Paul[2]; [1]*Rochester, NY/US*, [2]*Toronto, ON/CA (samuel.richard@carestream.com)*

Purpose: Anatomical noise (AN) is a leading cause of reduced object conspicuity in digital radiographic (DR) imaging. Dual-energy (DE) imaging reduces the influence of AN via tissue discrimination, while digital tomosynthesis (DT) reduces AN via depth discrimination. This study investigates the relative impact of these advanced imaging technologies on lung nodule conspicuity.
Methods and Materials: An anthropomorphic chest phantom with a spherical nodule (0.5 cm, 100 HU) was imaged with DR, DE, and DT with the same in-room system. DE images were acquired with fixed and differential filtration and DT images were acquired at three dose levels (DT30%, DT50%, DT100%). A standard chest DR provided a performance reference. AN was estimated via Fourier spectrum analysis and combined with the nodule's signal to generate the detectability index (d'), which was shown to correlate with conspicuity. d' was further normalized by entrance surface exposure (ESE).
Results: The d' values for DE were 1.2 and 1.3 for fixed and differential filtration, respectively, and 11.8, 14.6, and 18.1 for DT30%, DT50%, DT100%, respectively, where d'=1 for DR. The d'/sqrt (ESE) values for DE were 0.7 and 1.1 for fixed and differential filtration, respectively, and 7.9, 7.8, and 6.4 for DT30%, DT50%, DT100%, respectively, where d'/sqrt (ESE)=1 for DR.
Conclusion: The study provides a method for comparing performance across x-ray modalities. Results indicate that: differential filtration for DE provides significant dose efficiency; DT makes better use of x-rays compared to DR via depth discrimination; and DT becomes AN limited (not dose limited) above a certain dose level, (i.e., DT50%).

Author Disclosures:
S. Richard: Employee; Carestream Health. **S. Sajja:** Research/Grant Support; Carestream Health Grant. **X. Wang:** Employee; Carestream Health. **L. Vogelsang:** Employee; Carestream Health. **N. Paul:** Research/Grant Support; Carestream Health Grant, Toshiba Grant Grant.

10:30 - 12:00 **Room D1**

Chest

SS 1804

Obstructive pulmonary diseases and reduced lung function

Moderators:
G.R. Ferretti; Grenoble/FR
A.P. Parkar; Bergen/NO

B-1109 10:30

Predictive value of CT-quantified emphysema and airway wall thickness on all-cause mortality in current and former smokers with and without COPD

F.A.A. Mohamed Hoesein[1], E. Pompe[1], M. Schmidt[2], R. Vliegenthart[3], E.M. Van Rikxoort[4], H.J. De Koning[5], J.-W.J. Lammers[1], P.A. De Jong[1]; [1]*Utrecht/NL*, [2]*Bremen/DE*, [3]*Groningen/NL*, [4]*Nijmegen/NL*, [5]*Rotterdam/NL (fmohamedhoesein@gmail.com)*

Purpose: Chronic obstructive pulmonary disease (COPD) is one of the major healthcare problems worldwide. Finding factors associated with COPD mortality are therefore pivotal. Advances in chest computed tomography (CT) make it possible to automatically quantify the pathologic changes causing lower lung function, i.e. emphysema and airway wall thickening. The aim of the study is to examine if emphysema and airway wall thickening add to predicting mortality in smokers with and without COPD.
Methods and Materials: Participants of the NELSON lung cancer screening trial were included. Emphysema and airway wall thickening were quantified automatically and expressed as the 15th percentile (Perc15) and square root of wall area for a theoretical airway with 10 mm lumen perimeter (Pi10), respectively. All-cause mortality was verified by linking with national death registries. Cox-proportional hazard analyses with FEV1, emphysema and airway wall thickening as predictive factors in addition to age, packyears and smoking status (current or former smoker) was performed.
Results: In total 3,359 subjects were included. Mean (SD) follow-up was 63.2 (15.5) months and 185 subjects (5.2%) died during the follow-up period. FEV1 %predicted was significantly associated with all-cause mortality, hazard ratio (95% confidence interval) (HR (CI95%) 1.01 (1.05 - 1.015) per percent. Pi10 was also significantly associated with all-cause, HR (CI95%) 1.31 (1.07 - 1.60) per millimetre. Perc15 was not significantly associated with mortality, HR (CI95%) 0.99 (-0.98 - 1.01).
Conclusion: Airway wall thickness, but not emphysema significantly associated with all-cause mortality independent of FEV1 %predicted, age and smoking details.

B-1110 10:38

The pulmonary vascular alteration in COPD as determined by quantitative CT measurement: a two-year longitudinal study

N. Yu, C. Jin, Y. Li, J. Ma, Y. Guo; *Xi'an/CN (349863320@qq.com)*

Purpose: Pulmonary vascular alteration is a key contributor to pulmonary vascular resistance in COPD and can be observed in histological study. However, longitudinal studies with direct measures of the pulmonary vessels are lacking. Therefore, we investigated the change of pulmonary vessels in CT in a longitudinal cohort of COPD; we also explored if he change of pulmonary vessels were associated with the extent of emphysema.
Methods and Materials: We used a new quantitative CT measurement to assess of pulmonary vessels and its longitudinal change over 2 years in 121 patients with COPD enrolled. Pulmonary vessels were measured for total number of small pulmonary vessels in cross sectional area that ran at right angle to the airway in the every CT scan. The extent of emphysema was defined as percentage of low attenuation areas less than a threshold of -950 Hounsfield units (%LAA-950).
Results: Pulmonary vascular alteration at baseline was influenced by current smoking status and the extent of emphysema. The annual decline in vascular number was more rapid in current smokers (additional –3 per year, p=0.013) than in former smokers (additional –1 per year, p=0.083). The total number of small pulmonary vessels in the level of the fifth generation of bronchus of right upper lobe section had the significant negative correlations with %LAA-950 (r=-0.87, P < 0.001).
Conclusion: This study shows that decline in pulmonary vessels in COPD can be measured, that it is variable, and related to smoking status, and may reflects the presence and progression of emphysema.

B-1112 10:54

Correlation study of emphysema based on each lobe and small airway remodeling by using CT quantitative analysis in patients with chronic obstructive pulmonary disease

Y. Guan, Y. Xia, L. Fan, Y. Jiang, S. Liu; *Shanghai/CN (guan.yu8635@163.com)*

Purpose: To analyze emphysema index (EI) based on each lobe and small airway remodeling quantitatively by using a novel automated software tool (COPD prototype, Philips Healthcare) in patients with COPD.
Methods and Materials: Thin-section CT was acquired with 256-slice MDCT scanner during the inspiratory phase in 60 patients (63±6years, 50 men) diagnosed as COPD. All images were reconstructed with 1 mm slice and retrospectively analyzed using a software with fully-automated 3D airway extraction, lung lobe segmentation and emphysema analysis based on each lobe. Airway parameters including wall thickness (WT), luminal diameter (LD) and wall area percentage (WA%) were measured in the 4th, 5th and 6th order bronchus as follows, RB1, RB4, RB10, LB1 and LB10. EI were calculated at the threshold of -950 HU.
Results: There were significant positive correlations between WA% of 6th order bronchus and EI on right upper lobe and left lower lobe (r=0.66,P=0.02; r=053.0.01, respectively), while WA% of 4th and 5th order bronchus has no significant correlation with EI. LD of 6th bronchus has a negative correlation with EI on left lower lobe (r=-0.66,p=0.01), while LD of 4th and 5th order bronchus have positive correlations with EI on right upper lobe (r=0.61,p=0.02; r=0.57,p=0.03, respectively).
Conclusion: EI based on each lobe and small airway remodeling can be assessed by using CT quantitative methods. WA% of 6th order bronchus has a significant positive correlation with EI, which indicates the extent of distal bronchial wall thickening is more relevant with emphysema.

Author Disclosures:
Y. Jiang: Employee; Philips.

Sunday

B-1111 10:46

Quantitative regional analysis of functional lung imaging in chronic obstructive pulmonary disease (COPD)

T.N.H. Matin, X. Xu, T. Doel, V. Grau, N. Rahman, A. Nickol, F.V. Gleeson; *Oxford/UK (tahreema.matin2@ouh.nhs.uk)*

Purpose: To derive quantitative regional imaging lung function parameters using hyperpolarised xenon MRI (Xe-MRI) and computed tomography (QCT), and compare these to pulmonary function tests (PFTs) in subjects with chronic pulmonary obstructive disease (COPD).
Methods and Materials: Twenty-two patients with COPD (stage II - IV GOLD criteria classification) underwent Xe-MRI at 1.5 T, QCT, and PFTs. Whole lung and lobar percentage ventilated volumes were obtained using automated segmentation of Xe-MRI ventilation images using in-house software. Average whole lung apparent diffusion coefficients (ADCs) were calculated from Xe-MRI diffusion-weighted images (b=20.855sec/cm2). Whole lung and lobar QCT-derived metrics for emphysema and bronchial wall thickness were calculated from percentage of lung tissue with density of <-950 HU and Pi10 (the square root of wall area for an airway with lumen perimeter of 10 mm). Pearson's correlation coefficients were used to evaluate the relationship between imaging measures and PFTs.
Results: Xe-MRI whole lung average ADC showed significant correlation with: whole lung QCT percentage emphysema (r= 0.79, P=0.001), percentage predicted functional residual capacity (FRC) (r= 0.635, $P < 0.05$) and percentage predicted TLCO (r= -0.81, $P < 0.001$). Whole lung QCT percentage emphysema also showed significant correlation with percentage predicted TLCO (r= -0.80, $P < 0.001$). Xe-MRI lobar percentage ventilated volume showed significant correlation with lobar QCT percentage emphysema (r= -0.51, $P << 0.001$).
Conclusion: These data demonstrate excellent correlation between Xe-MRI, QCT and PFTs in COPD. New quantitative regional imaging parameters have been derived that may be of value when assessing patients with COPD for regional treatment and in trialling new therapies.

B-1113 11:02

Impact of HIV infection lenght on CT assessed emphysema and respiratory bronchiolitis prevalence and pattern

R. Scaglioni[1], G. Besutti[1], G. Ligabue[1], A. Santoro[1], S. Zona[1], J. Leipsic[2], G. Guaraldi[1], P. Torricelli[1]; [1]*Modena/IT*, [2]*Vancouver, BC/CA (riccardo.scaglioni@hotmail.it)*

Purpose: To evaluate the impact of HIV infection length on the prevalence and pattern of emphysema and respiratory bronchiolitis.
Methods and Materials: ECG-gated CT scans performed by 1420 HIV-infected patients (48.5±7.6 years, 28.7% females, 39.5% smokers) to evaluate coronary artery calcium score were reviewed to assess lung abnormalities. Emphysema was classified by assigning a visual semi-quantitative score (0 to 4) to each lobe (total score 0=absence; 1-4=mild to moderate; > 4=severe), and characterized as centrilobular, paraseptal, mixed and bullous. Bronchiolitis was semi-quantitatively graded from 0 to 3. Associations of prevalence, score and pattern of emphysema and bronchiolitis with HIV infection length were evaluated by using test for trend across HIV duration tertiles (0.5-14.3 yrs; 14.3-20.4 yrs; 20.4-27.5 yrs). Ordered and multinomial logistic regressions were performed to identify factors independently associated with parenchimal abnormalities.
Results: In univariate analysis, prevalence of emphysema (p=0.001), severe emphysema ($p < 0.001$), mixed emphysema (p=0.001), severe bullous disease (p=0.022), and bronchiolitis=3 ($p < 0.001$) were associated with longer HIV infection duration. After adjustment for age, sex and smoke, the third tertile of HIV length was significantly associated with severe emphysema (OR=1.46; p=0.008) and mixed emphysema (OR=1.84; p=0.001). The second and third tertiles were associated with bronchiolitis=3 (OR=1.43; p=0.026 and OR=1.46; p=0.017, respectively).
Conclusion: Prevalence and severity of emphysema and severity of respiratory bronchiolitis are associated with HIV infection length, even when corrected for age and smoke.

B-1114 11:10

Incidentally detected lymphangioleiomyomatosis like lesions in male patients on thoracic MDCT

S. Malekzadeh, M. Christodoulou, T. Christoforidis, V. Soubeyran, C. Constantin, M.-E. Kamel; *Sion/CH (soonazmalakzadeh@gmail.com)*

Purpose: To describe the radiological pattern along with the potential causes of incidentally detected lymphangioleiomyomatosis (LAM) like lesions in male patients on MDCT of the thorax.
Methods and Materials: Thirteen male patients (38 to 89 y, mean 66 ±15) were identified with pericentimetric pulmonary cysts at MDCT. The distribution, form, and location of these cysts were noted. The radiological and clinical features along with the predisposing factors of pulmonary cystic diseases were all studied. Furthermore, potential causes or clues of hormonal imbalance were documented in the entire study group.
Results: In 10/13 patients (77%), LAM-like lesions were located bilaterally. They presented as thin walled rounded structures diffusely distributed throughout the lung. Strikingly, all patients had overt liver steatosis coupled with bilateral gynecomastia on CT, suggesting that the etiology of these lesions is likely hormonal related as previously established for women where LAM strikes during their childbearing age. Of note is that the majority of our patients (9/13, 69%) were non-smokers rendering the diagnosis of histiocytosis X or emphysema unlikely, and the same held true for tuberous sclerosis and lung firosis associated cysts since no clinical or radiological evidences of these two entities were identified.
Conclusion: In male patients with concomitant presentation of liver steatosis, gynecomastia, and pericentimetric pulmonary cysts, the diagnosis of LAM-like lesions should be considered besides other pulmonary cyst forming pathologies. Future prospective studies are required to strengthen these preliminary observations.

B-1115 11:18

CT airway morphology related to obesity: evaluation pre- and post bariatric surgery with functional correlation

A.C. Carlton Jones[1], N. Soneji[1], J. Cousins[1], A. Ahmed[1], A. Edey[2], A. Wells[1], S. Copley[1]; [1]*London/UK*, [2]*Bristol/UK (lalanidias@doctors.org.uk)*

Purpose: To prospectively evaluate CT airway and lung appearances related to obesity in individuals pre and post bariatric surgery, with functional and symptomatic correlation.
Methods and Materials: Following ethics committee approval, 32 consecutive healthy volunteers referred for bariatric surgery (male to female ratio 13:19, age range 41-72 years, mean 52.8 years) were prospectively identified. All individuals were evaluated with limited thin section thoracic CT pre and 6 months post surgery. Concurrent lung function, BMI and symptomatic indices were also obtained. Two experienced observers scored the expiratory CTs evaluating the percentage of air trapping at each level, expiratory tracheal shape and cross sectional area.
Results: There were statistically significant improvements in overall percentage air trapping (p=0.0005), tracheal shape (p=0.001) and cross-sectional area ($p < 0.0001$) post bariatric surgery. On univariate analysis, there were statistically significant correlations between pre surgery % air trapping and lung function parameters, in particular with reduced FVC (r=-0.362, $p < 0.05$) and apnoea scores (r=-0.418, $p < 0.02$). On multivariate analysis, % air trapping was the strongest determinant of FVC (R2=0.194, $p < 0.05$).
Conclusion: Obesity has significant CT morphological effects on the trachea and small airways, which correlate with functional and symptomatic indices. Significant improvements are demonstrated in lung and airway appearances post bariatric surgery.

B-1116 11:26

Correlation of radiological findings and immunological parameters in patients with allergic bronchopulmonary aspergillosis (ABPA) based on high-attenuation mucus (HAM) impaction and mean CT density

S. Phuyal; *Kathmandu/NP (drsphuyal17@gmail.com)*

Purpose: To correlate the radiological findings and immunological parameters in patients with allergic bronchopulmonary aspergillosis (ABPA) based on high attenuation mucus (HAM) impaction and mean CT density. Also to evaluate the severity of ABPA in radiologically classified four groups.
Methods and Materials: All HRCT chest were assessed for - Presence or absence of central bronchiectasis and mucoid impaction with number of bronchial segments affected. Patients with mucoid impaction were classified as HAM and Non HAM and corresponding CT attenuation values were recorded and mean CT density calculated. Patients were classified radiologically as: ABPA-S (seropositive), ABPA-B (central bronchiectasis), ABPA-B-HAM, ABPA-B-Non HAM. The serological severity in various groups and correlation between various parameters (immunological severity, mean CT density value, number of bronchial segments affected) were analyzed.
Results: Out of 100 diagnosed cases of ABPA, this study shows significant difference between the studied groups (ABPA-S, ABPA-B, ABPA-B-HAM,ABPA-B-Non HAM) in terms of levels of total IgE ($P < 0.001$), and specific IgE ($P = 0.03$) and number of bronchial segments affected ($P < 0.001$) being significantly higher in patients with HAM (ABPA-B-HAM).We also found a statistical significant difference in Total IgE, AEC and number of bronchial segments affected between patients with and without HAM and number of bronchial segments affected between patients with and without mucoid impaction.
Conclusion: The HAM and mean CT density most consistently predicts immunological severity in ABPA. There was a statistical significance correlation between mean CT density with Total IgE, AEC and number of bronchial segment affected.

B-1117 11:34

Automated quantification of bronchiectasis, airway wall thickening and lumen tapering in chest CT

A. Perez-Rovira[1], W. Kuo[1], J. Petersen[2], H.A.W.M. Tiddens[1], M. de Bruijne[1]; [1]*Rotterdam/NL*, [2]*Copenhagen/DK (a.perezrovira@erasmusmc.nl)*

Purpose: To automatically quantify airway structural properties visualised on CT in children with cystic fibrosis (CF) and controls, including: bronchiectasis, airway wall thickening, and lumen tapering.
Methods and Materials: The 3D surface of the airway lumen, outer wall, and bronchial arteries were obtained using a fully automatic, in-house developed, segmentation method. Subsequently, for each detected airway branch, the Airway-Artery Ratio (AAR, ratio between airway outer wall and accompanying artery radius, a bronchiectasis measurement), Wall-Artery Ratio (WAR, ratio between airway wall thickness and accompanying artery radius), and inter-branch Lumen-Ratio (LR, ratio between a branch's lumen and its parent branch lumen radius, a tapering measurement) were computed. Because CF-related structural abnormalities only affect a portion of branches, the 75th percentile was used as summarising measurement for each subject.
Results: Spirometer-guided inspiratory chest CTs of 12 CF patients (median age 10.6 years, 5 females) and 12 age and gender matched controls - lungs evaluated as normal on CT - (median age 12.4 years, 5 females) were retrospectively selected in the Sophia Children's Hospital. 3650 airway branches were measured. We found good agreement with manually measured radii of lumen (Spearman correlation: 0.901), outer wall (0.860), and artery (0.867) on a subset of 1958 branches. CF population showed increased AAR (CF: 1.703, Controls: 1.310, $p < 0.011$), WAR (CF: 0.850, Controls: 0.632, $p < 0.003$), and LR (CF: 0.866, Controls: 0.771, $p < 0.002$). All results reported are the 75th percentile.
Conclusion: State-of-the-art image analysis algorithms are a sensitive method to detect and quantify CF-related structural changes of the airways.

B-1118 11:42

Feasibility study of low dose CT with a hybrid iterative reconstruction technique for evaluation of airway stents in patients with malignant tracheal stenosis

T. Li[1], Y. Zhang[1], J.B. Gao[1], Y. Jiang[2]; [1]*Zhenzhou of Henan province/CN*, [2]*Shanghai/CN (13676938925@163.com)*

Purpose: To investigate the image quality of low dose CT with a hybrid iterative reconstruction technique (iDose4, Philips Healthcare) for airway stents evaluation compared to routine dose CT in patients with malignant tracheal stenosis.
Methods and Materials: 60 patients (59±9.3 years, 37 male) with airway stent who are randomly assigned into two groups[routine-dose (RD) and low-dose (LD) group, 30 for each]underwent chest CT on a 256-slice CT (RD-group 120 kV,250 mAs; LD-group 120 kV,120 mAs). Images were reconstructed by filtered back projection (FBP) in RD-group and iDose4 in LD-group. CTDIvol of both groups was recorded. Image quality assessment was performed by two radiologists according to structure demarcation near stents, artifacts, noise, and diagnostic confidence using a five-point scale[1 (poor) to 5 (excellent)]. Image noise, SNR and CNR were measured.
Results: The CTDIvol of LD-group was reduced 52.3% compared with RD-group ($p > 0.05$), while iDose4 enabled a higher score in image quality of artifacts in LD-group compared with those in RD-group ($p=0.03$). Image noise was significantly lower, SNR and CNR were significantly higher of LD-group than RD-group (all, $p < 0.01$).
Conclusion: iDose4 improves image quality of low dose CT by comparison of routine dose images reconstructed by FBP, which indicates that iDose4 may help low dose CT to become a routine use for airway stents evaluation that will benefit patients with malignant tracheal stenosis for less radiation burden.

B-1119 11:50

Regional image-derived lung function and structure in chronic obstructive pulmonary disease (COPD) and non-small cell lung cancer (NSCLC)

T.N.H. Matin, X. Xu, D.R. McGowan, T. Doel, N. Rahman, V. Grau, A. Nickol, F.V. Gleeson; *Oxford/UK (tahreema.matin2@ouh.nhs.uk)*

Purpose: To correlate regional lung function and structure with nuclear medicine-perfusion (NM-Q) scanning and quantitative computed tomography (QCT) in subjects with chronic obstructive pulmonary disease (COPD) and non-small cell lung cancer (NSCLC).
Methods and Materials: Twenty-three adult patients with COPD (stage II - IV GOLD criteria classification) and any stage non-small cell lung cancer underwent NM-Q scans and QCT at a single time point. Perfusion SPECT-CT was performed on a GE Discovery 670 (GE, Milwalkee, USA). For the SPECT, patients were injected with 200 MBq Technetium labelled macro-aggregated albumin (99mTc-MAA) and images acquired with a 128 x 128 matrix. For CT, images were taken 60 seconds post-intravenous contrast with a 1.25 mm slice thickness. NM-Q scans were analysed to obtain lobar relative percentage perfusion using Hermes Hybrid 3D lung lobar quantification (Hermes Medical Solutions AB, Stockholm). Lobar QCT-derived metrics for emphysema and bronchial wall thickness were calculated from percentage of lung tissue with density of less than -950 HU and Pi10 (the square root of wall area for an airway with lumen perimeter of 10 mm). Pearson's correlation coefficients were used to evaluate the relationship between imaging measures.
Results: Lobar NM-Q relative percentage perfusion showed significant correlation with lobar QCT percentage emphysema ($r=0.38$, $p << 0.001$) and lobar Pi10 ($r=-0.25$, $p < 0.02$).
Conclusion: This study demonstrates successful regional analysis of NM-Q and QCT in patients with COPD and NSCLC. The close correlation between imaging parameters supports the role of NM-Q and QCT for comprehensive structural and functional evaluation of the lungs in these disease cohorts.

10:30 - 12:00 **Room D2**

Interventional Radiology

SS 1809

GI and abdominal interventions

Moderators:
A.D. Karaosmanoglu; Ankara/TR
A. Veltri; Turin/IT

B-1120 10:30

Fluoroscopic gastroduodenal stent placement vs surgical gastrojejunostomy: palliation for patients with gastric obstructions due to unresectable gastric cancer

H.-Y. Song, J.-H. Park, J. Kim, M.-H. Ryu, M.-W. Yoo, J. Lee; *Seoul/KR (hysong@amc.seoul.kr)*

Purpose: To retrospectively compare the clinical effectiveness between fluoroscopic self-expandable metallic stent (SEMS) placement and surgical gastrojejunostomy (GJ) in patients with gastric obstructions caused by unresectable gastric cancer.
Methods and Materials: A retrospective cohort study was performed in a single, tertiary-referral, university hospital in 676 consecutive patients with gastric obstructions, which were treated by either placement of SEMS (n = 301) or surgical GJ (n=375).
Results: A total of 224 patients were suitable for this retrospective cohort study; 124 patients for SEMS placement (stent group) and 100 patients for surgical GJ (surgery group). In the 74 matched pairs of patients, there was no significant difference between the two groups in any of covariate and following variables: technical and clinical success rates, complications, and patient survival. The dysphagia scores were significantly better in stent group than in surgery group (1.50 in stent group vs. 2.07 in surgery group, $P < 0.001$). Symptom free duration was significantly longer in surgery group than in stent group (105 days vs. 225 days; $P = 0.002$). Hospital stays were shorter in stent group than in surgery group (12.8 days vs. 20.6 days, $P < 0.001$).
Conclusion: We found no significant difference in patient survival, complication rates, and clinical and technical success rates between the two groups. Fluoroscopic stent placement can provide a faster symptom relief and a shorter hospitalization, while surgical GJ can provide longer symptom free duration and relative less recurrent obstruction symptom.

B-1121 10:38

Efficacy of gastric balloon dilatation and/or retrievable stent insertion for pyloric spasm after pylorus-preserving distal gastrectomy

J. Bae, S. Kim, C.-I. Shin, I. Joo, J. Yoon, J. Baek, J. Han, B. Choi; *Seoul/KR*

Purpose: Pylorus-preserving distal gastrectomy (PPDG) has been recognised as a function-preserving surgey in patients with early gastric cancer. However, pyloric spasms can occasionally occur after PPDG owing to vagus nerve injury. The purpose of this study is to investigate the feasibility and efficacy of balloon dilatation or retrievable stent insertion for pyloric spasms after PPDG.
Methods and Materials: From 2008 to 2014, 47 patients experiencing pyloric spasms after PPDG underwent balloon dilation or retrievable stent insertion to alleviate their obstructive symptoms. In all patients, balloon dilation was initially performed. Patients who showed good response to initial balloon dilatation were classified into balloon group and patients who showed poor response to balloon dilation underwent subsequent retrievable stent placement and were

classified into stent group. Characteristics between the two groups were compared.
Results: Balloon dilations were successfully performed in all patients except one with a transmural tear. Thirty-four of 47 patients (72%) showed good response to initial balloon dilation requiring no further treatment. Conversely, 13 patients (28%) showed poor response after initial balloon dilation requiring subsequent retrievable stent insertion. At univariate analysis, stent group showed a significantly higher mean score for epigastric discomfort than balloon group (9.8 vs 8.8). Overall clinical success for a mean follow-up of 27 months was achieved in all patients after a single balloon dilation (n=30), multiple balloon dilations (n=4), and retrievable stent placement (n=13).
Conclusion: Balloon dilation is a safe and effective treatment option for patients with pyloric spasms after PPDG. In patients refractory to initial balloon dilations, retrievable stent placement can be effective.

B-1122 10:46

Incidence and management of esophageal perforation after fluoroscopic balloon dilation in 820 adult patients with esophageal strictures
H.-Y. Song[1], W.-Z. Zhou[2], J.-H. Park[1], H.-Y. Jung[1], Y. Kim[1]; [1]*Seoul/KR*, [2]*Nanjing/CN (hysong@amc.seoul.kr)*

Purpose: To investigate the incidence, management, and outcomes of esophageal perforation following fluoroscopic balloon dilation (FBD) in 820 adult patients with esophageal strictures.
Methods and Materials: Between December 1990 and April 2014, a total of 820 adult patients, age 21 to 93 years, underwent 1,869 FBD sessions (mean, 2.3 sessions per patient; range, 1-29 sessions) for esophageal strictures. We retrospectively reviewed the prospectively collected medical records and images of these patients and collected the data of patients who developed esophageal perforation following FBD.
Results: Perforation occurred in a total of 12 patients (6 male and 6 female; mean age, 51 years; range, 28-69 years). The perforation rate was 1.5% per patient and 0.6% per dilation. In the first 8 patients, 4 patients who were treated by surgery had perforation sizes ≥ 2 cm and the other 4 who were treated by fasting, parenteral alimentation, and antibiotics had perforation sizes< 2 cm. The last 4 patients underwent temporary stent placement immediately following their diagnosis regardless of their perforation sizes, which were removed 6 to 8 weeks later. The median hospital stay was 11.5 days.
Conclusion: FBD of esophageal strictures is a safe procedure with a low perforation rate. A perforation size greater than 2 cm required aggressive treatment. Although further clinical trials are needed, temporary stent placement seems to be an alternative to surgery in the management of esophageal perforation following FBD.

B-1123 10:54

Management of benign biliary strictures by percutaneous interventional techniques
C.B. Kulkarni, S. Moorthy, S. Karumathil Pullara, N. Prabhu, R. Kannan, N.P.K; *Cochin/IN (chidoc@rediffmail.com)*

Purpose: To retrospectively analyze the percutaneous techniques of treatment and outcome in patients with benign biliary strictures.
Methods and Materials: Institutional review board approved this study. We identified 41 patients [Male: Female = 23:18; Mean age 50.7±16.3 years (range:3-77 years)] with benign biliary strictures and treated by percutaneous interventional techniques between 2000 and 2014. Clinical records and images were retrieved from electronic medical record and picture archiving and communication system.
Results: The causes were post-cholecystectomy anastomotic stricture (40%), recurrent pyogenic cholangitis (22.5%), postoperative strictures for malignancies (20%), post-choledochal cyst excision (10%), chronic pancreatitis (5%) and actinomycosis of pancreas (2.5%). The majority of patients (28, 68.3%) were treated with percutaneous balloon dilatation. Eight patients were treated with both balloon dilatation and stenting whereas remaining three were treated with only stenting. The average duration of treatment was 3.1 ±1.3 months [range 0.23-24months]. Technical success was achieved in 95.1%. The primary outcome measure of symptom free clinical status was achieved in 87.5% of patients. Recurrence of disease was seen in four patients (9.7%). The post treatment mean time of follow-up was 31.2 ± 34.8 months and was available in 95.1% patients. Kaplan-Meier test showed the mean disease free survival time was 119.7 months. One year and two year clinical success rate was 89% and 84.3% respectively.
Conclusion: Percutaneous treatment of benign biliary stricture is minimally invasive and effective option with good technical/ clinical outcome in patients with failed surgical anastomotic revisions and in patients whose anatomy makes endoscopic instrumentation technically difficult.

B-1124 11:02

Treatment of benign biliary strictures with bioabsorbable biliary stent: preliminary results of a multicentric study
G. Mauri[1], C. Michelozzi[1], F. Melchiorre[1], D. Poretti[1], V. Pedicini[2], G. Paone[1], M. Salvetti[1], E. Criado[3], J. Fages[3], M. De Gregorio[4], L. Monfardini[1], M. Gimenez[5]; [1]*Milan/IT*, [2]*Rozzano/IT*, [3]*Sabadell/ES*, [4]*Zaragoza/ES*, [5]*Buenos Aires/AR (vanni.mauri@gmail.com)*

Purpose: To report the preliminary results of a multicentric study on the treatment of benign biliary strictures with a novel bioabsorbable biliary stent.
Methods and Materials: 10 hospitals in Europe and Argentina with high experience in percutaneous treatment of biliary disease are participating in the study. Up to now, 59 patients, 35 (59.3%) males and 24 (40.7%) females, age 56.8 ± 18.9 years (mean ± standard deviation) were retrospectively evaluated. They were treated with the implantation of 67 bioabsorbable biliary stent (Ella-DV biliary stent, ELLA-CS, Czech Republic) for the treatment of a benign biliary stricture refractory to standard bilioplasty. Technical success (correct implantation of the stent as preoperatively planned), clinical effectiveness (resolution of the clinical problem), immediate or late complications, and rate of restenosis at follow-up were evaluated.
Results: The procedure was successfully performed in 58/59 patients (technical success 98.3%). In one case a malpositioning of the stent during the procedure occurred. Procedure was clinically effective in all cases. There were four (6.8%) immediate complications, including the case of malpositioning and three mild haemobilia, that resolved spontaneously. No late complications related to the stent positioning occurred. At a mean follow-up time of 23.2 ± 15.1 months (mean ± standard deviation); there were 11 (18.6%) cases of restenosis, with a mean time to restenosis of 16.2 ± 8.2 months (mean ± standard deviation).
Conclusion: Percutaneous bioabsorbable biliary stent placement is feasible in the large majority of cases, and represents a safe and effective novel treatment of benign biliary strictures.

Author Disclosures:
G. Mauri: Consultant; Esaote S.p.a.

B-1125 11:10

Balloon dilatation biopsy of the Biliary stricture through the PTBD tract: feasibility and diagnostic accuracy
H. Ryeom, J. Hong; *Daegu/KR (blushain@naver.com)*

Purpose: To evaluate the feasibility and diagnostic accuracy of the balloon dilatation biopsy for the biliary stricture through the percutaneous transhepatic biliary drainage (PTBD) tract.
Methods and Materials: Thirty five patients (23 male, 12 female; mean age of 71.2 years old) who underwent balloon dilatation biopsy for the biliary stricture through the PTBD tract were included in this study. Balloon dilatation of the biliary stricture was done with a 10-mm or 12-mm diametered balloon catheter. Fragments of the soft tissue adherent to the retrieved deflated balloon catheter and soft tissue component separated by gauze filtration of evacuated bile during the procedure were sampled for histopathologic examination. The results of balloon dilatation biopsy were compared with the final diagnosis which was made by clinical and imaging follow-up for mean 542 days (range, 85-3711 days) in 34 patients and surgery with histopathologic examination in one patient. Procedure related complications and diagnostic accuracy were assessed.
Results: Tissues adequate for histopathologic examination were obtained in 31 out of 35 patients (88.6%). In three patients, self-limiting hemobilia was noted during the procedure. No major complication was noted. The sensitivity, specificity, and diagnostic accuracy for diagnosis of malignant stricture were 70.0%, 90.5%, and 83.9%, respectively. The positive and negative predictive values for malignant stricture were 77.8% and 86.4%, respectively.
Conclusion: Balloon dilatation biopsy of the biliary stricture via PTBD tract is feasible and accurate diagnostic method. It can be a safe alternative to the endoscopic retrograde cholangiographic biopsy or forceps biopsy via PTBD tract.

B-1126 11:18

Endoluminal radiofrequency ablation of malignant biliary stenoses
T. Andrasina, J. Panek, J. Hlavsa, V. Bernard, V. Valek; *Brno/CZ (andrasinatomas@gmail.com)*

Purpose: To prove efficacy of endoluminal radiofrequency ablation before stenting of malignant biliary stenoses.
Methods and Materials: 54 patients with histologically proven malignant biliary stenoses have been enrolled in a prospective randomised study from 2010. 73 non-covered self-expandable metal stents were inserted. In group A (n=22) the endoluminal ablation with a bipolar radiofrequency catheter (EndoHPB;EMcision Ltd.,London,UK) was performed 0-48hours prior to the stent insertion, in group B (n=32) the stent was implanted without a prior

ablation. The primary endpoints of the study were to determine the rate of complications, duration of stent patency and survival of patients (Kaplan-Meyer analysis).
Results: No major complications related to the stent insertion and endoluminal ablation were recorded. 30 day mortality was 3.7%. The average primary stent patency was 5.6 and 5.2 months in group A and B, respectively, 3-months and 6-months stent failure was 9.1% and 13.6% in group A and 15% and 25% in group B. The median survival from the insertion of the stent was 5.9 (2.9-6.7) and 5.4 (3.7-8.6) months, the median survival from the initial drainage was 9.6 (5.6-12.2) and 8.5 (5.8-12.7) months in group A and B, respectively. The difference was not statistically significant.
Conclusion: In the prospective randomised clinical study the effect of an endoluminal ablation on patients survival was not proven. However, in the group of patients undergoing ablation there is a tendency of a lower rate of early stent failure. In addition, the intervention was not associated with higher rates of complications.

Author Disclosures:
T. Andrasina: Research/Grant Support; Research grant of the Ministry of Health (Czech Republic) NT14586. **J. Panek:** Research/Grant Support; Research grant of the Ministry of Health (Czech Republic) NT14586. **J. Hlavsa:** Research/Grant Support; Research grant of the Ministry of Health (Czech Republic) NT14586. **V. Bernard:** Research/Grant Support; Research grant of the Ministry of Health (Czech Republic) NT14586. **V. Valek:** Research/Grant Support; Research grant of the Ministry of Health (Czech Republic) NT14586.

B-1127 11:26

Long-term outcomes of intraductal photodynamic therapy in Klatskin tumour patients
O.N. Sergeeva, A. Kukushkin, V. Panov, B. Dolgishin; *Moscow/RU (7s_olga@mail.ru)*

Purpose: Demonstration of long-term intraductal photodynamic therapy (PDT) outcomes in Klatskin tumour patients.
Methods and Materials: Ninety-three PDT procedures (from one to ten per patient) have been performed in 30 biopsy confirmed Klatskin tumour patients (12 female, 18 male, age range 34-75 years) with previous percutaneous bile duct drainage in N. N. Blokhin Cancer Research Center since February 2008. All patients had Bismuth IV type tumours and were not surgical candidates. The second generation chlorin sensitizers, 0.6-2.0 mg/kg, were administrated intravenously two to four hours prior the procedure with consecutive intraductal laser irradiation (662 nm laser LAHTA-MILON) at low fluence rate pulse mode regimens (12-50 mW/cm2, up to 1000 J per liver). The follow-up included clinical examination, lab tests and abdomen MRI every three months.
Results: There was no post-procedural mortality. The only patient developed post-procedural liver abscess required percutaneous biliary drainage. The intraductal PDT resulted in bile duct recanalization, cholangitis abatement and improvement of liver function tests. Several MRI findings (post-PDT peritumoural inflammatory infiltration, lymph node reaction, etc). assumed possible immune system activation. The median survival, one and two-year survival rates were 13.2 months (min-max 2-47 months) 65.7%, 23.5% and 27.6 months (min-max 5-68 months), 81.8%, 54.5% from the first PDT procedure and from the diagnosis, respectively.
Conclusion: The intraductal PDT is a safe and an effective strategy in non-surgical Klatskin tumour patient management, increasing both survival rate and quality of life.

B-1128 11:34

Percutaneous endoluminal RFA in biliary, Wirsung duct and PV inoperable malignant block recanalisation
M. Mizandari, N. Habib, A. Mtvaradze, T. Azrumelashvili; *Tbilisi/GE (mgmizandari@gmail.com)*

Purpose: Novel technique presented.
Methods and Materials: 119 patients underwent 137 procedures; biliary block - 96 (cholangiocarcinoma 34, pancreatic cancer 21, liver metastatic invasion 19, gallbladder cancer 8, hepatocellular carcinoma 6, papilla of Vater tumour 5, tumour blocked metal stent 2, retroperitoneal fibrosis 1), Wirsung block - 5 (pancreatic cancer), PV thrombosis - 18 (HCC 16, cirrhosis 1, retroperitoneal sarcoma 1). Block was processed by bipolar endoluminal RF device (Habib™ EndoHPB, EMcision Ltd., London, UK), placed in duct or PV-blocked area using guidewire technique, followed by balloon ducto- or angioplasty (10 biliary and 4 PVT patients) or metal stent placement (all the rest). Drainage catheter was repositioned in biliary and Wirsung duct cases in to maintain access to the processed block.
Results: RFA completed in 130 (94.9%) procedures; in 7 (5.1 %) cases, failure was due to wire conduction problem. In 2 (1.4%) cases, contrast extravasation was detected after stent placement. Biliary and Wirsung patency has been restored in 117 (98.3%) of 119 procedures, showing significant positive clinical impact. Biliary stent mean patency increased by 2 weeks, survival by 3 weeks. In 6 (46.1%) of 13 PVT patients procedure technical success was followed by significant clinical improvement; In 2 (1.4%) PVT cases, postprocedure bleeding has been detected; one patient (0.7%), curable and the other patient (0.7%) died of polyorganic failure.
Conclusion: Endoluminal RFA of unresectable biliary and Wirsung duct block is safe and effective; PV thrombosis patients respond to this therapy also.

Author Disclosures:
N. Habib: Shareholder; EMCisison LTD.

B-1130 11:42

In vitro effectiveness of vasodilators used in intra-arterial infusion therapy of non-occlusive mesenteric ischemia
C. Mahlke, J.-P. Kühn, B. Mensel, A. Glitsch, A. Schreiber, N. Hosten, O. Grisk; *Greiswald/DE (mahlkec@uni-greifswald.de)*

Purpose: Non-occlusive mesenteric ischemia (NOMI) has a high mortality. Current therapy includes intra-arterial infusion of vasodilators to counteract mesenteric artery spasm. Treatment standards are missing and the effectiveness of vasodilators in human mesenteric arteries is not well defined. Therefore, the potency of three clinically used substances to dilate pre-constricted human mesenteric arteries was compared in the present study.
Methods and Materials: Tissue samples were obtained from 10 patients who underwent elective abdominal surgery and gave informed consent (6 men, 4 women, aged 26 to 81 years). Cumulative concentration response curves were obtained for the synthetic prostacyclin analogue iloprost, prostaglandin E1 and papaverine in isolated mesenteric artery rings pre-constricted with 1 µmol/l endothelin-1 (ET-1) by small vessel myography.
Results: All three vasodilators induced a concentration-dependent decrease in vascular tone. Maximum vasodilatation was between 22 and 28% of ET-1-induced wall tension and did not differ significantly between substances. However, logEC50 for iloprost (-7.54 ± 0.07 mol/l) was significantly less than for prostaglandin E1 (-6.50 ± 0.10 mol/l) and papaverine (-6.44 ± 014 mol/l), respectively ($p < 0.001$).
Conclusion: All three substances tested dilate pre-constricted human mesenteric arteries with similar potency and may be suitable for intra-arterial administration in NOMI patients. The higher sensitivity of mesenteric arteries to iloprost suggests that lower tissue concentrations may be required under clinical conditions which may be an advantage of iloprost application in NOMI treatment compared to prostaglandin E1 and papaverine.

10:30 - 12:00 **Room G**

Genitourinary

SS 1807
GU special topics

Moderators:
A. Tsili; Ioannina/GR
A. Wibmer; Vienna/AT

B-1131 10:30

Scrotal ultrasonography in adult patients with cystic fibrosis
M. Buscaglia, L.E. Derchi, R. Casciaro, F. Cresta, L. Minicucci; *Genoa/IT (michelebuscaglia@libero.it)*

Purpose: Cystic fibrosis (CF) is a genetic disorder mainly affecting the pulmonary and digestive systems. Males with CF are usually (97%) infertile because of bilateral absence/atrophy of the vas deferens, and pathological changes are shown at scrotal ultrasonography (US) in CF children. Although the disease can be fatal in childhood, survival has greatly improved in recent years and many patients now reach adulthood. We describe herein the scrotal US findings observed in adult CF patients.
Methods and Materials: Scrotal US was performed in 21 CF patients (age range 24-57) looking for volumetric and structural changes of testes and epididymi. The vas deferens was specifically searched for at inguinal regions.
Results: Testicular length ranged from 32 to 61 mm (mean 41 mm); one patient, with history of chriptorchidysm, had asymmetry (right 42 mm; left 29 mm). Echostructure was normal in 30/42 testes (71.4%); 10 had heterogeneous or striated appearance; 2 had focal irregularities, without solid nodules. There was dilatation of rete testis in 13 (30.9%); intratesticular cysts in 6 (14.3%); calcifications in 3 (7.1%). There were cysts in 12/42 (28.5%) epididymal heads; 3 contained echogenic fluid. Segments of the vas deferent were seen bilaterally in 4 cases: 3 at inguinal region and 1 posteriorly to the epididymal tail.
Conclusion: Obstructive azospermia is the cause of infertility in men with CF, and sperms may be obtained either by aspiration or microsurgery from the epididymal head or the testis. Knowledge of pathologic changes affecting scrotal structures may help to plan the best approach to sperm retrival.

B-1132 10:38

Can we investigate the patient with more than 70% dose reduction CT urography without affecting the diagnostic value?

M. Al-Amin, I. Diakov; *Sofia/BG (dr_alamin@abv.bg)*

Purpose: The AIM of this study is share the results of the use of three different protocols - a standard one (120 kV) and two low-dose protocols (100 kV and 80 kV) for CT Urography.
Methods and Materials: 94 patients underwent urography on a 64-row MDCT system. CTDIvol was recorded and effective dose was calculated using CT Expo 2.1.software. Phantom measurements were performed to compare data with patient dosimetry and image quality. Quality of images was assessed by two radiologists based on CNR, SNR and FOM.
Results: Phantom measurements in automatic exposure control resulted in reduction of CTDI vol by 35% when changing from 120 kV to 100 kV and by 62 % when using 80 kV protocol. Effective dose was lowered by more than 65% when using 100 kV and more than 77 % using 80 kV protocol. At the same time patient images obtained with the new low-kV protocols have maintained their diagnostic quality.
Conclusion: With the low-dose CT urography protocols, significant dose reduction can be achieved, while the overall quality of the produced images and their diagnostic value remain relatively unaffected.

B-1133 10:46

Efficacy of bosentan, an endothelin receptor antagonist, in preventing contrast-induced nephropathy

A. Nawaz, H. Elzeftawy, M. Salama, I. Mamoun, I. Junaid; *Jeddah/SA (j1502300@kfshrc.edu.sa)*

Purpose: Selective antagonism of endothelin receptor A (Eta) may be efficacious in the prevention of contrast-induced nephrophathy (CIN).The incidence and severity of CIN in patients receiving bosentan, a mixed ETa and ETb receptor antagonist, with a 10-fold greater affinity for the ETa receptor is retrospectively reviewed.
Methods and Materials: 101 episodes of intravenous contrast administration were evaluated for 52 inpatients who were receiving bosentan for treatment of pulmonary hypertension. Serum creatinine (SCr) levels pre- and post-contrast administration were analysed. CIN was defined as: an increase in SCr by more than 25% or 44 umol/L occurring within 48 hours following the intravascular administration of contrast media in the absence of alternative aetiology. The incidence and severity of CIN in this patient population was compared to a control group of 177 patients, matched for CIN risk using the MEHRAN scoring system.
Results: The incidence of CIN was lower in the bosentan group as compared to the control (2.9% vs. 10.7%, repectively, p=0.021). The mean change in serum creatinine 48 hours after contrast administration was greater in the control group (4± 22.49 umol/L) than in the treatment group [(-0.87 ± 10.1 umol/L), p=0.05]. The risk for CIN was similar for the two groups [mean MEHRAN score: control group (5.7 ± 3.69) vs. bosentan group (5.34 ± 3.18), p=0.407].
Conclusion: Antagonism of the ETa receptor by bosentan was beneficial in preventing CIN. Results should be further validated in a prospective study.

B-1134 10:54

Dynamic contrast-enhanced computed tomography: a new diagnostic tool to assess renal perfusion after ischemia-reperfusion injury in mice

M. Braunagel[1], A. Helck[1], M. Notohamiprodjo[2], N. Schupp[1], A. Wagner[1], M.F. Reiser[1], A. Habicht[1]; [1]*Munich/DE*, [2]*Tübingen/DE (margarita.braunagel@med.uni-muenchen.de)*

Purpose: To investigate the diagnostic value of dynamic contrast-enhanced computed tomography (DCE-CT) in quantitative renal perfusion after ischemia/reperfusion injury (I/R injury).
Methods and Materials: Balb/c wildtype mice were subjected to 45 min (AKI45) or 60 min (AKI60) of warm I/R injury by clamping the pedicle of the left kidney. DCE-CT (128-slice) with a scan time of 90 seconds was performed on day 0 (n=3) and on day 2, 7 and 18 in AKI45 (d2 n=6; d7 n=7; d18 n=8) and AKI60 (d2 n=7; d7 n=7; d18 n=6) with presurgical heparin administration (10 units). An automated contrast bolus injection (0.2 mL at a rate of 2.5 mL/min) of iomeprol 300 was given via a catheter insertion in the right retroorbital vein plexus. Mean values of blood flow within renal cortex were quantitatively assessed. Structural renal damage was evaluated using histologic analysis.
Results: On day 2, perfusion of the renal cortex after AKI was significantly reduced in AKI45 (287 ± 32.5) and AKI60 (249 ± 32), compared to perfusion of the contralateral kidneys (404 ± 29 and 460 ± 83 mL/100 mL/ min, respectively; $p < 0.05$) and persisted to day 18. Only on day 7, a significant difference between clamping of 45 and 60 min with lower perfusion values for AKI60 were observed ($p < 0.05$). Finally, cortex perfusion showed good correlation (r= -0.8) with histological damage.
Conclusion: DCE-CT is a noninvasive method to diagnose and quantitatively assess the severity of acute perfusion changes of renal cortex after unilateral AKI in mice.

Author Disclosures:
M.F. Reiser: Other; Editor-in-chief of European Radiology.

B-1135 11:02

Arterial spin labeling and T1-mapping for assessment of acute renal allograft rejection in mice

K. Hueper[1], B. Hensen[1], S. Rong[1], M. Gutberlet[1], M. Meier[1], M. Mengel[2], F. Wacker[1], D. Hartung[1], F. Gueler[1]; [1]*Hannover/DE*, [2]*Edmonton, AB/CA (hueper.katja@mh-hannover.de)*

Purpose: To evaluate perfusion changes and oedema formation in a mouse model of acute renal allograft rejection by arterial spin labelling (ASL) and T1-mapping.
Methods and Materials: Acute rejection was induced by allogenic kidney transplantation (ktx) of C57Bl/6-kidneys to Balb/c-mice (n=11). Animals after isogenic ktx (C57Bl/6-kindeys to C57Bl/6-mice), which developed ischaemia reperfusion injury but no rejection, served as controls (n=11). MRI was performed 1 and 6 days after ktx using a 7-T scanner. Flow alternating inversion recovery (FAIR) echo-planar ASL sequences were acquired, and parameter maps of renal perfusion and T1 time were calculated. Renal histology was analysed to confirm pathological changes.
Results: One animal after allogenic and two after isogenic ktx died due to surgical complications. Renal histology after allogenic ktx showed acute T cell-mediated rejection (BanffIIB/III) and was unremarkable after isogenic ktx. Compared to normal C57Bl/6-mice renal perfusion was lower and T1 times were higher in both transplantation groups. After allogenic ktx, renal perfusion significantly decreased from 282±41 ml/(min*100 ml) at d1 to 80±13 ml/(min*100 ml) at d6 after ktx ($p < 0.01$, normal perfusion in C57Bl6-mice 500 ml/(min*100 ml)). T1 values increased from 1524±35 ms at d1 to 1673±62 ms at d6 in the outer medullary stripe ($p < 0.01$, normal T1 1200 ms). In contrast, after isogenic ktx, renal perfusion remained stable until d6. At d6, renal perfusion was significantly lower after allogenic than after isogenic ktx (80±13 vs. 260±33 ml/(min*100 ml), $p < 0.001$).
Conclusion: Acute renal allograft rejection following allogenic ktx is associated with stronger renal perfusion impairment and oedema formation (T1-increase) than ischaemia reperfusion injury following isogenic ktx.

B-1136 11:10

Dual-phase triple-split-bolus protocol for pre-operative CT evaluation of laparoscopic donor kidney anatomy: a way for dose reduction

A. Posa, R. Iezzi, M. Nestola, A. Contegiacomo, F. Citterio, L. Bonomo; *Rome/IT (alessandro.posa@gmail.com)*

Purpose: To evaluate the diagnostic performance of a tri-bolus dual-phase acquisition protocol (Unenhanced and combined Arterial-Venous-Excretory-Phases) for the preoperative assessment of kidney anatomy (arterial, venous and excretory system) in renal living donors.
Methods and Materials: Twenty consecutive patients were enrolled in our single-center prospective randomized study: 10 patients (Group A) underwent standard quadri-phase CT examination (unenhanced, arterial, venous and delayed phase) during a single injection bolus of CM (100 mL), whereas the other 10 patients (Group B) underwent a dual-phase CT protocol (Unenhanced and combined Arterial-Venous-Excretory-Phases). Combined Arterial-Venous-Excretory-Phase (Renal Triple-Rule-Out) was performed with a triple split-bolus injection protocol (30+30+40 mL@4 mL/sec) and an optimized time delay, triggered to obtain both artery, veins and renal pelvis opacification at the same time. Axial and tridimentional imaging were quantitively and qualitatively compared by two blinded independent readers. The two protocol were also compared in terms of diagnostic performance, using the surgical assessment during esplantation as gold standard.
Results: All CT examinations were technically adequate. No complications occurred. Significantly higher vascular attenuation values (renal arteries and veins) were obtained in Group A. No significant differences between the two groups were noted in terms of image quality with either axial source images or tridimentional reconstructions. No significant differences were found in terms of noise and diagnostic performance. Overall dose reduction of 55% was obtained in Group B.
Conclusion: Renal Triple-Rule-Out CT acquisition protocol is feasible and effective in the evaluation of kidney anatomy in the preoperative planning in laparoscopic living donors, with a significant reduction in radiation dose.

B-1137 11:18

Virtual monochromatic spectral CT imaging with adaptive iterative reconstruction technique for urinary system:preliminary research

Y. Zhou, J.B. Gao; *Zhengzhou/CN (zhouyue779@163.com)*

Purpose: To explore the diagnostic value of virtual monochromatic spectral CT imaging with adaptive statistical iterative reconstruction (ASIR) technique for urinary system.
Methods and Materials: Retrospective analysis 25 cases with contrast-enhanced CT urography for urinary system. The original images underwent gemstone spectral imaging (GSI) CT imaging for renal cortex phase, renal parenchyma phase and delay phase. VMS-ASIR images were post-processed by 70 keV virtual monochromatic spectral image (VMS) with 50% of ASIR. The image noise and signal-to-noise Ratio (SNR) for each phase were calculated between VMS-FBP group and VMS-ASIR group. Image quality was subjectively assessed by two doctors separately.
Results: During renal cortex phase, renal parenchyma Phase and delay phase, the CT atteunation between two groups had no statistical difference (P> 0.05); the image noise of VMS-ASIR group is lower than that of VMS-FBP, SNR is higher than that of VMS-FBP group (P < 0.05); the image subjective scores of VMS-ASIR were higher than that of VMS-FBP group (P < 0.05).
Conclusion: VMS-ASIR images at 70 keV can reduce the image noise and more conducive improve the image quality of all kinds of urinary diseases for providing favorable clinical diagnosis.

B-1138 11:26

MR imaging in patients with stress urinary incontinence

A. Solopova, M. Barinova, N. Tupikina, S.K. Ternovoy; *Moscow/RU*

Purpose: The objective of this study was to improve the role of static and dynamic MRI in evaluating of functional and anatomic abnormalities in patients with stress urinary incontinence (SUI).
Methods and Materials: We performed MRI in 50 patients with SUI (mean age 55).All patients were examined by urologist and underwent static and dynamic MRI before surgical treatment. Static 2 mm T2-weighted turbo spin-echo images were used in evaluating of structural derangements. Functional dynamic balanced fast-field echo images were used in detecting functional abnormalities and recording measurements of the main supporting structures. Control group included 20 patients (mean age 51).
Results: There was a significantly higher pubourethral distortion (p< 0.05) and asymmetry of pubococcygeus muscles (p< 0.05) in patients with SUI. The vesicourethral angle and the retropubic space were larger in patients with SUI ($152.09^0 \pm 10.62^0$ and 7.8 mm) comparing with control group ($138.8^0 \pm 12.59^0$ and 4.9 mm), (p< 0.05). We didn't observe any differences in the level of bladder neck and base prolapse in two groups.
Conclusion: Combined analysis of static and dynamic MR images of patients with SUI provides a new approach to the study of the mechanisms of urinary incontinence based on anatomical and topographical characteristics of the female urethra, it can help us to understand the mechanisms of existing methods of surgical treatment. MRI is useful in identification of certain structural abnormalities in patients with SUI. Further studies are needed to investigate influence of these abnormalities on postoperative results and potential complications. The study was funded by the grant of the President of RF, MK-1921.2013.7.

B-1139 11:34

Estimates of glomerular filtration rate by cystatin C formula by Larson to assess renal function in outpatients undergoing injection of iodinated contrast for CT

J.I.F. Melo, R. Chojniak, A.G.V. Bitencourt, D.H.C. Silva, J.J. Oliveira, D.H. Silva; *São Paulo/BR (italo_me@outlook.com)*

Purpose: Aim of this study was to evaluate renal function aa of cancer patients, before and after injection of contrast media in the investigation of CIN, using the dosage of serum cystatin C and an estimated GFR by the formula of Larson.
Methods and Materials: 400 outpatients with cancer were evaluated, underwent computed tomography with injection of iodinated low-osmolar contrast, serum cystatin C determined by nephelometry and the calculation of the estimated GFR was made by Larson equation ((77.24 × cystatin C-1.2623)). The post where the contrast was evaluated within 72 hours.
Results: Only 269 patients were assessed by cystatin C were calculated and these same estimates of glomerular filtration rate by larson equation. Compared with pre-contrast values, cystatin C concentrations were significantly higher (p = 0.015) and estimated GFRs were significantly lower (Larsson, p = 0.021) after contrast administration. Briguori et al. evaluated the incidence of CIN (defined as ≥10% increase in cystatin C concentration) in 410 consecutive patients found 21.2% of the sample. We observed such an increase in 27.9% of our patients.
Conclusion: Assessment using serum cystatin C concentrations showed that renal function was normal among patients with cancer undergoing contrast-enhanced CT examination. GFR estimation cystatin C (Larsson equation) concentrations demonstrated no significant renal damage related to the use of low-osmolarity iodinated contrast medium, despite variations in methodology, indicating that the use of this contrast medium at the dosage employed in this study is safe in patients with câncer.

B-1140 11:42

MR-guided focal laser ablation for prostate cancer followed by radical prostatectomy: validation of MR predicted ablation volume

J.G.R. Bomers[1], E.B. Cornel[2], S.F.M. Jenniskens[1], C.A. Hulsbergen-van de Kaa[1], J.A. Witjes[1], J.P.M. Sedelaar[1], J.J. Fütterer[1]; [1]*Nijmegen/NL*, [2]*Hengelo/NL (jurgen.futterer@radboudumc.nl)*

Purpose: To validate MR-guided focal laser ablation (MRgFLA): Before radical prostatectomy (RP), patients with prostate cancer (PCa) were treated with transrectal MRgFLA. Damage estimation maps, MR images and histopathologic specimens were used to assess the size of the ablated region.
Methods and Materials: The study was approved by the Institutional Review Board. Six patients with histopathologically proven low/intermediate grade PCa were included. All MRgFLA procedures were performed under local anaesthesia. The ablation was continuously monitored with real-time MR temperature mapping. Based on the temperature maps, damage estimation maps of the ablation zone were computed by a special algorithm accompanying the laser system. A post-ablation T1-weighted contrast enhanced (T1wCE) sequence was acquired. The patients underwent RP after 3 weeks. The prostate specimens underwent hematoxylin-eosin- and immunostaining to verify tissue necrosis. Ablation volumes were contoured and measured on histopathologic specimens, T1wCE images and damage estimation maps.
Results: The median ablation volumes estimated by the algorithm and measured on T1wCE images were respectively 6.7x (range 1.6-29.2) and 0.9x (range 0.5-2.4) larger than the necrotic volume measured on the histopathology specimen. On histopathology, the homogeneous necrotic area was surrounded by a reactive transition zone of variable thickness (1-5 mm), showing neovascularisation and an increased mitotic index, indicating increased tumour activity.
Conclusion: The final necrotic volume was better indicated by T1wCE than by the damage estimation maps. Histopathology results point out that the total tumour must be ablated with a 5 mm safety margin around it.

B-1141 11:50

Evaluation of periprostatic nerve fibers using diffusion tensor imaging tractography at 3 T: correlation with radical prostatectomy specimens

C. Kim, B. Jeong, G. Kwon, J. Park, B. Park, S. Park; *Seoul/KR (psoyoon09@naver.com)*

Purpose: Anatomic variations of periprostatic nerve fibers exist. The aim of our study was to investigate the feasibility of diffusion tensor imaging (DTI) tractography at 3 T in assessing the distributions of periprostatic nerve fibers.
Methods and Materials: Twenty-seven patients with prostate cancer who received non-nerve-sparing radical prostatectomy underwent preoperative DTI tractography, and were enrolled in this study. DTI with diffusion gradients of 15 noncollinear directions was performed with a single-shot echo-planar imaging at 3 T. The prostate was divided into eight designated zones (anterior, anteriolateral, posterolateral and posterior of each right and left lobe) for base, midgland and apex. The distributions of periprostatic nerve fibers from surgical specimens were mapped by a genitourinary pathologist: 586 designated zones were mapped. The concordance of DTI tractography with pathologic results was evaluated by an experienced radiologist. The quality of DTI tractographic images was evaluated.
Results: The distributions of periprostatic nerve fibers on histopathologic findings were 59.2% in posterolateral/posterior and 40.8% in anterior/anterolateral zones. The overall concordance rate of DTI tractography was 90.1 % (528/586). Of non-concordance rate (9.9%, 58/586) of DTI tractography, false-positive cases were 65.5% (38/58) and false-negative cases were 34.5% (20/58), respectively. The distributions of non-concordance of DTI tractography were anterior 41.4% (24/58), posterior 25.9% (15/58) and anterolateral 17.2% (10/58), respectively. Imaging quality of DTI tractographic images was satisfactory or better in all patients.
Conclusion: DTI tractography at 3 T appears to be feasible and useful to predict the distributions of periprostatic nerve fibers in the prostate.

10:30 - 12:00 **Room K**

Radiographers

SS 1814

Professional challenges for radiographers

Moderators:
S. Geers Van Gemeren; Utrecht/NL
C. Roche; Galway/IE

B-1142 10:30

An eye-tracking study investigating radiographers' visual search patterns whilst reviewing x-ray examination request forms

E. Hendy, J. Grehan, T. Herlihy, L.A. Rainford; *Dublin/IE*
(eva.hendy@hotmail.com)

Purpose: The X-ray examination request form is essential in the prescription of ionising radiation. Studies have shown that the importance of the request form is often highly underestimated by referring clinicians who fail to provide all required information on the request. There is a lack of research regarding the radiographer's role in reviewing the request form. This study aimed to examine radiographers' practice of reviewing X-ray examination request forms to identify whether or not visual attention is focussed on all of the provided information.
Methods and Materials: An experimental data set of 16 request forms was created using a chosen radiology request form template acquired from a single clinical centre. Each form presented a variety of fictional patient scenarios. In preparation for eye-tracking specific areas of interest (AOI) were drawn around key information points on each request. The Tobii TX 300 eye-tracking device and associated Tobii Studio Software were utilised. Time to first fixation and total fixation duration metrics were analysed.
Results: 31 radiographers participated. The results demonstrated that the radiographers did not consistently focus their visual attention on all of the information provided by the referring clinician on the X-ray request form. Only 34% (n=172) of the precaution AOIs; 42% (n=209) of the allergy AOIs; 46% (n=227) of the previous X-ray AOIs and 57% of the priority AOIs were fixated on by the participants respectively.
Conclusion: Radiographers are not consistent when reviewing information provided on X-ray request forms further research is recommended to identify the reason for inconsistencies.

B-1143 10:38

Chest x-ray agreement: comparative analysis between consultant radiologists, reporting radiographers and expert chest radiologists

N.H. Woznitza[1], K. Piper[2], S. Burke[1], S. Ellis[1], G. Bothamley[1]; [1]*London/UK*, [2]*Kent/UK (nicholas.woznitza@nhs.net)*

Purpose: Research evidence related to chest x-ray (CXR) interpretation by appropriately trained radiographers is limited to diagnostic accuracy studies undertaken in a controlled environment. The aim of this study was to examine agreement between expert radiologists and reports provided by radiographers and radiologists in clinical practice.
Methods and Materials: Adult CXRs (n=193) from a single site were included; 83% randomly selected from CXRs performed over one year, and 17% selected from the discrepancy meeting. CXRs were independently interpreted by two expert chest radiologists (CC1/2).Clinical history, previous and follow-up imaging was available, but not the original clinical report. Expert and clinical reports were compared independently by two arbiters. Kappa (K) and McNemar tests were performed to determine inter-observer agreement. Ethical approval was obtained.
Results: CC1 interpreted 187 (97%) and CC2 186 (96%) CXRs, with 162 cases interpreted by both experts. Radiologists and reporting radiographers provided 96 and 97 of the original clinical reports respectively. Consensus between both experts and the radiographer clinical report was 71 (CC1;K=0.64) and 68 (CC2; K=0.61), and comparable to agreement between experts and the radiologist clinical report (CC1=72,K=0.68; CC2=68, K=0.64). Expert radiologists agreed in 124 cases (K=0.52). There was no difference in agreement between either expert radiologist, when the clinical report was provided by radiographers ($p > 0.4$; $p > 0.9$) or radiologists ($p > 0.9$; $p > 0.9$) or for the selected difficult cases from the discrepancy meeting ($p > 0.17$; $p > 0.9$).
Conclusion: No statistically significant difference was found in agreement between expert radiologists and radiographer or radiologist CXR reports in clinical practice at a single centre.

Author Disclosures:
N.H. Woznitza: Research/Grant Support; College of Radiographers Research Award.

B-1144 10:46

A self-test for screening radiographers in the Netherlands, in signalling apparent abnormalities

C. van Landsveld-Verhoeven, J.M.H. Timmers, P. van de Looi, G.J. den Heeten, M.J.M. Broeders; *Nijmegen/NL*
(c.vanlandsveld-verhoeven@lrcb.nl)

Purpose: To evaluate a self-test for Dutch breast screening radiographers, assessing their mammogram classification that was introduced to assist screening radiologists in recall decision.
Methods and Materials: Since 2012, all radiographers (n=554) in the Dutch breast cancer screening programme have been trained to assign a radiographer classification in line with the BI-RADS classification used by screening radiologists. 126 radiographers, Foundation of Population Screening Mid-West, were invited to anonymously complete a test set of 30 mammograms in 2013. Participants assigned findings such as radiographer classification, most suspicious lesion and lesion type. We determined case and lesion sensitivity, specificity, true and false-positive rate. Individual feedback on performance was provided to each participant directly after completing the self-test.
Results: 114 radiographers completed the self-test (90.5%). The correct radiographer classification was applied in 60%. Mean case sensitivity was 82%, mean location sensitivity 72%, specificity 77%, true and false-positive rates were 8.2% and 22.6%, respectively. Radiographers performed best in classifying calcifications (correct in 82%). In contrast, assignment of asymmetry (correct in 17%) could be improved.
Conclusion: One year after the introduction of the radiographer classification, we found an encouraging mean case sensitivity. However, additional training is required to increase correct radiographer classification and improve specificity. On balance, the radiographer self-test could become part of the quality assurance system and continuing medical education. Because of the individual feedback, radiographers are able to determine their educational needs. At group level, one can monitor and improve quality.

Author Disclosures:
G.J. den Heeten: Founder; Spin off company from the Academic Medical Centre Amsterdam, Sigmascreening.

B-1145 10:54

Comparative study of diagnostic accuracy between CT colonography and optical colonoscopy

N.F. Pinto, A.F.C.L. Abrantes, L.P. Ribeiro, S. Rodrigues, R.P.P. Almeida, K.B. Azevedo, B. Tomás, J.P. Pinheiro; *Faro/PT (npinto@ualg.pt)*

Purpose: Determine the diagnostic accuracy of CT colonography (CTC) and Optical Colonoscopy (OC) in the diagnosis of colorectal diseases and thus determine if CTC is a good technique for colorectal pathologic detection.
Methods and Materials: Medical reports of 33 patients that undergone both techniques with an interval of less than 6 months were compared on their acuity. The CTC were acquired in a16 slices equipment and the variables in this study were the presence of polyps (less than 6 mm, between 6 and 9 mm and above 10 mm), diverticula, adenomas and coloretal cancer. Sensitivity, Specificity, Positive Predictive and Negative Predictive Values were calculated.
Results: For polyps smaller than 6 mm, the CTC has a sensitivity and specificity of 100% and for the OC as a sensitivity of 0% and a specificity of 100%. To polyps between 6-9 mm CTC has a sensitivity of 60% and a specificity of 100 % and the OC has a sensitivity of 60% and a a specificity of 100%; to polyps bigger than 10 mm CTC has a sensitivity of 100% and a specificity of 100% and OC has a S of 0% and a E of 100%; to detection of colorectal cancer CTC has a specificity of 87.5% and a specificity of 100% and OC has a specificity of 93.8 and a specificity of 100%.
Conclusion: We conclude that both techniques have the same diagnostic acuity, with higher values in CTC for polyps and in OC for adenomas. Both techniques present high sensitivity in the evaluation of coloretal cancer.

B-1146 11:02

An investigation into the accuracy of computed radiography in detecting ferromagnetic intra-ocular foreign bodies

H. Momoniat, A.E. England; *Manchester/UK (A.England@salford.ac.uk)*

Purpose: The aim of this study was to determine the accuracy of orbital X-rays, when using computed radiography (CR), in detecting ferromagnetic IOFBs prior to MRI.
Methods and Materials: A total of 64 orbital X-rays of an anthropomorphic head phantom were acquired using CR. For each image 1, 2, 3, or 4, large, medium, or small IOFBs were fixed to the anterior surface of the left or right orbit. Each of the acquired images with an IOFB was duplicated in order to increase the sample size. A further 16 normal images (no IOFB) were also included in the sample. Observers were invited to independently review the images and classify each image as to whether there was an IOFB present.

Results: Eight observers (4 radiographers; 4 reporting radiographers) independently reviewed the images. The mean sensitivity for all observers was 74.4% SD 5.1% whereas the mean specificity was higher (99.5% SD 0.5%). Overall the mean accuracy for the eight observers was 93.7% SD 1.1%. Sensitivity was shown to be affected by both the size (large 91%, medium 80% and small 49% IOFBs) and location (quadrant; upper lateral 78%; upper medial 86%; lower lateral 60% and lower medial 81%) of the IOFB. Sensitivity was affected to a lesser extent by observer type (radiographers 71% versus reporting radiographers 78%).
Conclusion: Findings from this study using CR support previous conclusions that conventional X-rays fail to detect metallic IOFBs in 100% of cases.

B-1148 11:10

What is the minimum amount of simulated breast movement required for visual detection of blurring?
P.H. Hogg[1], W. Ma[1], R. Aspin[1], D. Brettle[2], S. Millington[3], J. Kelly[3];
[1]*Manchester/UK*, [2]*Leeds/UK*, [3]*Chester/UK (P.Hogg@salford.ac.uk)*

Purpose: Image blurring in mammography causes significant image degradation. A potential source is paddle movement during image formation. Paddle movement has been shown to be ~0.6 mm. No study has been performed to determine how much motion would be noticeable, visually. This study determines the minimum amount of simulated breast movement at which blurring can be detected visually.
Methods and Materials: 25 artefact free mammogram images were selected. Mathematical simulation software (using an evaluated pixel motion convolution mask) was created to mimic blurring produced by breast movement during exposure. Motion simulation was imposed to 15 levels - 0.1 mm to 1.5 mm stepping through 0.1 mm. For each of the 25 images, 15 degraded and 1 perfect image were de-identified, randomized and assessed on a blinded basis by two clinical experts to determine presence or absence of blurring. Statistical testing assessed consistency between the two observers.
Results: All the non-motion images were identified by the observers. A minimum movement of 0.3 mm is required for the blurring to be detected visually. For the images which had motion simulation, the average successful rate of blurring detection for 0.1 mm, 0.2 mm and 0.3 mm movement are 40%, 82% and 96% respectively. If the motion simulation is larger than 0.3 mm the successful rate is 100%. Cohen's Kappa for all the levels of simulated blurring is 0.689 ($p < 0.05$), representing substantial agreement for the two observers.
Conclusion: A simulated motion of 0.3 mm is required for the blurring to be detected visually.

B-1149 11:18

An investigation into preliminary clinical evaluation in an Irish x-ray departmental setting
R. Murphy, L.A. Rainford, T. Herlihy, J. Grehan, M. Lotter; *Dublin/IE*
(Ruth.murphy.2@ucdconnect.ie)

Purpose: Currently the most common method used by radiographers to identify potential abnormalities on radiographs is the 'Red Dot' system. Undeniably a useful tool the 'Red Dot' is not however without limitations. Guidelines from the College of Radiographers, London identified a need to further develop a system of radiographer engagement. This tool is known as Preliminary Clinical Evaluation (PCE). The aim of this research study was to perform a pilot PCE trial in a major clinical centre, where the inclusion of red dot practice was incorporated into the existing radiographer role, this function being optional.
Methods and Materials: Radiographers (n =9) working in the Emergency Department over an one month period were asked to provide a description of potential abnormalities they could identify after each radiographic examination they performed whilst working on-call, out of normal working hours. To investigate the accuracy of these comments, a scoring system was applied against the definitive radiologists report and all radiographic examinations reviewed (n= 128). A feedback session was held with each participating radiographer. The radiographer's feedback was critically reviewed alongside the results of the PCE findings and outcomes were reviewed.
Results: Participating radiographers achieved an overall accuracy of 70.67%, a sensitivity rate of 79.59 % and a specificity rate of 86.08% in their interpretations. General consensus identified a willingness to undertake the advanced role of PCE.
Conclusion: Considerable resistance existed in terms of making radiographer commenting a mandatory requirement of routine practice. The requirement for training was identified, which currently is not provided.

B-1150 11:26

Evaluation of the performance and efficiency of technology and radiographer: the Italian model
D. Di Feo[1], C. Dionisi[2], S. Barbera[3]; [1]*Florence/IT*, [2]*Treviso/IT*, [3]*Biella/IT*
(daniele.difeo@gmail.com)

Purpose: The epidemiological and social changes have caused a reduction in acute care for populations and an exponential growth in the number of chronic case. This has resulted in an exponential increase of radiological examinations with increased financial costs and waiting times.This paper compares the experiences of five Italian hospitals to create a model of organizational analysis to improve efficiency and reduce costs and waiting times.
Methods and Materials: The Italian National Federation of Colleges of Radiographer created a working group represented by 5 structures (public and private partnership with the Italian NHS) to analyze certified activity data and define organizational models. The project is divided into "four steps" with objectives measured by indicators of process properly formulated :1. Definition and analysis of the phases of the "standard" diagnostic process. 2. Formulations of weighting factors related to the complexity expressed by the diagnostic process. 3. Formulation of coefficients related to variables that can significantly change the productivity and diagnostic facilities efficiency. The aspects considered are: a. Type of patients, b. Type of technology, c. Logistical/structural Features, 4. Design of a organisational model.
Results: The result of the study has created organizational guidelines based on the comparison of different health facilities that can be used all over the country.
Conclusion: The project aims to create a tool for the operational management that contribute to increase efficiency of radiographer and technology through the use of specific standards for the establishment of "guidelines" based on organisational benchmarking of Italian territory.

B-1151 11:34

Adverse event reporting
S. Browne, L.A. Rainford, J. Grehan, T. Herlihy; *Dublin/IE*
(suzannebrowne@live.com)

Purpose: An adverse event is any event that caused harm to a patient.literature. To date, no study of adverse event reporting by radiographers in Irish hospitals is apparent. The aim of the current study was to investigate radiographers reporting of adverse events and to determine whether barriers are perceived to exist.
Methods and Materials: A self-completion questionnaire was piloted and distributed to radiographers (n=100) in five University Dublin teaching hospitals. A variety of closed, fixed choice and open questions were included.
Results: The response rate was 87% (n=87). Whilst the frequency of reporting adverse events was similar across all hospitals, the training provided to radiographers varied. Only 33% (n=29) of radiographers had received training on adverse event reporting, the majority of those without training stated it would be advantageous. 96% (n=25) of those who had received feedback found it beneficial. 35% (n=30) of respondents perceived barriers including time constraints, fear of blame, perceived lack of confidentiality and poor feedback. Male radiographers were more likely to let an adverse event go unreported (p=0.002), and perceive a lack of confidentiality and a fear of blame as obstacles to reporting adverse events.
Conclusion: The need for increased levels of training was identified. Staff reporting adverse events stated feedback was beneficial on any actions arising from the report. Further research investigating gender issues in adverse event reporting is recommended.

B-1152 11:42

Endovascular treatment of ruptered abdominal aortic aneurysm (rAAA)
J. Jensen, H. Mogensen; *Odense/DK (jette.skjellerup.jensen@rsyd.dk)*

Purpose: To describe and evaluate short-term outcome of the first Danish experience of endovascular treatment of rAAA.
Methods and Materials: Patients eligible for endovascular treatment of rAAA are hemodynamic stabile with a systolic pressure ≥80 mmHg. The length of the aneurysm neck to the renal arteries is minimum 15 mm and angulation of the aneurysm neck is max 75°. Eventually mural thrombosis or calcification should be 25-30% smaller than the diameter of aorta. The iliac arteries must have a lumen of minimum 6-7 mm and no to moderate angulation. The procedure is performed in local anesthesia due to the abdominal tone and the temporarily tamponade effect.

Results: From October 2012 to November 2014 50 patients have undergone treatment for rAAA using this method with a mortality rate of 8% (4 pt). versus 30-35% with traditionally open surgery in full anesthesia. A cost benefit analysis has shown that this treatment is more expensive than traditionally open surgery (approx. 2.700 EUR) primarily due to the higher price of the stent graft. In this analysis, only the cost of the actual treatment is considered. Apart from the lower mortality rate it seems to involve less pain and faster recovery for the patients undergoing endovascular treatment as opposed to open surgery.
Conclusion: Our short-term outcome has shown a better mortality rate using endovascular treatment of rAAA as opposed traditional open surgery. Despite the higher price, the benefits for the patient seem apparent at endovascular treatment of rAAA.

14:00 - 15:30 **Room A**

Breast

SS 1902a

Multiparametric MRI and PET

Moderators:
E.M. Fallenberg; Berlin/DE
V. Girardi; Brescia/IT

B-1153 14:00

Implementation of multiparametric MRI with high-resolution DCE and DWI MRI at 7T of breast tumours: a feasibility study
K. Pinker-Domenig, P.A.T. Baltzer, W. Bogner, D. Leithner, S. Trattnig, O. Zaric, P. Dubsky, Z. Bago-Horvath, T.H. Helbich; *Vienna/AT (katja.pinker-domenig@meduniwien.ac.at)*

Purpose: The current study was undertaken to ascertain whether multiparametric magnetic resonance (MR) imaging of the breast combining high-resolution dynamic contrast-enhanced (DCE) MR imaging and diffusion-weighted imaging (DWI) at 7T is feasible and improves diagnostic accuracy.
Methods and Materials: Forty patients with a suspicious breast lesion were included in this IRB-approved prospective study. All patients underwent bilateral multiparametric MR imaging of the breast at 7T. Lesions were classified according to the revised BI-RADS® atlas, and assessed for apparent diffusion coefficient (ADC) values by two readers independently. For the combined analysis of DCE MR imaging and DWI, we used the BI-RADS®-adapted reading algorithm, which adapted ADC thresholds to the assigned BI-RADS® assessment category to estimate the likelihood of malignancy. Sensitivity, specificity, and diagnostic accuracy of multiparametric DCE MR imaging and DWI were calculated and ROC analysis was performed. Image quality and inter-reader agreement was assessed. Histopathology was used as the standard of reference.
Results: There were 29 malignant and 17 benign breast lesions. Multiparametric MR imaging yielded a greater AUC with 0.941, than DCE MR imaging with 0.765, and DWI with 0.907. Multiparametric MR imaging of the breast at 7T eliminated all false-negatives, reduced false-positives from eight with DCE-MRI to two, thus obviating unnecessary breast biopsies in 75%. Multiparametric MR imaging demonstrated excellent image quality (ICC=0.9772) and inter-reader agreement (κ = 0.89-1.00).
Conclusion: The clinical use of multiparametric MR imaging at 7T is feasible, with excellent image quality, is robust to inter-reader variability, and improves diagnostic accuracy.

Author Disclosures:
K. Pinker-Domenig: Board Member; EUSOBI. Research/Grant Support; Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082. **P.A.T. Baltzer:** Research/Grant Support; Funding was provided by the Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082. **W. Bogner:** Research/Grant Support; Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082. **S. Trattnig:** Research/Grant Support; Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082. **T.H. Helbich:** Research/Grant Support; Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082.

B-1154 14:08

Quantitative assessment of primary breast cancer at 3.0 T MRI
R. Bedair, A.J. Patterson, M.A. McLean, R. Manavaki, S. Reid, M. Graves, F.J. Gilbert; *Cambridge/UK (rb648@cam.ac.uk)*

Purpose: Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) enables pharmacokinetic modelling of tumour vascularity that can provide functional information about the efflux of contrast into the extracellular extravascular space (Ktrans). We exploit the improved spatiotemporal resolution at 3.0 T to investigate the relationship between Ktrans and the histopathological profile within a cohort of breast cancer patients.
Methods and Materials: 57 patients with locally advanced breast cancer underwent MRI examination prior to surgery. 60 malignant lesions were identified. T10 maps were generated using 3D SPGR images and corrected for B1+ non-uniformity. DCE data were acquired using a 3D segmented k-space (VIBRANT-TRICKS) acquisition, with a temporal resolution of 9s and a voxel size of 1x1x1.4 mm. Data analysis was performed using DCETool in OsiriX. Mann-Whitney-U tests were performed to investigate differences between Ktrans, tumour type and grade.
Results: We examined 34 invasive ductal, 17 lobular, 4 mucinous, 2 papillary and 3 tubular carcinomas, of which 8 were grade 1, 38 were grade 2 and 14 grade 3. Hotspot Ktrans was higher in the ductal type. Distribution of hotspot Ktrans was consistent with the literature with mean values of 0.51 min-1, 2.24 min-1 and 2.44 min-1 for grades 1, 2 and 3 respectively. Borderline significance (p=0.056) was found between Ktrans of grades 1 and 3, however, differences between grades 1 and 2 tumours were not significant (p= 0.128).
Conclusion: Higher Ktrans is associated with the aggressiveness of tumours. This work demonstrates that high spatiotemporal DCE at 3.0 T can distinguish between histological subtypes and the angiogenic status of breast tumours.

B-1155 14:16

Application of total choline compound integral in diferentiating benign and malignant breast disease
R. Chen, W.-G. Zhang; *Chongqing/CN (chenr701@163.com)*

Purpose: To investigate the value of total choline compound (tCho) integral obtained by 1H-MRS in differentiating benign and malignant breast disease.
Methods and Materials: A total of 305 patients were subjected to plain scan, dynamic contrast-enhanced MRI and 1H-MRS in order. Statistical analysis was performed using t test and receiver operating characteristic (ROC) analysis. And a comparative analysis of MRI, 1H-MRS and pathologic diagnosis results was performed.
Results: Of the 305 patients, 119 lesions were benign, 186 lesions were malignant. The mean tCho integral was 13.77±11.28 in benign lesions and 42.30±32.90 in malignant lesions. The difference between the median tCho integral of malignant versus benign lesions was highly significant ($P < 0.001$). At ROC analysis, the optimal threshold was 29.95 for tCho integral, with 60.22% sensitivity and 92.44% specificity.
Conclusion: Differentiation between benign and malignant breast disease with tCho integral semiquantification was applicable. The combination of tCho integral, morphologic and kinetic analysis can improve the accuracy of diagnosing breast disease.

B-1156 14:24

Value of 1H spectroscopy 3 T MR imaging in breast lesions in addition to BIRADS MR findings and DWI: a preliminary report
R. Asadov, M.E. Aribal, A. Ramazan, M.U. Ugurlu, H. Kaya; *Istanbul/TR (dr.esedov@gmail.com)*

Purpose: The value of 1H spectroscopy MR was evaluated in addition to MR BIRADS findings and DWI.
Methods and Materials: Fortynine patient with 54 breast lesions were evaluated with 3 T MR. Morphologic findings according to the MR BIRADS, 1H spectroscopy and ADC measurements were evaluated blindly. This prospective study was statisticaly analyzed with Ki-Square and Fisher Exact test. For ADC and Spect measurements ROC curve analyses was used. The histopathologic diagnosis of lesions was accepted as the gold standard.
Results: MR morphological and dynamic findings as irregular shape, spiculated and illdefined margins, type 2 and 3 enhancement pattern were accepted as signs of malignancy. The AUC for spectroscopy and ADC was 0.850 and 0.740 respectively ($p < 0.001$). Cutoff values for ADC and Spectroscopy choline level were determined as 1.118 and 1.3 respectively. When any three of; shape, margin, enhancement pattern, ADC or Spectroscopy were taken in consideration for malignancy sensitivity, specificity, accuracy and NPV were 96.7%, 79.2%, 88.9%, and 95% respectively. When any one of BIRADS MR category, ADC or Spectroscopy values were evaluated; sensitivity and NPV were 100% both.
Conclusion: Spectroscopy and ADC measurements add value to the routine breast MRI evaluation that unnecessary breast biopsies can be avoided and malignant lesion detection sensitivity can be increased.

B-1157 14:32

The role of high-field MR spectroscopy in the multiparametric evaluation of breast lesions
C. Cavedon, I. Baglio, L. Camera, G. Meliadò, F. Caumo, S. Montemezzi; *Verona/IT (carlo.cavedon@ospedaleuniverona.it)*

Purpose: To study the role of high-field MR Spectroscopy (MRS) in improving the specificity of multiparametric MR evaluation of breast lesions.
Methods and Materials: 193 patients (201 lesions, range 0.05-115.45 cm3, mean 7.92 cm3) were enrolled in the study (age 18-84 yrs, mean 55.7 yrs). All

patients had breast abnormalities on mammography or sonography, confirmed by cytology and/or micro-biopsy. T1-TSE (TR/TE=400/10 ms) and T2-STIR (TR/TE=5000/60 ms) imaging, dynamic-contrast-enhanced MRI (DCE-MRI), diffusion-weighted-imaging (DWI) for apparent diffusion coefficient (ADC) estimation (b=0;800sec/mm2), and single-voxel MRS (10x10x10 mm3, PRESS, TR/TE=3000/135 ms) were performed by means of a Philips Achieva STx 3.0 T scanner equipped with a multi-source RF transmitter. The presence of total choline (tCho) was assumed if the signal-to-noise ratio (SNR) of the peak at 3.2 ppm was ≥2. A classifier-based analysis (support-vector-machines, SVM) was performed with 4-dimensional vectors defined by morphology, kinetic curve type, ADC mean value within in-lesion ROI (threshold 1.1x10-3 mm2/sec), and SNRtCho≥2 at MRS. A comparison with 3-dimensional analysis (excluding MRS) was performed to test for MRS impact on specificity.
Results: 136 patients had acceptable spectra, of which 51 showed tCho SNR≥2. Comparison with histopathological examination of surgical specimens (or micro-biopsy for benign lesions) showed 91.8% specificity without the inclusion of MRS in the SVM analysis. When MRS was included, specificity increased to 94.6%.
Conclusion: In this study, inclusion of MRS improved specificity of multiparametric high-field MR examinations of the breast. Further research is necessary to find the optimal dimensionality of the classifier and to test linear vs. non-linear models, in order to maximize the diagnostic power of multiparametric examinations.

B-1158 14:40

Intraindividual assessment of tumour neovascularity, microenvironment, glucose metabolism and hypoxia in breast cancer patients by multiparametric ^{18}F-FDG/ ^{18}F-FMISO PET/MRI at 3 T: a feasibility study

K. Pinker-Domenig, P. Andrzejewski, H. Magometschnigg, T.H. Helbich, D. Georg, G. Karanikas, W. Wadsak, P. Kapetas, P.A.T. Baltzer; *Vienna/AT (katja.pinker-domenig@meduniwien.ac.at)*

Purpose: To prove feasibility of fused multiparametric positron emission tomography/magnetic resonance imaging (PET/MRI) with dynamic contrast-enhanced MRI (DCE-MRI) for tumour neoangiogenesis, diffusion-weighted imaging (DWI) for assessment of tumour-microenvironment (TME), the tracer ^{18F}F-fluorodesoxyglucose (^{18}F-FDG) for detection of increased glycolysis and the tracer ^{18}F-fluoromisonidazole (^{18}F-FMISO) for detection of tumour hypoxia at 3 T (3 T MP ^{18}F-FDG/^{18}F-FMISO PET-MRI.
Methods and Materials: In this IRB-approved prospective study, eight patients with suspicious breast lesions (BIRADS 4/5) underwent sequential 3 T MP ^{18}F-FDG/^{18}F FMISO PET/MRI. The MRI protocol included a high-resolution DCE equence (0.1 mmol/kg Gd-DOTA, Dotarem) and a DWI rsEPI sequence b=50/850). All patients were subjected to ^{18}F-FDG/^{18}F-FMISO PET/CT scanning. CT data were used for attenuation correction. PET and MR image were registered using Mirada RTx (Mirada Medical, Oxford, UK, ver.1.4.0.23) software. 3 T MP ^{18}F-FDG/^{18}F-FMISO PET/MRI was assessed for enhancement-kinetics, quantitative diffusivity and ^{18}F-FDG/^{18}F-FMISO avidity. Results were compared with pathological features grading, proliferation-rate, IHC) and clinical endpoints (metastasis, death) using multiple correlation analysis. Histopathology was used as the goldstandard.
Results: Seven invasive malignant and one benign fibrocystic lesion were identified. There were several intermediate to strong correlations identified between quantitative imaging markers, grading, receptor status and proliferation-rate. Multiparametric criteria provided independent information. DCE, ^{18}F-FDG and ^{18}F-FMISO-avidity correlated with presence of metastasis (n=4; r=0.745, 0.507, 0.620, respectively; lowest P-value: 0.03), while ADC did not (r=-0.113, P=0.789).
Conclusion: MP ^{18}F-FDG/^{18}F-FMISO PET-MRI in patients with breast tumours at 3 T is feasible. 3 T MP ^{18}F-FDG/^{18}F-FMISO PET-MRI provides detailed quantitative prognostic information in breast cancer patients.

Author Disclosures:
K. Pinker-Domenig: Board Member; EUSOBI. Research/Grant Support; Austrian Nationalbank 'Jubiläumsfond' Project Nr.15082.

B-1159 14:48

Value of simultaneous PET MR mammography in patients with breast cancer undergoing neoadjuvant chemotherapy: preliminary results

S. Kinner, J. Nagarajah, J. Grüneisen, L. Umutlu, O. Hoffmann, A.-K. Bittner, K. Nassenstein, T. Pöppel; *Essen/DE (Sonja.Kinner@uni-due.de)*

Purpose: To assess if simultaneous 18 F-Fluorodeoxyglucose (FDG) positron emission tomography (PET) magnetic resonance mammography (MRM; PET/MRM) in breast caner patients before and under neoadjuvant chemotherapy (NAC) can discriminate between responders and non-responders and predict response to therapy.
Methods and Materials: 15 Patients with invasive breast cancer underwent simultaneous PET/MRM (Biograph mMR, Siemens, Erlangen, Germany) before and under NAC. Two readers evaluated in consensus i) MRM concerning size difference, ii) PET concerning changes of standard uptake value (SUV) and iii) simultaneous PET/MRM concerning response. Image ratings were correlated with histopathology (complete response; CR non-complete response: non-CR) and regression score after Sinn (0:no effect; 4:no residual tumour) after surgery.
Results: MRM alone diagnosed CR in 8 and non-CR in 7 patients while PET alone diagnosed CR in 9 and non-CR in 6 patients. PET/MRM diagnosed CR in 8 and non-CR in 7 patients. One patient with no tracer uptake on PET (rated as CR) showed a residual enhancing lesion on MRM (non-CR) and was diagnosed correctly as non-CR on PET/MR (Sinn score 2 on histopathology). In another patient with SUV reduction (PET: non-CR but responder) and no change in size (MRM: non-CR, non-responder) histopathology showed partial reaction (Sinn score 2). PET/MRM correctly diagnosed this patient as non-CR, responder.
Conclusion: In this preliminary study we showed that simultaneous PET/MRM in breast cancer patients under NAC is feasible and a valuable diagnostic tool. Both imaging modalities complement one another and help to distinguish responders from non-responders and can predict CR or non-CR.

B-1160 14:56

Diagnostic accuracy of 18 F-FDG PET/CT of the breast: comparison to DCE MRI imaging at 3 Tesla

H. Magometschnigg, P.A.T. Baltzer, B. Fueger, T.H. Helbich, G. Karanikas, P. Dubsky, M. Rudas, M. Weber, K. Pinker-Domenig; *Vienna/AT (heinrich.magometschnigg@meduniwien.ac.at)*

Purpose: To compare the diagnostic accuracy of prone 18 F-fluorodeoxyglucose positron emission tomography-computed tomography (18 F-FDG PET/CT) with dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) at 3 T in breast lesions.
Methods and Materials: There were 172 consecutive patients with an imaging abnormality included in this IRB-approved prospective study. All patients underwent 18 F-FDG PET/CT and 3 T DCE-MRI of the breast in the prone position. The likelihood of malignancy of breast lesions was assessed by two reader-teams for 18 F-FDG PET/CT and DCE-MRI independently. Histopathology was used as the standard of reference. Appropriate statistical tests were used to assess sensitivity, specificity, diagnostic accuracy, the area under the curve (AUC), and inter-reader agreement.
Results: There were 132 malignant and 40 benign lesions. 18 F-FDG PET/CT achieved a sensitivity, specificity, and diagnostic accuracy of 97%, 80%, and 93%, respectively, with an AUC of 0.89 and excellent inter-reader agreement. DCE-MRI at 3 T achieved a sensitivity, specificity, and diagnostic accuracy of 100%, 70%, and 93%, respectively, with an AUC of 0.85 excellent inter-reader agreement. The diagnostic accuracy of 18 F-FDG PET/CT for breast cancer diagnosis was not significantly different from that of DCE-MRI at 3 T (p=1). ROC analysis demonstrated that the application of a SUVMAX threshold is not helpful in for breast cancer diagnosis.
Conclusion: Both 18 F-FDG PET/CT and DCE-MRI at 3 T are useful in breast cancer diagnosis. DCE-MR at 3 T imaging is more sensitive, but 18 F-FDG PET/CT is more specific when interpreted by an experienced reader. 18 F-FDG PET/CT may serve as an alternative in patients who are not candidates for DCE-MRI.

B-1161 15:04

18 F-FDG PET/CT for initial staging in breast cancer patients: is there a relevant impact on treatment planning compared to conventional staging modalities?

J. Krammer, C.G. Kaiser, A. Schnitzer, K.A. Buesing, S.O. Schoenberg, E. Sperk, M. Suetterlin, K. Wasser; *Mannheim/DE*

Purpose: To evaluate the impact of whole-body 18 F-FDG PET/CT on initial staging of breast cancer in comparison to conventional staging modalities.
Methods and Materials: This prospective study included 101 breast cancer patients. Preoperative whole-body staging with PET/CT was performed in patients with clinical stage ≥ T2 tumours or positive local lymph nodes (n=91). Postoperative PET/CT was performed in patients without these criteria but positive sentinel lymph node biopsy (n=10). All patients underwent PET/CT and a conventional staging algorithm, which included bone scan, chest X-ray and abdominal ultrasound. PET/CT findings were compared to conventional staging and the impact on therapeutic management was evaluated.
Results: PET/CT findings led to a modification of the N or M stage in 19 patients (19%); the N stage was upgraded in 18 patients and the M stage was upgraded in 3 patients. In two patients (2%) PET/CT newly identified manifestation of breast cancer. PET/CT findings caused a change in treatment of 11 patients (11%).
Conclusion: PET/CT is superior to a conventional staging algorithm leading to a modification of the initial tumour stage in many patients. PET/CT has a relevant impact on the treatment of breast cancer when compared to conventional modalities. Further studies should assess inclusion criteria beyond the conventional T and N status, e.g. tumour grading and receptor status.

B-1162 15:12

Feasibility of [F-18]FDG-PET/CT for clinicopathological evaluation in patients with Ductal Carcinoma In-Situ (DCIS) of the breast

T. Fujioka, K. Kubota, A. Toriihara, Y. Saida, U. Tateishi; *Tokyo/JP (tomoyukifujioka@hotmail.com)*

Purpose: This study evaluates the relationship between [F-18]FDG-PET/CT and clinicopathological factors of DCIS.
Methods and Materials: This study retrospectively reviewed 52 consecutive lesions in 50 surgical patients with pathologically proven pure DCIS who underwent [F-18]FDG PET/CT before surgery. [F-18]FDG uptake by visual analysis and SUVmax were compared with clinical, imaging and pathological factors.
Results: [F-18]FDG uptake was visualized in 28 patients (53 %), and SUVmax were 1.63 ± 0.90 (mean $\pm$ SD). SUVmax were significantly associated with symptomatic presentation (P=0.002), palpability (P=0.024), use of core-needle biopsy (vs vacuum assisted biopsy) (P=0.012), US guided biopsy (vs stereotactic biopsy) (P=0.006), high BI-RADS category (P=0.02), larger size of enhancing lesion at MRI (P=0.01), and larger tumour size at histopathology (P=0.008) by univariate analyses. However, SUVmax were not significantly associated with age, presence of calcification at MG, mass formation at MRI, presence of comedonecrosis, hormone status (ER, PgR, HER2), nuclear grade. On multivariate analysis, SUVmax were associated with symptomatic presentation (P=0.02), use of core-needle biopsy (P=0.039).
Conclusion: [F-18]FDG-PET/CT is feasible to evaluate patients with DCIS. Symptomatic and large tumour tend to exhibit significant [F-18]FDG uptake.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 1901a

Pancreas: tumours, pancreatitis

Moderators:
V. Maniatis; Aabenraa/DK
P. Rodríguez; Madrid/ES

B-1164 14:00

Frequency and morphological features of incidental pancreatic cystic lesions seen on 256 detector row CT: a large population series

P. Allegranza, D. Ippolito, P. Bonaffini, F. Leone, D. Fior, A. Casiraghi, S. Sironi; *Monza/IT (pietroallegranza@gmail.com)*

Purpose: To assess frequency of incidental pancreatic cystic lesions (IPCL) detected on 256 multi detector CT (MDCT) and to evaluate morphological features associated with high risk of malignancy in MDC studies not aimed on pancreas.
Methods and Materials: We retrospectively reviewed 6389 MDCT abdominal scans performed between January 2011 and February 2013 on a 256-row detector scanner for presence of IPCL. Inclusion criteria were: presence of IPCL (s) in asymptomatic patients with no history or suspicious of pancreatic disease. Images were evaluated by two radiologist;for each lesion they reported location, multifocality, size, communication with main pancreatic duct (MPD), MPD size, presence of inner septa, awl thickening and mural enhancing nodules.
Results: A total of 292 IPCL (incidence 2.05 per 100 patients) was found in 192 patients (males/females 93/99; age range: 31-90).Solitary cysts were found in 145/292 (75.5%), 2 in 27/192 (14.1%) and >2 in 20/192 patients (10.4%).Diagnosis was established by histopathology or by imaging analysis: solitary branch-type IPMN (93/192;48.4%), multifocal branch-type IPMN (27/192;14.1%), main-type IPMN (25/192;13%), mixed IPMN (20/192;10.4%), pseudocysts (5/192;2.6%), mucinous (14/192;7.3%) and serous cystoadenoma (7/192;3.6%), metastasis (1/192;0.5%). Mean size was 15 mm (range 3-145). Most common location was pancreatic body (87/292;29.8%). We found intralesional septa in52/292 lesions (17.8%), wall thickening >2 mm in 13/292 (4.5%) and mural enhancing nodules in 12/292 (4.1%). Communication with ductal system was evident in 45 cases and MPD in 10.
Conclusion: IPCL are discovered with increased frequency on CT studies, even when studies are not focused on pancreas and 256 row MDCT allows the evaluation of features associated with high risk of malignancy.

B-1165 14:08

Clinical and MDCT features of pancreas metastasis from various primary malignancies

T. Choi, S. Kim, C.-I. Shin, J. Han, B. Choi; *Seoul/KR (dllimit@naver.com)*

Purpose: To describe the clinical and MDCT features of metastatic pancreatic tumours (MPTs) from various primary malignancies and to determine characteristic CT features of MPTs according to primary tumours.
Methods and Materials: Thirty-six patients with pathologically proven MPTs who underwent MDCT were retrospectively enrolled. Median survival and factors associated with prolonged survival were analyzed using Cox regression analysis. MDCT was analyzed for the location, number, enhancement patterns, and margin of MPTs and main pancreatic duct (MPD) dilatation.
Results: The most common primary tumours were renal cell carcinomas (RCC)(n=18), gastric cancers (n=7), and colorectal cancers (n=5). Mean survival was significantly different between RCC (108.1 months) and non-RCC (25.5 months) metastases ($P < 0.001$). A primary tumour of RCC was the only factor associated with prolonged survival (hazard ratio:8.96, P=0.004). Metastatic adenocarcinomas (n=16) did not accompany with MPD dilatation which was different from primary pancreatic cancer. There were significant differences in the number and location of MPTs, enhancement patterns, and margin according to tumour histologies. Metastases from RCC were frequently multifocal whereas all non-RCC metastases were solitary (P=0.003). RCC metastases were usually located at the center of the pancreas whereas non-RCC metastases were located off-center (P=0.001). RCC metastases were usually homogeneous and well-defined with early wash-in and persistent enhancement while non-RCC metastases appeared as heterogeneous, ill-defined nodules with persistent low attenuation ($P < 0.05$).
Conclusion: Various non-RCC tumours as well as RCC can metastasize to the pancreas. A primary tumour of RCC is the only factor associated with prolonged survival. CT features of MPTs are different from primary pancreatic cancers and are significantly different between the various primary tumours.

B-1166 14:16

Diagnostic value of 256 MDCT scan in defining imaging features of incidentally detected hypervascular pancreatic lesions: prevalence and characterisation in large cohort of patients

P. Allegranza, D. Ippolito, P.A. Bonaffini, F. Leone, D. Fior, A. Casiraghi, S. Sironi; *Monza/IT (pietroallegranza@gmail.com)*

Purpose: To assess frequency of hypervascular pancreatic lesions (HPL) incidentally detected on multi-detector CT (MDCT) and to evaluate morphological features that allow their characterization.
Methods and Materials: A total of 6389 consecutive contrast-enhanced abdominal MCDT performer on a 256 row scanner (iCT, Philips) in different clinical settings from January 2011 to February 2013 were retrospectively reviewed. The inclusion criteria was the incidental detection of one or more HPL in patients with no symptoms related to the lesion itself. For each HPL (either single of multifocal) the following CT findings were reported and correlated with clinical data: location, size, morphology, presence of calcifications and vascular pattern (solid vs mixed).
Results: 28 solid HPL (prevalence 0.4%) were detected in 14 patients (9 males, 5 females; age range 67-83 years). Size range was 3-58 mm (mean 13 mm), most common site of the lesion was the pancreatic tail (11/28);1/28 lesion demonstrated calcifications. 16/28 lesions showed a solid pattern. Main pancreatic duct (MPD) obstruction was found in 1 patient (renal cell tumour metastasis, RCCM). Diagnosis was established by clinical history and histopathological findings: pancreatic neuroendocrine tumours (NET, 11/28), intrapancreatic accessory spleen (IPAS, 1/28), RCCM (16/28). Symptoms were present in 2/14 (14%) patients (SIADH, 1 case and vague abdominal pain, 1 case). Dimensional growth over time was observed in 21/28 cases (16/21 RCCM,5/21 NET).
Conclusion: Incidental HPLs are an uncommon finding on MDCT routine studies. Along with clinical history, multi-phasic MDCT might be helpful in their characterization but only IPAS showed a pathognomonic pattern

B-1167 14:24

Enhancement pattern, clinical features and perfusional characteristics of symptomatic pancreatic endocrine tumours

L. Zhu, H.-d. Xue, X. Wang, Y.-l. He, H. Sun, Z.-y. Jin; *Beijing/CN (zhuliang_pumc@163.com)*

Purpose: To retrospectively investigate the CT enhancement pattern of symptomatic pancreatic endocrine tumours (PETs), and to compare clinical and perfusional characteristics between hyperattenuating and isoattenuating tumours.
Methods and Materials: This study was IRB proved. Patient informed consent was waived. From 2010.7 to 2014.6, 172 patients (67 males, 105 females) with PET-related symptoms underwent dual phase enhanced CT before surgery. Their tumours were confirmed by surgical pathology. The frequency of

isoattenuating tumours was determined. Surgical approach, hospital stay, tumour size and pathological gradings were investigated. 129 patients also underwent whole-pancreas CT perfusion before surgery. Tumour perfusion and partitional pancreatic perfusion data were analyzed.
Results: 45 of 183 surgically removed tumours were isoattenuating. 23.8% patients had at least one isoattenuating tumour. The frequency of isoattenuating tumours was higher in male patients (38.8% v.s.14.3%). More invasive surgery procedure was performed, and the overall hospital stay was longer for patients with isoattenuating tumours (both $P < 0.05$). Tumour size and WHO grading were identical between isoattenuating and hyperattenuating tumours. Mean tumour blood flow (BF-mean) were lower in isoattenuating tumours ($P < 0.05$), whereas the standard deviation (SD) were identical ($P=0.22$). Tumour-harbouring pancreatic parenchyma had higher partitional BF-mean and BF-SD, compared to tumour-free neighbouring parts (all $P < 0.05$).
Conclusion: Male patients had an inclination for isoattenuating tumours. Patients with isoattenuating tumours had more invasive surgery approach and longer hospital stay. Isoattenuating tumours had lower BF-mean, but the BF-SD were comparable to hyperattenuating tumours. Partitional pancreatic BF could suggest tumour location, even if the tumour was "invisible".

B-1168 14:32

Survival outcomes of patients with pancreas neuroendocrine neoplasms who receive surgical resection: association with dynamic contrast-enhanced CT

D. Kim, H. Kim, K. Kim; *Seoul/KR (fsnoruen@gmail.com)*

Purpose: To evaluate whether dynamic contrast-enhanced CT findings are associated with recurrence-free and overall survival in patients pancreas neuroendocrine neoplasms (PanNENs) who received surgical resection.
Methods and Materials: Between January 2004 and December 2012, 161 consecutive patients who underwent preoperative dynamic CT and surgical resection with curative intent for PanNENs were identified. The tumour shape, margin, presence of calcification, pancreatic duct dilatation, bile duct dilatation, and vascular invasion were evaluated by two reviewers in consensus. The tumour size, arterial enhancement ratio, and portal enhancement ratio were measured. The enhancement ratio was defined as HU of the tumour/HU of the pancreas parenchyma. The Cox proportional hazard model was used to determine the association between dynamic CT features and recurrence-free survival and overall survival.
Results: There were 31 events during the follow-up period of recurrence-free survival and 17 deaths during the follow-up period of overall survival. At multivariate analysis, tumour size (> 3 cm) (hazard ratio, 3.314; $P = 0.006$), portal enhancement ratio (≤ 1.1) (hazard ratio, 2.718; $P = 0.006$), and hepatic metastases (hazard ratio, 4.374; $P = 0.003$) were the independent variables associated with recurrence-free survival. Portal enhancement ratio (≤ 1.1) (hazard ratio, 5.951; $P = 0.001$) and hepatic metastases (hazard ratio, 4.122; $P = 0.021$) were the independent variables associated with overall survival.
Conclusion: Portal enhancement ratio (≤ 1.1) and hepatic metastases assessed with dynamic CT were the common independent prognostic factors of worse recurrence-free survival and overall survival in patients with PanNENs who received surgical resection.

B-1169 14:40

Comparison of MDCT and Gadobutrol-enhanced MRI for detection and characterisation of small (< 3 cm) pancreatic solid lesions

T. Choi, J. Lee, M. Yu, J. Kim, J. Han, B. Choi; *Seoul/KR (dllimit@naver.com)*

Purpose: To compare overall diagnostic performance of multiphasic MDCT and Gadobutrol-enhanced MRI in detection and characterization of small solid pancreatic tumours (< 3 cm in diameter).
Methods and Materials: From January 2006 to August 2014, 196 patients with small (< 3 cm in diameter) solid pancreatic lesions, and 55 subjects with normal pancreas who underwent both MDCT and gadobutrol-enhanced MRI including MRCP and diffusion weighted imaging (DWI) were included. There were ductal adenocarcinoma (n=127), solid pseudopapillary tumour (n=10), neuroendocrine tumour (n=46), metastasis (n=6), or mass-forming autoimmune pancreatitis (n=7). Two radiologists blinded to pathologic diagnoses reviewed those CT and MR images independently and evaluated the conspicuity of the lesion, probability of malignancy and most likely diagnosis. The differences in diagnostic performance of those modalities in evaluation of solid pancreatic lesions were determined by using McNemar test.
Results: MRI provided significantly higher lesion conspicuity than CT ($p < 0.05$). The overall accuracy of CT and MRI for detecting pancreatic lesions were 97.2% (244/251) and 97.6% (245/251), respectively, for reviewer 1 ($p=1.000$) and 97.6% (245/251) and 99.6% (250/251), respectively, for reviewer 2 ($p=0.125$). The overall diagnostic performance of CT and MRI for making specific diagnosis were 85.7% (215/251) and 86.5% (217/251), respectively, for reviewer 1 ($p=0.868$) and 91.6% (230/251) and 93.6% (235/251), respectively, for reviewer 2 ($p=0.332$).
Conclusion: Gadobutrol-enhanced MRI including MRCP and DWI showed excellent detection rates and good characterization for small pancreatic solid tumours, comparable to that of MDCT, while proving better lesion conspicuity.

B-1170 14:48

Efficacy of contrast-enhanced magnetic resonance imaging in the differentiation between malignant and benign pancreatic cystic neoplasms

C. Spick, S. Polanec, D. Tamandl, D. Javor, M. Schindl, M. Weber, A. Ba-Ssalamah; *Vienna/AT (claudio.spick@meduniwien.ac.at)*

Purpose: To evaluate the efficacy of contrast-enhanced magnetic resonance imaging (MRI) in the differentiation between malignant and benign pancreatic cystic neoplasms (PCNs).
Methods and Materials: In this IRB-approved, single-center-study, 50 patients (mean-age, 60±11 years; age range, 37-83 yrs) underwent high-resolution, dynamic, contrast-enhanced MRI. Imaging features of PCNs were reviewed including worrisome features, such as 1) solid components, 2) size of the cyst (> 30 mm), and 3) duct dilatation. The final diagnosis, based on MRI results, was compared to the reference standard, histopathology, using the Cohen's-kappa coefficient. In addition, we calculated the diagnostic accuracy of worrisome features for malignancy.
Results: An accurate diagnosis of PCNs was obtained in 3 of 4 (75%) main-duct intrapapillary mucinous neoplasms (IPMN), seven of 10 (70%) branch-duct IPMN, 5 of 8 (62.5%) mixed-type IPMN, 7 of 7 (100%) mucinous cystic neoplasms, 6 of 9 (66.7%) serous cystadenomas, 7 of 8 (87.5%) pseudocysts (87.5%), and 3 of 4 (75%) cystic neuroendocrine tumours. Consequently, in 38 (76%) of 50 patients, MRI features provided an accurate diagnosis (κ=.718). The diagnostic accuracy of at least one worrisome feature revealed a sensitivity of 91.7%, a specificity of 36.8%, a PPV of 31.4%, and an NPV of 93.3%. Presence of two worrisome features showed a sensitivity of 67% and a specificity of 77%. If all worrisome features were present a sensitivity of 16.7%, a specificity of 92.1%, a PPV of 40%, and an NPV of 77.8% was revealed.
Conclusion: Contrast-enhanced MRI is a valuable non-invasive diagnostic tool that can differentiate malignant and benign PCNs.

B-1171 14:56

MRI features in differential diagnosis between mucinous cystoadenomas and mucinous cystoadenocarcinomas of the pancreas

V. Di Paola, S. Mehrabi, R. Manfredi, R. Pozzi-Mucelli; *Verona/IT (dipaola.valerio@libero.it)*

Purpose: To identify MRI-features to differentiate pancreatic Mucinous Cystoadenomas (MCAs) from Mucinous Cystoadenocarcinomas (MCACs) for a better surgical planning and prognostic definition.
Methods and Materials: 41 Patients (35 females and 6 males, mean age of 56 years) with histopathological diagnosis of MCAs/MCACs and availability of MR examination were included. Exclusion criteria was: lack of histopathological results and/or MR examination. A quantitative analysis (size, thickness of septa and wall, number of cysts), and a qualitative analysis (T1 high-signal intensity, mural nodules, enhancement of septa, compression/infiltration of adjacent structures, metastases) was performed. T-student test for quantitative variables and Fisher test for non-quantitative variables were calculated for both MCAs and MCACs to evaluate differences between the two groups. K-Cohen for each parameter was calculated to evaluate their agreement on malignancy.
Results: Histopathological findings revealed 24/41 (58.5%) MCAs and 17/41 (41.5%) MCACs. A statistically significant difference between the two groups ($p > 0.05$) was found for size, thickness of septa and wall, number of cysts, T1 high-signal intensity, mural nodules, enhancement of septa, compression/infiltration of adjacent structures. The agreement on malignancy was higher for nodules, enhancement of septa, and thickness of septa and of wall > 5 mm (k=0.949), slightly lower for T1-high signal intensity, number of cysts > 6, size > 6 cm (k=0.900) and infiltration of adjacent structures (k=0.851).
Conclusion: MRI can differentiate pancreatic MCAs from MCACs; MRI features better correlated with malignancy are nodules, enhancement of septa, and thickness of septa and of wall > 5 mm (k=0.949).

B-1172 15:04

Magnetic resonance imaging (MRI) to detect early pancreatic alterations and monitor volume variations of abdominal fat stores in a transgenic mouse model of pancreatic adenocarcinoma, during disease development

P. Marra, A. Esposito, E. Dugnani, T. Canu, V. Pasquale, D. Liberati, L. Piemonti, F. De Cobelli, A. Del Maschio; *Milan/IT (marrapaolo87@libero.it)*

Purpose: The development of pancreatic cancer seems associated to early alterations in the metabolism of carbohydrates and lipids. A mouse strain with KRAS/p53 mutation, predisposed to develop pancreatic adenocarcinoma,

underwent serial abdominal MRI for early detection and monitoring of pancreatic cancer and volume quantification of abdominal fat deposits.
Methods and Materials: 23 KRAS-mutated mice (KPC) and 23 wild-type mice (Cre) underwent serial in-vivo 7T MRI under inhalational anesthesia at 2, 4 and/or 6 months of life to detect pancreatic alterations and quantify abdominal fat volume (AFV) and liver volume (LV). At each time point, on the basis of morphological fat-sat T2-weighted sequences, KPC mice were classified as stage-1 (normal pancreas), stage-2 (heterogeneous parenchyma with cystic alterations), stage-3 (small intra-pancreatic tumour) and stage-4 (extended pancreatic cancer).
Results: Only 30% of KPC mice presented no evident pancreatic cancer at MRI at 6 months. KPC mice with no detectable tumour (stage-1 or 2) presented a lower average AFV than Cre mice both at 2, 4 and 6 months with improved statistical significance when AFV was normalized to the LV: at 2 months AFV/LV of KPC vs Cre was 0.45±0.15 vs 0.72±0.26 (p=0.007); at 4 months 0.51±0.19 vs 0.70±0.29 (p=0.059); at 6 months 0.48±0.23 vs 0.78±0.27 (p=0.003).
Conclusion: Even with the criticism that none of the parameters assessed was significantly different between genotype groups at stage-1 disease, which is the early phase of pancreatic carcinogenesis, our preliminary results showed that the development of pancreatic cancer is associated to MRI-detectable alterations of abdominal fat stores.

B-1173 15:12

Added value of diffusion-weighted imaging for detecting acute pancreatitis in clinically suspected patients

I. Nam, S. Kim, S.-J. Kim, Y.-j. Lim; *Busan/KR (sky_hall@naver.com)*

Purpose: To evaluate the added value of diffusion-weighted imaging (DWI) to computed tomography (CT) for detecting acute pancreatitis in patients with clinically suspected acute pancreatitis.
Methods and Materials: A total of 85 patients who visited emergency room with abdominal pain and whose serum amylase and lipase level was elevated were eligible between Dec 2012 and Jan 2014. They underwent abdomino-pelvic CT using a 128-channel CT and subsequent DWI using a 3-T scanner. Two blinded radiologists independently performed a 4-week-interval reading. They recorded their confidence score using a 5-point scale for acute pancreatitis based on CT image sets first, then combined CT and DWI image sets later. The diagnostic criteria on DWI (b=800 s/mm^2) were the increased signal intensity in the pancreas. To evaluate the added value of DWI, McNemar test was used. The clinical evidence based on serum lipase and amylase results served as the reference standard for acute pancreatitis (over 3 times of the normal levels).
Results: 43 patients with acute pancreatitis and 42 patients having hyperlipasemia and hyperamylasemia (less than 3 times of the normal levels) were identified. The sensitivity for acute pancreatitis increased from 42% to 70% for reader 1 (p=0.0005), from 44% to 72% for reader 2 (p=0.0005) after combined reading of DWI and CT. The sensitivity for hyperlipasemia and hyperamylasemia also increased from 10% to 26% for reader 1 (p=0.0156), from 7% to 29% for reader 2 (p=0.0039).
Conclusion: Sensitivity for detecting acute pancreatitis significantly increased after adding DWI to CT.

B-1174 15:20

Secretin-enhanced MRCP features of Santorinicele before and after minor papilla sphincterotomy

E. Boninsegna, R. Manfredi, A. Ventriglia, R. Negrelli, B. Pedrinolla, A.J. Cybulski, S. Mehrabi, R. Pozzi-Mucelli; *Verona/IT (boninsegnae@gmail.com)*

Purpose: To evaluate secretin enhanced-MRCP (S-MRCP) features of patients with pancreas divisum and Santorinicele, before and after Minor Papilla Sphincterotomy.
Methods and Materials: S-MRCP examinations of 519 patients with suspected pancreatic disease were included. Size of the main pancreatic duct, presence and caliber of Santorinicele were evaluated. Duodenal filling was assessed on dynamic images. After sphincterotomy the same parameters and the clinical findings have been reevaluated.
Results: Pancreas divisum was depicted in 55/ 519 patients (11%) at MRCP and in additional 26/519 at S-MRCP (total 81/519, 16%). Santorinicele was detected in 7/81 patients (8.6%) with pancreas divisum at MRCP and in additional 20/81 at S-MRCP (total 27/81, 33%). Dorsal duct in patients with Santorinicele was significantly larger in the head compared with patients with only pancreas divisum ($p < 0.01$), in basal conditions (average 2.4 versus 1.9 mm) and after secretin administration (average 3.0 versus 2.4 mm). Duodenal filling was impaired in 11/27 patients (41%) with Santorinicele. After sphincterotomy significant reduction in size of Santorinicele (-33%) and dorsal duct (-17%), increase of pancreatic juice and symptoms improvement were observed.
Conclusion: Secretin administration increases the accuracy of MRCP to detect Santorinicele and demonstrates the impaired duodenal filling. S-MRCP is also useful to assess results of sphincterotomy.

14:00 - 15:30 **Room C**

Breast

SS 1902b

Preoperative imaging

Moderators:
P. Panizza; Milan/IT
S. Perez Rodrigo; Madrid/ES

B-1175 14:00

Indications and prescriptions for preoperative breast MRI: first data from the MIPA study. The MIPA study group

R.M. Trimboli[1], G. Di Leo[1], A. Benedek[1], T.H. Helbich[2], F.J. Gilbert[3], N. Houssami[4], F. Sardanelli[1]; [1]*San Donato Milanese/IT*, [2]*Vienna/AT*, [3]*Rotterdam/NL*, [4]*Sydney/AU (trimboli.rm@gmail.com)*

Purpose: The MIPA study is an ongoing observational international multicenter study of preoperative breast MRI. We present the current position in 35 centers worldwide.
Methods and Materials: In 2012, following an international call nearly one hundred applications were received and 35 centers were initially selected. Patients with newly diagnosed breast cancer were enrolled. For patient who had breast MRI, the setting (screening, diagnostic, or preoperative staging) and the ordering physician (radiologist, surgeon, oncologist, radiation therapist, or general practitioner) were recorded.
Results: Analyzing completed electronic data for 716 patients, 473 (66%) patients underwent breast MRI and 243 (34%) did not. Reasons for MRI were: preoperative staging in 432 (91%), screening in 14 (3%) and diagnostic purposes in 27 (6%). Major diagnostic purposes were equivocal findings at standard conventional imaging (16/27, 59%) and nipple discharge (3/27, 11%). Most common reasons to preoperative MRI were: usual routine practice (41%); suspected multiple and/or bilateral tumours at conventional imaging (35%); dense breasts (25%); young age (10%); DCIS associated to an invasive cancer at needle biopsy (9%); invasive lobular pathology (8%). A radiologist ordered MRI in 51% of patients, a surgeon in 30%, an oncologist in 3%, and a combination of in 11%; other in 5%.
Conclusion: Breast MRI was performed in about two thirds of patients. Forty-1% of preoperative MRI was performed as routine local practice; 9% of breast MRI was initially performed for screening or diagnostic purposes. Both radiologists and non-radiologists (mainly surgeons) ordered breast MRI.

Author Disclosures:
R.M. Trimboli: Other; Sponsored by Bracco Imaging SpA. **G. Di Leo:** Other; Sponsored by Bracco Imaging SpA. **F. Sardanelli:** Speaker; Bracco Imaging SpA.

B-1176 14:08

Gadobutrol-enhanced breast MRI in the preoperative setting: results on 390 patients from an international multicenter study with European blinded readers

R.M. Trimboli[1], L.A. Carbonaro[1], F.M. Vogt[2], K. Siegmann[3], K. Partanen[4], M.L. Rosenberg[5], F. Sardanelli[1]; [1]*San Donato Milanese/IT*, [2]*Lübeck/DE*, [3]*Tübingen/DE*, [4]*Helsinki/FI*, [5]*Clifton, NJ/US (trimboli.rm@gmail.com)*

Purpose: Investigating diagnostic performance of Gadobutrol-enhanced breast MRI in the preoperative setting.
Methods and Materials: Patients with breast cancer with a recent mammogram were enrolled. They underwent preoperative 1.5 T MRI using bilateral coils with 0.1 mmol/kg of Gadobutrol. Blinded reading (BR) was performed by six independent readers, three for MRI and three for mammography. Investigators'reading (IR) was recorded. Image assessment was done on a region basis (four quadrants and retroareolar region). Within-subject sensitivity was calculated as follows: all malignant regions in both breasts had to be detected to achieve 100% sensitivity. Specificity was calculated for non-malignant breasts. Reference standard was histology for all malignant regions, and ultrasound for negative regions.
Results: 446 patients enrolled, 643 malignant regions, 3,240 non-malignant regions, no serious adverse events. Within-subject sensitivity (n=388 patients) was 68%-72% for mammography, 80%-87% for MRI at BR, 87% and 94% at IR ($P < 0.001$). Specificity (n=372 breasts) was 91%-94% for mammography and 86%-95% for MRI at BR, 99% and 95% at IR. For additional cancers (n=87 patients) sensitivity was 26%-35% for mammography and 56%-66% for MRI at BR, 10% and 60% at IR; for multifocal disease (regions, n=67) 13%-21% and 31%-52% at BR, 37% and 60% at IR; for multicentric disease (breasts, n=53)

13%-26% and 42%-60% at BR, 40% and 70% at IR; for bilateral cancers (patients, n=16) 13%-50% and 44%-81% at BR, 38% and 88% at IR, respectively.
Conclusion: Gadobutrol-enhanced preoperative breast MRI was safe and outperformed mammography reaching 94% sensitivity and 95% specificity at IR.

Author Disclosures:
M.L. Rosenberg: Employee; Bayer Healthcare Pharmaceuticals. **F. Sardanelli:** Research/Grant Support; Bracco Group, Bayer AG. Speaker; Bracco Group.

B-1177 14:16

Gadobutrol-enhanced breast MRI in the preoperative setting: results on 397 patients from an international multicenter study with United States blinded readers

H. Abe[1], E. Wenkel[2], S. Malgorzata[3], V. Martin[4], M. Rosenberg[5], G. Newstead[1]; [1]*Chicago, IL/US*, [2]*Erlangen/DE*, [3]*Bydgoszczy/PL*, [4]*Barcelona/ES*, [5]*Berlin/DE (habe@radiology.bsd.uchicago.edu)*

Purpose: We investigated the diagnostic performance of Gadobutrol-enhanced breast MRI in the preoperative setting.
Methods and Materials: Patients with newly histologically confirmed invasive or in-situ carcinoma underwent preoperative 1.5 T breast MRI with gadobutrol (0.1 mmol/kg). Blinded reading (BR) was performed by six independent US readers, three for MRI and three for mammography (XRM), unaware of any patient data including clinical setting. Investigators' reading (IR) was recorded. Image assessment was done on a region basis. The reference standard showed 630 malignant regions and 3,197 non-malignant regions in 397 patients. Within-subject sensitivity (n=390 patients) was 70%-73% for XRM and 86%-89% for MRI at BR ($P < 0.001$), 89% and 96% at IR ($P < 0.001$). Specificity (n=367 breasts) was 86%-93% for XRM and 83%-92% for MRI at BR, 98% and 95% at IR.
Results: Sensitivity for additional cancer (n=84 patients) was 26%-42% for XRM and 68%-79% for MRI at BR 32% and 73% at IR ($P < 0.001$ both); for multifocal disease (regions, n=60) it was 8%-28% for XRM and 42%-72% for MRI at BR ($P < 0.001$ readers 1 and 2, 0.074 reader 3), 32% and 66% at IR ($P < 0.001$); for multicentric disease (breasts, n=44) it was 14%-30% for XRM and 73%-89% for MRI at BR, 30% and 82% at IR ($P < 0.001$ both); for bilateral cancer (patients, n=14) it was 21%-43% for XMR and 79%-86% for MRI at BR, 50% and 100% at IR ($P < 0.05$), respectively. No serious adverse events were reported.
Conclusion: Gadobutrol-enhanced preoperative breast MRI was safe and had superior sensitivity than mammography with acceptable specificity.

Author Disclosures:
H. Abe: Consultant; Seno Medical Instrument. **G. Newstead:** Advisory Board; Quantitative Insights. Consultant; Bayer AG, Three Palm Software LLC, VuCOMP, Inc.

B-1179 14:24

Evaluation of microcalcifications extent on mammograms in patients with ductal carcinoma in situ (DCIS) predicts the value of MRI for DCIS staging

C. Borelli, P. Rinaldi, R. Fubelli, C. Buccheri, M. Giuliani, P. Belli, L. Bonomo; *Rome/IT (cristinaborelli@hotmail.it)*

Purpose: MRI has been shown to be more accurate than mammography in evaluating the extent of DCIS. However, not all mammographically detected DCIS is visible in MRI. This study aims to evaluate if the mammographic extent of biopsy-proven DCIS is helpful in selecting patients for preoperative MRI staging.
Methods and Materials: The mammograms and MRI scans of 63 consecutive patients with 68 pathologically proven DCIS associated with microcalcifications were retrospectively reviewed. Mammographic extent was measured by a dedicated breast radiologist. On MR images we evaluated the presence of corresponding enhancement on dynamic sequences (including all kinetic patterns) and hyperintensity on diffusion-weighted sequences with apparent diffusion coefficient values < 1.4x10-3 mm2/sec. Measurements of DCIS mammographic extent were correlated to MRI findings. Statistical analysis was perfomed with parametric tests.
Results: DCIS size on mammograms varied from 5 mm to 95 mm (mean 29.04 mm, SD 23.71 mm). MRI detection of DCIS (including all nuclear grades) increased significantly with increasing extent of microcalcifications on mammogram (p=0.002). Based upon our data a cut-off value of 10 mm of microcalcifications extent was proven to be optimal; statistical analysis revealed that positive MR findings were significantly associated with microcalcifications extent > 10 mm (sensitivity 88.7%) and negative MR findings with microcalcifications extent ≤10 mm (sensitivity 40%) ($p < 0.01$).
Conclusion: MRI detection of DCIS lesions with microcalcifications depends on the tumour extent on mammogram. The measurement of DCIS mammographic extent could be helpful in suggesting the use of MRI for assessment of disease extension.

B-1180 14:32

Breast MR imaging for the assessment of residual disease following initial surgery for breast cancer with positive margins

J. Krammer[1], E.R. Price[2], E. Watson[3], M. Jochelson[3], M.P. Murray[3], S.O. Schoenberg[1], E.A. Morris[3]; [1]*Mannheim/DE*, [2]*San Fransisco, CA/US*, [3]*New York, NY/US (Julia.Krammer@medma.uni-heidelberg.de)*

Purpose: To determine if MR imaging of the breast can reliably identify residual disease in patients with positive margins following initial open surgery.
Methods and Materials: 175 patients with positive margins following excision for breast cancer were evaluated with breast MR. Two expert readers independently re-evaluated the MR images for detection of residual disease at the surgical cavity and multifocal/multicentric disease. All patients underwent definitive surgery and MR findings were correlated to histopathology.
Results: 139/175 (80%) patients had residual disease at surgery: 94/139 (68%) patients had residual disease at the surgical site only, 4/139 (3%) patients had just multicentric or multifocal disease and 41/139 (29%) patients had both. Sensitivity, specificity, PPV and NPV for residual disease at the surgical cavity were 62%, 78%, 91% and 36% (reader 1) and 83%, 68%, 90% and 54% (reader 2). Reader 1 depicted 61/64 (95%) patients and reader 2 62/64 (97%) patients with residual invasive carcinoma of 5 mm or more at the cavity and 43/54 (80%) and 51/54 (94%) patients with residual DCIS in this size range. Sensitivity, specificity, PPV and NPV for multifocal or multicentric disease were 87%, 96%, 88% and 96% (reader 1) and 93%, 95%, 98% and 81% (reader 2).
Conclusion: Post-operative breast MR can accurately detect residual disease at the surgical cavity and multifocal or multicentric residual disease. Breast MR imaging may aid the surgeon in deciding further patient management including the necessity of performing mastectomy or mapping residual disease prior to reexcision for breast conserving therapy.

B-1181 14:40

Feasibility and diagnostic accuracy of dynamic breast MR in supine compared to prone position

C. Forte, A. Fausto, A. Carboni, P. Maccari, L. Volterrani; *Siena/IT (forte_cosimo@libero.it)*

Purpose: The aim of this study is to evaluate both feasibility and accuracy of breast MR in supine compared to prone position using pathology as reference.
Methods and Materials: IRB approval and patient informed consent were obtained. Seventy-seven breast MR examinations for local staging were repeated in supine position due to the lack of correlation at second-look US. Both examinations were acquired with the same equipment, voxel, sequences (T1w GRE with fat saturation, 1 pre and 4 postcontrast) and contrast media. An 8-channels coil was used for prone exam, while a synergy double body coil was used for supine breast MR. BIRADS classification was used to evaluate lesions characteristics. Lesions extensions were also compared in both positions. Malignant lesion detection rates and diagnostic performances were measured in a double-blind, randomized fashion by two experienced radiologists. Pathology examination was the standard of reference. Wilcoxon and McNemar tests were used.
Results: A total of 124 breast lesions were studied. Eighty-one were malignant and 43 benign after pathology examination. All supine MR examinations were correctly performed. No significant differences were found by the two readers in terms of diagnostic performance for breast cancer detection in prone and supine position. Lesions extension in prone position was significantly larger than in supine position ($p < 0.05$).
Conclusion: Supine breast MR is feasible and accurate as well as prone position, particularly for invasive lesions. Intraductal component extension could be underestimated in supine position due to the different vascularity; lesions extensions seem to be overestimated in prone position.

Author Disclosures:
A. Fausto: Speaker; GE HealthCare.

B-1182 14:48

Breast mapping of lesion displacement from prone MRI to supine MRI-focused US: what the radiologist should know?

M. Telegrafo, M. Moschetta, A. Stabile Ianora, G. Angelelli; *Bari/IT*
(mikitele@hotmail.it)

Purpose: To evaluate the breast lesion spatial displacement from the MR prone position to the US supine position and to determine whether the degree of displacement may be associated with breast density and lesion nature.
Methods and Materials: 380 patients underwent breast contrast-enhanced MR examination and MRI-focused US. For both MR and US lesions, the position within the breast gland, the distances from anatomical landmarks and the spatial displacement were evaluated. Differences between MR and US measurements, the association between the degree of spatial displacement and both the breast BIRADS density and the nature of breast lesions were calculated.
Results: In 290/380 (76%) patients 300 MR breast lesions were detected. 285 out of 300 (95%) lesions were recognized on MRI-focused US. By comparing MR and US lesion positions, region displacement occurred in 102/285 (35.7%) cases. A significant association between the degree of lesion spatial displacement and breast density was found ($p < 0.00001$). No significant association between the degree of displacement and the nature of breast lesions was found ($p=0.1$).
Conclusion: Lesion spatial displacement from MRI to US may occur especially in the adipose breasts. Lesion-nipple distance and the centrifugal displacement from the nipple need to be considered for US lesion detection.

B-1183 14:56

PET/MR mammography for local tumour staging of patients with primary breast cancer: a comparison with PET/CT and MRI alone

J. Grueneisen[1], J. Nagarajah[1], C. Buchbender[2], O. Hoffmann[1], M. Forsting[1], L. Umutlu[1], S. Kinner[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE*
(johannes.grueneisen@uk-essen.de)

Purpose: To assess the diagnostic performance of integrated PET/MR mammography for local tumour staging of patients with primary breast cancer in comparison to PET/CT and MRI alone.
Methods and Materials: 49 patients with biopsy-proven invasive breast cancer underwent a PET/CT and subsequently a PET/MR mammography. The corresponding datasets (PET/CT, MRI and PET/MRI) were rated separately by two radiologists with regard to detection or primary breast cancer lesions and lymph node metastases. Furthermore, the T-stage for each patient was determined. The sensitivity, specificity and diagnostic accuracy for PET/CT, MRI and PET/MRI were calculated and McNemar test was used to determine the significance of differences between the different imaging procedures.
Results: A total of 83 lesions (malignant=61; benign=22) were described. Sensitivity, specificity and diagnostic accuracy for the detection of primary breast cancer lesions were 85%, 91% and 87% for PET/CT, 95%, 73% and 89% for MRI and 93%, 86% and 92% for PET/MRI. PET/MRI and MRI showed identical results and defined the correct T stage in significantly more cases than PETCT (PET/MRI and MRI: 41/50, 82%; PET/CT: 34/50, 68%). Furthermore, in 18 (37%) of the 49 patients, lymph node metastases were present. Sensitivity, specificity and diagnostic accuracy for the identification of nodal positive patients were 78%, 94% and 88% for PET/CT, 67%, 87% and 80% for MRI and 78%, 90% and 86% for PET/MRI.
Conclusion: Integrated PET/MRI, combining the individual advantages of PET and MRI, is a promising imaging technique for local breast cancer staging using one single imaging method.

B-1184 15:04

Digital breast tomosynthesis for preoperative local staging of breast cancer in dense breasts

J. Krammer, K. Stepniewski, C.G. Kaiser, A. Schnitzer, S.O. Schoenberg, K. Wasser; *Mannheim/DE*

Purpose: To evaluate the diagnostic value of digital breast tomosynthesis (DBT) for preoperative local staging of breast cancer in dense breasts.
Methods and Materials: 55 patients with dense breasts (according to ACR 3 or 4) classified as BI-RADS 5 or 6 on conventional digital mammography or BI-RADS 0 with suspicious clinical findings were retrospectively included. One or two plain DBT was performed prior to surgery for further diagnostic workup (54 patients unilateral, 1 patient bilateral). DBT was compared to conventional mammography by two independent readers. Ultrasound, breast MRI, biopsy and histopathology served as reference standard.
Results: Invasive carcinomas were found in 56 breasts: 32 (57%) invasive ductal carcinomas, 17 (30%) invasive lobular carcinomas, 4 (7%) mixed tumour types and 3 (5%) other tumour types. 39/56 (70%) lesions were detected on both, conventional mammography and DBT, whereas 14/56 (25%) lesions were only seen on DBT. Three lesions were not detected on both imaging modalities including two invasive lobular carcinomas. DBT significantly changed size measurement in six (15%) lesions. Multifocal/multicentric disease occurred in 18 breasts. Conventional mammography had a sensitivity and specificity of 22% and 97% compared to 67% and 92% for DBT regarding the detection of multifocality or multicentricity. Of six breasts with multifocal/multicentric disease not detected on conventional mammography and DBT three had invasive lobular carcinoma.
Conclusion: Preoperative local staging of breast cancer in patients with dense breasts could substantially be improved using DBT compared to conventional mammography. Nevertheless, limitations have to be expected in case of lobular invasive carcinoma.

14:00 - 15:30 **Room Z**

Computer Applications

SS 1905

Methods for image interpretation and reporting

Moderators:
M. Fatehi; Tehran/IR
W.J. Niessen; Rotterdam/NL

K-28

Keynote lecture

W.J. Niessen; *Rotterdam/NL*

B-1186 14:09

IHE-compliant templates for structured reporting: first implementations

D. Pinto dos Santos, G. Klos, P. Mildenberger; *Mainz/DE*
(pintodossantos@uni-mainz.de)

Purpose: To develop a modular and open-source platform for the use of IHE-compliant HTML5-Templates in radiology reporting.
Methods and Materials: Keeping flexibility and the radiologists needs in mind we build a reporting environment using HTML/PHP/MySQL/JavaScript and the ZEND framework for ease of programming.
Results: software supports worklists generated by the PACS and is capable of handling any IHE-compliant Template. User input is stored in a MySQL database as well as formatted and outputted for use with the institutions RIS. To date we do not support speech recognition or import of measurements from other software but this could easily be integrated due to the modular architecture of the software.
Conclusion: Literature shows that in general clinicians and radiologists have a preference for "structured" reports. As vendors to our knowledge do not yet support generic interfaces to import IHE MRRT-compliant templates, we present our work in progress of development of an open-source reporting platform. Structured reporting could be crucial for the future of radiology. Not only would referring clinicians be more satisfied and value the work of radiologists more but also would it be able to build large well-organized and easily searchable databases of radiology reports for the use in research and teaching. We would like to encourage others to participate in the development.

B-1187 14:17

Free text reporting vs structured reporting of MRI of the pelvis in patients with rectal cancer: potential effects for surgical planning

M. Armbruster, J. D'Haese, M.F. Reiser, W.H. Sommer; *Munich/DE*
(marco.armbruster@med.uni-muenchen.de)

Purpose: To compare free-text reports vs. structured-reports of MRI of the pelvis in a cohort of patients with rectal cancer and to evaluate quality criteria and referring physician's satisfaction.
Methods and Materials: We included 28 patients with suspected rectal cancer who underwent an initial contrast-enhanced MRI examination for confirmation of the diagnosis and surgical planning. We acquired both standard free-text reports and structured-reports, which were performed with an online software with dedicated oncology templates and clickable decision trees with concomitant generation of structured reports. The template was specific for MRI of the pelvis to stage rectal cancer and included specific information relevant to both surgical and oncologic planning. All reports were evaluated with regard to sufficiency for surgical planning, unambiguousness of reported key features, and convenience of information extraction.
Results: Overall 28 structured and 28 free-text reports were reviewed by surgeons. Surgeons had sufficient information for surgical planning in 79% of structured and 18% of nonstructured reports. Reported key features were ambiguous in 14% of structured and 61% of nonstructured reports, whereas 7% of structured and 21% of nonstructured reports were considered to be incomplete. Convenience of data extraction was higher for structured reports in 92% of all cases (Fisher's-z-Test: $p < 0.005$).

Conclusion: Structured reporting of MRI of the pelvis in patients with rectal cancer facilitates surgical planning and potentially leads to a higher satisfaction of referring physicians.

Author Disclosures:
M. Armbruster: Founder; Founder of a software company. **W. Sommer:** Founder; Founder of a software company.

B-1188 14:25

Development of eye movement adaptation during the interpretation of CT studies from resident to specialist radiologists: a potential new tool to measure resident training progress

F.V. Bensch[1], J.K. Kaakinen[2], R. Bertram[2], L. Helle[2], N. Lundbom[1]; [1]*Helsinki/FI*, [2]*Turku/FI (frank.bensch@hus.fi)*

Purpose: To investigate the development of expertise in radiology by examining residents' and specialists' diagnostic performance and eye movements while viewing computed tomography (CT) studies.
Methods and Materials: Early phase residents of radiology (n=15; 10 female), advanced residents (n=14; 8 female), and specialists (n=12; 6 female) viewed 24 abdominal CT studies with a total of 70 lesions at either slow or fast speed. Eye movements and detection rates were recorded, and data analyzed by linear mixed effects models.
Results: All effects were significant at $p < .05$ level. Specialists' detection rate for lesions (60 % ± 6 %) was higher than residents', and advanced (55 % ± 9 %) higher than early residents' (49 % ± 11 %). Overall detection rates improved at slow (57 % ± 12 %) compared to fast (51 % ± 12 %) presentation speeds, although statistically significantly only for residents. Early residents' detection performance decreased with fatigue. Specialists and advanced residents showed longer fixation durations at fast vs. slow presentation speeds (specialists: 301 ms ± 1.15 ms vs. 297 ms ± 1.10 ms; advanced residents: 309 ms ± 1.16 ms vs. 300 ms ± 1.16 ms). Saccade lengths were shorter with a lesion present (3.12 ± 1.10) than without (3.18 ± 1.10); this effect was greater in specialists than in residents. Detection rates correlated with effects of lesion and presentation speed on saccade lengths.
Conclusion: Good detection performance is characterized by effective eye movement responses, making them potential parameters for measuring progress in resident training.

B-1189 14:33

Difference in attitudes towards radiology video reporting between inpatient/emergency medicine and subspecialty providers

J.D. Balkman, T.L. Cooke, E.S. Cooke; *Lebanon, NH/US (jshining@gmail.com)*

Purpose: Radiology video-reporting is not well-studied as a supplemental form of audio/visual communication between radiologists and referring clinicians. This work evaluates video reporting feedback obtained from inpatient medicine, emergency medicine, and several subspecialty providers.
Methods and Materials: An Institutional Review Board waiver was obtained. Video reports were created from plain film, CT, and MRI studies ordered by a total 15 attending-level physicians practicing in an academic setting within general inpatient medicine (five), emergency medicine (five), and subspecialty services including orthopaedics (one), trauma surgery (one), rheumatology (one), and oncology (two). Referring physicians graded the video reports on a five-point scale, where 5 = "very helpful, would definitely use again", and 1 = "not helpful, would not use again". Video reports in MP4 format were created shortly after the completion of the studies using SnagIt screen capture software, Philips iSite PACS, a standard dictaphone, and a dedicated website, www.rayvid.com created by the authors.
Results: All ten in-patient and emergency medicine physicians surveyed assigned a 5 rating to the videos, indicating the supplemental audio/visual reports were both very helpful and were definitely worth using again. The average rating for subspecialty providers was 3.4, a comparatively significant difference in mean value ($p = 0.008$).
Conclusion: Radiology video reporting may be more helpful to general inpatient and emergency medicine physicians compared with subspecialty providers. This may reflect the subspecialist's greater familiarity with specific types of radiologic studies, as in orthopaedics, where there is typically a greater comfort level reading musculoskeletal x-rays.

B-1190 14:41

Comparison of consumer grade, tablet and 6MP-displays: observer performance in detection of anatomical and pathological structures in panoramic radiographs

S. Kallio-Pulkkinen[1], M. Haapea[1], E. Liukkonen[1], S. Huumonen[2], O. Tervonen[1], M. Nieminen[1]; [1]*Oulu/FI*, [2]*Turku/FI (soili.kallio-pulkkinen@ppshp.fi)*

Purpose: To compare observer performance in detecting anatomical structures and pathology in panoramic radiographs using a consumer grade display (CG) and tablet (3rd generation iPad) under suboptimal, with reference to 6 MegaPixels display (6MP) under dim-lighting conditions.
Methods and Materials: Thirty panoramic radiographs were blindly evaluated on the three displays, CG and tablet under approx. 510 lx ambient light and 6MP under approx. 16 lx, by two observers with different amounts of experience. Dentino-enamel junction, dentinal caries and periapical inflammatory lesions, visibility of cortical border of the floor and pathological lesions in maxillary sinus were evaluated. Consensus between the observers was considered as reference. Intraobserver agreement was also determined. Proportion of equivalent ratings and weighted kappa were used to assess the reliability.
Results: Proportion of equivalent ratings with consensus did not differ between different displays for observer 1, but was higher with 6MP than CG or tablet in dentinal caries in upper (P=0.027) and lower (P=0.042) molars and periapical lesions in upper molar (P=0.005) for observer 2. Agreement of observer 1 increased from CG to 6MP (P=0.020) for pathological lesions in sinus. Observer 2 performed worse on tablet than 6MP in dentinal caries in lower (P=0.014) and periapical lesions in upper (P=0.012) molar. Intraobserver reliability was higher in detecting dentinal caries than periapical and maxillary sinus pathology.
Conclusion: A dentist with less experience in interpreting panoramic radiographs may be more dependent on the high-quality display used under optimal viewing conditions compared to a more experienced dentist.

B-1191 14:49

Patient lifetime graphs as an aid to subsequent image interpretations

D.J. Vining[1], A. Pitici[2], A. Prisacariu[2], C. Popovici[2]; [1]*Houston, TX/US*, [2]*Chapel Hill, NC/US (dvining@mdanderson.org)*

Purpose: To create a patient lifetime graph that illustrates multidisciplinary information from prior imaging, surgery, chemotherapy, and radiation therapy to aid a radiologist with rapid access to that data during subsequent image interpretations.
Methods and Materials: We developed a multimedia structured reporting system, called ViSion, that records key images and voice descriptions of image findings, tags the images with metadata defined by an ontology, and assembles a multimedia structured report. The system is applicable to any image-based medical specialty, including radiology, pathology, cardiology, gastroenterology, oncology, radiation therapy and surgery. The system provides the ability to link radiological disease metrics from serial exams to generate disease response timelines, such as Response Evaluation Criteria in Solid Tumours (RECIST), with overlays of icons representing major medical events to create a patient lifetime graph. Details from prior medical events are easily accessible using this interactive display. Furthermore, ViSion provides a means to data mine information contained in the disease timelines and lifetime graphs to yield outcomes in cohorts of patients.
Results: Review of prior imaging exams, clinical information, and disease response criteria during a radiologist's interpretation of new imaging exams can be tedious and time-consuming. We have developed a multimedia structured reporting system with a patient lifetime graph feature that enables rapid access to prior medical events and information.
Conclusion: Patient lifetime graphs incorporating multidisciplinary information may improve the efficiency and accuracy of radiology reporting.

Author Disclosures:
D.J. Vining: CEO; VisionSR, Inc. Founder; VisionSR, Inc. Shareholder; VisionSR, Inc. **A. Pitici:** Employee; Eloquentix, Inc. **A. Prisacariu:** Employee; Eloquentix, Inc. **C. Popovici:** Employee; Eloquentix, Inc.

B-1192 14:57

Comparing the utility and usability of the Microsoft Kinect and Leap Motion sensor devices in the context of their application for gesture control of biomedical images

P. Hughes, N. Nestorov, N.A. Healy, N. Sheehy, N. O'Hare; *Dublin/IE (phughes@tcd.ie)*

Purpose: Interaction with medical images while maintaining asepsis imposes certain restrictions on the scrubbed clinician when using the traditional mouse and keyboard. Touch-free image control systems, based on Commercial Off-The-Shelf (COTS) sensors such as the Microsoft Kinect and Leap Motion, could enable the clinician to assume direct control of medical image navigation and manipulation while maintaining sterility.
Methods and Materials: Surgeons and radiologists trialled the Leap Motion and Microsoft Kinect as part of a pre-commercial Natural User Interface (NUI) system. The usability and utility of the two input devices were compared. Additional feedback was obtained on the perceived utility of both systems. The speed and accuracy of the two controllers for anatomical structure measurement were compared with those of a standard computer mouse.
Results: Data analysis showed marginal to average acceptability of both devices. Microsoft Kinect was found to have better utility and usability, particularly for Surgeons and Interventional Radiologists. The accuracy of the Leap Motion sensor was superior and comparable with that of a computer mouse. Also, a link was found between the system usability and the perception of utility with better perceived usability translating into better perceived utility. Specific advantages and limitations of each device are highlighted.
Conclusion: Advanced, touch-free NUI image control systems, based on low-cost COTS sensors, are available and prospectively useful for interacting with biomedical images in sterile clinical setting. Further research is required to establish design specifications, installation guidelines and user training requirements that can ensure successful deployment.

Author Disclosures:
N. Nestorov: Author; N Nesterov is employed by Telefonica Ireland whose parent, Telefonica S.A., has a share in the start-up company TedCas Medical Systems, which supplied the system used in the research.

B-1193 15:05

Development of a publicly accessible Bayesian CADx algorithm for mammographic mass lesions based on the breast imaging: reporting and data system (BI-RADS) lexicon

M. Benndorf[1], E. Kotter[1], M. Langer[1], C. Herda[2], Y. Wu[3], E. Burnside[3]; [1]*Freiburg/DE*, [2]*Graubünden/CH*, [3]*Madison, WI/US (matthias.benndorf@uniklinik-freiburg.de)*

Purpose: We aim at the development and validation of a publicly accessible computer assisted diagnosis (CADx) algorithm for mammographic mass lesions based on a standardized descriptor terminology (BI-RADS lexicon).
Methods and Materials: We process a training dataset of 1276 mammographic mass lesions (138 malignant) and a validation dataset of 1177 mass lesions (175 malignant). Both datasets were consecutively acquired between 2005 and 2011. Reference standard was established by matching with a cancer registry or follow-up information > 365 days. We induce naïve Bayes classifiers from the training dataset, we account for internal validity by 10-fold cross validation. Model1 features morphological BI-RADS descriptors, BI-RADS assessment categories and patient age as predictive variables. Model2 features morphological BI-RADS descriptors and patient age as predictive variables. We apply Model1 and Model2 to the validation dataset and perform ROC analysis for both models.
Results: Model1 yields an AUC of 0.959 in the training dataset, Model2 here yields an AUC of 0.910 ($P < 0.001$). Model1 is superior to the clinical performance (BI-RADS categories alone, $P < 0.001$), Model2 performs similar. When applied to the validation dataset, Model1 yields an AUC of 0.935, Model2 here yields an AUC of 0.876 ($P < 0.001$). Again, Model1 is superior to the clinical performance ($P < 0.001$), Model2 performs similar.
Conclusion: We consider our CADx algorithm a step towards a more standardised interpretation of combinations of morphological BI-RADS descriptors. We provide our CADx algorithm at www.ebm-radiology.com/nbmm/index.html.

Author Disclosures:
M. Benndorf: Research/Grant Support; DFG 5474/1-1. **E. Burnside:** Research/Grant Support; NIH R01LM010921, NIH R01CA165229.

B-1194 15:13

Is PI-RADs-score more accurate versus DWI+T2w at 3 T MRI of the prostatic gland: analysis according to 189 MR-guided prostate biopsies

A. Malich; *Nordhausen/DE (ansgar.malich@shk-ndh.de)*

Purpose: PIRADS-score was established with equivalent importance of DWI/T2w/CAD-based dynamic-MRI at prostatic MRI. Study aimed to verify, whether DWI+T2w is similar accurate to PIRADS, based on MR-guided biopsy proven cases.
Methods and Materials: 189 prostatic lesions were histologicaly verified by MR-guided biopsy (3 T MRI Philips/Ingenia) according to multiparametric MRI (dynamic analysis by DynaCAD/Confirma-CAD/Sentinel-CAD). PI-RADs-scheme of all features and the sum T2w+DWI were matched to histopathology. A sum of 10 (DWI+T2w+CE-MRI) and 7 (DWI+T2w) were used as cut off.
Results: Outcome was: 71/189 lesions invasive-malignant, 14/189 ASAP, 39/189 prostatitis, 31/189 hyperplasia, 34/189 other benign entities. In 2/71 PCA PI-RADS sum of 9 was found; in 4 cases 10 pts., 7x11 pts.; 13x12 pts.; 12x13 pts.; 6x14 pts.; 27x15 pts. Using T2w+DWI only, 1 lesion had 5 pts.; 1x6 pts, 8x7 pts.; 16x8 pts, 11x9 pts and 34x10 pts. 1 ASAP-case had 9points (PIRADS) and 6 points (DWI+T2w). Out of the prostatitis-cases 2 had a PI-RADS-sum of 14/15; 25 were in the range of 10-13 and 12 with 10 pts. or less. For T2w/DWI only, 4 lesions had a sum of 9/10; 24 7/8 and 11 less pts. Hyperplastic nodules were scored according to PIRADs with 14/15 pts 3x; 10-13 pts 22x and less in 6 cases: DWI+T2w showed 6 hyperplastic nodules with 9/10 pts., 18x7/8points, remaining less. According to suggested Cut off values PPV was: PIRADS: 82/162 (50.6%); DWI/T2w: 82/157 (52.2%); Sensitivity: PIRADS: 82/85 (96.5%); DWI/T2w: 82/85 (96.5%).
Conclusion: At least in case of contraindications for contrast agent application, reliable prostate-MRI can be obtained without CAD-based contrast-uptake analysis without a lowered sensitivity.

B-1195 15:21

The impact of peer-review introduction on the subsequent publication rate and impact factor of presentations at national radiology meetings

A.M. Cahalane, Y. Purcell, D.E. Malone, E.J. Heffernan; *Dublin/IE (yvonne.purcell@gmail.com)*

Purpose: Scientific research underpins evolution of medical knowledge. Presentation of research findings at scientific meetings is the first step in the promulgation of information. Wide variation in subsequent publication rates of these presentations has been demonstrated. Peer review is now applied almost universally prior to acceptance of submissions. Our objective was to appraise the impact of introducing peer review of material submitted to national radiology meetings, from the perspective of subsequent publication rates and journal impact factor.
Methods and Materials: Proceedings of all national radiology meetings conducted in a single year prior to the introduction of peer review were reviewed, and all presentations from domestic academic teaching hospitals (ATH) subsequently published in Medline-indexed journals were identified. These results were tabulated and the ultimate publication rates and impact factor of the relevant journals were recorded. This process was repeated for several years after the introduction of a formal peer-review process. A comparison of publication rates and journal impact factor between the non-peer review and peer-review cohorts was then conducted.
Results: 8/47 presentations from ATH were ultimately published in the period prior to peer-review introduction (17%), with an average journal impact factor of 2.513. After the introduction of peer review, 41/209 presentations (19.6%) from ATH were ultimately published in journals with an average impact factor of 1.9.
Conclusion: Despite the introduction of peer review for material submitted for presentation to a series of national radiology meetings, the ultimate publication rate of those presentations accepted increased only slightly while average journal impact factor fell.

14:00 - 15:30 **Room M**

Abdominal Viscera

SS 1901b

Liver CT and ultrasound: new techniques

Moderators:
M. Laniado; Dresden/DE
V. Vandecaveye; Leuven/BE

B-1196 14:00

Preoperative CT texture analysis predicts outcome in patients with colorectal liver metastases post liver resection

A. Schulz[1], K. Skogen[1], A. Bethke[1], K.J. Labori[1], B. Ganeshan[2], N.-E. Kløw[1], J.B. Dormagen[1]; [1]*Oslo/NO*, [2]*London/UK (anselm.schulz@gmail.com)*

Purpose: To evaluate parameters derived from CT texture analysis (CTTA) as novel predictors of outcome for patients with colorectal liver metastases (CRLM) prior to liver resection.
Methods and Materials: Forty-six patients with CRLM prior to liver resection were retrospectively evaluated. Median tumour size was 3.0 cm (range 0.8-18.0 cm) and median number of CRLM per patient was 2.0 (range 1.0-11.0). CTTA of the CRLM with the largest diameter per patient was performed in portal phase using TexRAD, a commercially available research software (www.texrad.org, Somerset, UK). Mean gray-level intensity (M); standard-deviation, entropy (E), skewness and kurtosis were evaluated at different spatial scale filter (SSF) values corresponding to features of different sizes/radius (without-filtration, SSF=0; fine, SSF=2 mm; medium, SSF=3 mm; coarse, SSF=4 mm). Kaplan-Meier (KM) analysis was performed to identify the best predictors of overall survival (OS) and recurrence-free survival (RFS). Multivariate-Cox-Regression (CR) was performed to verify the predictors as independent risk factors.
Results: M and E were the best predictors of OS and RFS. Patients with lower unfiltered M values (threshold 58.8) had shorter OS (mean 1306 vs 1873 days p=0.009/0.01KM/CR resp). and the hazard ratio was 6.6 (1.58-27.90). Patients with higher E at fine texture scale (threshold 4.9) had poorer RFS (mean 1358 vs 557 days p=0.002/0.036 KM/CR resp). and the hazard ratio was 3.3 (1.09-10.26).
Conclusion: CTTA showed promising results in predicting outcome prior to liver resection for CRLM with the potential to be a novel and independent preoperative predictor of both OS and RFS. Further research is needed to validate these preliminary findings/thresholds.

Author Disclosures:
B. Ganeshan: Shareholder; of TexRAD Ltd, a supplier of texture analysis software for medical images.

B-1197 14:08

The optimal body size index for determining the iodine dose for hepatic dynamic CT: a prospective multicenter study using hierarchical multivariate linear regression analysis

K. Awai[1], M. Kanematsu[2], K. Tonsok[3], T. Ichikawa[4], K. Yoshioka[5], T. Mochizuki[6], N. Matsunaga[7], Y. Yamashita[8]; [1]*Hiroshima/JP*, [2]*Gifu/JP*, [3]*Osaka/JP*, [4]*Chuo/JP*, [5]*Morioka/JP*, [6]*Matsuyama/JP*, [7]*Ube/JP*, [8]*Kumamoto/JP*

Purpose: To identify the most optimal body size parameter to determine the contrast medium (CM) dose for hepatic dynamic computed tomography (CT) in a large patient population enrolled in a multicenter study.
Methods and Materials: This prospective study was approved by the ethics committee of each of the 31 participating institutions where 1,342 patients were enrolled. All underwent hepatic dynamic CT including pre-enhanced-, hepatic arterial phase (HAP)-, and portal venous phase (PVP) scanning under the routine scan protocols of each institute. Changes in the CT number (in Hounsfield units, HU) per gram of iodine in the aorta and liver [eA/I, eL/I; HU)/g] during HAP and PVP scans were recorded for each patient. We performed hierarchical multivariate linear regression analysis in which the outcome variable was eA/I or eL/I; the independent variables were the age, sex, one body size parameter (height, body weight, body mass index, lean body weight [LBW], body surface area), and liver function. We used a two-level hierarchical model where patients were level 1 and the institute was level 2.
Results: All body size was significantly correlated with eA/I and eL/I ($p < 0.001$). LBW manifested the strongest correlation with eA/I and eL/I ($r = -0.561$ and -0.601, respectively). Our gender-stratified analysis showed that in females the LBW exhibited a stronger correlation with eA/I and eL/I ($r = -0.779$ and -0.948, respectively) than in the non-stratified total population.
Conclusion: LBW was the most optimal body size index for determining the CM dose for hepatic dynamic CT.

Author Disclosures:
K. Awai: Research/Grant Support; Bayer Yakuhin Ltd. **Y. Yamashita:** Research/Grant Support; Bayer Yakuhin Ltd.

B-1198 14:16

Reproducibility and variability of very low-dose hepatic perfusion CT in metastatic liver disease

O. Topcuoglu, M. Ozmen, E. Topcuoglu, M. Karcaaltincaba, D. Akata; *Ankara/TR (omtopcuoglu@gmail.com)*

Purpose: The purpose of this prospective study was to determine the intra- and interobserver agreement on the perfusion measurements of very low-dose hepatic perfusion CT (pCT) and to evaluate whether very low-dose pCT can be utilized in routine clinical practise for repeated perfusion examinations.
Methods and Materials: 53 pCT examinations were obtained from 21 patients (16 men, 5 women; mean age, 60.4 years) with proven liver metastasis from various primary cancers. PCT examinations were analyzed by two readers independently and perfusion parameters were noted for whole liver, whole metastasis, metastasis wall and normally looking liver. Readers repeated analysis after an interval of 1 month. Intra- and interobserver agreement were assessed with intraclass correlation coefficients (ICC) and Bland-Altman statistics.
Results: The mean ICC between readers was 0.91, 0.93, 0.86, 0.45, 0.53 and 0.66 for BF, BV, permeability, ALP, PVP and HPI, respectively. The mean ICC between readings was 0.86, 0.91, 0.81, 0.53, 0.56 and 0.71 for BF, BV, permeability, ALP, PVP and HPI, respectively. There was greater agreement on the parameters measured for the whole metastasis than the parameters measured for the metastasis wall. The effective dose of all pCT examinations was 2.9 mSv.
Conclusion: Hepatic pCT with an effective dose of 2.9 mSv can be utilized for assessing therapy response in cancer patients requiring multiple perfusion examinations. There is greater intra- and interobserver agreement for BF and BV than permeability, ALP, PVP, HPI, which seems to be more appropriate using these measurements for deciding positive or negative response.

B-1199 14:24

Small-size low-contrast liver lesion detectability: dual energy CT (DECT) versus conventional CT

G. Van Gompel, N. Buls, P. Covens, J. de Mey; *Brussels/BE (Gert.vangompel@uzbrussel.be)*

Purpose: To assess the detectability of small-size low-contrast liver lesions using a humanoid contrast-detail phantom.
Methods and Materials: A total of 25 holes with diameters (3, 2, 1.5, 1, 0.6 mm; five times each) drilled in rods of a Rando-Alderson (RA) phantom, were filled with diluted contrast agents (0.5, 1, 2, 3, 6 mgI/ml, five times each) to obtain 25 different concentration-diameter combinations. The rods were inserted in a liver section by a 5x5 matrix with 5 mm interdistance. The phantom was scanned (HD750, GE Healthcare) with multiple CT (120-100-80 kVp) and DECT acquisitions at constant dose level ($CTDI_{vol}$ 17.7 mGy). Figure of merit is the area under the contrast-detail curves (AUC) obtained from an observer detection study (0 and 1 reflect minimal and maximal detectability). Furthermore, the contrast-to-noise ratio (CNR) was computed from CT value and noise measurements in the 3 mm-6 mgI/ml hole and background tissue. With DECT we evaluated monochromatic keV reconstructions and iodine images.
Results: For DECT acquisition, the monochromatic 70keV (AUC 0.21) showed a slightly improved detectability compared to 40keV and iodine images (both AUC 0.15). Detectability with CT at 80 kVp (AUC 0.42) was superior compared to DECT 70keV images (AUC 0.21) and in lesser amount compared to 100 kVp and 120 kVp (AUC 0.32 and 0.29, respectively). The good correspondence (correlation 0.71) of AUC with the objective CNR measurements confirms these results.
Conclusion: For small-size low-contrast lesion detection, low-kVp acquisitions might be preferred above DECT acquisition as detection in DECT images is hindered by increased noise levels and blob-like noise texture.

Author Disclosures:
G. Van Gompel: Speaker; Speaker at DECT workshop GE Healthcare. **N. Buls:** Speaker; Speaker at DECT workshop GE Healthcare.

B-1200 14:32

Performance of ultrasonic transient elastography for the noninvasive assessment of liver steatosis

M. Lupsor-Platon, D. Feier, H. Stefanescu, A. Tamas, E. Botan, R. Badea; *Cluj Napoca/RO (mmlupsor@yahoo.com)*

Purpose: A novel non-invasive tool based on the evaluation of ultrasound attenuation using transient elastography (TE) has been developed, called controlled attenuation parameter (CAP). We aim to establish CAP performance in predicting each steatosis grade on a group of biopsied chronic liver diseases (CLD) patients.
Methods and Materials: We prospectively analyzed 201 consecutive CLD patients (118 with HCV, 48 HBV, 24 NASH, 11 autoimmune hepatitis) which underwent CAP measurements using TE. Liver fibrosis, necro-inflammatory activity and steatosis were staged and graded through the pathological analysis of bioptic specimens. Steatosis was assessed as: S0: steatosis in less than 10% of hepatocytes, S1: 11-33%, S2: 34-66% and S3: 67%-100%.
Results: Of the histopathologic parameters, CAP correlated significantly only with steatosis ($r=0.568$, $p < 0.0001$). No correlation was found between CAP and fibrosis, activity, ballooning, or lobular inflammation. The median (range) CAP values (dB/m) according to the steatosis grades were: 212 (124-359) for S0; 266 (153-353) for S1; 304 (215-359) for S2 and 321 (218-377) for S3. The differences were statistically significant between all the steatosis grades, except S2 vs S3. CAP performance in quantifying liver steatosis was: for S≥1 AUROC= 0.813 (cutoff=260, Se=64.84%, Sp=87.27%, PPV=80.8%, NPV=75%, +LR=5.09, -LR=0.40); for S≥2 AUROC=0.822 (cutoff=285, Se=69.70%, Sp=85.12%, PPV=47.9%, NPV=93.5%, +LR=4.68, -LR=0.36) and for S=3 AUROC=0.838 (cutoff=294, Se=83.33%, Sp=82.54%, PPV=23.3%, NPV=98.7%, +LR=4.77, -LR=0.20).
Conclusion: CAP is a non-invasive ultrasonographic method for steatosis prediction, with AUROC between 0.813-0.838. It could be useful clinically especially to exclude significant steatosis grades, with a negative predictive value of 93.5-98.7%.

B-1201 14:40

Acoustic radiation force impulse (ARFI) imaging in the pre-operative liver function evaluation in patients candidate to liver resection

S. Crosara, M. D'Onofrio, A. Ruzzenente, S. Valcanover, R. Pozzi-Mucelli; *Verona/IT (ste_cros@yahoo.it)*

Purpose: The purpose of the present study is to evaluate ARFI application in the pre-operative liver function assessment in patients candidate to liver resection.
Methods and Materials: The study included thirty-eight patients candidate to liver resection. Liver function was preoperatively evaluated by means of biochemical analyses (transaminases, gamma-glutamyltransferase, total bilirubin, plasma albumin, plasma sodium, PTT-INR), dynamic biochemical analyses (ICGR15), liver volumetry CT evaluation and liver stiffness measurement by means of ARFI elastography. Surgery-related variables (minor or major hepatectomies; blood loss entity) and post-operative parameters (morbidity, mortality, major post-operative complications and extralesional liver fibrosis pathologic assessment) have also been considered.
Results: ARFI elastography shows a statistically significant correlation with pre-operative bilirubin level (p=0.001), ICGR15 (p=0.02) value and MELD score (p=0.04). In post-operative patient monitoring, ARFI elastography shows a statistically significant correlation with post-operative liver-related complications development (p=0.001), specifically ascitis (p=0.03) and post-operative liver failure (p=0.009).
Conclusion: ARFI elastography can be applied to the pre-operative liver function evaluation in patients candidate to liver resection, in order to estimate the risk of post-operative liver-related complications.

B-1202 14:48

Differential diagnosis of polypoid lesions of the gallbladder using contrast-enhanced ultrasonography

X.-S. Liu, L.-H. Gu, J. Du, J.-G. Xia, F.-H. Li; *Shanghai/CN (cedarsky@163.com)*

Purpose: To evaluate the usefulness of real-time contrast-enhanced ultrasonography (CEUS) and micro-vascular imaging (MVI) for the differential diagnosis of neoplastic and non-neoplastic polypoid lesions of the gallbladder (PLGs).
Methods and Materials: Real-time CEUS and MVI were performed in 128 patients with PLGs larger than 6 mm in diameter. The enhancement pattern, MVI types, and kinetic parameters were analyzed on CEUS. The maximum diameters of the lesions measured by ultrasonography (US) and CEUS were also recorded and subjected to comparative analysis.
Results: Of the 128 patients, histological diagnosis was obtained in 83 patients (27 neoplastic PLGs and 56 non-neoplastic PLGs), which comprised the study group. On CEUS, mild enhancement and absence of contrast agent were more easily found in non-neoplastic PLGs (12 [21.4%]), whereas all neoplastic PLGs showed marked enhancement extent (44 [78.6%]; $P= 0.006$). Of the 27 neoplastic polyps, six malignant tumours had a perfusion defect seen on CEUS, whereas none of the non-neoplastic PLGs showed perfusion defect ($P= 0.003$). The microvascular architecture of the lesions was categorized into four types: spotty, linear, branched, and spinous, and there were significant differences between the two groups ($P < 0.001$). For kinetic evaluation, none of the parameters reached statistical significance (all $P > 0.05$). There was a discrepancy in maximum diameters between US and CEUS in both groups but the discrepancy was significantly larger in the non-neoplastic group ($P= 0.026$).
Conclusion: CEUS is a useful imaging technique and an adjunct to US for the differential diagnosis of neoplastic and non-neoplastic PLGs.

B-1203 14:56

Colour-coded perfusion imaging with CEUS for evaluation of the post-interventional success following trans-arterial chemoembolisation (TACE) and ablative techniques of liver lesions: first results

J. Rennert, C. Niessen, C. Stroszczynski, E.M. Jung; *Regenbsurg/DE (jarennert@yahoo.de)*

Purpose: To evaluate the success of interventional treatments of liver tumours using a colour-coded perfusion quantification software with CEUS.
Methods and Materials: In 26 malignant liver lesions (22 Patients, age 20 - 69 years, mean 59.4 years) CEUS was performed using a multifrequency probe (1-5 MHz) within 24 hours following interventional treatment (3 TACE, 14 IRE, 5 RFA). The digitally stored cine loops of the tumour microvascularisation were evaluated retrospectively using a perfusion software (VueBox, BRACCO, Italy) regarding time to peak (TTP), mean transit time (mTT), peak enhancement (pE) and Wash-in Area Under the Curve (WiAUC). Each parameter was analyzed in the center and border area of the lesion. In 18 lesions, each parameter was additionally evaluated in the tumour periphery. Statistical evaluation was performed using the Wilcoxon-test.
Results: The pre-interventional tumour size ranged from 11 mm to 55 mm, mean 26 mm in diameter. The post-interventional defect size ranged from 11 mm to 73 mm, mean 38 mm. In all patients, a post-interventional reduction of the tumour microvascularisation was observed. Regarding the WiAUC ($p < 0.05$) and TTP ($p < 0.01$) the differences between center of the lesion vs. border area and periphery were found to be statistically significant. Evaluation of mTT showed no significant difference between center, border area or periphery whereas for pE the differences between center and border area were also found to be statistically significant ($p < 0.05$).
Conclusion: CEUS with perfusion imaging offers new possibilities for the measurement of results following interventional treatment of liver lesions.

B-1204 15:04

Liver stiffness evaluation after radioembolisation by real-time Shear-wave elastography

A. Bas, C. Samanci, F. Gulsen, F. Ustabasioglu, M. Cantasdemir, L. Kabasakal, F. Kantarci, F. Numan; *Istanbul/TR (dr.ahmetbas@hotmail.com)*

Purpose: To evaluate shear-wave elastography for the assessment of liver fibrosis after radioembolisation in patients with liver malignancy.
Methods and Materials: We prospectively examined 17 adult patients to evaluate shear-wave elastography (SWE) in the pre- and post-radioembolisation (RE) periods between June 2012 and September 2013. All of the patients underwent SWE within 1 month before and 3 months (96.3 ± 22.9 days) after RE. Measurements were made in segments III, IV, V and VI representing the the left lobe lateral and medial, right lobe anterior and posterior, respectively. Liver stiffness was studied in 39 segments that received treatment.
Results: The mean liver tissue stiffness on pre- RE SWE measurements was not different from post- RE SWE measurements in segments where RE was not performed. Conversely, segments that were treated with RE were significantly stiffer on post-RE SWE measurements (mean SWE, 17.4 kPa) compared with baseline measurements (mean SWE, 7.0 kPa) ($p < 0.001$). Patients with hepatocellular carcinoma (HCC)and pre-existing hepatitis B and C virus infection had higher pre-embolisation stiffness values and the postembolisation stiffness measurements of the treated segments were higher than those of the rest of the study population.
Conclusion: Our study results showed that liver stiffness measurements by SWE increase as early as the 3rd post-RE month. We suggest that SWE could be used as a non-invasive, complementary imaging method for the preliminary assessment of liver fibrosis in pre- and post-RE patients.

B-1205 15:12

Future liver remnant volume estimation after portal vein embolisation and contralateral application of stem cells

J. Ludvík, J. Ferda, P. Duras, V. Tře ka, J. Brůha, D. Lysák; *Plzeň/CZ (jardalud@seznam.cz)*

Purpose: This study aimed to evaluate progress of so-called future liver remnant volume (FLRV) in patients with liver metastasis of cololorectal cancer after portal vein embolisation (PVE) with subsequent application of haematopoietic stem cells (HSC) and compare it with control group of patients with liver metastasis of colorectal cancer after PVE without HSC.
Methods and Materials: Fourteen patients (11 men, 3 women, mean age 63.6 year with range 51-75) with liver metastasis of colorectal cancer underwent between years 2009-2014 the PVE with the application of autologous HSC to the non-embolised branch of portal vein after 1-2 days. CD 133+ and CD 34+ HSC were collected from perifery blood after stimulation by G-CSF or obtained by direct sampling from blood marrow. CT liver volumometry was performed 7., 14. and 21.day after application of HSC and thereafter FLRV was determined. A sample of sixteen patients (11 men, 5 women, mean age 63.4 year with range 46-78) with liver metastasis who underwent only PVE without HSC application was used as a control group.
Results: FLRV grew up mean by 189.21 ml (standard deviation = 93.03) during 3 weeks after utilisation of PVE/HSC technique, whereas by 78.81 ml (standard deviation = 71.45) after performation PVE solely (p value = 0.001).
Conclusion: PVE with subsequent application of HSC facilitates significantly quicker, more progressive and more reliable growth of FLRV in comparison with PVE exclusively. This method is one of a new approaches to increasing of resectability of liver tumours.

B-1206 15:20

An experimental study on the relationship between the haemodynamic changes and liver regeneration based on a rat model of different degrees of portal vein stenosis following 70% partial hepatectomy

L. Yang, Y. Luo; *Chengdu/CN (yllivy@163.com)*

Purpose: To establish a rat model of different degrees of portal vein stenosis (PVS) following 70% partial hepatectomy (PH). Try to explore the relationship between the haemodynamic changes and liver regeneration.
Methods and Materials: Rats were subjected to sham operation group; simple 70%PH (A); mild, moderate, severe PVS following 70%PH (B, C, D,). The diameter and velocity of portal vein at the prestenotic (PVDpre, PVVpre) and stenotic site (PVDs, PVVs) were detected by ultrasound on days 1, 3, 7, 14 after surgery. The ratio of diameter (DR) and velocity (VR) were also calculated. Liver regeneration rate (LRR), PCNA and Ki67 were applied to evaluate regeneration status.
Results: DR increased with the aggravating stenosis degree and changed little over time.The LRR of groups A and B reached above 90% on the 14th day, leaving group C and D remained respective (83.36±27.32) % and (70.99±5.71) %. PCNA and Ki67 in PVS groups increased on the 1st day after operation and peaked on the 3rd day, then fell. While, they kept low expression in group D in the whole experiment. The results of linear regression analysis showed a negative correlation between DR, VR and LRR, whose correlation coefficient was respective -0.509 and -0.522.
Conclusion: Ultrasonography can well demonstrate the PVD and PVV changes of rats in different degrees of PVS. The PVDs, DR and VR can reflect the stenosis degree of PV to some extent. Different degrees of PVS had an effect on liver regeneration, which can be reflected by ultrasound haemodynamic parameters indirectly.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 1910

Knee

Moderators:
L. Cerezal; Santander/ES
L.M. Sconfienza; San Donato Milanese/IT

K-29

Keynote lecture

M. Mechl; *Brno/CZ*

B-1207 14:09

Smaller volume of anterior cruciate ligament increases the risk of anterior cruciate ligament injury: a MRI based case-control study

P.S. Mahajan[1], N.M. Al Moosawi[2], Y.S. Al Nahedh[2]; [1]*Doha/QA*, [2]*Kuwait City/KW (mdfrcr@gmail.com)*

Purpose: To test if anterior cruciate ligament (ACL) volume is smaller in persons who have suffered a non-contact ACL injury than that of matched controls.
Methods and Materials: Using three-dimensional spoiled gradient-echo sequence, ACL contour was traced and its volume calculated in sagittal magnetic resonance images, in contralateral healthy knees of 100 subjects who had non-contact ACL injury and in 100 controls matched for height, weight, age, gender and ethnicity. Regression analysis was performed to estimate ACL volume difference between injured and control groups. Interobserver and intraobserver variation was studied.
Results: Average volume of contralateral healthy ACL for injured group was significantly smaller than for the controls. At an average body weight of 89.3 kg, subjects with non-contact ACL injury had an average contralateral normal ACL volume of 1899cubic-mm. The corresponding control group had an average volume of 2180cubic-mm. There was a difference of 281cubic-mm between the two groups after adjusting for weight. In the regression analysis, ACL volume was found significantly proportional to body weight and not significantly associated to height, gender, age, and ethnicity. Moderate interobserver and intraobserver correlation was observed.
Conclusion: This is the second and the largest study in the literature. It establishes presence of morphological differences between knees of ACL-injured and healthy subjects. This in turn suggests that a smaller ACL is also a weaker one and more prone to injury.

B-1208 14:17

Lateral patellar tilt: the best measurement to unmask patellar maltracking with weight-bearing MRI

S. Mariani, F. Arrigoni, A. La Marra, L.M. Gregori, A. Barile, C. Masciocchi; *L'Aquila/IT (mari.silvia@hotmail.it)*

Purpose: To prove that LPT, during WB-MRI, may unmask a patello-femoral maltracking with respect to standard-MRI.
Methods and Materials: We collected 95 patients (age 16-26 years), divided in 2 groups: Group A (control group) of 20 patients clinically negative, and Group B of 75 patients clinically suspected of chronic patellar maltracking. All patients underwent a dedicated MRI, in supine and WB position, with a knee flexion of 12°-15°. We used the measurement (performed by Carestream Vue Solutions 11.3 system) of the LPT and, for statistical analysis, quantitative and qualitative tests (ANOVA, Friedman, Kappa of Cohen and Coefficient of variations from duplicate measurements) to compare the standard and WB-MRI data.
Results: Group A patients showed no statistically significant variations for the LPT both on standard and WB-MRI. On the basis of standard MRI, Group B patients were divided in Group B1 (49 pts) (LPT negative) and in Group B2 (26 pts) (LPT positive). After WB-MRI, patients of Group B1 were divided in Group B1a (16 pts) if they remained LPT negative and in Group B1b (33 pts) if they became positive at the LPT measurement. Patients of Group B2 confirmed to be LPT positive at WB-MRI. Qualitative analysis demonstrated that LPT was a predictive measurement (K=0.278) between standard and WB-MRI. Quantitative analysis showed that LPT (for Group B1b=60.3%) represents a great reproducible and clinically useful measurement.
Conclusion: The study demonstrates the high diagnostic value of WB-MRI in unmasking PF-maltracking and the predictive value of LPT measurement.

B-1209 14:25

Diagnostic value of the meniscal stability of the knee: weight-bearing MRI vs arthroscopy

A. La Marra, S. Mariani, F. Arrigoni, L.M. Gregori, F. Smaldone, A. Barile, C. Masciocchi; *L'Aquila/IT (alicelm@hotmail.it)*

Purpose: To assess the role of dedicated low-field standard (1.5 t) and weight-bearing MRI in the evaluation of stable or unstable traumatic tears of medial meniscus in comparison with arthroscopy.
Methods and Materials: We evaluated 3500 knee MRI scans performed with a high-field.Based on clinical and imaging diagnosis, we selected two groups (A-B). In group A 70 patients of normal knee and in group B 275 pts with clinical evidence of medial meniscus traumatic lesions. All patient after conventional exam underwent upright weight-bearing MRI. 275 patients had an arthroscopy between 7 and 21 days after diagnostic examination.
Results: In group A there were no anatomical variations of the signal intensity, position and morphology of the Medial Meniscus. In group B the 1.5 T MRI showed in 32 cases (B1) a meniscocapsular separation, in 106 (B2) a longitudinal lesion, in 67 (B3) horizontal lesion and in 70 a radial tear (B4).In B1 w-b MRI showed unstable tear in all 32 cases. In B2, w-b MRI showed unstable tear in 89 /106 patients. In B3, w-b MRI showed an unstable meniscal tear in 45/67 cases. In group B4 w-b MRI showed an unstable meniscal tear in 45/70 cases.In all cases of group B1-B2 and B3 arthroscopy confirmed w-b MRI diagnosis.In group B4 arthroscopy showed unstable tear in 65/70 cases (20 were false negative).
Conclusion: This new approach to meniscus pathology gives a better management of a diagnostic- therapeutic approach in which standard MRI has not played a key role, so far.

B-1210 14:33

Association of MRI features with development of radiographic knee osteoarthritis in early knee osteoarthritis patients

K. van Oudenaarde[1], B. Jobke[2], M. Kloppenburg[1], A. Oostveen[3], A.-K. Marijnissen[4], J. Wesseling[4], S. Bierma-Zeinstra[5], H. Bloem[1], M. Reijnierse[1]; [1]*Leiden/NL*, [2]*Heidelberg/DE*, [3]*Almelo/NL*, [4]*Utrecht/NL*, [5]*Rotterdam/NL (kvanoudenaarde@lumc.nl)*

Purpose: To investigate which MRI features are associated with radiographic OA development in knees with OA related complaints.
Methods and Materials: In 148 participants of Cohort Hip En Cohort Knee (CHECK, mean age 56 years, 78% women), with OA related knee complaints and Kellgren-Lawrence (KL) score < 2, we obtained knee MRI scans and standardized radiographs. Five years later radiographs were repeated. Development of radiographic OA was defined as a KL score ≥2. MRIs of the femorotibial joint were scored with validated scoring systems (KOSS, MOAKS). Binary logistic regression analyses were used to calculate odds ratios with 95% confidence intervals (OR (95%CI)) per 1 score increase in the predictor and OA development, adjusted for age, sex and BMI.
Results: At baseline most patients (60%) had a KL score of 1; 26 % developed radiographic OA. Increasing scores of cartilage defects, osteophytes, bone marrow lesions and effusion were associated with radiographic OA development (OR 1.7 (95%CI 1.1-2.6), 2.8 (1.6-5.0), 2.0 (1.1-3.4) and 2.1 (1.2-3.5), respectively). Increasing scores of extrusion of the medial meniscus (1.9 (1.1-3.4)) and maceration or tear (presence/absence) of the lateral meniscus (6.9 (1.1-41.9) and 4.7 (1.3-16.8)) were associated as well, whereas no associations were seen with Baker's cysts and maceration or tearing of the medial meniscus.
Conclusion: In early knee OA, with doubtful or no radiographic OA features, cartilage defects, bone abnormalities, effusion and meniscal pathology were associated with radiographic OA development, suggesting that already in early OA stages the whole joint is involved.

B-1211 14:41

Postero-lateral instability of the knee in young patients: association between postero-lateral corner involvment and anterior cruciate ligament injury and the role of the weight-bearing MRI

S. Mariani, F. Arrigoni, A. La Marra, L.M. Gregori, A. Barile, C. Masciocchi; *L'Aquila/IT (mari.silvia@hotmail.it)*

Purpose: To evaluate the value of WB-MRI respect to standard-MRI in the diagnosis of PLC involvement and the possible PLI associated to ACL injury.
Methods and Materials: We prospectively analyzed 100 patients positive for acute ACL injury; they underwent a dedicated MRI in supine and WB-position with knee flexion of 12°-15°. We evaluated knees for 3 direct signs of ACL injury (discontinuity, ACL alterated morphology and deflection) and for 4 indirect signs (bone bruise, anterior tibial traslation, uncovered lateral meniscus and hyperbuckled posterior cruciate ligament (PCL). We evaluated the involvment of PLC capsuloligamentous structures. All patients underwent arthroscopy.
Results: At standard-MRI, among direct signs, we obtained that ACL abnormal appearance confirmed to be the single most sensitive and specific sign of ACL injury (100%), followed by ACL deflection (73%) and discontinuity (61%); among indirect signs anterior tibial traslation (62%) was followed by bone bruise (46%), uncovered lateral meniscus (44%) and hyperbuckled PLC (34%). PLC capsuloligamentous structures were involved in 47%. WB-MRI, among direct signs, showed only an increase of ACL deflection (86%). Among indirect signs, anterior tibial traslation increased to 88%, uncovered lateral meniscus (63%) and hyperbuckled PCL (42%); no modifications of bone bruise. Finally, involvement of PCL capsuloligamentous structures was increased to 88%. Arthroscopy confirmed ACL tear with diagnosis of PLI in 82% of cases.
Conclusion: This study discovers the value of WB-MRI in recognising the most sensitive direct and indirect signs of ACL injury and to diagnose a PLC involvement, leading patients to the right surgical treatment.

B-1212 14:49

Role of MDCT for evaluating prosthetic malrotation in patients with painful knee prosthesis

G. De Franco, G. Martino, C. Campagna, V. Favia, A. Spinarelli, G. Angelelli; *Bari/IT (dottguelfodefranco@yahoo.it)*

Purpose: To evaluate the role of MDCT for evaluating malrotation in patients with painful knee prosthesis.
Methods and Materials: We evaluated the CT scans of 20 patients with a total knee arthroplasty: 10 suffering from pain in the front and 10 with a good functional and clinical outcome. Two blinded radiologists evaluated the axial CT images and calculated the internal rotation angles of the femoral and tibial components of the prosthesis. The differences between the mean values of the angles in the two groups of patients were evaluated by student t-test. The interobserver agreement was calculated using the kappa statistic.
Results: In asymptomatic patients, the values of the internal rotation angles ranged between 1.3 ° and 2.8 ° (mean = 1.8 ± 0.5 °) for the femoral component and between 5 ° and 20 ° (mean= 12 ° ± 4.5) for the tibial one. In symptomatic patients the values of the internal rotation angles ranged between 2.8 ° and 3.6 ° (mean = 2.9 ± 0.2 °) for the femoral component and between 19 ° and 23 °(mean = 20.5 ± 1.6 °) for the tibial one. The differences between the mean values of the angles of femoral-tibial internal rotation were statistically significant with values a little higher in the group of patients with a painful arthroplasty compared with asymptomatic patients. Interobserver agreement was found high (k =0.84).
Conclusion: MDCT allows to recognize cases of prosthetic knee pain from malrotation and give and indication of possible intervention by surgical revision.

B-1213 14:57

Anterolateral ligament of the knee: correlation of MR imaging with anatomical findings

E. Tahir, C. Berliner, S. Yarar, G. Lüers, M. Karul, G. Adam, J. Yamamura; *Hamburg/DE (e.tahir@uke.de)*

Purpose: Recently, evidence has been accumulating for the existence of a previously unknown structure at the anterolateral aspect of the human knee named anterolateral ligament (ALL). The aim of this study was to investigate ALL using magnetic resonance imaging (MRI) and to correlate the results with gross anatomical findings. To our knowledge this is the first study combining these two methods to analyse ALL.
Methods and Materials: 16 human knees were obtained from cadavers. All specimens were examined with plain film radiography to exclude advanced degenerative arthrosis or prior injuries of the knee as well as joint replacement. Subsequently, they were scanned with 3 Tesla MRI. Two blinded readers analyzed MRI data in consensus. In all 16 knees the lateral supporting structures were carefully dissected by an orthopedic surgeon and an anatomist to identify the possible course of ALL and lateral collateral ligament (LCL).
Results: MR imaging-anatomic correlation allowed us to identify a consistent structure correspondent to ALL in 11 knees (68%). The ALL origin was situated at the lateral femoral epicondyle and its proximal part was adjacent, but distinctive to the LCL. Distally this ligament passed obliquely and attached to the lateral tibial plateau between Gerdy's tubercle and the head of the fibula.
Conclusion: Knee MRI was accurate and sensitive to identify the intact ALL. It appeared as a thin black structure on T1w sequences and was best visualized on coronal images. Information concerning this structure may be crucial with respect to the diagnosis and understanding of knee pathologies.

B-1214 15:05

Effects of extremity positioning on femoral tunnel localisation after anatomic single bundle anterior cruciate ligament reconstruction - evaluation by digitally reconstructed radiographs

P.S. Mahajan, P. Chandra, N. Ahamad, S.A. Hussein; *Doha/QA (mdfrcr@gmail.com)*

Purpose: to assess (A) anterior cruciate ligament (ACL) graft tunnel location post anatomic single-bundle reconstruction (ASBR) and (B) effects of extremity malpositioning on tunnel orifice localization in comparison to Blumensaat's line (BL); and (C) to discuss usefulness of radiographs in evaluation of femoral tunnel location and role of radiography as compared to that of three-dimensional imaging techniques.
Methods and Materials: All three-dimensional computed tomography scans (3DCT) of knees post ASBR performed in our institute during the period 2005-2012 with available 3DCT data (22 knees of 22 subjects) were evaluated. 3DCT data was used to digitally reconstruct true lateral radiographs, which were subsequently made use of to assess the graft tunnel location on the distal femoral shaft along and perpendicular to the Blumensaat's line (BL). Following this, we digitally rotated the femur to simulate varus, valgus, internal rotation and external rotation in 5-degree increments from 0 to 20-degree. At each incremental rotated position of the femur, position of ACL graft tunnel was calculated relative to BL and difference from true lateral x-ray was estimated.
Results: Tunnel position was 30.6 (±4.4)% along BL and 33.1 (±5.4)% perpendicular to BL. Only, more than 10-degree of internal rotation significantly affected the tunnel position estimates ($P < 0.05$) and rest of the rotations didn't have any significant effect.
Conclusion: Femoral tunnel location can be reliably determined on lateral radiographs post ASBR. If a strict limb positioning algorithm is followed to restrict limb malpositioning within 10-degree of any rotation, radiographic evaluation can be clinically as useful as 3D-imaging techniques.

B-1215 15:13

3-dimensional isotropic high spatial resolution proton-density-weighted fat-suppressed and T1-weighted imaging of the knee at 3.0 Tesla

R. Homsi[1], G.M. Kukuk[1], J. Gieseke[2], H.H. Schild[1], W.A. Willinek[1], D.R. Hadizadeh[1]; [1]*Bonn/DE*, [2]*Best/NL*

Purpose: To evaluate whether high-resolution proton-density-weighted fat-suppressed (PDwFS) and T1-weighted (T1w) 3D-sequences of the knee may replace multiple 2D-sequences.
Methods and Materials: 19 patients with suspected knee injury (9 men, mean age 42±15.4 years) received knee imaging on a 3.0 Tesla whole body MRI. 2D sequences included PDwFS [three planes] and T1w [sagittal plane] (total acquisition time, 456s; voxel sizes, (0.4-0.62x0.44-0.89x3.0)mm³). 3D- PDwFS was performed in 397s (voxel size, (0.63x0.68x0.63)mm³) and 3D-T1w in 255s (voxel size, (0.68x0.68x0.68)mm). Overall image quality (OIQ), artifacts, and conspicuity of knee structures (CoS) were evaluated by two blinded radiologists (ratings: excellent, good, moderate, and poor). Contrast-ratios (CR) were calculated for the meniscus (MEN) and anterior (ACL) and posterior cruciate ligaments (PCL) compared to the popliteal muscle.
Results: 3D-PDwFS-images were rated to have a higher OIQ (p=0.0001) and lesser artifacts (p=0.00004) compared to 2D-images, but no significant differences were found in CoS (p=0.0882). 2D-T1w-images showed significantly fewer artifacts (p= 0.0001) but no significant difference in OIQ (p=0.6887) and CoS (p=0.3526) compared to multiplanar reformats of 3D-T1w-images. Kendall-W-coefficients of concordance indicated a moderate to good inter-observer agreement (0.415-0.744). CR was significantly higher in the ACL in 3D- compared to 2D-PDwFS (p=0.0003). No significant differences were found for PCL and MEN.
Conclusion: Isotropic high spatial resolution 3D PDwFS and T1w data sets of the knee at 3.0 T have the potential to replace standard 2D knee imaging with the advantages of multiplanar reformation and lower acquisition time compared to three 2D-planes.

Author Disclosures:
G.M. Kukuk: Speaker; Phillips Healthcare. **J. Gieseke:** Employee; Phillips Healthcare. **W.A. Willinek:** Advisory Board; Bayer. Speaker; Bayer Healthcare, Phillips Healthcare. **D.R. Hadizadeh:** Consultant; Bayer Healthcare.

B-1216 15:21

Clinical significance of dark cartilage lesions identified on MRI

R. Kijowski, B.K. Markhardt; *Madison, WI/US (rkijowski@uwhealth.org)*

Purpose: To determine the clinical significance of focal areas of low T2 signal in morphologically normal cartilage on MRI.
Methods and Materials: A musculoskeletal radiologist restrospectively reviewed the knee MRI examinations of 901 patients who had subsequent knee arthroscopy to determine the presence of focal linear and globular areas of low T2 signal in morphologically normal cartilage (dark cartilage lesions) on each articular surface of the knee joint. The surgical reports of all patients were reviewed to determine the presence of cartilage degeneration on each articular surface at arthroscopy.
Results: In the patella, 5 of 9 (56%) linear and 8 of 22 (36%) globular dark cartilage lesions were arthroscopically positive for cartilage degeneration; in the trochlea, 19 of 35 (54%) linear and 11 of 21 (52%) globular dark cartilage lesions were positive; in the medial femur, 8 of 9 (90%) linear and 3 of 4 (75%) globular dark cartilage lesions were positive; in the medial tibial, 2 of 6 (33%) globular dark cartilage lesions were positive; in the lateral femur, 1 of 2 (50%) linear dark cartilage leisons were positive; and in lateral tibia, 7 of 15 (50%) linear and 35 of 52 (67%) globular dark cartilage lesions were positive.
Conclusion: A significant proportion of dark cartilage lesions corresponded to areas of cartilage degeneration at arthroscopy which indicates that these lesions should not be considered clinically insignificant but instead reported as possible areas of cartilage degeneration.

14:00 - 15:30 **Room E2**

Neuro

SS 1911

Advanced imaging

Moderators:
M.T. Fernández Taranilla; Toledo/ES
C. Mandel; East Melbourne/AU

B-1218 14:00

Diagnostic performance of diffusion tensor imaging in visual pathways of primary open angle glaucoma patients

B. Özkul[1], F. Yenihayat[1], N. Yüksel[1], A. Akça[2], A. Arslan[1]; [1]*Kocaeli/TR*, [2]*İstanbul/TR (bahozkul@yahoo.com)*

Purpose: To evaluate the diagnostic performance of DTI in detecting neurodegeneration in the optic nerve and pathways in patients with glaucoma.
Methods and Materials: Compared with the controls, FA were lower, MD and RD were higher in the optic nerves and tracts of glaucoma patients ($p < 0.0001$). DTI parameters showed no significant difference in the optic radiation. With a cut-off value of 1.288 x10-3 mm2/sec, MD showed 52.31% sensitivity, 94.59% specificity, and 89.5% PPV in the optic tract and optic nerve. With a cut-off value of ≤0.496, FA showed 73.85% sensitivity, 89.19% specificity and 85.7% PPV in the optic tract and optic nerve. With a cut-off value of >0.714 x10-3 mm2/s, RD showed 66.15% sensitivity, 64.86% specificity and 62.3% PPV in the optic nerve. There was a significant difference of FA in the optic nerve, and FA and MD in the optic tract between all glaucoma stages and the control group (p≤.005). The retinal nerve fiber layer thickness and FA in the optic nerve (r=0.555) and the tract (r=0.416) and MD in the optic tract (r=0.405) showed a significant correlation.
Conclusion: DT imaging parameters MD, FA and RD may be used to detect neurodegeneration in the optic nerve and the optic tract and may serve as a biomarker of disease severity, complementary to clinical examination.

B-1219 14:08

A first insight in regional brain changes after parabolic flight: a voxel-based morphometry study

A. Van Ombergen[1], B. Jeurissen[1], F. Vanhevel[2], D. Loeckx[3], V. Dousset[4], S. Laureys[5], P.H. Van de Heyning[1], P.M. Parizel[2], F.L. Wuyts[1]; [1]*Antwerp/BE*, [2]*Edegem/BE*, [3]*Leuven/BE*, [4]*Bordeaux/FR*, [5]*Liege/BE (angelique.vanombergen@uantwerpen.be)*

Purpose: Several aspects of spaceflight on human health have already been studied thoroughly and include cardiovascular, muscle and bone physiology. Furthermore, it has been proposed that weightlessness can impair processes at the level of the central and peripheral nervous system. However, brain morphology and brain connectivity changes associated with spaceflight have not been investigated. The purpose of this study was to investigate possible effects of short-term gravity transitions on brain connectivity and morphology.

Methods and Materials: Sixteen first-time parabolic flyers were included and underwent a MRI scan before and immediately (2-4 hours) after the parabolic flight. Gray matter (GM) differences were assessed using high-resolution T1-weighted, volumetric MRI data sets (3 T MRI).
Results: VBM analysis showed a significant decrease ($p < 0.001$, uncorrected) from pre to post parabolic flight in GM volume in parts of the frontal, occipital and temporal gyri and a significant increase ($p < 0.001$, uncorrected) in the cerebellum and frontal gyrus.
Conclusion: This study suggests that alteration of gravity has an impact on brain morphology and possibly also connectivity, in regions that are know to play a pivotal role in the integration of neurosensory information (vestibular, visual and proprioceptive info). Future research and the parellel linking of these results to long duration spaceflight is necesarry to support these preliminary findings and to get a first insight in the effects of spaceflight on the function and morphology of the central nervous system. This is pivotal information that should be extended, especially with the eye on interplanetary missions and space habitats.

B-1220 14:16

Evaluating the intracranial perforating branches by new x-ray system using a cerium anode

C. Tanaka; *Isehara-City/JP (chitty@is.icc.u-tokai.ac.jp)*

Purpose: We developed a microangiographic X-ray system using a cerium anode. The usefulness of the system for evaluating the perforating branches from the middle cerebral artery which is responsible for the lacunar infarction was assessed.
Methods and Materials: The system has a cerium anode which has peak energy at 34.6 kilo electron volt which is close to K-edge of the materials. Therefore, the contrast effect of the materials becomes maximum being emitted by the cerium anode. The generator which has 5 mega heat units allows maintaining photon number. The X-ray chart was irradiated to assess the resolution of the system. Then, 32 mice and 3 dogs were injected with barium to be perfused into the intracranial vessels, and the brains were removed and exposed. As in situ practice, iodine was injected into the ascending aorta under the irradiation in living 2 dogs.
Results: The cerium anode system showed the 4.86 LP of the X-ray chart, and the resolution was kept with the acrylic plate which simulated the body thickness. The perforating branches in the mice and dogs were pictured clearly. The minimum diameter of vessels visualized was approximately 50 µm. The resolution was much better with the cerium anode system compared to the conventional X-ray system. Additionally, the system pictured the real-time movement of the iodine inside of the perforating branches.
Conclusion: The cerium anode system has the ability of visualizing the perforating branches in situ animal models. It can be used in clinical, and will help evaluating the microvessels.

Author Disclosures:
C. Tanaka: Research/Grant Support; Health and Labor Sciences Research grant: 2004-2006, Grants-in-Aid for Scientific Research (B): 2007-2009, Grants-in-Aid for Scientific Research (B): 2009-2011, Grant-in-Aid for Young Scientists (B): 2013-2014.

B-1221 14:24

Diffusion tensor imaging in cord compression: the future functional biomarker?

S. Sivasubramanian; *Tamil Nadu/IN (S.sanjitha@yahoo.co.in)*

Purpose: To study diffusion tensor imaging in cervical spine in cord compression to assess if it can identify changes earlier than routine MRI.
Methods and Materials: The study is a prospective case-control study with 28 cases of cord compression,(chronic spondylosis and acute traumatic compression) and 18 healthy volunteers. Cases and controls were subject to imaging in a 3-T MRI. Axial DTI sequence using multishot echoplanar imaging was done in addition to conventional T1,T2 sequences. DTI metrics such as mean diffusivity (MD), fractional anisotropy (FA), longitudinal diffusivity (E1) and radial diffusivity (E2+E3)/2 are measured in each of the lateral, anterior, central and posterior columns of white matter tracts from C2-3 to C6-7 levels.
Results: Conventional sequences show cord signal changes only in 30% of cases. DTI metrics showed changes in all cases even with normal appearing cord. In spondylosis, the FA values are decreased, with increased ADC values. In trauma, ADC decreases. Radial diffusion differs significantly than longitudinal diffusion.
Conclusion: DTI is a novel biomarker which can assess functional changes at a microstructural level in cord compression and identify changes ahead of routine MRI. Axial plane of DTI may provide better anatomical localisation especially with multishot echoplanar Imaging.

B-1222 14:32

Usefulness of diffusion-weighted (DWI) magnetic resonance for distinguishing neuroborreliosis from acute disseminated encephalomyelitis

A. Ivkovic, T. Milosavljevic; *Niš/RS (aleksandarvkvc@hotmail.com)*

Purpose: To determine usefulness of diffusion-weighted (DWI) magnetic resonance for distinguishing neuroborreliosis from acute disseminated encephalomyelitis. Neuroborreliosis (LBN) is a disorder of the central nervous system caused by infection with a spirochete of the genus Borrelia. LNB is neurologic involvement secondary to systemic infection. Acute disseminated encephalomyelitis (ADEM) is an immune-mediated disease of the brain.
Methods and Materials: We enrolled 37 patients with flu-like symptoms and meningoradiculitis, cranial nerve abnormalities, and altered mental status. All patients were examined using MDCT and MRI. 21 were males and 16 females aged 16 to 67 (mean 43+-14). 11 of them were previously treated with antibiotics.
Results: All patients were without erythema migrans. Encephalomyelitis is a very rare complication of borreliosis. Acute disseminated encephalomyelitis is usually following viral infection or vaccination. It is well known that MRI finding is remarkably similar to that in MS, but without involvement of the periventricular white matter. LBN and ADEM have similar MRI findings on T1W, T2W and FLAIR with more sharpen edges on DWI and STIR of LBN than ADEM but on MDCT perfusion, there is a difference in border lines with longer transit times. MR imaging findings in paediatric LNB include the presence of prominent Virchow-Robin spaces. From 37 patients, we find LBN in 21 patients, ADEM in 7. Other 9 patients were with MS. ADC values of LBN (2.14±0.87×10-3 mm2/s) were higher than that of ADEM (1.31±0.50×10-3 mm 2/s) ($P < 0.001$).
Conclusion: DWI can help differentiate neuroborreliosis from acute disseminated encephalomyelitis.

B-1223 14:40

3D time-resolved vessel-selective angiography based on pseudo-continuous arterial spin labelling

T. Lindner[1], U. Jensen-Kondering[1], M.J.P. van Osch[2], M. Helle[3], O. Jansen[1]; [1]*Kiel/DE*, [2]*Leiden/NL*, [3]*Hamburg/DE (Thomas.Lindner@uksh.de)*

Purpose: Selective visualization of the intracranial arteries is an important diagnostic tool in neuroradiology. Digital Subtraction Angiography is considered as the gold standard to obtain this information, however this method depends on contrast agent and X-Ray application. In this study, a non-invasive method for selective, non-contrast enhanced angiography using arterial spin labelled (ASL) MRI is presented.
Methods and Materials: Using ASL, it is possible to alter the magnetic state of the inflowing blood spins, which changes their contrast with respect to the static tissue. By subtracting two images with and without magnetic blood spin inversion, it is possible to obtain angiograms. Furthermore, a recently developed method named super selective ASL allows for tagging of single intracranial arteries. Time-resolved imaging is achieved by increasing the delay time between tagging and readout. To keep the acquisition time at clinically acceptable durations, keyhole scanning is used. This keyhole factor, as well as the acquisition flip angle were optimized in simulations with respect to image quality and total scan time and experimentally verified prior to the application to healthy volunteers. Scan parameters were: Philips 3 T Achieva, 400 ms Labelling, 3D T1-TFE Scan, FoV 210x210 mm^2,110 slices, Voxel: 0.9x0.9x0.9 mm^3, 25° flip-angle, 100 ms temporal resolution, 50% keyholefactor, 5 min scan time.
Results: In all three major arteries (ACIs, BA), selective angiograms could be obtained with an isotropic resolution of less than 1 mm.
Conclusion: Super selective ASL combined with keyhole scanning allows for selective acquisition of the cerebral arteries in clinical acceptable scan time of 5 minutes.

Author Disclosures:
M. Helle: Employee; Philips Healthcare.

B-1224 14:48

Dynamic CT angiography for the evaluation of shunting vascular malformation of brain and spine

F. D'orazio, L.M. Gregori, A.V. Giordano, S. Carducci, A. Splendiani, M. Gallucci; *L'Aquila/IT (federico.dorazio@gmail.com)*

Purpose: To evaluate the effectiveness of 4D CT angiography for the assessment of brain and spinal vascular shunting malformations in comparison with DSA.
Methods and Materials: In the period between January and June 2014, 13 intracranial and 2 spinal 4D CTA examinations were performed in 15 patients. A 320 row detector CT scanner (Toshiba®AquilionOne) was used; it allowed volumetric, continuous (cine) scans with the following parameters:

FOV=160 mm/80 KV/300 mA/Rotation Time=0.35 s/Tot Scan time=15 s/Collimation=0.5 mm. After obtaining informed consent, we performed 4D CTA. Subsequently, all DSA and 4D CTA studies were anonymised and independently evaluated by 2 different neuroradiologists, by using a standardised scoring sheet.
Results: All 4D CTA studies confirmed the presence of a shunting vascular malformation of the brain (11 AVM, 2 dFAV) and spine (2 dFAV) and were judged suitable for assessing the architecture of vascular lesions observed in terms of classification according to the SpetzlerMartin grade scale (brain AVM) and to the Cognard classification (dFAV). Because of the 4D CTA high spatial and temporal resolution we could correctly evaluate both with DSA and 4D CTA the presence of the vascular malformations,their position,the size of the nidus,the number of arterial feeders observed, the pattern of venous their drainage (i.e. superficial and/or deep) allowing to plan a further endovascular treatment when technically achievable.
Conclusion: 4D CTA demonstrated to be a powerful new diagnostic tool to investigate the haemodynamics of vascular shunting lesions both in brain and spine. We believe that using 4D CTA can be useful in the diagnostic setup of these kind of vascular lesions, and could reduce, in the future, the use of DSA only for therapeutic purposes.

B-1225 14:56

The typical and atypical MR imaging appearances of tuberculosis of the central nervous system. An imaging based experience of 100 cases

A. Banerjee; *Ludhiana/IN (dravik11@gmail.com)*

Purpose: Tuberculosis of the central nervous system is a common and routinely encountered entity in India. Our aim was to evaluate the typical and atypical neuroimaging features of tuberculosis of the brain and spine so as to form guidelines for their imaging recognition and differentiation from tumoural, vascular and other entities that warrant a different line of therapy.
Methods and Materials: The imaging studies of 100 patients with suspected tuberculosis of the brain and spine was reviewed and the neuroradiological diagnosis correlated with the CSF/biochemical/ histopathological/microbiological analysis.
Results: Tubercular infection of the brain was seen in four different patterns. Tubercular meningitis [57%], parenchymal tuberculosis [viz tuberculoma[62%],tubercular abscess [17%]and tubercular cerebritis [13%] and the rare pachymeningeal tuberculosis[5%]. Rare cases included tuberculosis presenting as optic nerve involvement,giant tuberculomas which were confused with glioma, sellar tuberculosis, solitary cerebellar tubercular abscess,tuberculosis presenting as infratemporal fossa mass with pachymeningitis and enplaque meningeal tuberculosis. Statistically significant differences between tuberculoma and neurocysticercosis were found, also using spectroscopic parameters. As regards the spinal column involvement, patients with tuberculous spondylitis had a significantly higher incidence of thoracic vertebral involvement (46.8%) contiguous involvement of three or more vertebra (25%),skip lesions (25%), vertebral intraosseous abscess (40%), thin smooth wall (50%) versus thick irregular abscess wall in pyogenic (70%) infection.
Conclusion: Visualization of typical lesion patterns not only allows a rapid diagnosis and subsequent therapeutic decisions but also is indispensable in monitoring therapeutic response. Particularly recognization of certain atypical imaging of tuberculosis must be kept in mind in order to avoid a diagnostic dilemma and delay appropriate therapy.

B-1226 15:04

The additional value of neuroimaging combined with visual rating scales to the clinical diagnosis of dementia

M.V. Verhagen, G.L. Guit, G.J. Hafkamp, C.J. Kalisvaart; *Haarlem/NL (Mvverhagen@gmail.com)*

Purpose: Dementia is foremost a clinical diagnosis. However in diagnosing dementia it is advocated to perform at least one neuroimaging study. This has two purposes. First: to rule out potential reversible dementia (PRD). Secondly: to help determine the dementia subtype using visual rating scales. To our knowledge no studies have been published that demonstrated the actual value of these rating scales. Our first goal was to establish if neuroimaging combined with visual rating scales has additional value to the clinical diagnosis. The second goal was to demonstrate if neuroimaging contributed to the confidence level of the geriatrician in making the final diagnosis.
Methods and Materials: A prospective observational single centre study was performed in which the dementia subtype was determined prior to, and after neuroimaging. Neuroimaging consisted of either MRI or CT, the visual rating scales used were: global cortical atrophy (GCA), medial temporal atrophy (MTA), and white matter hyper intensity according to the Fazekas scale. The confidence level of the geriatrician in the diagnosis was determined by using a visual analogue scale.
Results: 148 Patients were enrolled; 13 patients (8.8%) underwent a CT examination, 135 patients (91.2%) underwent a MRI examination. After neuroimaging the diagnosis changed in 14.5% (CI 9.7%-20.7%) of all cases. We found PRD in 2% of all patients. The confidence level in the final diagnosis increased significantly after neuroimaging (p=0.001).
Conclusion: Neuroimaging combined with visual rating scales has a significant impact on the dementia subtype diagnosis and confidence level of the geriatrician in making the final diagnosis.

B-1227 15:12

Multimodal imaging of disorders of consciousness

L. Hermoye[1], L. Tshibanda[2], C. Di Perri[2], V. Katsaros[3], S. Laureys[2]; [1]*Brussels/BE*, [2]*Liège/BE*, [3]*Athens/GR (hermoye@imagilys.com)*

Purpose: We examine the diagnostic and prognostic value of different brain imaging techniques (MRI, PET scan) in patients with disorders of consciousness (coma, vegetative state, minimally conscious state, locked-in syndrome), following traumatic or hypoxic brain injury.
Methods and Materials: Since 2010, we have scanned 232 patients. The MRI procedure included sequences of anatomical and functional MRI, resting-state fMRI, diffusion tensor imaging, and spectroscopy. FDG-PET scans were also acquired to assess the brain's metabolic activity. The results of medical imaging studies were confronted to one of the behavioural assessment and to other neurophysiological examinations (EEG, TMS-EEG, brain-computer interface).
Results: Imaging is feasible in these patients, but requires a multidisciplinary team. Spasms, typical in these patients, can cause motion artefacts, and sometimes require a sedation, to keep image quality to an acceptable level. Task-based fMRI, resting-state fMRI and PET scans were useful in assessing the state of consciousness of the patients, i.e. in making the differential diagnosis between coma, vegetative state, minimally conscious state and locked-in syndrome. Anatomical MRI, DTI and spectroscopy were useful for establishing a prognosis. In some "miracle" cases, the functional MRI examination demonstrated signs of consciousness, which could not be detected by the behavioural examination.
Conclusion: The combination of imaging examinations with electrophysiological examinations, along with a comprehensive behavioural assessment, can provide an indication to the medical staff and to the patient's family, about his state of consciousness and prognosis.

Author Disclosures:
L. Hermoye: CEO; Imagilys. Shareholder; Imagilys.

14:00 - 15:30 **Room F1**

Oncologic Imaging

SS 1916

Oncologic imaging of the GI tract

Moderators:
G. Conte; Milan/IT
J. Sosna; Jerusalem/IL

B-1228 14:00

Value of FDG PET/CT in the assessment of patients with colon cancer comparing to CT alone

K. Akbari; *Linz/AT (kaveh.akbari@akh.linz.at)*

Purpose: To evaluate the potential of FDG PET/CT vs. CT alone in the assessment of histopathologically verified colon cancer in primary staging, re-staging and follow-up setting.
Methods and Materials: Seventy patients (39 men, 31 women, mean age: 70.7 ± 10.7) were included in this retrospective study: 28 (40%) primary staging, 42 (60%) re-staging and follow-up patients. Fifty-eight (58/70) patients (83%) had a primary tumour stage of ≥ T3. Diagnostic contrast-enhanced CT was performed in all patients. All results were verified with histological findings or imaging and/or clinical follow-up studies.
Results: In the preoperative setting, FDG PET had an influence on the staging in 11 (11/28) patients (39%). Nine (9/28) patients (32%) were downstaged, 6 of them with suspicious organ metastases, 3 patients with suspicious lymph node metastases and 1 patient with both suspicious organ metastases and lymph nodes metastases on CT. Two (2/28) patients (7%) were upstaged by FDG PET/CT, one of them with an unclear lung lesion on CT and a malignant hilar lymph node. The second patient showed peritoneal carcinosis on FDG PET. Only 3 (3/42) patients (7%) from the restaging and follow-up group were down staged, while concordant findings were seen on both imaging modalities for the rest of the patients.
Conclusion: This study clearly showed that for primary staging of distant metastases in colon cancer patients, FDG PET/CT is more advantageous and overcomes the lower specificity of CT alone. In postoperative cases, FDG PET provides additional findings only in few cases.

B-1229 14:08

MR imaging for dedicated staging of colon cancer patients: preliminary results

M.J. Lahaye[1], D.M.J. Lambregts[1], E. Nerad[2], G.L. Beets[1], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Eindhoven/NL (MJ.Lahaye@gmail.com)*

Purpose: CT is used for both local and distant staging of colon cancer. In the revised Dutch guidelines MRI is recommended as a liver staging tool because of its superiority to CT. If MRI proves valuable to stage the local tumour it would be beneficial to perform a one-stop-shop MR staging tool with the added benefit of avoiding radiation & nephrotoxic contrast agents. The purpose of this prospective study was tot evaluate the performance of MRI for local staging of colon cancer.
Methods and Materials: In an ongoing pilot study we prospectively included 21 colon cancer patients, undergoing MRI (1.5 T) including T2TSE, BTFE and DWI sequences of the whole abdomen. Two experienced readers independently evaluated the examinations and scored; tumour invasion (T1-2 vs T3-4), nearby fascia/serosal involvement (involved/not involved) and the presence of malignant nodes (N0/N+). Histopathological findings served as reference standard.
Results: Histology found 15/21T3-4 tumours, 6/21 Facia involvement and 7/21N+ tumours. For reader 1, tumour invasion, fascia/serosal involvement and N+status had a sensitivity/specificity of 92%/63%, 83%/80% and 86%/86% and for reader 2 86%/57%, 86%/78% and 66%/80%. The corresponding interobserver agreements (kappa's) between both readers were moderate to almost perfect (0.48, 0.48 and 0.91, respectively).
Conclusion: Our pilot data suggest that MRI has a high sensitivity for detecting the most important prognostic factors and thus might replace CT in staging colon cancer patients. In addition, if the FOXTROT trial will prove that neoadjuvant chemotherapy for locally advanced colon tumour will effect outcome, MRI has potential to accurately identify high-risk patients.

B-1230 14:16

Modified, high resolution pelvic MRI in rectal cancer: a comparison of field strengths - 7T vs. 1.5 T

K. Beiderwellen, O. Kraff, A. Laader, S. Johst, S. Maderwald, M. Forsting, T.C. Lauenstein, L. Umutlu; *Essen/DE (karsten.beiderwellen@uk-essen.de)*

Purpose: The evaluation of a modified high-resolution protocol for pelvic MRI at 7T in comparison to 1.5 T in healthy volunteers and patients with rectal cancer.
Methods and Materials: 10 healthy volunteers and 5 patients with rectal cancer underwent pelvic MRI at 7T (Magnetom 7T, Siemens) as well as at 1.5 T (Magnetom Aera, Siemens). The protocol included 1) T1w 2D FLASH ax. pre and post contrast, 2) T1w TSE ax. pre and post contrast, 3) dynamic VIBE ax., 4) T1w 3D FLASH DIXON (7T only; calculation of fat and water image) and 5) T2w MR imaging. Two readers assessed overall image quality, contrast, delineation of pelvic organs, pelvic vessels, rectal cancer conspicuity and the presence of artifacts (1:non-diagnostic to 5:excellent). Statistical analysis was performed using Wilcoxon's rank sum test.
Results: The increase in SNR could be translated into higher spatial resolution at 7T for all T1w sequences, allowing for improved conspicuity of the tumour manifestations (mean 7T 4.5; mean 1.5 T 4.0). Post-contrast 2D FLASH MRI revealed comparable image quality for both field strengths (1.5 T: mean: 4.5; 7 T: mean 4.2). 7T DIXON fat imaging allowed for good delineation of the rectal wall (mean: 3.3). Due to artifact exacerbation, image quality in 7T T1w TSE and T2w MRI was rated inferior towards 1.5 T ($p < 0.01$).
Conclusion: The results demonstrate the feasibility of high-resolution pelvic MRI at 7T, offering highly defined conspicuity of rectal cancer features. As T2w MRI is restricted at 7T, DIXON fat imaging may offer an alternative for the assessment of the rectal wall.

Author Disclosures:
K. Beiderwellen: Speaker; Siemens, Healthcare Sector. **L. Umutlu:** Consultant; Bayer Healthcare. Speaker; Bayer Healthcare.

B-1231 14:24

A novel T3 subgroup system based on MRI for stratifying T3 rectal cancer into favorable and unfavorable subgroups

S. Moon, S. Cho, K.-M. Shin, H. Kim, G. Kim, Y.-J. Jang, H. Ryeom; *Daegu/KR (msj31218@gmail.com)*

Purpose: To investigate MRI-based (mr) prognostic factors for stratifying mid/lower T3 rectal cancer into favourable and unfavourable subgroups and to develop a novel T3 subgroup system using these factors.
Methods and Materials: One hundred eighty-two patients with mrT3 adenocarcinoma were enrolled in this retrospective study. Two radiologists measured the tumour height, size and distance of mesorectal tumour extension (MTE) and evaluated the existence of lymph node metastasis, circumferential resection margin (CRM) involvement and extramural vascular invasion on pre-therapeutic MRI. Receiver operating characteristic curves, a Cox proportional hazard model and the Kaplan-Meier method with log-rank test were used. Oncologic outcomes were based on 5-year metastasis-free-survival (MFS) and local recurrence rate (LRR).
Results: mrMTEs of 4 mm and 5 mm were determined as the optimal cut-off points for MFS (83.7% vs. 60.7%) and LRR (5.7% vs. 18.8%), respectively. A 4-mm mrMTE (HR, 2.782; 95% CI 1.250-6.194; P = 0.013) and an involved mrCRM (HR, 2.031; 95% CI 1.020-4.041; P = 0.045) were independent prognostic factors for MFS, and an involved mrCRM (HR, 5.042; 95% CI 1.661-15.301; P = 0.004) alone predicted LRR. The favourable T3 subgroup (mrMTE â‰¤ 5 mm and clear mrCRM) showed better oncologic outcomes than the unfavorable subgroup (mrMTE > 5 mm or involved mrCRM) (5-year MFS, 88.8% vs. 53.7%, P < 0.001; 5-year LRR, 2.7% vs. 19.8%, P = 0.001).
Conclusion: A combination of MRI-based 5-mm MTE and CRM status could be used as a prognostic indicator for stratifying T3 rectal cancer into favourable and unfavourable subgroups.

B-1232 14:32

Does multiparametric MRI allow for response prediction of neoadjuvant chemoradiation in patients with advanced rectal cancer?

D. Hausmann, N. Rathmann, U.I. Attenberger, S.O. Schönberg, F. Doyon, P. Kienle, R.D. Hofheinz; *Mannheim/DE (danielhausmann@hotmail.com)*

Purpose: To evaluate multiparametric MRI (mMRI) as a tool to predict response to neoadjuvant chemoradiation (CHRT) in patients with advanced rectal cancer.
Methods and Materials: 21 consecutive patients with rectal cancer (cT3/4 or cN+) (5 female; 16 male; mean age: 60.2 ±12.9 years) who underwent 3 T mMRI (Dynamic Contrast-Enhanced Imaging, (DCE); Diffusion-Weighted Imaging (DWI)) prior (T1) and post (T2) CHRT were included. Staging and inclusion was based on the results of the initial MRI. Plasma flow (PF), Mean transit time (MTT) and Apparent Diffusion Coefficient (ADC) were analyzed and compared by two experienced observers. Response to treatment was rated histopathologically according to the Japanese Society for Cancer of the Colon and Rectum (JSCCR) criteria of 1997. Additionally, correlation between DWI and DCE values of both examinations and histopathological tumour stage was evaluated.
Results: We observed a significant correlation between an increase of ADC values (median: T1 740; T2: 843 x 10^-6 mm/s^2) and treatment response (p=0.041). Changes of DCE values did not correlate significantly with histopathological response (median: PF (T1): 331; (T2): 190 ml^100 ml^min; p= 0.50; MTT (T1): 56; T2: 54 sec; p=0.74). Interreader agreement for these values was good (ADC (T1): 0.77; T2: 0.89; PF (T1): 0.68: T2 0.58) except for MTT of the second examination (MTT (T1): 0.73; (T2): 0.31). There was no correlation between DCE and DWI values and histopathological tumour stage.
Conclusion: Our results suggest that DWI allows for prediction of response to CHRT in advanced rectal cancer, whereas DCE seems to have a limited prognostic value.

B-1233 14:40

Evaluation of rectal cancer response to therapy: role of MR tumour regression grade to predict pathological complete response

M. Rengo, M. Ciolina, C.N. de Cecco, D. Caruso, C. Forina, S. Marzi, A. Laghi; *Rome/IT (marco.rengo@gmail.com)*

Purpose: To determine if a pathological complete response to therapy in rectal cancer can be predicted by tumour regression grade evaluated by MR (MR-TRG).
Methods and Materials: Thirty-seven patients, diagnosed with locally advanced rectal cancer were prospectively enrolled in the study. All patients underwent MRI on a 3 Tesla before, during and after chemoradiotherapy (CRT). All patients underwent total mesorectal excision (TME). MR-TRG was evaluated on T2-weighted fast spin-echo (FSE) multi-planar imaging. The MR-TRG was determined by the fibrosis/tumour ratio and was divided into 4 grades based on the percentage of fibrosis (< 25%, < 50%, < 75%, 100%). Measurements were performed on all axial images including the tumour. MR-TRG evaluated on the second examination (during therapy) was correlated with the pathological finding after surgery, defined as partial response or complete response.
Results: A complete pathologic response was observed only in patients (17) with MR-TRG 4 (100% fibrosis) with a negative predictive value of 100%. In lower MR-TRG groups (1, 2 and 3), a partial response was observed (20 patients).
Conclusion: MR-TRG 4 is a accurate predictor of complete response after CRT. When a lower MR-TRG is observed, the persistence of disease should be suspected. This method, applied during therapy, may reduce the time to surgery.

B-1234 14:48

The possibility of MR dynamic contrast enhancement to separate groups of potentially good and bad response after preoperative chemoradiotherapy in patients with rectal cancer

K.B. Puzakov, N. Rubtsova, D. Sidorov, O. Mainovskaya, I. Droshneva; *Moscow/RU (fetobizuar@mail.ru)*

Purpose: Individualization of the treatment plan for patients is important objective of multi-disciplinary teams.Prediction of tumour response to preoperative chemoradiotherapy could be a great assistance for this purpose.The aim of this study was to examine the parameters and patterns of dynamic contrast intravenous gadolinium enhancement for the prediction of tumour response to chemoradiotherapy (CRT).
Methods and Materials: The study included 86 patients with rectal cancer.Studies were performed on 1.5 T MR imaging with a flexible 4-channel body coil.Evaluation dynamic MR series of rectal tumours was carried out on the stage prior to the n-CRT and 6 weeks after.In all cases,MRI and histology data are compared,according Mandards criteria.All pathients are divided into good (TRG 1-2)and poor responders (TRG3-5).The parameters of dynamic contrast enchancement were: rising portion of the graph, first peak, delayed portion of the graph, and area under the first 60.90,and120 second of the enhancement graph (AUC60, AUC90, AUC120)were determined from relative signal intensity against time graphs.
Results: In poor responders group,before preoperative CRT,the delayed portion of the graph was significantly higher (4.31x10-3) compared with the good responders (-1.23x10-3),p=0.004).After CRT first peak,AUC90 and AUC120 were significantly higher in the poor responders group than in another group 1.41/1.18, 121/95, 176/132 ($p < 0.03$). Rising portion of the graph, first peak and AUC60.90,120 changed more considerably after CRT in the good responders group. ROC-curves varied from 0.71 to 0.85.
Conclusion: Dynamic contrast-enhanced MRI with drawing a graph and calculating its parameters can help in the prediction and assessment of tumour response to CRT.

B-1235 14:56

Modification in abdominal fat distribution in mCRC patients after Cetuximab

S. Battisti, F. Greco, A. Pallottino, B. Beomonte Zobel; *Rome/IT (sofia.battisti@hotmail.it)*

Purpose: Colorectal cancer is the third most common cancer presently a major cause of morbidity and mortality all over the world. The role of gender and body mass index (BMI) on the molecular carcinogenesis of the disease is unclear if it can affect CRC treatment, recurrence, survival and quality of life.
Methods and Materials: 92 patients (male:54 female: 38 mean age 55.8 yo ±11.7yo) with histologically confirmed metastatic colon rectal cancer (mCRC) were evaluated with CT before and after receiving adjuvant chemoimmunotherapy with cetuximab (follow-up 25.4± 19.4months). Abdominal fat distribution analysis was calculated obtaining total abdominal adipose tissue (TAAT)volume (mm3), subcutaneous fat tissue (SAT) and visceral adipose tissue (VAT).
Two groups were created based on K-ras mutation status. Group A who presented K-ras wild type, and Group B who presented a mutation. The VAT/SAT ratio was calculated for both groups and compared with Variance ratio test (F-test).
Results: A significant modification of VAT/SAT ratio was observed (from 1.4 to 1.6) in the two groups, reflecting a relative increased volume of VAT (mean 18%) in the mutant k-ras patients comparing with wild type.
Conclusion: In our study, therapy with cetuximab mCRC was accompanied with a change in fat distribution to relatively greater VAT/SAT ratio in the k-ras mutant patients, regardless of whether they gained or lost weight after therapy. Since this pattern of fat distribution is associated with the metabolic syndrome, attention must be paid to these clinical manifestations in patients during their follow-up management,

B-1236 15:04

3.0-T magnetic resonance imaging in predicting subtypes of IPMN and invasive IPMN

R. Graziani, G. Lo Bue, L. Monti, C. Bonifacio, A. Zerbi, L. Balzarini; *Rozzano/IT (rossella.paola.graziani@gmail.com)*

Purpose: To determine 3.0-T MR imaging (MRI) indicative criteria of IPMN subtypes,because assessing subtypes of invasive carcinoma arising in IPMN (colloid:CT,tubular:CTT,oncocytic:OCT)and underlying IPMN (gastric:GT,intestinal:IT,pancreatobiliary:PBT,oncocytic:OT)is useful for clinical management.
Methods and Materials: 20 surgical patients with pathologically proven IPMN of main duct (MPD)and branches ducts (BD),were retrospectively enrolled.Patients underwent Gd-enhanced 3.0-T MRI with Diffusion Weighted imaging (DWI)and MRCP.Qualitative image analysis included: presence/absence of enhanced endoluminal filling defects,enhanced thickened (> 1 mm)ductal walls (MPD/BD), pancreatic duct dilation (MPD/BD);endoductal no-enhanced filling defects, vascular infiltration,DWI high signal intensity at high b value (b=1000 sec/mm2). Quantitative analysis included maximal diameter of MPD/BD.Tumours were subdivided in IPMN and invasive IPMN subtypes, according to pathologic examination. A Chi-Square test was performed.

Results: At pathological proven 5/20 GT, 4/20 IT, 2/20 PBT, 2/20 OT and 7/20 CTT resulted. We observed enhanced endoluminal filling defects in 1/5GT (20%), 3/4 IT (75%), 1/2 PBT (50%), 1/2 OT (50%),7/7 CTT (100%), enhanced thickened ductal walls in 0/5 GT (0%),4/4 IT (100%),2/2 PBT (100%),1/2 OT (50%), 7/7CTT (100%); MPD dilation in 0/5GT (0%),2/4 IT (50%),1/2PBT and OT (50%),4/7 CTT (57%), and BD dilation in 1/5 GT (20%),2/4 IT (50%),1/2 PBT and OT (50%),4/7 CTT (57%);non-enhanced mural nodules were present in 3/5 GT (60%),4/4 IT (100%),2/2 PBT (100%), 1/2 OT (50%), 6/7 CTT (85%);vascular invasion was present in 1/7 (CTT:14%); DWI high signal intensity was absent in GT and PBT (0%),present in 4/4 IT (100%);2/2 OT (100%)and in 7/7 CTT (100%).The mean size of MPD and BD was 11.7 mm (5.2-20.28 mm) and 27.4 mm (6-68 mm)respectively.Enhanced endoluminal filling defect and thickened ductal walls as well DWI high signal intensity at high b value significantly correlated with IPMN subtypes ($p < 0.05$).
Conclusion: The main distinctive 3 T-MRI features in IPMN subtypes were absence of enhanced endoluminal filling defects and thickened ductal walls,as well DWI in GTand presence of the same features in CTT.

B-1237 15:12

Gastrointestinal stromal tumours of the stomach: CT percentage of tumour necrosis and prediction of malignancy

N. Cioffi Squitieri, M.A. Mazzei, C. Vindigni, G. Sadotti, P. Mercuri, L. Righi, S. Guerrini, F.G. Mazzei, L. Volterrani; *Siena/IT (nevadacioffi@gmail.com)*

Purpose: The purpose of this study was to identify the predictors of malignancy on CT for the evaluation of gastrointestinal stromal tumours of the stomach (GIST), correlating CT findings with the mitotic index.
Methods and Materials: The medical records at our institution of 39 patients (mean age 67 years) with a histologic diagnosis of GIST were reviewed. One radiologist and one resident in radiology with 10- and 4-year experience in oncological field, retrospectively and blindly reviewed the CT findings by consensus with respect to location, lesion size, contour, tumour growth pattern, enhancing pattern, degree of enhancement of tumour, percentage of tumour necrosis, mesenteric fat infiltration, ulceration, calcification, regional lymphadenopathy, direct invasion to adjacent organ, and distant metastasis. All parameters were correlated with the mitotic index evaluated at histopathological analysis following surgery. Normality of variables was evaluated using Shapiro-Wilk test. Pearson's correlation test was used to test the interaction between variables. The diagnostic accuracy of percentage of tumour necrosis in detecting if the number of mitosis per 50 high-power fields was > 5 was measured by using receiver operating characteristic (ROC) analysis.
Results: A significant statistical correlation was found between percentage of tumour necrosis and the mitotic index ($p < 0.005$), dimension and location of the tumour.
Conclusion: CT could be an accurate technique in the prediction of malignancy of GIST in a CT risk assessment system, based on the location of the tumour, its size and the percentage of tumour necrosis.

B-1238 15:20

Gastrointestinal stromal tumour xenografts: therapeutic repose to treatment with imatinib assessed by intravoxel incoherent motion diffusion-weighted MR imaging with histopathological correlation

F. Pan[1], J. Deng[2], Y. Wang[1], H. Wang[3], J. Cheng[1], W. Wu[1]; [1]*Beijing/CN*, [2]*Chicago, IL/US*, [3]*Shanghai/CN (panfenghxh@163.com)*

Purpose: To exploit DWMRI with IVIM model in evaluating therapeutic response toimatinib in a mouse GSIT model.
Methods and Materials: Mouse xenografts bearing GIST -T1 cell line with mutation of KIT exon 11 were randomly divided in a non-treated and a treated group receiving imatinib. Imatinib was orally administrated by gavage at 150 mg/kg twice a day for 7 consecutive days starting on day-1. DWMRI with 14 b-values (0-1500 s/mm^2) was performed before (day -1) and after treatment (day 1, 3 and 7). Perfusion fraction (PF) and perfusion coefficient (D*) were calculated by fitting the two-compartment bi-exponential signal model. Conventional apparent diffusion coefficient (ADC) was also calculated. The mean change from baseline (day -1) for each measurement (ΔADC%, ΔPF% and ΔD*%) was calculated to evaluate response to treatment and compare with the histopathological analyses.
Results: Increases in ADC of the treated group (ΔADCtreated%=11%, 9%, 42%) were higher than those of the control group (ΔADCcontrol%=-1%, 1%, 10%) on day1, 3 and 7, whereas no significant difference was obtained (P=0.6698, P=0.0538, P=0.0686). In contrast, the IVIM-related D* decreased significantly at the same time points in the treated group (ΔD*treated%=-41%, -49%, -49%) compared to the control group (ΔD*control%=-9%, -7%, -14%) (P=0.0001, P=0.0001, P=0.0001). Significant increases of PF were also demonstrated (ΔPFtreated%=79%, 82%, 110%) compared to the control group (ΔPFcontrol%=11%, 15%, 41%) (P=0.001, P=0.0001,P=0.0007).
Conclusion: IVIM related PF and D* may more sensitive for assessing imatinib responses in GIST occurring as early as one day after treatment, superior to ADC measurements.

14:00 - 15:30 **Room F2**

Physics in Radiology

SS 1913

Patient and staff dose studies

Moderators:
H. de las Heras; Madrid/ES
N. Leitgeb; Graz/AT

K-30 14:00

Keynote lecture

C. Leidecker; *Forchheim/DE*

B-1239 14:09

Comparing CT dose performance to regional and national benchmarks: multicenter experience in Belgium

L. Pyfferoen[1], T.H. Mulkens[2], T. De Bondt[3], J.W. Casselman[1], P.M. Parizel[3], F. Zanca[4]; [1]*Bruges/BE*, [2]*Lier/BE*, [3]*Antwerp/BE*, [4]*Leuven/BE, Brussels/BE (lotte.pyfferoen@azsintjan.be)*

Purpose: To benchmark CT dose indices for standard adult examinations to regional and national reference levels and to optimise scanning protocols.
Methods and Materials: Data from five CT scanners (16, 64, 128 slices) from three hospitals were automatically collected using the same dose management solution over a 1-year period. Inclusion criteria were: patient age> 18y and standard exams with only one helical scan; CT-Head, CT-Sinus, CT-Cervical spine, CT-Lumbar spine, CT-Thorax, CT-Thorax-Angiography, CT-Abdomen-Pelvis, CT-Abdomen-Urolithiasis. Demographic data, BMI, CTDIvol, DLP and scan length were analysed and compared among facilities and to regional/national reference levels. The use of dose reduction techniques was documented.
Results: A total of 23749 standardised exams were registered, mainly head (27%), abdomen-pelvis (24%) and thorax (19%) exams. Each institution reported dose indices below P75 of the national DRLs. Marked variability (up to 5x) within and across facilities was found, in particular with respect to one hospital where a protocol optimisation process was set in place since ten years (DRLs at P25, minimal variability). Largest CTDIvol (mGy) variability was found for CT-scans of head (19.25-50.10), for cervical-spine (6.67-30.45) and for thorax-angiography (2.71-12.26). DLPs followed the same trend. All three centra used iterative reconstructions and tube-current modulation.
Conclusion: Dose tracking systems help to benchmark and develop quality programs for improved patient care. Although dose levels are below national DRLs, sharing dose and protocol data between hospitals offers great potential for improvement of everyday CT practice. A long-term dose management approach helps achieving P25 DRLs and reducing variability in standard exams dose indices.

Author Disclosures:
F. Zanca: Employee; GE.

B-1240 14:17

Effective dose in cardiac CT - evaluation of a new dose monitoring software (radimetrics™)

S. Suntharalingam, N. Guberina, F.F. Stecker, J.M. Theysohn, K. Nassenstein, M. Forsting, A. Ringelstein, T. Schlosser; *Essen/DE (Saravanabavaan.Suntharalingam@uk-essen.de)*

Purpose: To compare dose-length product (DLP)-based estimates of effective dose (ED) with organ dose-based calculations in high pitch spiral mode (FLASH) for cardiac CTs.
Methods and Materials: ED was estimated retrospectively for 243 consecutive patients who underwent coronary calcium scoring (CCS) and CT coronary angiography (CTCA), using the most recent tissue weighting factors (ICRP 103) with Bayer's dose-monitoring-software "radimetrics". For the same examinations ED was generated from the respective DLP using conversion coefficient of 0.014 mSv mGy-1 cm-1 for the chest.
Results: ED calculated for CCS using organ dose estimates and ICRP 103 tissue-weighting factors were significantly higher compared to DLP-based estimates for female patients (0.92 vs. 0.50 mSv; $p < 0.05$) and for male patients (0.81 vs. 0.50 mSv; $p < 0.05$). In CTCA there was a significant difference between both dose estimating algorithms. For female patients ED with organ-dose based estimates were higher at 80 kVp (0.70 vs. 0.37 mSv; $p < 0.05$), at 100 kVp (1.67 vs. 0.81 mSv; $p < 0.05$) and at 120 kVp (3.87 vs. 1.69 mSv $p < 0.05$) compared to DLP-based estimates of ED. The same was true for male patients at 80 kVp (0.64 vs. 0.39 mSv; $p < 0.05$), at 100 kVp (1.40 vs. 0.78 mSv; $p < 0.05$) and at 120 kVp (3.38 vs. 1.70 mSv; $p < 0.05$).

Conclusion: The convenient way underestimates ED for CCS and CTCA, especially for women. The extent of the false estimation is depending on body weight. These differences in calculating ED suggest the need to reassess DLP to ED conversion coefficients when adopting ICRP 103 for CCS and CTCA.

B-1241 14:25

Limits and strengths of novel dose monitoring programme eXposure

N. Guberina, F.F. Stecker, S. Suntharalingam, M. Schlamann, M. Forsting, J.M. Theysohn, B. Mukherjee, U. Lechel, A. Ringelstein; *Essen/DE (nika.guberina@uk-essen.de)*

Purpose: In a retrospective "dose-alert" procedure we observed that the dose monitoring program eXposure (Bayer HealthCare, Germany) assessed identical effective radiation doses for the eye lens in unenhanced cranial CT-protocols at our 128-multislice-single-source and the dual-source CT-scanner, viz. with (+nCT) and without (-nCT) gantry angulation. The discrepancy between expected and obtained results, motivated us to evaluate the limits and strengths of dose monitoring program eXposure when used in cranial CT-protocols.
Methods and Materials: We performed phantom measurements with thermoluminescence-dosimeters (LiF:Mg,Ti; TLD-100) on an anthropomorphic phantom using different CT-protocols (+nCT, -nCT). The phantom measurements served as a gold standard for radiation dose estimation. Effective radiation doses assessed with eXposure and measured on the anthropomorphic phantom were averaged and compared between the modalities.
Results: Our intermodality comparison shows a discrepancy between effective radiation doses estimated by eXposure and measured with TLDs in (+nCT). Effective radiation doses are summarized as follows: (I) for the eye lens in +nCT (a) eXposure 45mSv (b) TLD 5mSv; (II) for the eye lens in -nCT (c) eXposure 41mSv, (d) TLD 35mSv. Analysis of specific CT-protocol features reveals the lack of registration of gantry angulation by dose monitoring program eXposure in +CT.
Conclusion: The disregard of gantry angulation leads to an overestimation of effective radiation dose for the eye lens at single-source CT-scanners. The current data help to account protocol-specific influences and correct underlying software algorithms.

B-1242 14:33

Implementation of a dose monitoring software in clinical routine: first experiences

C. Heilmaier, N. Zuber, D. Weishaupt; *Zurich/CH (christina.heilmaier@triemli.zuerich.ch)*

Purpose: Radiation exposure due to medical imaging considerably increased during the last decades, now making up almost 50% of the yearly background radiation exposure of the public. Especially, computed tomography (CT) contributes to irradiation. We therefore first im-plemented a dose monitoring software at our institute's 2 CT scanners.
Methods and Materials: We retrospectively analyzed dose data from June to September 2014 using GE's dose monitoring software DoseWatch® with reference levels set as 75th percentile. Analysis focused on number of alerts and reasons for alerts. Moreover, we compared data gained from our emergency CT (LightSpeed® VCT, GE) with that from our "clinical routine" CT (Discovery CT750 HD, GE, Milwaukee, WI).
Results: A total of 4,263 CTs were included in analysis. Of these 221 caused an alert: 66 (June), 61 (July), 43 (August), and 51 (September), respectively. Reasons were wrong protocol name (e.g. abdomen portal-venous chosen, but additional delayed phase scanned; 99/221), patient centering (not perfectly in isocenter of scanner; 26/221), scan repeat (e.g. due to severe motion artifacts; 13/221), osteosynthesis in situ (10/221), high body weight (68/221), and scan of the paranasal sinuses (5/221). Alert quota was relatively stable, fluctuating between 4.1-6.2%. When comparing both CT scanners we detected the following differences: more often scan repeat and wrong protocol name at emergency CT (possibly due to stress), less frequently high body weight or osteosynthesis in situ, no significant difference between scanners in patient centering and scan of sinuses.
Conclusion: Dose monitoring software provides important information useful to improve patients' safety.

B-1243 14:41

Comparison of iterative reconstruction techniques for reduced-dose liver computed tomography following transarterial chemoembolisation for hepatocellular carcinoma

W. Lee[1], W. Jeong[1], M. Cha[1], Y. Kim[1], S. Lim[2], S.-Y. Choi[2], D. Choi[1]; [1]*Seoul/KR*, [2]*Gyeonggi-do/KR*

Purpose: To compare low-dose computed tomography (CT) image quality and diagnostic performance among three reconstruction techniques-adaptive statistical iterative reconstruction (ASIR), model-based iterative reconstruction (MBIR), and filtered back projection (FBP)-after patients received transcatheter arterial chemoembolization (TACE) of hepatocellular carcinomas (HCC).
Methods and Materials: Institutional review board approval and written informed consents were obtained. Of the 60 consecutive patients who underwent TACE for HCCs, a half (25 male, 5 female; mean age: 59.1) underwent liver CT with 30% reduced dose relative to conventional scanning (protocol I), and the other half (28 male, 2 female; mean age: 61.7) received 60% reduced dose (protocol II). CT images were reconstructed using three algorithms: FBP, ASIR, and MBIR. For objective analysis, image noise and signal-to-noise ratio (SNR) were compared among reconstruction methods. For subjective analysis, three radiologists independently assessed image quality. Ability to detect viable HCCs in the images was also evaluated.
Results: MBIR and ASIR produced images with less noise and higher SNR compared with FBP regardless of protocol (*P*s <.017). However, in terms of subjective image blotchiness, sharpness, and overall quality, MBIR was inferior to FBP and ASIR in both protocols (*P*s <.001). We found no significant differences among reconstruction algorithms in the detection of viable HCCs.
Conclusion: Although MBIR can potentially allow a reduction in radiation dose by producing images with less noise, subjective evaluations of MBIR images suggest that they are of lower quality compared with FBP and ASIR images regardless of the reduction in radiation dose.

B-1244 14:49

Detection of midfacial and orbital fractures using ultralow dose CT and iterative reconstructions

G. Widmann, D. Dalla Torre, R. Hoermann, P. Schullian, E.-M. Gassner, R. Bale, W. Puelacher; *Innsbruck/AT (gerlig.widmann@i-med.ac.at)*

Purpose: After emergency computed tomography (CT), surgical treatment of complex midfacial and orbital fractures may require additional CT scans for treatment planning, stereolithographic model fabrication and guided surgery. Purpose was to evaluate the influence of high resolution ultralow dose protocols and iterative reconstructions on the diagnostic quality compared with a standard cranial emergency protocol.
Methods and Materials: All protocols and reconstructions were performed using a 64-multi slice CT scanner. Application software was used to calculate CT dose index volume (CTDIvol) and effective doses. Noise was evaluated as standard deviation in Hounsfield Units within an identical region of interest in the posterior fossa. The detection rate of midfacial and orbital fractures of a human cadaver head was assessed by two readers in consensus.
Results: The emergency protocol had a CTDIvol of 35.3 mGy and effective dose of 3.6 mSv. Dislocated craniofacial fractures may be sufficiently diagnosed by ultralow dose protocols down to CTDIvol 1.0 mGy (0.1 mSv) (97% dose reduction). Non-dislocated fractures may be detected at CTDIvol 2.6 mGy (0.3 mSv) (93% dose reduction). Adaptive statistical iterative reconstruction 50 and 100 reduced average noise by 30% and 56%, and model based iterative reconstruction by 93%, but had no influence on diagnostic quality.
Conclusion: High resolution ultralow dose protocols for craniomaxillofacial surgery may provide dose reductions of more than 90%. Iterative reconstructions substantially reduce noise but may not improve diagnosis of non-dislocated fractures due to smoothing effects.

B-1245 14:57

CTPA bolus timing techniques in pregnancy: an underappreciated contributor to breast radiation dose

D.P. Mitchell, M. Rowan, M. Crockett, F. Ni Ainle, P. Mac Mahon; *Dublin/IE (dpmmitchell@gmail.com)*

Purpose: To investigate the impact of contrast bolus timing techniques on the breast dose of pregnant patients undergoing CTPA.
Methods and Materials: 30 CTPA studies performed on 26 consecutive pregnant patients in a single centre were retrospectively analysed using Radimetrics software to calculate DLP and breast dose due to both the contrast bolus scan and the subsequent CTPA scan. The contrast bolus timing method and number of repeat timing techniques was noted.

Results: The average DLP for the contrast bolus scan and the CTPA study was 16.4 cmGy and 126.9 cmGy respectively however, the average breast dose was 3.0 mSv and 6.9mSv respectively. As bolus timing methods use a very short scan length, they contribute little to the total DLP (11.4%), however as the scan is centered over the breast, it contributes 30% to the overall breast dose.
Conclusion: It is well known that performing CTPA in the pregnant population can be technically challenging. To optimise opacification of the pulmonary vessels, repeated bolus-timing or bolus tracking techniques may be performed prior to formal CTPA study acquisition. The radiation exposure due to the additional bolus timing sequences are frequently overlooked due to their negligible effect on the total DLP (16.4 cmGy in our study). We have found that they have a disproportionate effect on the breast dose, contributing up to 50% in some cases, which is of particular concern in the young female pregnant population. Our study has demonstrated that bolus timing techniques are an under-appreciated yet significant contributor to breast dose.

B-1246 15:05

Clinical indications and radiation doses to the conceptus associated with CT scanning in pregnancy: a retrospective study
S.E. Woussen, F. Zanca, H. Bosmans, D. Vanbeckevoort, R.H. Oyen;
Leuven/BE (sofie.woussen@gmail.com)

Purpose: To evaluate the number of CT exams performed on pregnant patients as well as clinical indication and procedure and to estimate the radiation doses to the conceptus associated with these CT exams.
Methods and Materials: A retrospective review of all CT exams performed in a single center on pregnant patients between January 2008 and July 2013. Demographics, gestational age (GA), clinical indication, eventual occurrence of accidental exposure and scan parameters were noted. Radiation doses to the conceptus were estimated using CT-Expo version 2.2. The results were compared with published data.
Results: The number of CT exams during pregnancy increased through the years, from 3-4 per year in 2008-2011 to 11 per year in 2012. Clinical indications were headache or trauma for head/cervical spine CT, suspected pulmonary embolism (PE), staging and polytrauma for chest CT, fetal skeletal dysplasia and polytrauma for abdominopelvic CT. The mean estimated conceptus radiation dose was considered negligible for CT of the head and cervical spine, < 0.01 mGy, and for CT of the chest, < 0.01 mGy. The estimated conceptus radiation dose from abdominopelvic CT was on average 28.7 mGy (range, 6.7-60.5 mGy).
Conclusion: The number of CT scans of pregnant patients increased tri-fold in the last years. While all clinical indications and doses showed to be in line with good clinical practice, standard operating procedures were missing. In practice, there is a need for better guidelines regarding communication with pregnant patients and referring doctors, to reduce the anxiety concerning radiobiological effects in the foetus.

B-1247 15:13

Pregnant employee in the cardiac catheterisation lab: data for estimation of conceptus dose
K. Perisinakis, J. Stratakis, G. Solomou, J. Damilakis; *Iraklion/GR (Kostas.Perisinakis@med.uoc.gr)*

Purpose: To provide data for the estimation of conceptus dose from maternal occupational exposures in the cardiac catheterization suit.
Methods and Materials: A Rando anthropomorphic phantom was placed on patient table and ten standard cardiac fluoroscopic projections commonly utilized during cardiac catheterization procedures were successively simulated. A survey meter was used to measure air-kerma rates from each projection at different positions inside the operating room. Data were derived for a square grid every 0.5 m distance to cover every possible location of all staff members involved in cardiac interventional procedures. Data were obtained for three different field sizes i.e. 12x12, 15x15 and 20x20 cm, three different filter-combinations i.e.3.0 mmAl+0.0 mmCu, 3.0 mmAl+0.1 mmCu and 3.0 mmAl+0.2 mmCu, and seven different operating x-ray tube voltage values i.e. 50, 60, 70, 80, 90 and 100 kV. All dose rates measured were normalized to the corresponding DAP-rate of the fluoroscopic system.
Results: Maps of dose rate normalized to DAP were derived around the patient table for ten standard cardiac fluoroscopic projections commonly utilized during cardiac catheterization procedures. Dose rates were found to significantly increase with increasing field size and operating tube voltage and decreasing beam filtration ($p < 0.001$). Conceptus dose in case of a pregnant employee involved in a cardiac catheterization procedure may be estimated using provided data, given that the total DAP per projection, mean kV per projection and mean added filter per projection has been recorded.
Conclusion: Data and methods were developed for the estimation of conceptus dose from maternal occupational exposure in the cardiac catheterization laboratory.

Author Disclosures:
K. Perisinakis: Research/Grant Support; ARISTEIA grant from General Secretariat of Research of Greece. **J. Stratakis:** Research/Grant Support; ARISTEIA grant from General Secretariat of Research of Greece. **G. Solomou:** Research/Grant Support; ARISTEIA grant from General Secretariat of Research of Greece. **J. Damilakis:** Research/Grant Support; ARISTEIA grant from General Secretariat of Research of Greece.

B-1248 15:21

Personnel dose reduction for Y90 microspheres liver-directed radioembolisation: from angiogram suite to patient ward
M. Law, K. Wong, W. Tso, V. Lee, M. Luk; *Hong Kong/HK (lawwm@ha.org.hk)*

Purpose: To describe a method to reduce radiation emitted from patient after ^{90}Y liver-directed radioembolisation, to measure occupational dose for personnel involved after implementing the method for dose reduction and to discuss radiation exposure to nearby patients if the radioembolised patient needs hospitalisation.
Methods and Materials: A lead-lined blanket was used to cover the patient thorax-abdominal region right after radioembolisation procedure. For dose comparison, radiation doses have been measured at 10 cm above patient abdomen and at radiologist with and without the use of blanket.
Results: The radiation exposures above the patient abdomen and at radiologist have been statistically reduced with the use the lead line blanket. Interventional radiologist, performing puncture site compression at the end of radioembolisation procedure, would receive 0.92 µSv on the extremity and 0.4 µSv under his own apron for a 2 GBq ^{90}Y infusioin. Other personnel would receive occupational dose comparable to an hour of background radiation. If the radioembolised patient needs hospitalisation in a common ward, keeping the nearby patient to 2 m and using the lead lined blanket would keep the exposure at the adjacent patient at background level.
Conclusion: By placing a lead-lined blanket on the patient thorax-abdominal region after ^{90}Y radioembolisation, hospital staff would receive minimal radiation exposure in order to comply the radiation protection 'as low as reasonably achieveable' principle. The radioembolised patient can stay at a corner bed of a common ward if isolation room with private toilet is not available at the end of radioembolisation procedure.

14:00 - 15:30 **Room D1**

Chest

SS 1904

Infection, transplantation and quality issues

Moderators:
J. Babar; Cambridge/UK
C.J. Herold; Vienna/AT

B-1249 14:00

Prevalence and diagnostic value of the vessel occlusion sign in CT pulmonary angiography of patients with invasive pulmonary aspergillosis: comparison with other characteristic radiomorphological patterns
C. Hagelstein, M. Reinwald, D. Buchheidt, K.W. Neff, S.O. Schoenberg, T. Henzler; *Mannheim/DE (Claudia.Hagelstein@umm.de)*

Purpose: Diagnosis of invasive pulmonary aspergillosis (IPA) in immunocompromised patients remains difficult. Interruption of pulmonary arteries has been proposed as a radiological sign in IPA. The aim of this study was to investigate the prevalence of the vessel occlusion sign (VOS) in CT pulmonary angiography (CTPA) studies of patients with IPA in comparison to other radiological signs that do not require intravenous contrast administration.
Methods and Materials: 442 patients with suspected IPA based on microbiological evidence were retrospectively analyzed. All patients with IPA according to the 2008 EORTC/MSG criteria and an available CTPA study were included in this study (64/442). CTPA studies were evaluated by two radiologists for the presence of VOS, halo sign, infarct shaped consolidations, internal low attenuation sign, ground glass opacities, air-crescent sign, and cavitation.
Results: VOS detected by CTPA showed the highest prevalence compared to all other radiological signs indicating IPA (51/64,[80%]). Prevalence of the characteristically halo sign was slightly less frequent (48/64,[75%]). 47/64 (67%) patients showed infarct shaped consolidations and the air-crescent sign was present in 27/64 (42%) patients. The internal low attenuation sign was observed in 25/64 (39%) patients. Cavitation was present in 18/64 (28%) cases and ground glass opacities were detected in only 14/64 (22%) patients.

Conclusion: The VOS on CTPA studies seems to be the most frequently observed radiological sign in patients with IPA compared to other radiological signs. Thus, CTPA studies have an additional diagnostic value over non-contrast enhanced CT studies and should be performed more frequently if IPA is suspected.

B-1250 14:08

Pulmonary MRI at 3 T in immunocompromised patients with invasive fungal infections

S.N. Nagel, Y. Löschmann, S. Schwartz, B. Hamm, T. Elgeti;
Berlin/DE (sebastian.nagel@charite.de)

Purpose: To evaluate pulmonary magnetic resonance (MR) imaging at 3 T for further characterisation of atypical pulmonary infiltrates in immunocompromised patients with haematological diseases.
Methods and Materials: Patients with atypical pulmonary infiltrates in computed tomography (CT) and suspected invasive fungal infection according to EORTC/MSG were examined prospectively using the following protocol: coronal steady-state free precession (SSFP), axial T2-weighted fast spin echo (FSE) with/without fat saturation and T1-weighted gradient echo (GRE) sequences. Visibility and size of lesions in the different MR sequences were compared to CT findings.
Results: All 10 included patients completed the examination. A total of 69 lesions were evaluated, of which 64 were nodular. In T2w images, 47 lesions were clearly visible, 6 poorly, and 7 not visible, 4 lesions were only identified in conjunction with CT. For T2w-fatsat images, frequencies were: 40, 8, 10, and 6, respectively. For T1w images, frequencies were: 46, 8, 5, and 5, respectively. SSFP imaging did not show pulmonary lesions sufficiently. Lesion sizes measured in T2w and T2w-fatsat (9.2±4.6 mm and 9.1±4.0) were significantly larger compared to CT (7.2±3.6 mm; p=0.001 and $p < 0.001$). No significant difference was seen in T1w (7.8±3.52 mm; p=0.14). In 4 nodular lesions and 5 consolidations, central low T2 signal was found.
Conclusion: Pulmonary MRI at 3 T could identify atypical pulmonary infiltrates. Additional information on pulmonary consolidations were obtained using T2w images. These changes possibly reflect an immunogenic response or therapeutic effect. Larger studies are necessary to determine the role of 3 T MRI in the diagnostic assessment and follow-up in immunocompromised patients.

Author Disclosures:
S. Schwartz: Research/Grant Support; Pfizer, MSD Sharp & Dohme, Gilead Sciences. Speaker; Pfizer, MSD Sharp & Dohme, Gilead Sciences. Other; Pfizer, MSD Sharp & Dohme, Gilead Sciences. **B. Hamm:** Grant Recipient; 1. Abbott, 2. Actelion Pharmaceuticals, 3. Bayer Schering Pharma, 4. Bayer Vital, 5. BRACCO Group, 6. Bristol-Myers Squibb, 7. Charite research organisation GmbH, 8. Deutsche Krebshilfe, 9. Dt. Stiftung für Herzforschung, 10.Essex Pharma, 11.EU Programmes, 12.Fibrex Medical Inc., 13.Focused Ultrasound Surgery Foundation 14.Fraunhofer Gesellschaft, 15. Guerbet, 16.INC Research, 17.InSightec Ud., 18.IPSEN Pharma, 19.Kendlel MorphoSys AG, 20. Lilly GmbH, 21. Lundbeck GmbH, 22. MeVis Medical Solutions AG, 23. Nexus Oncology, 24. Novartis, 25. Parexel CRO Service, 26. Perceptive, 27. Pfizer GmbH, 28. Philipps, 29.sanofis-aventis S.A, 30. Siemens, 31.Spectranetics GmbH, 32.Terumo Medical Corporation, 33.TNS Healthcare GMbH, 34. Toshiba, 35. UCB Pharma, 36.Wyeth Pharma, 37.Zukunftsfond Berlin (TSB), 38.Amgen, 39.AO Foundation, 40.BARD, 41. Braun 42. Boehring Ingelheimer, 43. Brainsgate, 44. PPD (CRO), 45.CELLACT Pharma, 46.Celgene, 47.CeloNova BioSciences, 48.Covance, 49. DC Deviees, Ine. USA 50. Ganymed, 51. Gilead Scienees, 52. Glaxo Smith Kline, 53.ICON (CRO) 54.Jansen, 55. LUX Bioseienees, 56. MedPass, 57. Merek, 58. Mologen, 59. Nuvisan, 60. Pluristem, 61. Quintiles, 62. Roehe, 63. Sehumaeher GmbH 4. Seattle Geneties, 65. Symphogen, 66. TauRx Therapeuties Ud., 67. Accovion, 68.AIO: Arbeitsgemeinschaft Internistische Onkologie, 69.ASR Advanced sleep research, 70. Astellas, 71. Theradex, 72. Galena Biopharma, 73. Chiltern, 74.PRAint, 75.Inspiremd, 76. Medtronic, 77. Respicardia, 78. Silena Therapeutics 79. Spectrum Pharmaceuticals, 80. St. Jude.

B-1251 14:16

Incidence of the reversed halo sign and the evolution of the radiologic findings in 20 patients with proven pulmonary mucormycosis

J. Choe, M.Y. Kim, S.-H. Kim; *Seoul/KR (jooae23@gmail.com)*

Purpose: We aimed to find out the incidence of reversed halo sign (RHS) and the evolution of the radiologic finding by the time between the first clinical signs and the first CT scan in proven pulmonary mucormycosis (PM).
Methods and Materials: Over the 12-year period, adult patients who met the modified criteria for proven PM by the revised European Organization for Research and Treatment of Cancer/Invasive Fungal Infections Cooperative Group and the National Institute of Allergy and Infectious Diseases Mycoses Study Group (EORTC/MSG) definition were retrospectively enrolled. Initial thoracic CT scans (0-5, 6-14 and 15-30 days) were reviewed by an experienced radiologist blinded to the patients'demographics and clinical outcomes.
Results: During the study period, total 20 proven PM cases were enrolled. Among the 7 patients who underwent CT between day 0 and day 5, macronodule (43%), halo sign (43%), or mass-like consolidation (43%) were frequently found, followed by RHS (29%) and bird nest sign (BNS) (29%). Among 9 patients who underwent CT between day 6 and day 14, consolidation (67%), pleural effusion (67%), halo sign (56%), bird nest sign (56%), ground grass opacity (56%) were found, followed by air-crescent sign (33%) and RHS (22%). RHS was no longer observed after day 14, and mass like consolidation (75%) was the most common feature in the later course of the disease.
Conclusion: RHS or bird nest sign were seen in about two-thirds of patients with PM, especially in early course of PM, which may help physicians to preemptively initiate Zygomycetes-active antifungal treatment.

B-1252 14:24

Computed tomography features of pulmonary nocardiosis

R. Aslani Menareh Bazari, P. Mehrian, M.A. Karimi, E. Esfandiari; *Tehran/IR*

Purpose: No dominant imaging features have been reported for pulmonary nocardiosis in previous studies. Determining a specific computed tomography (CT) pattern can be valuable diagnostic tools and obviates the need for invasive diagnostic methods. The aim of this study was to describe the computed tomography features of pulmonary nocardiosis.
Methods and Materials: CT images of 25 patients (Mean age=39.5; 76% male) with pulmonary nocardiosis (proved by bronchoalveolar lavage or biopsy) admitted to Masih-e-Daneshvari hospital from 2001 to 2012 were reviewed by an experienced pulmonary radiologist and detailed findings were reported. Fourteen patients (56%) had no underlying immunocompromising condition and 44% were immunocompromised.
Results: Pulmonary nodules (96%), consolidation (76%) and cavity (52%) were the common CT findings. Other findings were as: bronchiectasis (48%), pleural thickening (40%), ground glass opacity (32%), mass like consolidation (20%), lymphadenopathy (16%), pleural effusion (12%), reticular infiltration (4%) and pericardial effusion (4%). All pulmonary nodules were multiple and 40% were diffuse. 58% of consolidations were bilateral multifocal. There was no statistically significant difference in CT findings of immunocompromised and immunocompetent groups. Mean age of patients with bronchiectasis was significantly higher than that of patients without bronchiectasis (46.5 vs. 33 years, p=0.04). There was no cavitary or tree-in bud nodules in men, while both type of nodules were seen in 33% of women (p=0.003).
Conclusion: The main CT presentations of pulmonary nocardiosis include nodules, consolidation and cavity. These findings are not specific and do not obviate the need for biopsy or BAL.

B-1253 14:32

Comparison of chest-CT findings of influenza virus-associated pneumonia in immunocompetent vs. immunocompromised patients: patterns of involvement and interchangeability at time

C. Kloth, K. Nikolaou, M. Horger; *Tübingen/DE*
(christopher.kloth@med.uni-tuebingen.de)

Purpose: To retrospectively compare CT patterns of pulmonary infiltration caused by Influenza viruses in immunocompetent and immunocompromised patients for possible discrimination.
Methods and Materials: Between January 2009 and April 2014, 56 patients (female 26; male 30; median age 55.8y, range 17-86y; SD±14.4y) underwent chest-HRCT of 538 patients who were tested positive for Influenza A and B by bronchoalveolar lavage by a retrospective database search. All patients underwent chest-CT showing signs of pulmonary infection. Chest-CT was initiated by the presence of pulmonary or systemic symptoms accompanied by fever and abnormalities at the physical examination. We registered all CT-findings compatible with pulmonary infection classifying them as airway predominant (e.g. tree-in-bud, centrilobular nodules, peribronchial ground-glass-opacity and consolidation) vs interstitial (bilateral, symmetrical consisting of GGO, consolidation, crazy paving, interlobular-septal-thickening). 28 patients had follow-up CT-studies (0.78mean, SD±5.8scans).
Results: 34 patients were immunocompromised (group I) whereas 22 patients were immunocompetent (group II). An as airway predominant pattern of infection was found in 15 patients (group I) and 14 patients (group II) whereas an interstitial pattern was found in 14 patients (group I) and 2 patients (group II). 11 patients had a mixed pattern with no clear assignment to one group. At FU, 9 patients from group.i. and 1 from group II showed interchangeable infiltration patterns. No significant differences in the pattern of pulmonary infection were found between influenza A and B.
Conclusion: Patterns of pulmonary infiltration caused by Influenza viruses do not significantly differ between immunocompetent and immunocompromised patients. One possible explanation for this could be the temporarily interchangeable character of pulmonary infiltration of this infection.

B-1254 14:40

Restrictive allograft syndrome after lung transplantation: new radiological insights

A. Dubbeldam, J. Coolen, J. Verschakelen, W. De Wever; *Leuven/BE (adriana.dubbeldam@gmail.com)*

Purpose: To describe onset and progression pattern of Computed Tomography (CT) findings of Restrictive Allograft Syndrome (RAS) in patients after lung transplantation (LTX).
Methods and Materials: In a retrospective study, 22 patients with functionally confirmed RAS after LTX were included. All patients underwent CT-examinations between november-2001 and august-2014 as follow-up after LTX.
Results: 14 patients progressed towards RAS in a multi-step pattern of exacerbations. Average onset until first non-regressing CT-abnormalities was 46.9months. In this group, CT-findings that did not regress anymore, started with a discrete nodular-reticular pattern. This pattern progressed to RAS over an average period of 13.9months. Median graft survival is 33.5months after first onset non-regressing abnormalities, with most patients alive and in follow-up (9/14). 7 patients showed sudden onset and rapid progression towards RAS. Average onset until first non-regressing CT-abnormalities was 75.4months. In this group, CT-findings that did not regress anymore started with a consolidation pattern, diffuse and mostly peripheral. This pattern progressed to RAS over an average of 2.8months. Median graft survival is 6.4months after first onset non-regressing abnormalities, with most patients retransplanted (5/8) or deceased (1/8).
Conclusion: Besides the well-established pattern of multi-step progression towards RAS, our study showed a distinction between 2 groups, with either 'slow' or 'fast' progression to RAS, and with different graft survival. These patients also show a different onset pattern of CT-abnormalities: a discrete nodular-reticular pattern in the 'slow' progression group, and a more diffuse peripheral consolidation pattern in the 'fast' progression group.

B-1255 14:48

Diagnostic accuracy of ultra-low-dose chest CT with model-based iterative reconstruction (MBIR) in the detection of early pulmonary complications within the first six months following lung transplantation

M.-P. Debray[1], G. Dauriat[1], A. Khalil[1], S. Leygnac[1], A. Grandjean[2], E. Schouman-Claeys[1], P. Ou[1]; [1]*Paris/FR*, [2]*Buc/FR (marie-pierre.debray@bch.aphp.fr)*

Purpose: Early complications are frequent during the first 6 months following a pulmonary transplantation, requiring repetitive chest CT. Recently, the use of MBIR has led to dramatically reduce the CT radiation doses. The purpose of this prospective study was to assess the accuracy of ultra-low-dose chest CT (ULD-Chest-CT) with MBIR in detecting usual early abnormalities following pulmonary transplantation, using conventional dose CT with adaptative statistical iterative reconstruction (ASIR) as the reference standard.
Methods and Materials: We prospectively evaluated 34 examinations in 13 patients performed routinely during the first 6 months following lung transplantation. Each examination consisted of the acquisition (GE Discovery CT750HD) of a conventional (0.625 mm helical, 100 kV, noise index 45, ASIR) and of an ULD-Chest-CT (0.625 mm helical, 100 kV, 16 or 24 mAs/slice, MBIR). Images were evaluated separately by two thoracic radiologists for the detection and/or evolution of usual complications.
Results: Mean CTDIvol was 4.01±0.8 and 0.63±0.07 mGy for conventional and ULD-Chest-CT, respectively. Complications were found in 30/34 (88%) examinations, including 22 cases suggestive or compatible with viral or bacterial pneumonia, 5 with fungal infection, 21 with pleural effusion, 17 with pneumothorax, 11 with bronchial fistula and 2 cases with acute rejection. Compared with conventional CT findings, ULD-Chest-CT with MBIR had 91% sensitivity, 95% specificity, 92% PPV and 94.5% NPV on a per-complication basis.
Conclusion: ULD-Chest-CT with MBIR is accurate for delineating most usual pulmonary complications in the first 6 months following a pulmonary transplantation and might deserve to be used routinely for the early monitoring of pulmonary allograft.

Author Disclosures:
A. Grandjean: Employee; Employee of GE Healthcare.

B-1256 14:56

Non-infectious panbronchiolitis in the setting of allogeneic stem cell transplantation: a potential mimic of lower respiratory tract infection

C. Kloth, U. Grosse, S. Wirths, S. Gatidis, W. Bethge, K. Nikolaou, M. Horger; *Tübingen/DE (christopher.kloth@med.uni-tuebingen.de)*

Purpose: To describe a little known therapy-related small airway phenomenon presumably caused by mucous irritation in patients undergoing allogeneic stem cell transplantation (allo-SCT).
Methods and Materials: Retrospective database search at our institution identified 739 hematological patients who underwent chemotherapy+allo-SCT between September 2004 and March 2014. After excluding infectious pulmonary complications, 75 patients (female=24; male=51; median age=47y) with signs of panbronchiolitis on chest-HRCT were identified. CT was performed proximate to chemotherapy-onset; 92% had follow-up CT (mean, 1.9weeks). The presence of centrilobular nodularities, bronchial wall thickening (BWT), tree-in-bud (distributed diffuse vs. focal), ground-glass-opacity (GGO), airspace opacification, luminal impactions, air-trapping and mosaic pattern was correlated with occurrence and duration of oral mucositis and therapy characteristics. Intensity of tree-in-bud and centrilobular nodularities was graded absent (grade=0), moderate (grade=1) and marked (grade=2).
Results: Overall incidence of panbronchiolitis among patients undergoing allo-SCT was 10.7%. Panbronchiolitis was diagnosed at the time point of SCT with a mean duration of CT-findings of 4 weeks (±2.7). Tree-in-bud (17%[grade 2] and 83%[grade 1]) and BWT was present in 100%. Centrilobular nodularities were found in 45.5% of the patients (20%[grade 2, 24%[grade 1] and 56%[none]) being always diffusely distributed. Air-trapping and mosaic pattern were found in 13% and 16%. Resolution of panbronchiolitis was spontaneous. Panbronchiolitis and its severity correlated with the temporal course and grade of oral mucositis; their frequency and degree was not significantly influenced by the chemotherapy regimen.
Conclusion: Panbronchiolitis is a frequent phenomenon during chemotherapy for allo-SCT. It is characterized by an even distribution of tree-in-bud, BWT and centrilobular nodules, mild clinical symptoms and spontaneous resolution.

B-1257 15:04

Does the use of a checklist help medical students in the detection of abnormalities on a chest radiograph?

A. Abed, E.M. Kok, S.G.F. Robben; *Maastricht/NL (s.robben@mumc.nl)*

Purpose: The interpretation of a chest radiograph remains a complex task that is prone to diagnostic error, especially for medical students. The aim of this study is to investigate the extent to which medical students benefit from the use of a checklist regarding to the detection of abnormalities on a chest radiograph.
Methods and Materials: We developed a checklist based on the literature and interviews with experienced thorax radiologists. 40 medical students in the clinical phase assessed 18 chest radiographs during a computer test, either with (n = 20) or without (n = 20) the checklist. We measured performance and asked participants for feedback using a survey.
Results: On average, the checklist group scored higher (M = 23.65, SD = 6.17) than the control group (M = 20.08, SD = 5.70), F (1.39) = 35.3, t (39) = 35.3, p = 0.065). The post-experimental survey shows that on average, students found the checklist helpful (M = 3.25 on a 5-point scale), but also time consuming (M = 3.30 on a 5-point scale). Most students (75%) would like to use our checklist in clinical practice.
Conclusion: A checklist can help medical students to detect abnormalities in chest radiographs. Moreover, students tend to prefer the use of a checklist during the assessment of a chest radiograph. Therefore, a checklist seems to be a potentially important tool to improve radiology education in the medical curriculum.

B-1258 15:12

Using comparison films in education

E.M. Kok, A.B.H. de Bruin, J. Leppink, J.J.G. van Merriënboer, S.G.F. Robben; *Maastricht/NL (s.robben@mumc.nl)*

Purpose: It is a common practice for radiologists to use comparison films to improve the diagnosis. Educational literature suggests that comparison is a promising way of learning the interpretation of radiographs as well. We investigated the effectiveness of three types of comparison: comparison of images from different patients with the same disease (same-disease comparison), comparison of images showing different diseases (different-disease comparison) and comparison of disease images with normal images, against a no-comparison control condition. Furthermore, we used eye-tracking to investigate how students compared these cases.
Methods and Materials: Eighty-four medical students were randomly assigned to the four conditions. They studied six cases of eight different diseases on chest radiographs, while their eye movements were measured, as well as the time they spent studying. After studying, participants took two tests in which they diagnosed new cases and indicated the location of abnormalities. Efficiency was defined as (z test score - z study time)/√2).
Results: Students learned most efficiently in the same-disease and different-disease comparison conditions (diagnosis: F (3.68) = 3.314, p =.025, location: F (3.65) = 2.875, p =.043). We found comparison in 91% of all trials in the comparison conditions. Comparisons between normal anatomy were more common (45.8%) than comparisons involving abnormalities (11.7%).

Conclusion: Comparing cases is an efficient way of learning radiograph interpretation, especially when different patients of the same disease, or images of different diseases are compared. Eye-tracking provided insight in the comparison process, for example by showing that hardly any comparisons between abnormalities and normal tissue were made.

B-1259 15:20

Clinical impact of double reading of thoracic CT

P.M. Lauritzen[1], J. Andersen[2], M. Stokke[3], A. Tennstrand[4], G. Bjerke[1], K. Stavem[1], P. Hurlen[1], G. Sandbæk[2], P. Gulbrandsen[5]; [1]*Lørenskog/NO*, [2]*Oslo/NO*, [3]*Drammen/NO*, [4]*Bærum/NO*, [5]*Nordbyhagen/NO* *(peter.m.lauritzen@gmail.com)*

Purpose: Consultant radiologists in Norwegian hospitals submit 39% of interpreted CT scans for quality assurance by double reading. The purpose of this study was to evaluate the clinical impact of changes to radiology reports made following double reading of thoracic CT scans of patients referred from departments of internal medicine.
Methods and Materials: Preliminary and final reports from 1023 consecutive double read thoracic CT scans were collected from five hospitals with a combined catchment population of 1.1 million. Preliminary and final reports were compared. Two experienced pulmonologists rated the clinical impact of all changes in content on a 5-point scale devised for this purpose. Clinically insignificant changes, not affecting investigation, controls or treatment, were rated "minimal" or "small". Changes affecting further investigations or controls were rated "intermediate". Changes implying a change of treatment or diagnosis were rated "large". Changes demanding immediate action were rated "critical".
Results: There were clinically significant changes in content to 130 (13%) of the 1023 reports. Changes in 73 (7%) of the reports were rated "intermediate", 50 (5%) were rated "large" and seven (< 1%) were rated "critical". Five of the seven "critical" changes concerned cardiovascular issues. From the 130 clinically significant changes, 95 (73%) represented an increase in severity while 21 (16%) represented a decrease in severity. In 14 cases (11%) we concluded that there was no change in severity.
Conclusion: Clinically significant changes were made to 13% of reports as a result of double reading. Three out of four represented an increase in severity.

Author Disclosures:
P.M. Lauritzen: Research/Grant Support; Research funding from the Norwegian Medical Association, Research funding from the Norwegian Association of Radiologists.

14:00 - 15:30 **Room D2**

Interventional Radiology

SS 1909a
Embolotherapy

Moderators:
A. Bharadwaz; Aahrus/DK
O. Pellerin; Paris/FR

K-31 14:00

Keynote lecture

R.W. Günther; *Berlin/DE*

B-1260 14:09

A promising non-adhesive cyanoacrylate preclinical study on animal model

J. Izaaryene, V. Vincent; *Marseille/FR (jizaaryene@yahoo.fr)*

Purpose: Purefill® is a new high purity cyanoacrylate. We studied the ability to exclude vessels, distal dispersion, adhesion strength to catheter and toxicity of Purefill ® versus Histoacryl® and Glubran®.
Methods and Materials: In six pigs, right rete mirabile (RM) and right renal arteries were embolized with Purefill ®, left rete mirabile and left renal artery were embolized with Histoacryl ® and Glubran2 ®. One minute after cyanoacrylate injection around the microcatheter, we measured the displacement of the kidney and of the pharyngeal artery during the retrieval of the microcatheter. After acute embolization (4 pigs) or three months follow-up (2 pigs), the kidneys and the RM were removed for CT scanning and were examined microscopically.
Results: Short and long-term embolic efficacy was the same with the 3 agents. Average displacement of kidney's pedicles for Purefill was 2.64 mm. Average distance for Histoacryl and Glubran was respectively 22.65 mm and 19.82 mm (p=0.021). Average angle of displacement of pharyngeal arteries for Purefill was 12.25°, 23.5° for Histoacryl and 30° for Glubran (p=0.070). Histopathological changes were the same for the 3 cyanoacrylates immediately or 90 days after embolization.
Conclusion: Purefill® has the same occlusive efficacy in the short and long term as Histoacryl and Glubran. Histopathological changes were the same for the 3 cyanoacrylates. The major finding of this study was that Purefill resulted in inferior displacement distance and angle compared to the other 2 embolic agents and this seems to reflect a less adhesive strength that could lead to a more secure embolization.

B-1261 14:17

Radial versus femoral artery access in patients undergoing peripheral artery embolisation

E. Khayrutdinov[1], A. Arablinskiy[1], V. Tsurkan[1], I. Vorontsov[2]; [1]*Moscow/RU*, [2]*Omsk/RU (eugkh@yandex.ru)*

Purpose: We aimed to assess whether radial approach (RA) was superior to femoral approach (FA) in patients undergoing peripheral artery embolisation.
Methods and Materials: 126 patients were enrolled in our study. Uterine fibroid embolisation (UFE) was done in 50 patients, transarterial chemoembolisation (TACE) in 62 patients and bronchial artery embolisation (BAE) in 14 patients. RA was used in 62 patients and FA in 64 patients. The duration of the procedure, time needed for catheterization of target arteries, and radiation exposure were assessed during the procedure. Major vascular complications were evaluated after the procedure.
Results: Embolisation procedure was successfully performed in all patients from both groups. The duration of the procedure (32.5 and 34.2 minutes, p> 0.05), the time needed for catheterization of target arteries (8.1 and 9.3 minutes, p> 0.05) and radiation exposure (0.37 and 0.55 mZv, p> 0.05) were comparable between the two groups. However, the time needed for catheterisation of both uterine arteries (7.9 and 15.2 minutes, $p < 0.05$) and radiation exposure (0.32 and 0.58 mZv, $p < 0.05$) were significantly lower in the RA group. In the RA group, major vascular complications were not seen and 7 (11.2%) patients had local haematoma. In the FA group, 2 (3.1%) patients had pseudoaneurysm and 9 (14%) patients had local haematoma.
Conclusion: The duration of the procedure (TACE and BAE) and radiation exposure are comparable between the two groups. RA is associated with a significant reduction in the duration of the UFE, time needed to catheterise both uterine arteries, and radiation exposure.

B-1262 14:25

Endovascular management of postpancreatectomy hemorrhage

M. Ronot, E. Pottier, S. Gaujoux, M. Abdel-Rehim, M. Lagadec, A. Sibert, A. Sauvanet, V. Vilgrain; *Clichy/FR (maxime.ronot@bjn.aphp.fr)*

Purpose: To evaluate the efficacy of endovascular management of postpancreatectomy hemorrhage (PPH).
Methods and Materials: Between 2005 and 2013, patients referred for endovascular treatment of PPH were included. Pretreatment CT scans were reviewed. Active bleeding, pseudo-aneurysm, arterial stenosis, and culprit artery were recorded. Endovascular procedures were classified as successful (bleeding origin identified and satisfactorily treated), failure (identified bleeding incompletely treated), and abstention (no vascular abnormality depicted and no treatment performed). Factors associated with postprocedural rebleeding were analyzed, together with second line therapeutic strategy.
Results: 69 patients (53 men, mean 58.5 years (32-75)) were included. CT showed 27 (39%) active bleeding, 25 (36%) pseudo-aneurysms, 2 (3%) arterial stenosis. In 22 (32%) cases, no culprit artery was found. Procedures were classified as Successful, Failure, or Abstention in 48 (70%), 9 (13%), and 12 cases (17%). 30 patients (44%) experienced rebleeding (median 2 days (range 0-46)). Rebleeding rates were 29%, 58%, and 100% in Success, Abstention or Failure ($p < 0.001$), respectively. Patient management during angiography was the only factor associated with rebleeding (success vs. failure $p < 0.001$; success vs. abstension p=0.09, abstention vs. failure p=0.04, overall $p < 0.001$). Rebleeding was treated by endovascular treatment, surgery, or both, in 12 (40%), 11 (37%) and 7 (23%) cases, respectively. Overall, 72% of the patients were successfully treated by endovascular procedures alone.
Conclusion: After a first endovascular procedure for PPH, around 40% of patients have recurrent bleeding. Rebleeding was associated with initial success of the embolization. However, the majority of patients were successfully treated by endovascular approach alone.

B-1263 14:33

Prostatic artery embolisation using the PerFectED technique in the treatment of prostatic benign hyperplasia: results of a single-centre prospective study

G. Amouyal, O. Pellerin, N. Thiounn, M. Sapoval; *Paris/FR (gregamouyal@hotmail.com)*

Purpose: To report technical, clinical findings and complications after prostatic artery embolisation (PAE) for symptomatic benign prostatic hyperplasia (BPH) using the PerFectED technique (PT).
Methods and Materials: In a prospective study, 18 consecutive patients underwent PAE (mean age = 64) between December 2013 and June 2014, after a urologic and interventional radiologic baseline assessment. Inclusion criteria were: patients with symptomatic BPH after failure of medical treatment and prostate volume &gt40 g, and refusal of surgery. Exclusion criteria were: complicated BPH, other cause of lower urinary tract symptoms (LUTS), cancer, advanced atherosclerosis. Patients underwent hyperselective PAE using the PT with 300-500µm trisacryl microspheres. Primary endpoints for clinical success were: International Prostatic Symptom Score (IPSS) -25% or &lt18, Quality of Life (QoL) - 1 or &lt4, or Qmax -25% or &gt7 mL/s at 3- or 6-month follow-up.
Results: Technical success: 100% (bilateral 16/18, unilateral 2/18). Major complications: none. A discrete post-embolisation syndrome including mild fever and pollakiuria was observed in all patients. Follow-up at 3 months: clinical success: n = 15/18 available patients. Follow-up at 6 months: clinical success n = 9/11 available patients. After a mean follow-up of 4.9 months, we observed significant decrease in IPSS (60%), QoL (-2.5) and Prostatic volume (-25%). We had 0 % of retrograde ejaculation after PAE.
Conclusion: PAE using the PerFectED technique (PT) does improve LUTS with no significant complication. Long-term follow-up is needed to confirm the durability of PAE.

B-1264 14:41

Functional and technical outcomes of patients treated with selective microcoil embolisation due to pseaudoaneurysms or arteriovenous fistulas after partial nephrectomy

F.F. Strobl, M. D'Anastasi, T. Waggershauser, C.G. Trumm, A. Graser, M.F. Reiser, P.M. Paprottka; *Munich/DE (frederik.strobl@med.lmu.de)*

Purpose: To report clinical and functional outcome of patients who underwent interventional transcatheter embolisation of renal pseudoaneurysms or arteriovenous fistulas which occurred after nephron-sparing partial nephrectomy.
Methods and Materials: This retrospective analysis included all consecutive patients having received transcatheter embolisation of renal pseudoaneurysm or arteriovenous fistula after partial nephrectomy in our department from 01/2003 to 09/2013. Technical success and functional outcome of all procedures were collected and analysed.
Results: During observation period, 1425 patients underwent open, laparoscopic or robotic-assisted partial nephrectomy at our hospital. Of these, 39 patients (2.7%) (mean age 65.7 years; 30 male) were referred to our department for transcatheter embolisation of pseudoaneuryms or arteriovenous fistulas. In all patients diagnosis of the arterial lesion was made by biphasic computed tomography or contrast-enhanced ultrasound and confirmed angiographically. Symptoms of arterial lesions occurred mean 15.3 days after the operation. In total, 35 patients (89.7%) could be treated successfully using selective micro coil embolisation although in three patients a subsequent second angiographic intervention had to be performed. Four patients (10.3%) still had to be operated after embolisation due to non-stopping haematuria, of these, three had to undergo nephrectomy. Pre- and postinterventional glomerular filtration rate did not differ significantly ($p > 0.05$). No major or minor complications related to the interventions were observed.
Conclusion: Renal pseudoaneurysms and arteriovenous fistulas which occured after nephron-sparing surgery can be treated safely and successfully by selective arterial embolisation. Further investigation is warranted to define the exact role of interventional embolisation in the treatment paradigm after nephron-sparing surgery.

B-1265 14:49

Bariatric embolisation using non-spherical Polyvinyl alcohol (PVA) for suppression of the ghrelin in swine models

J. Kim, M.-D. Kim; *Seoul/KR (dfl7025@yuhs.ac)*

Purpose: To prospectively evaluate if bariatric embolisation with non-spherical polyvinyl alcohol (PVA) can result in suppression of systemic ghrelin in swine models.
Methods and Materials: The institutional animal care approved this study. Eleven healthy swine (mean weight, 31.5 kg; weight range, 24.0-41.5 kg) were evaluated. Bariatric embolisation was performed by infusion of 150-250 µm PVA selectively into the gastric arteries that supply the fundus. Six swine underwent bariatric embolisation, while five control animals underwent a sham procedure with saline. Plasma ghrelin levels were obtained in animals at baseline and at every two weeks. Endoscopy was performed 3 weeks after bariatric embolisation to look into the occurrence of ulceration in stomach. Repeated angiography of celiac trunk was done to determine the durability of the occluded arteries. Necropsy was performed 8 weeks later.
Results: The pattern of change in ghrelin levels over time was different between control and experimental animals. Average postprocedure ghrelin values maximally decreased by 370.0 pg/mL in experimental animals at week 5 (mean 515.0 pg/mL±150.0, standard deviation, $p < 0.05$) relative to baseline (mean 880.0 pg/mL ± 559.5). Ulcerations were identified in 3 (50%) out of 6 experimental animals. Three (50%) animals demonstrated recanalisation of the embolised vessels in follow-up angiography.
Conclusion: Bariatric embolisation using PVA particle can significantly suppress ghrelin level. However, ulcerations in stomach were identified in 50% of experimental animals. Further study is needed regarding the effect of various embolic materials on ghrelin level and occurrence of ulceration.

B-1266 14:57

Selective arterial embolisation for hemangiomas

G. Facchini, G. Rossi, E. Rimondi, P. Spinnato, G. Filonzi, T. Bartalena, C. Errani, A. Bazzocchi; *Bologna/IT (giancarlo.facchini@gmail.com)*

Purpose: Embolization can be used for highly vascular tumours as primary or palliative treatment. The purpose of our study is to present the experience of our institution on selective arterial embolisation of hemangiomas (HA).
Methods and Materials: We retrospectively studied 68 patients (26M, 42 F, mean age 38 years) with painful bone (31 patients) and soft-tissue (35 patients) HA, treated with embolization using N-2-butyl cyanoacrylate from 2003 to 2013. Four patients (two with bone and two with soft tissue HA) didn't undergo embolization. 48 patients (75%; 23 patients with bone and 25 patients with soft-tissue HA) had one embolization, and 16 patients (25%; 8 patients with bone and 8 patients with soft-tissue HA) had repeated embolizations for recurrent pain. Mean follow-up was 64 months. The clinical and imaging effect of treatment was evaluated at follow-up with a pain score scale, tumour size, and ossification (XR).
Results: Forty-eight (75%) patients experienced a partial pain relief with a single embolization. Ten (15%) patients complete pain relief. Sixteen (25%) patients were treated with repeated embolization for pain recurrence. Mean tumour size before embolization was 6 cm for bone and 7 cm for soft-tissue HA. Ossification and tumour size reduction were higher in bone HA. Bone HA reduced to 4 cm (3-8 cm), while soft tissue to 5 cm (4-12 cm). Ischemic pain was more common in soft-tissue HA. In one patient skin necrosis occurred.
Conclusion: Embolization of bone and soft tissue HA with N-2-butyl cyanoacrylate is a low cost technique with both palliative and curative effects.

B-1267 15:05

Pre-delivery uterine arteries embolisation preventing peri-post-partum haemorrhage (PPH) in placenta implant anomalies

R. Niola[1], F. Giurazza[2], M. Silvestre[1], G. Nasti[1], M. Di Pasquale[1], F. Maglione[1]; [1]*Naples/IT*, [2]*Rome/IT (francescogiurazza@hotmail.it)*

Purpose: Increasing rate of cesarean delivery has led to many patients having placental implant anomalies (previa, accreta and percreta) in following pregnancies and so high risk of peri-post-partum haemorragies (PPH). Aim of this study is to assess the feasibility of predelivery intervention consisting in uterine artery embolization immediately before cesarean section in order to decrease patient morbidity due to bleeding and so the blood units transfused.
Methods and Materials: Between 2012 and 2014 we enrolled 30 patients with placental anomalies. All had previous cesarean delivery and at the moment of the intervention were at the 35-36 week of pregnancy. In the gynaecological operating room we used a mobile angiograph to superselectively embolise uterine arteries with reabsorbable pladgets injected through microcatether 2.7 Fr. We applied 5 dosimeters on the back of the patient to measure the radiation dose to the uterus, considered as to the foetus.
Results: The procedure was always technically completed. 63.3% of the patients did not require transfusions at all and the overall rate of blood units transfused was 0.8 ± 1.8; no patient underwent to intensive care unit. Mean procedural time was 6'24'' and mean dose to the uterus was 23.34 mGy. Mean time between embolization and delivery was 6'30''.
Conclusion: Predelivery UAE seems to be a valuable preventive technique able to significantly reduce bleeding during cesarean sections in patients with placental anomalies at high risk for PPH. In experienced hands, the radiation dose to the foetus is negligible considering 100 mGy as the threshold value.

B-1268 15:13

Endovascular management of massive post-partum hemorrhage in abnormal placental implantation deliveries

A. Rebonato, S. Mosca, M. Fischer, D. Maiettini, L. Bellantonio, C. Fusco, C. D'Elia, G. Crinò, M. Scialpi; *Perugia/IT (rebonatoalberto@gmail.com)*

Purpose: Retrospectively evaluate the safety and efficacy of pelvic artery embolis ation (PAE) in Post-Partum Haemorrhage (PPH) in Abnormal Placental Implantation (API) deliveries.
Methods and Materials: From January 2009 to April 2014 twelve patients with API and intractable intra-operative PPH underwent PAE after Caesarean delivery to control a haemorrhage not responsive to obstetrical and/or surgical treatments in our institution. API pregnancies were identified by US or MRI; a5 F common femoral artery introducer sheath was positioned before the Caesarean delivery; PAE was performed directly in the obstetrics operating room by an interventional radiologist standbying during the delivery, using a mobile angiographic system,even if patients were haemodynamically instable.
Results: PAE was performed in order to prevent hysterectomy in eight of 12cases (67%), avoiding hysterectomy in four (33%). In the remaining four patients PAE was performed after hysterectomy. Technical success was achieved in all patients. Maternal and fetal mortality and morbility was0%. Embolization procedures lasted an average of 38 minutes. A significant difference (p-value 0.0183) was found between the mean estimated intra-operative blood loss (2389 ml overall) between previa (1710±513 ml) and accreta (3340±1264 ml). No complications due to embolization were encountered after the procedure.
Conclusion: PAE is a suitable alternative to hysterectomy to control PPH in API pregnancies. The possibility of performing promptly embolic procedures without patient transfer using a radiologic interventional standbying allows to further reduce the blood loss and the mortality. Moreover PAE could be performed on hemodynamic unstable patient. The PAE is also a valuable and efficacious aid in the event of persistent post-hysterectomy bleeding.

B-1269 15:21

Fetal radiation dose during prophylactic balloon occlusion for morbidly adherent placenta - a single centre experience

V. Semeraro[1], A. Susac[1], A. Morasca[2], F. D'Antonio[1], A.-M. Belli[1]; [1]*London/UK*, [2]*Rome/IT (vittoriosemeraro@hotmail.it)*

Purpose: To assess the fetal absorbed radiation dose (FAD) when prophylactic occlusion balloon catheters (POBCs) were placed before surgery for morbidly adherent placenta (MAP).
Methods and Materials: Retrospective cohort study of women with an antenatal diagnosis of MAP who had POBC before surgery. The study population was divided into two groups. Group 1 treated between 2008-2011. Group 2 treated from 2012-2014 when the fluorsocopy pulse rate was reduced from 7.5 to 2 pulses per second. The median and interquartile range (IQR) of Dose Area Product (DAP) and FAD were compared using the Mann-U-Whitney test. FAD was calculated using the PCXMC Monte-Carlo calculation. All procedures were performed on the same equipment (Siemens Axiom Artis dTA) by the same team.
Results: 34 women underwent POBCs insertion before ceasarian delivery. 16 procedures were performed in Group 1 and 18 in Group 2. Overall median DAP was 1025.10 µGym2 (IQR 532.1-1775.3). Group 1 was 1713.25 µGym2 (IQR 1164.5-2274.5) and Group 2 was 660.70 µGym2 (IQR 440.9-1020.9) (p=0.027). Overall median FAD was 4.65 mGy (IQR 2.7-8.2). Group 1 was 6.25 mGy (IQR 4.4-10.6) and Group 2 was 3.05 mGy (IQR 2.0-5.4) (p=0.031).
Conclusion: FAD during POBCs insertion is low overall, but is significantly reduced by attention to dose reduction techniques. The only technical change between the two groups was a reduction in the pulsed fluoroscopy rate. This reinforces the importance of awareness of dose reduction techniques amongst radiologists.

14:00 - 15:30 **Room G**

Genitourinary

SS 1907

Urinary stones, ureters and bladder pathology

Moderators:
M. Bertolotto; Trieste/IT
L. Ponhold; St. Pölten/AT

B-1270 14:00

Additional spectral shaping by a tin filter (150 kV Sn) improves image quality and reduces dose in low-dose abdominal CT for urolithiasis

P. Dewes, C. Frellesen, J.-E. Scholtz, S. Fischer, B. Schulz, T.J. Vogl, R.W. Bauer; *Frankfurt/DE (patricia.dewes@kgu.de)*

Purpose: To compare a novel tin-filtered abdominal low-dose protocol for urolithiasis to low-dose protocols based on attenuation-based automated kV-selection.
Methods and Materials: 75 patients with suspected urolithiasis underwent non-contrast-enhanced low-dose CT. Each 25 patients were examined with a tin-filtration (150 kV Sn) protocol (group 1), or with automated kV-selection (80-140 kV) based on the scout view (CAREkV) on a third- (group 2) or second-generation (group 3) dual-source-CT. Automated exposure control was active in all groups. Image quality was subjectively evaluated on a 5-point-scale by two radiologists and interobserver agreement as well as signal-to-noise-ratio (SNR) was calculated. Dose-Length-Product (DLP) and CT-weighted-Dose-Index (CTDIvol) were used to analyze radiation exposure.
Results: Image quality was rated in favour for the tin filter protocol with 1.8 (vs. 2.1. vs. 2.6) with excellent interobserver agreement (ICC=0.84-0.85) SNR was significantly higher in group 1 and 2 compared to second-generation DSCT ($p < 0.001$). On third-generation dual-source CT, there was no significant difference in SNR between the 150 kV Sn and the CAREkV protocol ($p = 0.3$). DLP of group 1 was significantly reduced in comparison to group 2 and 3 by 23% and 27% (93 vs. 121 vs. 127 mGycm; $p < 0.02$). CTDIvol of group 1 was significant lower compared to group 2 (-36%) and 3 (-32%) (1.95 vs. 3.09 vs. 2.87 mGy; $p < 0.001$).
Conclusion: Additional shaping of a 150-kV spectrum by a tin filter can substantially lower patient exposure and improve image quality on low-dose unenhanced abdominal CT for urolithiasis.

Author Disclosures:
R.W. Bauer: Speaker; Siemens.

B-1271 14:08

Diagnostic efficiency of split-bolus dual-energy computed tomography for patients with suspected urinary stones

T. Lee, S. Kim; *Daegu/KR (kseehdr@dsmc.or.kr)*

Purpose: To evaluate efficiency of virtual non-contrast image (VNCI) generated from dual-energy split-bolus CT urography (DE-SBCTU) for urinary stones detection.
Methods and Materials: 356 patients received true non-contrast image (TNCI) and DE-SBCTU. Two radiologists evaluated opacification scores of DE-SBCTU, and iodine subtractions and image noise on VNCI. Diagnostic performance of the VNCI was evaluated using TNCI as a reference standard, according to diameter and image quality. The results were compared between patient groups with body mass index < 25 and ≥25k g/m^2.
Results: Agreements for opacification, iodine subtraction and image noise between radiologists were excellent, and there were no significant difference in two patients groups. 499 stones were detected on VNCI, with a sensitivity and diagnostic accuracy of 95.1% (468/492) and 92.9% (499/537). Mean diameter was significantly smaller on VNCI (3.6±2.3 mm) than on TNCI (4.4±2.0 mm) (P=0.01). The stone diameter with false interpretation was < 4 mm in 48 of 51 patients. The diameter and image quality on VNCI had no significant difference between the two patients groups.
Conclusion: VNCI displays high accuracy for detecting urinary stones, regardless of BMI.

B-1272 14:16

Dual energy CT classification of renal calculi using single energy scanners

V. Hietschold, F. Schaab, M. Laniado; *Dresden/DE (Volker.Hietschold@Uniklinikum-Dresden.de)*

Purpose: Classification of renal calculi is useful for therapy selection, although not yet implemented in the correspondig guidelines. Single energy CT based classification suffers from inaccuracy due to overlap of Hounsfield units (HU) of most types of calculi,. Using dual energy CT, material composition and density can be separated from each other. In this study, the potential of dual energy data acquired with single energy CT is analyzed, thus enabling any CT user to classify renal calculi in vivo.
Methods and Materials: Ex vivo measurements of 11 types of renal calculi were performed at 70 and 140 kV after infrared spectroscopy. Quotients (HU 70 kV+1000) /(HU140 kV+1000) were analyzed. Theoretical estimations of HU were performed based on tube spectra, absorption spectra of pure substances and different assumptions about filtration and detectors.
Results: All urate stones showed a quotient less than 1.25. Struvite and Dahllite stones' quotients were larger than 1.35, while this ratio for Wewelite and mixed stones lay between these values. Discrimination of stone compositions with HU 140 kV alone was not possible. The difference between quotients determined pixel-by-pixel or on mean HUs within ROIs resp. was ≤ 0.016. The quotients occurred to be much more homogenous compared to HU values. In theoretical estimations, quotient variations were limited to about 0.03.
Conclusion: Dual energy measurements and evaluations significantly improve the CT based classification of renal calculi. They can be performed on single energy scanners without special evaluation software without relevant loss of accuracy.

B-1273 14:24

Diagnostic value of B-TFE MR Urography and the effect of additional factors on the diagnosis of urinary stones

E. Cifci, G. Coban, T. Cicek, U. Gonulalan; *Konya/TR (egemencifci@gmail.com)*

Purpose: In this prospective study, we aimed to compare interobserver variability and accuracy of thin section balanced turbo field echo (B-TFE) sequence compared with unenhanced computed tomography (CT). Another purpose of the study was to determine the effect of additional factors (size, density and localization of the stones and the presence of ureter dilatation) on the sensitivity and specificity of B-TFE magnetic resonance urography (MRU).
Methods and Materials: Between January 2013 and November 2013, 159 patients (120 men and 39 women; mean age 41.5 years; age range 18-73 years) as highly suspected of urinary tract disease and in whom both B-TFE MRU and CT were performed, were included in this prospective study.
Results: The distribution of the results of the observers' that obtained with B-TFE sequence was fairly compatible with CT independently, and was statistically significant (Kappa = 0.846 and $p < 0.001$). The size and the density of the stone have an independent effect of the detectability of the stone on B-TFE MRU, and was statistically significant ($p < 0.05$).
Conclusion: In this study, we found that MRU with B-TFE sequence was nearly accurate as unenhanced CT in detecting ureter stones. It should be noted that the primary goal of our study was not to develop a technique to replace CT imaging. We tried to establish B-TFE MRU as a reasonable imaging alternative to CT, on long-term follow-up of patients, when ionizing radiation is undesirable.

B-1274 14:32

Renal stone composition in Vivo Determination: comparison between 100/140 kV Dual-energy CT and 120 kV Single-energy CT

M. Bonatti, F. Ferro, P. Pernter, M. Senoner, G. Bonatti; *Bolzano/IT (matteobonatti@hotmail.com)*

Purpose: To compare in vivo accuracy of 100/140 kV dual-energy CT with that of 120 kV single-energy CT in determining renal stone composition by means of an automated software.
Methods and Materials: Retrospective study approved by our Institutional Review Board;informed consent was obtained. We included 30 consecutive patients who underwent a CT on our second-generation dual-source scanner according to a "renal stone protocol"(120 kV single-energy acquisition of the whole abdomen followed by 100/140 kV dual-energy acquisition of the volume where stones were identified), with subsequent renal stone surgical extraction or spontaneous expulsion and stone examination. Stone largest diameter, estimated volume, attenuation values at 100,120 and 140 kV, and 100/140 kV attenuation ratios were calculated by means of an automated software (Syngo.via, "CT Dual Energy-Kidney Stones" application). Renal stones were classified as follows: uric acid (attenuation at 120 kV 1.24).
Results: 50 stones were detected in 30 patients. At laboratory, 17/50 (34%) stones were prevalently composed by uric acid, 4/50 (8%) by cystine and 29/50 (58%) of calcium oxalates and phosphates. Median diameter was 4.8 mm (1.0-24.1 mm) and median volume 35.7 mm3 (1.9-1390.0 mm3). 120 kV single-energy CT correctly assessed stone composition in 26/50 (52%) of the cases, whereas dual-energy CT in 45/50 (90%)($p < 0.05$). Single-energy CT correctly differentiated uric acid vs. non-uric acid stones in 40/50 (80%) of the cases, dual-energy CT in 48/50 (96%)($p < 0.05$);both the 2 wrongly assessed calculi at dual-energy CT were located in a ureter beneath ureteral catheter.
Conclusion: Dual-energy CT performs significantly better then single-energy CT in renal stone composition determination and reliably discriminates between uric acid and non-uric acid stones.

B-1275 14:40

Effective z accuracy to determine stone composition by single-source dual-energy computed tomography: an in vivo study

A. Fekir, C. Werquin, R. Levy, C. Sanavi, V. Macaigne, G. Hue, M. Bubenheim, A. Safsaf, J.-N. Dacher; *Rouen/FR (amel9219@hotmail.com)*

Purpose: To assess the ability of effective Z as obtained from single source dual-energy CT (SS DECT) to determine urinary tract calculi composition.
Methods and Materials: 54 patients referred for urinary stone disease underwent SS DECT in our centre. Thirty patients who benefited from infrared-spectroscopy formed retrospectively the cohort study. First, Z eff was estimated for all patients. Second, a qualitative study was performed using a dedicated software and histogram comparing the Z eff of calculi pixels to the reference Z eff of known structures measured in vitro. Two radiologists were then asked to rank stones into four groups (uric acid UA, cystine, struvite or other).
Results: Mean Z eff for UA stones could be significantly differentiated from non-UA stones ($p < 0.0001$). Using histogram, UA and cystine stone detection was 100% for both radiologists. All stones were properly classified into the four groups with an excellent interobserver agreement (K=0.958).
Conclusion: SS DECT allows uric acid stones' characterization with high accuracy using Z eff. Moreover, UA and cystine calculi can be easily detected from a qualitative analysis of Z eff.

Author Disclosures:
J. Dacher: Consultant; General Electric.

B-1276 14:48

Visceral obesity and urolithiasis - impact on disease incidence, stone size and radiation dose

J. Hansmann, S.O. Schönberg, A. Tran, T. Henzler, H. Haubenreisser; *Mannheim/DE (Holger.Haubenreisser@medma.uni-heidelberg.de)*

Purpose: To determine a potential association between the amount of visceral fat and the incidence urolithiasis.
Methods and Materials: 824 patients that underwent CT for evaluation of urolithiasis were retrospectively analyzed. Abdominal fat area consisting of visceral/subcutaneous/pararenal and total fat area at the level of the umbilicus was analyzed and correlated with the presence and size of urolithiasis. Effective radiation dose was estimated and correlated to the total body fat area (visceral+subcutaneous fat area).
Results: 260 out of 824 patients (31.5%) had urinary calculi on CT. No significant correlation was observed between the amount of abdominal fat on CT and the presence of kidney stones (all $p > 0.05$). There was no significant difference in abdominal fat between patients with and without kidney stone disease ($p > 0.05$). Patients were exposed to an average effective dose of 2.6 mSv (range 0.2 - 8.7 mSv). There was a positive correlation for increasing amounts of abdominal fat and the effective dose observed (correlation coefficient 0.56).
Conclusion: While obese patients were exposed to higher amounts of radiation, obesity did not show a significant correlation with the presence of kidney stones. No significant difference in abdominal fat was discerned between patients with and without kidney stones.

Author Disclosures:
T. Henzler: Speaker; Siemens Healthcare. **H. Haubenreisser:** Speaker; Siemens Healthcare.

B-1277 14:56

The role of multi-parametric MRI and the supplemental worth of diffusion-weighted MRI on bladder cancer before surgical operation

E. Hocaoglu, S. Aksoy, C. Colak, O. Kilickesmez, E. Inci; *Istanbul/TR*

Purpose: To assess the supplemental importance of diffusion-weighted (DW) MRI for T staging urinary bladder cancer before surgical procedure.
Methods and Materials: Forthy-eight patients (with an average age 64 years) with suspicion of urinary bladder cancer were subjected to an MRI, and cancer was diagnosed for all subjects. Patients were grouped based on the stage of cancer as Group.i. (T1) in 34, Group II (T2) in 12, and Group IV (T4) in 2 patients, respectively. Four distinct MRI scans were independently analyzed by 2 MRI experts as follows: (i) only T2- images; (ii) MR imaging with IV-gadolinium images; (iii) T2-diffusion-weighted, and (iv) only diffusion-weighted. Multiple parameters were determined for each sequence and subjected to statistical examination. The averages of the apparent diffusion coefficient (ADC)s were calculated according to the T stages of the tumours.
Results: DW-MRI demonstrated a highly specific (73%) T-staging capability for bladder cancer. The precision level was attained through T2-weighted combined with the DW scans; positive predictive values and positive likelihood ratios obtained by using DW images were also better than others. Bladder carcinomas have significantly lower ADC when muscle-invasive tumours (T2 or higher) ($1022.79 \pm 228.48 \times 10^{-6}$ mm^2/s) compared to non-invasive tumours (P=0.003).
Conclusion: These data imply that urinary bladder cancer can be detected with high precision using DW-MRI. The ADC of bladder tumours in combination with DW-MRI may benefit the diagnosis, staging, and treatment selection for urinary bladder carcinomas as well as other cancers screened preoperatively.

B-1278 15:04

Role of diffusion-weighted (DW) MRI to evaluate upper excreto urinary wall thickening

C. Roy, A. Labani, M. Ohana, G. Bierry, G. Aleman, H. Lang; *Strasbourg/FR (catherine.roy@chru-strasbourg.fr)*

Purpose: The purpose was to investigate the reliability of DW-MRI in differentiating malignant from benign thickening of the upper urinary excretory wall.
Methods and Materials: We prospectively evaluated 52 patients referred to an upper urinary tract wall abnormality (29 malignant, 23 benign). MR examinations were performed on a 3 T MR unit (Achieva, Philips Medical System) including to our conventional protocol an axial DWI (b =0 and 1000 mm^2/sec). Correlations were done with pathological data. Mann-Whitney test and Student t test were used to determine the efficiency of ADC value.
Results: Maximal axial diameter was 18±11 mm and 7± 5 mm) for malignant and benign lesions, respectively. All malignant lesions displayed high signal intensity on DW-MRI against 9 benign lesions. The mean ADC value in the malignant lesions was significantly lower than that in the benign lesions: $0.99+0.27 \times 10^{-3}$ mm^2/s against $1.54+0.43 \times 10^{-3}$ mm^2/s, respectively (p=0.0005). Twenty-four malignant lesions had an ADC value inferior to 1×10^{-3} mm^2/s and only one benign lesion. There was a significant difference among the mean ADC values of different grades of malignant tumours, corresponding to $0.84 \pm 0.12 \times 10^{-3}$ mm^2/s and $1.0 \pm 0.20 \times 10^{-3}$ mm^2/s ($p < 0.01$) in high-grade and low-grade epithelioma, respectively. By using a cut-off ADC value of 1×10^{-3} mm^2/s, the sensitivity, specificity and PPV of DW-MRI in the diagnosis of malignancy was 71%, 94% and 93%, respectively.
Conclusion: DW-MRI is efficient by means of ADC in the differentiation between benign from malignant upper urinary tract lesions. DW must be included in MR protocols for exploration of upper urinary tract.

B-1279 15:12

The value of diffusion-weighted MRI in the diagnosis of muscle-invasive bladder cancer

W. Xia, X. Chen, L. Wang, H. Li; *Zhengzhou/CN (51380696@qq.com)*

Purpose: To investigate the value of DWI comparing with conventional MRI for the diagnosis of muscle-invasive bladder cancer.
Methods and Materials: 65 patients (25 muscle-invasive bladder cancers, 40 non-muscle invasive bladder cancers) with integrated clinical data were enrolled in the study. Two readers (R1,R2) independently scored the likelihood of muscle-invasive bladder cancer on conventional MRI and on conventional MRI+DWI. Receiver operator characteristic (ROC) curve analyses were performed to evaluate the diagnostic performance for conventional MRI only and conventional MRI+DWI. Measure the apparent diffusion coefficient (ADC) value of local lesions adjacent to muscular layer of bladder wall, and analyses the ROC curve of ADC value for diagnosis of muscle-invasive bladder cancer, and calculate the sensitivity and specificity of the threshold for diagnosis of muscle-Invasive bladder cancer.
Results: R1 achieved an area under the ROC-curve (AUC) of 0.859, accuracy 80%, sensitivity 82.5% and specificity 76% on conventional MRI versus 0.907, 86.2%, 87.5% and 84% after addition of DWI ($p < 0.05$). For R2 these figures were 0.861, 83.1%,85% and 80% on conventional MRI versus 0.917.87.7% ,90% and 84% with DWI ($p < 0.05$). The ADC value of muscular layer in muscle-invasive bladder cancer was $1.52 \pm 0.15 \times 10^{-3}$ mm^2/s, the non-muscle invasive bladder cancer patients was $2.21 \pm 0.39 \times 10^{-3}$ mm^2/s. With ADC value of 1.61×10^{-3} mm^2/s as the threshold the sensitivity and specificity of ADC for the diagnosis of muscle-invasive bladdercancer were 91.2% and 90.4%.
Conclusion: Compared with conventional MRI, the application of DWI can improve the accuracy. Taking ADC value 1.61×10^{-3} mm^2/s as the threshold to identify muscle-invasive bladder cancer has higher sensitivity and specificity.

B-1280 15:20

The dynamic MRI compared to conventional cystogram in evaluation of vesico-urethral anastomosis after laparoscopic radical prostatectomy

M. Danti, F. Forte, S. Sbarbati, G. Pagliarella, P. Nardis, S. Della Sala; *Rome/IT (massimilianodanti@hotmail.com)*

Purpose: Aim of our study is to evaluate the diagnostic usefulness of the Dynamic MRI in comparison with the traditional retrograde cystogram for detection of vesico-urethral anastomosis leak after endoscopic extraperitoneal radical prostatectomy (EERPE).
Methods and Materials: 25 subjects, submitted to EERPE, were selected for the urethral study. They were first studied with conventional retrograde cystogram with iodine contrast agent to check the vesico-urethral anastomosis for tightness. Then, drained the bladder, the dynamic MRI (INTERA 1.5 T, Philips Medical Systems, Best, The Netherlands) was performed without contrast agent; we used balance sequences, every 0.5 sec., to obtain the dynamic MRI evaluation, during the trans urethral catheter filling of saline solution. By the agreement of results of the two methods, we removed the urethral probe. To perform the MRI dynamic phase (Cine-urethro-MRI) patients were exhorted to urinate autonomously; the exams were evaluated by two radiologist and an urologist.
Results: The dynamic MRI showed no essential discordance with the conventional cystogram in vesico-urethral watertight evaluation. 3 minor and 2 extensive leakages were detected both by the MRI and cystogram in same subjects: in one patient the MRI undervalued a leakage comparing to the cystogram. The Cine-urethro MRI acquisition was occasionally affected by distortions for the patients discomfort.
Conclusion: The dynamic MRI is a non-invasive non-contrast agent method which provides a dynamic phase evaluation; it shows a good diagnostic reliability in vesico-urethral anastomosis watertight study. The dynamic phase also essentially gives the whole urethral and sphyncterial morphology. Our further studies are in progress.

14:00 - 15:30 **Room K**

Interventional Radiology

SS 1909b
Aortic interventions

Moderators:
M. Köcher; Olomouc/CZ
B. Peynircioglu; Ankara/TR

K-32 14:00
Keynote lecture
M. Szczerbo-Trojanowska; *Lublin/PL*

B-1281 14:09
Two-stage implantation in thoracic endovascular aortic repair
M. Peng; *Beijing/CN (pengmingliang03@163.com)*

Purpose: To investigate the feasibility and clinical effect for the endovascular repair of Stanford B aortic dissection using personalized "Two-Stage" stent graft implantation.
Methods and Materials: A retrospective review of 56 patients (47 men; the median of age 57 years, range from 41 to 67 years) who underwent TSI during TEVAR for Stanford B aortic dissection from Jan 2012 to May 2013. Follow-up was performed at discharge, postoperative 3 months, 6 months, and yearly thereafter. Technique success, aortic remodeling and procedure-related complications were evaluated.
Results: The technical success rate was 100%. 112 thoracic stent grafts and 10 left subclavian artery chimney stents were used. The two-stent had mean length of 197.6±20.3 mm and mean tapered span of 7.5±1.8 mm. All patients were followed up from 6 to 16 months (mean 10±4 months), of whom 46 had a completely thrombosed false lumen and 1 had a partially thrombosed false lumen in two-stent segment, and 9 had a completely thrombosed false lumen, the total thrombosis rate of false lumen was 98.2% (55/56).Procedure-related complications during follow-up included paraplegia due to acute spinal cord ischemia (n=1) and malpostion of distal stent graft (n=1). No death, endoleak and malperfusion complications were observed during perioperative period and follow-up.
Conclusion: Two-Stage stent graft implantation is feasible and clinically effective in the treatment of Stanford B aortic dissection. It could avoid being limited by the stent length and diameter and according to the characteristics of the case for personalized treatment options.

Author Disclosures:
M. Peng: Author; Xiaoyong Huang, Lianjun Huang, Yueguo Xue, xl GUO.

B-1282 14:17
Re-expansion of thoraco-abdominal and infrarenal true lumen collapse by bare-metal stents in complicated acute aortic dissection type B
A. Massmann, P. Fries, R. Seidel, G.K. Schneider, A. Buecker, H.-J. Schäfers; *Homburg a.d. Saar/DE (Alexander.Massmann@uks.eu)*

Purpose: Mid-term outcome of large-diameter bare-metal stents for true-lumen collapse in complicated acute aortic dissection type-B (cAADB).
Methods and Materials: 15 male patients (mean-age 57±11years) suffering cAADB with thoraco-abdominal true-lumen collapse underwent implantation of large-diameter bare-metal nitinol-stents (SinusXL-10 F, Optimed, Germany; diameter 18-28 mm, length 40-80 mm) into the thoraco-abdominal aorta with intentional coverage of the celiac trunk and into the infrarenal abdominal aorta respectively. Preoperative CTA showed the extent of true-lumen collapse. Follow-up ultrasound and CTA were acquired 1week,3.6months and every year thereafter. Pre-/postinterventional diameters of the dissected aorta including the true- and false-lumen at the thoraco-abdominal segment, celiac trunk and aortic bifurcation were assessed.
Results: Technical success of stent-implantation was 100%. Expansion of the aortic true-lumen collapse was achieved in 100% resulting in completely resolved clinical symptoms (visceral ischemia and/or claudication) in all patients. Angiography and CTA showed no compromise of hepatic perfusion. Postinterventional liver function was within normal limits in all patients. Follow-up was mean 3 years (range 6-78months). Diameters of the thoraco-abdominal (mean-diameter 31 mm) and infrarenal aorta (mean-diameter 24 mm) showed no change. The aortic and the true-lumen diameter of the thoracoabdominal aorta stabilized in 100%. In 4 patients (26.7%) infrarenal stent-collapse with false-lumen increase occured after 1 week (p=0.0317). Re-expansion of collapsed stents by balloon-angioplasty failed. All patients were asymtomatic after initial breakthrough of visceral ischemia/claudication.
Conclusion: Expansion of symptomatic thoraco-abdominal true-lumen collapse in complicated-AADB by large-diameter stents and intentional overstenting of the celiac trunk is possible. Infrarenal stenting is associated with increased risk for stent-collapse without consequence.

B-1283 14:25
Application of color-coded DSA technique in intra-procedural assessment of thoracic endovascular aortic repair combined with chimney stenting for left subclavian artery
X. Guo, P. Li, W. Qiu, L. Ye, L.J. Huang; *Beijing/CN (linchao.ye@siemens.com)*

Purpose: For endovascular aortic repair of Stanford type B aortic dissection along with chimney technique for left subclavian artery (LSA) reconstruction, we tested the hypothesis that parametric color coding of DSA could be used for intra-procedural monitoring of hemodynamic change and instant evaluation of the clinical outcome in the angiography suite.
Methods and Materials: 18 patients with type B aortic dissection were admitted, among which 11 patients underwent single EVAR (Group I), the other 7 underwent combined TEVAR and chimney stent implantation for LSA (Group II). Quantitative analysis of both pre-and post-procedural thoracic aortography was conducted with a dedicated software. 5 Regions of interest (ROIs) were set on each color-coded DSA image. A Time-Density-Curve (TDC) of each ROI was derived by the software. In this study only the time-to-peak (TTP) value was taken for statistic analysis. The TTP variance were respectively calculated and further compared for pre-and post-procedural aortagraphy of 2 groups to analyze the risk of neurological or upper left extremity ischemia. Independent sample t test and paired samples t test were selected as statistical methods.
Results: No significant statistical difference was detected between the several ΔTTPs of Group.i. and Group II before and after stent implantation. For both Groups I and II, there was also no significant difference between preoperative ΔTTPs and postoperative ΔTTPs.
Conclusion: The color-coded DSA technology may be helpful for one-stop evaluation of hemodynamics changes in supra-aortic arteries during TEVAR and may assist physician by assessing the clinical outcome and making prognosis immediately.

B-1284 14:33
Sandwich-technique for hypogastric artery preservation by bilateral transfemoral access
A. Massmann[1], A. Buecker[1], N.J. Mosquera[2]; [1]*Homburg a.d. Saar/DE*, [2]*Ourense/ES (Alexander.Massmann@uks.eu)*

Purpose: Evaluation of anatomic reconstruction of iliac arteries by sandwich-technique via bilateral transfemoral access with "off-the-shelf" materials.
Methods and Materials: 21 patients (mean 71.7±7.1 [58-85] years) with complex aorto-iliac aneurysms underwent anatomic reconstruction of the iliac arteries (unilateral n=17; bi-lateral n=4) prior to EVAR. Preservation of the internal iliac artery (IIA) was performed in sandwich-technique with covered stentgrafts resulting in an iliac "neo-bifurcation". Deployment of the stentgrafts was done via bilateral transfemoral access. After implantation of a "mother-stentgraft" into the common iliac artery from ipsilateral, the lumen of the mother-stentgraft and IIA was catheterized cross-over via contralateral access. Then, the mother-stentgraft was extended by simultaneous deployment of stentgrafts into the external and internal iliac artery from ipsilateral and cross-over via the contralateral access respectively. Connection of the aortic stentgraft to the iliac neo-bifurcation was achieved by a bridging limb-stentgraft.
Results: Technical success of iliac artery reconstruction was 100%. Primary patency of iliac neo-bifurcation after 14.4±12.9 months was 96%. Freedom from endoleakage was 100%. Iliac aneurysm-size was stable in 52.9% and decreased (> 5 mm) in 47.1%. Compared to a historical control-group of 21 patients claudication was much more frequent after IIA-embolization (Fisher's-exact test p=0.004). Intervention-time for embolization/preservation including EVAR (mean 260±130 minutes) and morbidity including intracranial hemorrhage (n=1) or TIA (n=2) in both groups showed no statistical difference.
Conclusion: Hypogastric artery preservation by anatomic reconstruction of iliac arteries by sandwich-technique via bilateral transfemoral access is a safe and effective procedure for the treatment of complex aorto-iliac aneurysms with excellent short-term results.

B-1285 14:41

Evaluation of aneurysm neck angle change after endovascular aortic aneurysm repair

Y.S. Jeon, T.B. Le, M.H. Moon, K.C. Hong, S.G. Cho, K.M. Park; *Incheon/KR (radjeon@inha.ac.kr)*

Purpose: To evaluate aneurysm neck angle change and post EVAR complications.
Methods and Materials: We retrospectively analyzed 72 elective EVARs for AAA among 109 consecutive cases from December 2005 to April 2014 in a single institution. Patients were divided into 2 groups: severely angulated neck (SAN) and without severely angulated neck (WSAN). SAN was defined as neck angulation > 600. Neck angle was evaluated pre-and post EVAR during short (within 1 month), mid (from 3-6 months) and long-term (over 1 year) follow-up. Aneurysm sac diameter, aneurysm neck morphology, endoleaks and other post procedural complications were also documented.
Results: Thirty-four patients had SAN. There were no statistical differences in age, sex, follow-up duration, aneurysm neck profile and secondary intervention rate between two groups ($p > 0.05$). Mean preEVAR angle of SAN and WSAN were 81.27±19.81 and 37.97±12.19, respectively. Both group showed statistically significant and consistent decrease of the angulation during short, mid and long-term follow-up, as 52.85±14.30, 49.79±15.29, 48.01±18.20 for SAN compared to 28.24±14.30, 25.42±12.31, 27.61±18.77 for WSAN, respectively ($p < 0.01$). SAN group revealed more straightening than WSAN group as 22.45%. There was a trend of aneurysm sac regression overtime even though no difference between two groups was noted ($p=0.05$). PreEVAR angle was the only predictor for post procedural angle change ($p < 0.001$). Endoleak was not associated with neck angle ($p=0.461$).
Conclusion: EVAR is applicable for SAN group with tolerate and consistent neck straightening over long-term follow-up.

B-1286 14:49

Non-invasive 4-dimensional wireless aneurysm sac pressure monitoring after endovascular aortic aneurysm repair (EVAR): conceptional design of an integrated stent-graft and first in vitro results

C. Spink[1], B. John[1], W. Krautschneider[1], D. Schröder[1], R. Fischbach[2], M. Braunschweig[2], J.-H. Buhk[1], G. Adam[1], A. Koops[1]; [1]*Hamburg/DE*, [2]*Dresden/DE (c.spink@uke.de)*

Purpose: In vitro testing of a prototype stent-graft with an integrated array of pressure sensors within the stent-covering, capable of wireless digital data transmission for non-invasive array-measurement of aneurysm sac pressure after EVAR.
Methods and Materials: We designed 30 EVAR-stent-grafts (85 mm x 16 mm) with an integrated array of 16 sensors within a polytetrafluorethylene (PTFE) - membrane, mountable on 24 F applicators. Digital data conversion can be performed by customised integrated microcontrollers (ASIC) between the sensors within the PTFE-membrane providing energy and data transfer by inductive coupling. In vitro measurements were simultaneously taken from all sensors, creating array-measurements from the stent-graft's outer surface.
Results: First in vitro tests showed a capable EVAR-stent-graft-design with integrated electronics in a stable PTFE-covering after crimping. We took continuous pressure measurements with an accuracy of ±1.4 mmHg at 1 MHz along the stent-graft-membrane. There was no negative effect on the sensor-accuracy by simulated systemic blood pressure inside the stent-graft or different fluid consistencies.
Conclusion: The non-invasive acquisition of pressure profiles from a stent-graft's outer surface after EVAR via integrated sensors within the PTFE-membrane allow information on local pressure elevation, indicating early endoleakage development. First in vitro tests show a practical way of continuous array-pressure-monitoring in patients after EVAR. Further in vivo tests in a porcine model are scheduled, developing an implementation into a product.

B-1287 14:57

Ultra low profile polymer-filled stent graft for abdominal aortic aneurysm treatment: two-years follow-up

E. Macchi, G. De Marchi, A. Ierardi, E. Duka, N. Lucchina, L. Nocchi Cardim, F. Fontana, G. Carrafiello; *Varese/IT (edoardo.macchi86@gmail.com)*

Purpose: To evaluate 2 years follow-up of the Ovation Abdominal Stent Graft System (TriVascular Inc, Santa Rosa, Calif) for endovascular repair of abdominal aortic aneurysms (AAAs).
Methods and Materials: This multicenter retrospective study included 36 patients (median age 73.6 yo) with AAAs (mean diameter, 5.65 cm) treated with the Ovation stent graft and a follow-up available at least of 2 years. Safety and effectiveness of the Ovation stent graft was evaluated. Indications for EVAR were the following: AAA ≥5 cm, neck lenght ≥ 7 mm, angulation ≤60o and diameter < 30 mm; the presence of neck calcification and thrombosis was not considered a contraindication; distal iliac landing zones length of 10 mm, and diameter between 5 and 20 mm. Patients were treated under a common protocol, including clinical and imaging follow-up at discharge, 30 days, 6 months, and annually through 5 years. Adverse events, clinical and imaging data and possible re-intervention were recorded.
Results: Ovation stent graft was successfully implanted in 36 patients (100%). None of the patients required conversion to open surgery, none presented an aneurysm rupture. Endograft stent fracture or migration was not observed. No type I, III or IV endoleaks were observed; in 12 patients (33.3%) a type II endoleak was registered: with sac enlargement in one case not treated due to concomitant comorbidities and patient's decision.
Conclusion: The 2-years results of the Ovation Stent Graft System demonstrated excellent safety and effectiveness in treatment of patients with AAAs, particularly in patients with challenging anatomic characteristics.

B-1288 15:05

First experience with a novel bioabsorbable and non-synthetic vascular closure device: FISHing in the angio-suite

M. Treitl, M.F. Reiser, K. Treitl; *Munich/DE (mtreitl@med.uni-muenchen.de)*

Purpose: Synthetic vascular closure devices may induce access site scaring by a local inflammatory reaction. A novel femoral introducer sheath and haemostatic device (FISH) introduces small intestinal submucosa (SIS) as a closing agent to reduce scaring over. We present our first results of the usage of this novel closure device in daily routine.
Methods and Materials: 198 consecutive patients (132 m; mean age 71.7 yrs) with indication for therapeutic angiography of the lower limbs received the FISH device for access closure. The technical success rate, time to haemostasis, and time to ambulation were recorded. Clinical and sonographic access site control was done the following day. Small hematomas and bleedings were assessed as minor complications, pseudoaneurysms, bleedings requiring surgical intervention, and device embolization as major complications.
Results: Most patients were on ASA. Mean INR was 1.25. Technical success was achieved in 97.6%. 4 Minor complications were observed (2 pseudoaneurysms treated by manual compression). No major complication and no intravascular device loss were observed. Mean time to haemostasis was 45 ± 91 sec, mean time to ambulation 60 min. Re-puncture of the vessel the next day was necessary and successful in 10 cases. Re-puncture after > 3 months was done in 40 cases without observation of relevant scaring of the access vessel.
Conclusion: The novel FISH device is a safe and potent vascular closure device with excellent performance and a comparable low complication rate. It seems to induce less scaring of the access vessel and allows immediate re-puncture without the risk of embolization.

Author Disclosures:
M. Treitl: Advisory Board; Covidien. Consultant; Covidien, Biotronik, Endoscout.

B-1289 15:13

Treatment by embolisation of type 1 endoleak after EVAR

C. Marcelin, Y. Lebras, N. Grenier, A. Lasserre; *Bordeaux/FR (clement_marcelin@hotmail.com)*

Purpose: To report our experience of embolization of type I endoleaks.
Methods and Materials: Between 2008 and 2014, 10 patients (9 men; mean age 78.1 years) with type 1 endoleak (8 IA and 2 IB) diagnosed 5.5 months to 1 year after EVAR were treated by embolization with onyx with coils, because of complex graft (fenestrated, branched, chimney), insufficient landing zone and an unsuitable aortic diameter, or severe co morbidity. Endoleaks were accessed with a 4-F diagnostic catheter and a coaxially introduced dimethylsulfoxide-compatible microcatheter.
Results: Technical success of the procedure was achieved in all patients. The average duration of the procedure was 37 minutes and the average radiation dose area product was 4 Gy. Reperfusion of the type 1 endoleak was detected in 4 cases. The follow-up period after endoleak treatment was 5.5 months (range 2-12). The diameters of aneurysms was stable for 6 of 8 patients. There were one kidney failure after the embolization.
Conclusion: Embolization of type 1 endoleak is technically feasible, when no other treatment is possible.

B-1290 15:21

Hematrix® Active Patch for post-interventional hemostasis in femoral artery access: a study on efficacy and safety

A. Sauer, A. Dierks, F. Wolfschmidt, N. Hassold, T. Bley, R. Kickuth; *Wuerzburg/DE (sauer_A4@ukw.de)*

Purpose: After percutaneous vascular procedures safe and quick hemostasis may be a major concern. Aim of this prospective study was to evaluate safety and efficacy of a hemostatic dressing following femoral artery access.
Methods and Materials: Between 02/2014 and 10/2014, 76 patients (68±14 years) were treated with a hemostatic dressing patch (Hematrix®, Hematris, Neubiburg, Germany) after endovascular procedures with a femoral artery access from 6-F to 8-F. The patch contains aminocaproic acid, CaCl2 and thrombin. After removing the sheath the patch was placed on the puncture site and manual compression was performed (pressure time: 6-F 8 min; 7-F 9 min; 8-F 10 min). Hemostasis was checked clinically and with duplex ultrasound directly and after 24 hours. Patients were treated with an additional pressure bandage for 24 hours.
Results: A total of 38 6-F, 16 7-F and 22 8-F sheaths were employed. In 69 patients hemostasis was reached within above mentioned time. In 7 patients (6-F:4; 7-F:1; 8-F:2) a longer compression time was necessary (34±30 min). No serious major complication occurred. Two pseudoaneurysms were observed and treated successfully. Patients with initial hemostasis and those with prolonged compression did not differ substantially in INR (1.09±0.3 vs. 1.11±0.3), platelets (234±47 vs. 249±93) and systolic blood pressure (150±26 vs. 152±17 mmHg).
Conclusion: The evaluated dressing patch seems to be a safe and effective device in sealing arterial access sites. However, a randomized trial with larger populations of patients is necessary to confirm those preliminary data.

Wednesday, March 4

12:30 - 13:30 **Room N**

Late-breaking Clinical Trials

Moderators:
M. Dewey; Berlin/DE
N.R. Dunnick; Ann Arbor, MI/US

12:30

Image-based structural and functional phenotyping of the German COPD cohort (COSYCONET) using MRI and CT

B. Jobst[1], J. Biederer[1], I. Fellhauer[1], S. Triphan[1], K. Burmester[1], J. Schliebus[1], A. Karch[2], C.-P. Heußel[1], H.-U. Kauczor[1]; [1]*Heidelberg/DE*, [2]*Hannover/DE*

Purpose: Imaging allows for precise characterisation of regional lung alterations in COPD beyond global parameters such as spirometric indices. Since MRI allows for radiation-free regional morphological and functional assessment of the lung, it is the aim of this study to evaluate sensitivity and specificity of morpho-functional MRI to diagnose emphysema-and airway-phenotypes of COPD, with CT serving as a standard of reference.
Methods and Materials: Prospective lung imaging will be performed in 625 participants from a well-characterised multicentric cohort of COPD patients (COSYCONET). Standardised protocols were defined for 1H-MRI combining morphological and contrast-enhanced 3D dynamic perfusion acquisitions, and non-enhanced low-dose CT in inspiration and expiration (<3.5mSv). Phenotyping is performed by visual scoring and software-based analysis, providing quantitative CT-based airway- and emphysema parameters and quantitative MRI-based perfusion data.
Results: The study protocol, patient information and standardised SOPs for imaging were established. Quality control beyond regular scanner calibration is done by periodical phantom scans for CT and MRI. The workflow was implemented on occasion of initial training visits. The trial started in December 2013. Today, all 14 centres were initiated, and 9 centers have already examined 185 participants.
Limitations: Heterogeneity of image quality will be inevitable due to different imaging equipment. Contraindications to MRI and severe dyspnea in supine position will be more prevalent in advanced COPD. These patients might not consent to participate or drop out during the study.
Conclusion: This study will define the role of MRI in phenotyping COPD and validate innovative biomarkers for interventional COPD trials.

Author Disclosures:
B. Jobst: Other; Supported by The Federal Ministry of Education and Research FKZ 01GI0884. **J. Biederer:** Other; Sponsorship for MRI contrast medium by Bayer Healthcare, Leverkusen, Germany, Supported by The Federal Ministry of Education and Research FKZ 01GI0884. **H. Kauczor:** Other; Supported by The Federal Ministry of Education and Research FKZ 01GI0884.

12:40
Presentation by discussant:
J.B. Seo; Seoul/KR

12:45

A pragmatic randomised controlled trial of the comparative effectiveness of computed tomography versus invasive coronary angiography for the management of stable chest pain patients: Methods of the multicentre DISCHARGE trial

R. Haase, M. Dewey, on behalf of the DISCHARGE Consortium; *Berlin/DE (robert.haase@charite.de)*

Purpose: Computed tomography (CT) is the most accurate non-invasive diagnostic test for ruling out coronary artery disease (CAD) and may become the most effective strategy to reduce the ca. 2 million annual negative invasive coronary angiographies (ICAs) in Europe.
Methods and Materials: The DISCHARGE trial is the core of the DISCHARGE project funded by the European Union Seventh Framework Programme [FP7/2007-2013] under grant agreement no. EC-GA-603266. Over a period of 2 years patients with stable chest pain and 10-60% pretest probability of CAD who are indicated to undergo ICA will be randomised to CT or ICA. In both groups, patients with negative test results will be discharged and patients with positive test results (at least one obstructive coronary stenosis ≥50%) will undergo management by the local heart teams according to guidelines and guided by CT or ICA and non-invasive imaging ischemia tests. Plaque features and coronary artery calcium scores will be evaluated by CT to guide optimal medical therapy and intensified risk factor modification. MACE (cardiovascular death, myocardial infarction and stroke) will be the primary outcome measure and followed for four years.
Results: Approximately 3546 patients will be randomised. The primary hypothesis is that MACE will be reduced significantly in the CT group.
Limitations: The DISCHARGE trial will only be conducted in European countries.
Conclusion: The DISCHARGE trial will evaluate CT for the management of stable chest pain patients indicated to undergo ICA with an intermediate pretest probability of CAD.

Author Disclosures:
R. Haase: Grant Recipient; Federal Ministry of Education and Research. **M. Dewey:** Author; Coronary CT Angiography, Springer, 2009, Cardiac CT, Springer 2011 and 2014. Consultant; Guerbet. Grant Recipient; Heisenberg Program of the German Research Foundation (DFG) for a Professorship (DE 1361/14-1), FP7 Program of the European Commission for the randomized multicenter DISCHARGE trial (603266-2, HEALTH-2012.2.4.-2), European Regional Development Fund (20072013 2/05, 20072013 2/48), German Heart Foundation/German Foundation of Heart Research (F/23/08, F/27/10), Joint program of the DFG and the German Federal Ministry of Education and Research (BMBF) for meta-analyses (01KG1013, 01KG1110, 01KG1110), GE Healthcare, Bracco, Guerbet, Toshiba Medical Systems. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, Bayer-Schering. Other; Institutional master research agreements exist with Siemens Medical Solutions, Philips Medical Systems, and Toshiba Medical Systems, Cardiac CT Courses in Berlin: www.ct-kurs.de.

12:55
Presentation by discussant:
K. Kitagawa; Mie/JP

13:00

Economic evaluation of gadoxetic acid-enhanced magnetic resonance imaging (Gd-EOB-DTPA-MRI) in the diagnosis of colorectal-cancer metastasis in the liver: results from the VALUE trial

C.J. Zech[1], N. Justo[2], A. Lang[2], A. Ba-Ssalamah[3], M.-J. Kim[4], H. Rinde[5], E. Jonas[2]; [1]*Basle/CH*, [2]*Stockholm/SE*, [3]*Vienna/AT*, [4]*Seoul/KR*, [5]*Binningen/CH (Christoph.Zech@usb.ch)*

Purpose: This study compared cost of diagnostic workup and surgery after using one of three initial imaging modalities to assess hepatic resectability in patients with suspected or confirmed colorectal cancer liver metastases (CRCLM): gadoxetic-acid-enhanced MRI(Gd-EOB-DTPA-MRI), MRI with extracellular contrast media (ECCM-MRI) or contrast-enhanced-MDCT.
Methods and Materials: The within-trial economic evaluation was modelled as a decision-tree to calculate the cost of diagnosis and surgery associated with the three strategies. The model used clinical outcomes and resource utilisation data from a 360-patient randomised multicentre study. Cost analyses were performed for the 354-patient safety population in the eight participating countries.
Results: The cost of diagnostic workup using Gd-EOB-DTPA-MRI upfront resulted in savings when compared to ECCM-MRI in all countries except Thailand where the difference was < 2%. When compared to CE-MDCT, initial imaging with Gd-EOB-DTPA-MRI was less costly in all countries except Korea and Spain, where the differences were 4% and 8%, respectively. As for treatment, more patients in the Gd-EOB-DTPA-MRI group were eligible for surgery (39.3% (48/122) vs. 31.0% (36/116) and 26.7% (31/116) in the ECCM-MRI and CE-MDCT groups, respectively), allowing more patients to undergo potentially curative surgery, but resulting in higher cost of the diagnostic strategy starting with Gd-EOB-DTPA-MRI.
Limitations: Results of the long-term outcome are not available.
Conclusion: The potential clinical benefits and similar cost of diagnostic workup in the three groups suggest that Gd-EOB-DTPA-MRI should be the preferred initial imaging procedure to evaluate hepatic resectability in patients with CRCLM.

Author Disclosures:
C.J. Zech: Consultant; Bayer. Speaker; Bayer. **E. Jonas:** Consultant; Bayer. Speaker; Bayer.

13:10
Presentation by discussant:
V. Vilgrain; Clichy/FR

13:15

Proteus trial: comparing neoplasia yield and attendance of sigmoidoscopy and CT colonography in a colorectal cancer screening setting

D. Regge[1], C. Senore[2], G. Iussich[1], L. Correale[2], C. Hassan[3], S. Montemezzi[4], N. Segnan[2]; [1]*Candiolo/IT*, [2]*Turin/IT*, [3]*Rome/IT*, [4]*Verona/IT*
(daniele.regge@ircc.it)

Purpose: To compare participation and detection of AN (CRC/advanced adenomas) of sigmoidoscopy-(FS) and CT colonography-(CTC) in a screening setting.
Methods and Materials: Eligible subjects, 58 y/o, living in Torino were randomised to receive an invitation letter for CTC or FS screening. The primary outcome of this part of the study was participation of CTC vs. FS screening. Data on reason for (non)-participation were collected. To compare AN detection, an additional sample of eligible subjects, 58-60 y/o, living in the Piedmont Region and Verona, Italy were invited to participate in a screening trial. Participants were randomised to receive FS or CTC. Polyps≥6-mm at CTC and "high-risk" distal polyps at FS were referred for colonoscopy.
Results: Participation of CTC and FS was 30.4% (298/980) and 27.0% (264/976), respectively (RR: 1.12; 95%CI:0.98-1.29). Male uptake of CTC was significantly higher than FS (34.1% vs. 26.6%; RR: 1.28; 95%CI: 1.05-1.46); no difference was found among women (26.7% vs. 27.4%). Among CTC non-attendees, the main reasons to decline invitation were: structural obstacles (work/family impediments); test embarrassment; absence of symptoms. People asking general practitioners for counselling and those reading information materials were more likely to attend to CTC. In the detection study, the ability of CTC and FS for detecting AN was similar (5.1% vs. 4.7%).
Limitations: Analysis of detection was restricted to individuals who consented to randomisation. This could reduce external validation.
Conclusion: CTC significantly increased men's participation in CRC screening. Strategies to improve screening participation should address patient education, patient-physician interaction and structural obstacles.

Author Disclosures:
G. Iussich: Consultant; im3d. **L. Correale:** Employee; im3D S.p.A Torino.

13:25
Presentation by discussant:
A. Laghi; Latina/IT