B

Scientific Sessions (SS)

Thursday, March 4

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

Abdominal Viscera (Solid Organs)

SS 101a

The many different ways to evaluate the pancreas

Moderators:
R. Passariello; Rome/IT
S.T. Schindera; Berne/CH

B-001   14:00

320-slice dynamic volume CT to analyse early stages of severe acute pancreatitis

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Purpose: To evaluate perfusion differences between oedemic and necrotic pancreatic tissue in patients with initial stage of acute pancreatitis using 320-slice dynamic volume CT.

Methods and Materials: 20 patients with clinically suspected severe acute pancreatitis were referred for CT evaluation and imaged with a 320-slice CT unit within the first 24 hours after admission. Patients were prepared with oxygen hyperventilation. After intravenous contrast media injection (8 ml/s, 350 mg iodine/ml) and dynamic density measurements in the right ventricle, dynamic scanning was initiated manually. 15 low-dose 16 cm volume scans were applied within a time period of 90 seconds. Helical scan of the complete abdomen was subsequently performed following an additional intravenous injection of 90 ml of contrast media at a fixed delay of 30 seconds, at 120 kV and with tube current modulation. After image registration, perfusion was calculated with maximum slope technique; time-attenuation-curves and coloured perfusion maps were generated.

Results: In all patients, the entire pancreas was completely covered by the 16 cm scan field. Automatic image registration failed in two patients and manual adjustments were needed. Perfusion maps clearly showed the different perfusion patterns of areas with oedema, healthy pancreatic tissue and pancreatic necrosis. The perfusion values of normal pancreatic tissue ranged from 0.67 to 2.37 min^{-1}, in pancreatic oedema between 0.30 to 0.89 min^{-1}. No perfusion was noted in necrotic tissue areas. Conclusion: Perfusion imaging of the whole pancreas allows for discrimination between changes in pancreatic oedema and necrosis in early phase of severe acute pancreatitis.

B-002   14:09

Technical feasibility and first results of 64-row MDCT perfusion in differentiating pancreatic adenocarcinoma from normal parenchyma

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Purpose: The purpose of our study is to evaluate the feasibility of MDCT perfusion of the pancreas and assess its value in discriminating between normal parenchyma and pancreatic adenocarcinoma.

Methods and Materials: In this IRB-approved prospective study, 21 patients (10 males, 11 females; mean age 65.6 years) with pathology-proven pancreatic adenocarcinoma underwent a 120-second perfusion 64-row MDCT examination after injection of 70 cc of a 350 mgI/ml solution at 5 cc/s. 17 tumors were in the head, 4 in the body-tail; mean tumor diameter was 3 cm (range: 1.7-5.4 cm). Tumor perfusion, positive-enhancement-integral (PEI), time-to-peak (TTP) and blood-volume (BV) were determined on a commercially available workstation (Brilliance Workspace2.0, Philips Medical Systems), analyzing the slice with the largest tumor diameter. Perfusion values for normal parenchyma were obtained from the same patients, unless the normal parenchyma was too thin, and in 8 additional patients who were scanned with the same perfusion protocol, but had no pancreatic lesions. The perfusion parameters for tumors and normal parenchyma were compared using an unpaired t-test.

Results: MDCT perfusion was performed successfully, providing datasets that could be analyzed in all patients. A very significant difference was observed between tumor and normal pancreas for perfusion (17.3 vs 79.5; p < 0.0001), PEI (31.6 vs 48.1 HU; p < 0.0001), TTP (70.6 vs 17.9 s; p < 0.0001) and BV (26.0 vs 34.9 ml/100 g; p=0.0002).

Conclusion: From our preliminary experience, CT perfusion of the pancreas appears to be technically feasible and promising in characterizing pancreatic adenocarcinoma and differentiating it from normal parenchyma. MDCT perfusion might have a role in evaluating the effects of chemotherapy, anti-angiogenic therapy or local treatments.

B-003   14:18

MR perfusion of pancreatic lesions: Usefulness of time-signal intensity curves

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Purpose: To evaluate the usefulness of time-signal-intensity curves (TSIC) by using dynamic contrast-enhanced MR perfusion of pancreatic lesions.

Methods and Materials: Twenty patients without pancreatic disease and twenty with pathologically confirmed pancreatic lesions (ductal adenocarcinoma, n=10; endocrine tumor, n=4 with 7 lesions; focal chronic pancreatitis, n=5; autoimmune pancreatitis, n=1), underwent MR imaging at 1.5 T device. Dynamic contrast-enhanced MR perfusion consisted of a 3D axial free-breathing T1w LAVA sequence (TR/TE, 2.28/1.05 ms; 10.0 mmthk/-0.0 mmsp; field-of-view, 35-42 cm; matrix,128x128; 0.75 NEX; 1 second) repeated up to 5 minutes to cover the pancreatic head, body, and tail. A dose of 7 mL gadobenate-dimeglumine (Gd-BOPTA; MultiHance, Bracco) with a 20 mL saline flush was injected with a flow rate of 4 mL/sec. MR perfusion images were processed using a dedicated software by two experienced reviewers in conference that classified five TSIC shapes: type 1 (quick enhancement and quick decay followed by slowly decaying); type 2 (slow enhancement followed by slow constant enhancement); type 3 (fast enhancement followed by signal plateau); type 4 (fast enhancement followed by slowly decaying plateau); and type 5 (quick and marked enhancement followed by slow constant decay).

Results: All 20 patients with normal pancreas presented a TSIC-type 1. TSIC-type 2 was observed in all 10 ductal adenocarcinomas and in 1 endocrine tumor; TSIC-type 3 was recognized in all 5 focal chronic pancreatites and in 6 post-obstructive chronic pancreatites; TSIC-type 4 was identified in one case of autoimmune pancreatitis, and TSIC-type 5 in the 6 lesions of 3 patients with endocrine neoplasms.

Conclusion: MR perfusion by using time-signal-intensity curves could improve the diagnosis of focal and diffuse pancreatic disease.

B-004   14:27

Diffusion-weighted magnetic resonance imaging (DWI) of pancreatic focal lesions: Role of qualitative and quantitative assessment

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Purpose: Non-invasive differential diagnosis of pancreatic disease is still a challenge. DWI gives supplemental information to standard MRI by measuring water diffusivity, which can vary in normal and pathological glandular tissue. Our purpose was to set up a high-b-value DWI sequence and test its diagnostic performance in the assessment of pancreatic focal lesions.

Methods and Materials: Diffusion-weighted-MRI of upper abdomen (b factor: 600) was performed with and without background signal suppression (DWIBS) in 42 patients with 48 already characterized pancreatic lesions: 31 adenocarcinomas, 5 neuroendocrine carcinomas, 7 cystic lesions, 5 focal pancreatitis. Qualitative assessment (lesion conspicuity) was performed on Diffusion-Weighted Images, while quantitative analysis was obtained tracing peritumoral ROIs on Apparent Diffusion Coefficient (ADC) maps.

Results: Qualitative DWI was feasible and tolerated in all patients using respiratory triggering, with all solid lesions (diameter: 5 to 100 mm) clearly visible as hyperintense foci. Also DWIBS correctly depicted all lesions, offering PET-like images; however, false positives were found due to hyperintensity of intestinal fluid, nodes and spleen. With quantitative DWI only slight differences in mean ADC values between different solid masses were seen (adenocarcinoma: 1.52; neuroendocrine: 1.43; pancreatitis: 1.22x10^{-3} mm^2/s; P=n.s).; cystic lesions exhibited a higher mean ADC than solid (3.45x10^{-3} mm^2/s), as expected.

Conclusion: Qualitative DWI has a high diagnostic sensitivity in pancreatic focal disease, regardless its nature, and may improve visibility of very small lesions, especially hypervascular tumors. Quantitative DWI seems not to have a key role in lesion characterization, mainly due to heterogeneity and wide range of ADC values among cancer and pancreatitis.

B-005   14:36

Imaging of pancreatic lesions using DWI-based IVIM-imaging

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Purpose: Differentiation of pancreatic lesions is a continuing challenge in cancer imaging. Previous reports have discussed the value of DWI-derived ADC as a method for tumor depiction. Here, we describe a novel approach extracting perfusion information from DWI and use this for the differentiation of pancreatic lesions.

Methods and Materials: 29 patients and 10 volunteers were measured at 1.5 Tesla. Axial DWI was performed using a SE-EPI in expirational breathhold: TR/TE = 1300/60 ms, 14 slices, thickness 5 mm, resolution 3.5 mm, 4 averages, measurement time using 11 b-values: 12 minutes. ROIs were placed manually and images were post processed using a biexponential IVIM-approach. The perfusion fraction f, the diffusion coefficient D as well as the ADC were extracted. A pair wise Mann-Whitney U-test was used to test for statistically significant differences between groups.

Results: Both carcinoma (20) and pancreatitis (9) patients showed a significantly reduced perfusion fraction f (8.2 ± 4.0 and 16.3 ± 5.3%, respectively) when compared to healthy controls (p = 0.00044 and 0.0084, respectively). Furthermore, the difference in f between carcinoma and pacreatitis was highly significant (p=0.0001). The perfusion free diffusion fraction D showed no difference between the two patient groups (1.07 ± 0.224 and 1.09 ± 0.3 *10^{-3} mm²/s, p= 0.64). Thus, differences found in ADC, which represent a combined measure of perfusion and diffusion, can be completely attributed to perfusion effects.

Conclusion: f mapping provides a novel, fast, non-invasive visual and quantitative method for depiction and differentiation of pancreatic masses.

B-006 14:45

also EPOS

A T2* magnetic resonance imaging study of pancreatic iron overload in thalassemia major

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Purpose: To describe the T2* values of the pancreas in patients with beta-thalassemia major; to investigate the correlation between pancreatic and hepatic and myocardial siderosis; to assess the relationship between pancreatic siderosis and diabetes or glucose metabolism impairment, and between pancreatic iron overload and serum ferritin.

Methods and Materials: Study population: 147 consecutive thalassemia major patients enrolled in the Myocardial Iron Overload in Thalassemia network, an Italian network constituted by thalassemia and MRI centers. The pattern of disturbances of glucose metabolism was assessed with oral glucose tolerance test. MRI was performed using a 1.5-T MRI scanner. Myocardial T2* was measured with a fast-gradient-echo multi-echo sequence with electrocardiogram triggering. Liver and pancreatic T2*, were measured with a gradient-echo multiecho sequence. Analysis on T2* images was performed with a dedicated software.

Results: The pancreatic T2* value did not show a significant difference amongst men and women and increased weakly with age in a significant manner. There was a significant positive correlation between serum ferritin levels and pancreatic iron overload. Significant positive correlations of the pancreatic T2* were demonstrated for liver T2*, global heart T2* value, number of segments with normal T2* and T2* value in the mid-ventricular septum. Pancreatic T2* value was positively related with LV and RV EFs. There was no correlation between pancreatic T2* and diabetes or IGT.

Conclusion: Pancreatic iron overload is positively correlated to serum ferritin, hepatic and myocardial iron overload and negatively correlated to biventricular systolic function, while it does not show correlation with glucose metabolism disturbances.

B-007 14:54

Differentiation of pancreatobiliary- and intestinal-type ampullary carcinoma based on MR with MRCP

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Purpose: To investigate differential imaging findings of pancreatobiliary- and intestinal-type ampullary carcinoma by using MR with MRCP

Methods and Materials: Fifty patients of ampullary carcinoma who had preoperative MR with MRCP were enrolled in this study. Based on the immunohistochemical staining (CK7, CK20, MUC2, MUC5 AC) and hematoxylin-eosin staining, 35 patients were classified as pancreatobiliary type and 15 patients were classified as intestinal type ampullary carcinoma. Two radiologists who were blind to microscopic type of ampullary carcinoma evaluated the imaging findings in consensus. An independent sample t-test and Chi-square test were used for the statistical analysis.

Results: There was no statistical difference between two groups in age, sex, tumor stages and differentiation of tumor (P> 0.05). On MRI, pancreatobiliary type more frequently showed infiltrative gross morphology, whereas all of intestinal type showed mass forming gross morphology (P=0.001). Papillary bulging, epicenter of the lesion, shape, symmetry and narrowing pattern of distal CBD did not reach statistical difference (P> 0.05). On T2WI, pancreatobiliary type more frequently showed low signal intensity whereas none of intestinal type showed low signal

intensity, compared to duodenum (P=0.008). On MRCP, intestinal type more commonly manifested oval shape filling defect at the distal CBD (P < 0.001).

Conclusion: Mass forming gross morphology is to high signal intensity compared to adjacent duodenum on T2WI, and oval shape filling defect at the distal CBD on MRCP are suggestive findings of intestinal type ampullary carcinoma, whereas infiltrative gross morphology and low signal intensity compared to duodenum on T2WI are more common findings in pancreatobiliary type ampullary carcinoma.

B-008 15:03

also EPOS

Mass-forming autoimmune pancreatitis and pancreatic carcinoma: Differential diagnosis on the basis of computed tomography, magnetic resonance cholangiopancreatography, and diffusion-weighted imaging findings

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Purpose: To differentiate mass-forming autoimmune pancreatitis (AIP) from pancreatic carcinoma using computed tomography (CT) and magnetic resonance (MR) imaging findings.

Methods and Materials: We retrospectively reviewed dynamic contrast-enhanced CT, MR cholangiopancreatography (MRCP), and diffusion-weighted MR imaging data (DWI) for 10 patients with mass-forming AIP diagnosed by the revised clinical diagnostic criteria of AIP defined by the Japan pancreas society and for 70 patients with pathologically proven pancreatic carcinoma. We evaluated the following radiological findings: contrast-enhancement pattern, capsule-like rim, calcification, cyst, bulging contour, distal pancreatic atrophy, and appearance of the common bile duct and main pancreatic duct (MPD) on MRCP. Lesion visibility on DWI was determined and the apparent diffusion coefficient (ADC) was calculated. The sensitivity, specificity, and odds ratio of significant radiological findings and combinations of findings were also calculated.

Results: Seven radiological findings-early homogeneous enhancement, delayed homogeneous enhancement, capsule-like rim, absence of distal pancreatic atrophy, smooth MPD stenosis, MPD upstream dilatation ≤ 4 mm, and ADC ≤ 0.88 × 10^{-3} mm²/s-were found to be significant for differentiation of mass-forming AIP from pancreatic carcinoma (P < 0.05). When delayed homogeneous enhancement and ADC ≤ 0.88 × 10^{-3} mm²/s were used in combination, the sensitivity and specificity for diagnosing mass-forming AIP were 100 and 98%, respectively. When 4 of the 7 findings were used for the diagnosis of mass-forming AIP, a sensitivity of 91% and specificity of 100% were achieved.

Conclusion: Specific radiological findings can help differentiate mass-forming AIP from pancreatic carcinoma with high accuracy.

B-009 15:12

Comparison of contrast-enhanced ultrasonography and MRI in displaying anatomic features of pancreatic serous cystoadenomas

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Purpose: To compare the capability of magnetic resonance imaging (MRI) and contrast-enhanced ultrasonography (CEUS) in the detection of the imaging features of pancreatic serous cystoadenoma (PSCA) useful for characterization.

Methods and Materials: A retrospective study of 61 patients affected by PSCA studied with CEUS and dynamic MRI in a 5-year period was performed. The final diagnosis was achieved by pathological exam of the resected specimen. Location, size, wall (thickness, enhancement), septa (number, thickness, enhancement), and presence of central scar were retrospectively evaluated by two radiologists, independently. The lesions were classified into 3 categories: microcystic (thin wall, numerous thin septa); macrocystic (thin wall, few thin intralesional septa); and mixed micro-macrocystic. Se, sp, PPV, NPV, and accuracy were calculated with respect to the pathologic findings. Inter-observer variability with k agreement was determined.

Results: MRI correctly depicted intralesional septa in 51/56 lesions (se 91.07%; sp 83.33%; PPV 96.22%; NPV 71.42%; acc 87.09%), whereas CEUS in 52/56 lesions (92.85; 83.33; 98.11; 71.42; 88.70%). MRI correctly identified central scar in 12/14 cases (85.71; 97.87; 92.30; 96.83; 95.08%), whereas CEUS in 11/14 cases (78.57; 97.87; 91.16; 93.87; 93.44%). The difference between the diagnostic accuracy of CEUS and MRI was not significant (p> 0.05). MRI and CEUS showed good correlation with pathology as regards classification of lesions into categories (91.80, 90.16%), and regarding enhancement of wall (95.08%) and septa (91.80%). Interobserver agreement had a kappa value of 0.88-0.96.

Conclusion: CEUS and MRI findings correlate well with those found at pathology. CEUS may be useful in the characterization of PSCA.

B-010 15:21

Evaluation of pancreatic adenocarcinoma response to angiogenesis inhibitor therapy on MDCT

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Purpose: The size-based criteria for quantification of treatment response may fail to depict response to cytostatic agents. The purpose of this study is to evaluate change in size and density of pancreatic adenocarcinoma in response to angiogenesis inhibitor, bevacizumab.
Methods and Materials: 31 patients with locally advanced pancreatic adenocarcinoma treated with chemoradiotherapy were included. Treatment regimen consisted of gemcitabine and radiation alone (N=11) or in combination with bevacizumab (N=20). Patients were evaluated with triphasic MDCT. Tumors volumes were calculated on the pancreatic parenchymal phase (PPP) images. Tumor density (TD) was determined on PPP using 3 ROIs and was normalized by density of the normal parenchyma (PD) using formula: $TN=TD/PD\times100$. Tumor volume and normalized tumor density (TN) values were compared between the two groups.
Results: Mean tumor volume in patients treated without and with bevacizumab was 27.99 vs. 26.27 mL (P> 0.05) at baseline and 21.10 vs. 18.70 mL (P> 0.05) at follow-up. Decrease in tumor volume was insignificant in both groups (P> 0.05). Mean TN for patients treated without and with bevacizumab was 59 vs. 50 (P> 0.05) at baseline and 57 vs. 42 (P < 0.05) at follow-up. From baseline to follow-up, there was a significant decrease in TN in patients who received bevacizumab (P < 0.05). However, decrease in TN was insignificant in patients who did not receive bevacizumab (P> 0.05).
Conclusion: Despite stable tumor volume, tumor density declined significantly in response to bevacizumab. Tumor density may serve as a better surrogate biomarker of treatment response to angiogenesis inhibitors in pancreatic adenocarcinoma.

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

Musculoskeletal

SS 110

Cartilage

Moderators:
G.P. Schmidt; Munich/DE
S. Trattnig; Vienna/AT

B-011 14:00

Differentiation of cartilage repair tissue after matrix-associated autologous chondrocyte transplantation (MACT) using a hyaloronic acid based and collagen based scaffold by means of morphological MOCART scoring and biochemical T2 mapping

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Purpose: The aim of the present feasibility-study was to use advanced MR morphological scoring and biochemical T2-mapping to compare cartilage repair tissue at the femoral condyle after MACT using two different scaffolds (HyalograftC® (HC; hyaloronic acid based) and CaReS® (collagen-based)).
Methods and Materials: 20 patients after MACT (matched-pairs: 10 after HC, 10 after CaReS) underwent 3 T MRI 24 months after surgery. Clinical Brittberg score was assessed; morphological analysis was applied using the magnetic resonance observation of cartilage repair tissue (MOCART) score; global and zonal biochemical T2-mapping (multi-echo spin-echo based) was performed to reflect different biomechanical properties of the cartilage repair tissue regarding to collagen matrix/content and hydration. Groups were compared by analyses-of-variance.
Results: Clinical outcome was comparable in each group. The MOCART score showed slightly, however not significantly (p=0.210), improved results in the CaReS-group (76.5) compared to the HC-group (70.0). Global T2 relaxation times (ms) for healthy surrounding cartilage were comparable in both groups (HC: 49.9; CaReS: 51.9; p=0.398), whereas cartilage repair tissue showed significantly higher results in the CaReS-group (HC: 48.2; CaReS: 55.5; p=0.011). Zonal evaluation showed no significant differences (p≥0.05).
Conclusion: The present initial study is to our knowledge the first in-vivo approach to distinguish between two different scaffolds used for cartilage transplantation. Higher T2-values of the cartilage repair tissue based on a collagen scaffold compared to the hyaloronic-acid based scaffold indicated differences in the composition of the repair tissue even 2 years after implantation. To follow-up tissue engineering techniques and bioregenerative cartilage therapy approaches will in future become increasingly important.

B-012 14:09

High-field (3.0 T) and ultra-high-field (7.0T) MRI of knee cartilage: Comparison of quantitative T2, T2* and magnetization transfer contrast

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Purpose: The aim of this study was to compare the performance and the reproducibility of T2 mapping, T2* mapping and magnetization transfer contrast (MTC) of articular cartilage at 3.0 T and 7.0T.
Methods and Materials: Axial MRI of the patella was performed on 25 knees of healthy volunteers (mean age 25.8±5.7 years) at 3.0 T and 7.0T using a comparable surface-coil and MR systems of the same vendor side-by-side. 13 knee joints were measured once, and 4 knee joints were measured 3 times to assess reproducibility. Morphological PD-TSE sequence was obtained. For T2 relaxation, a multi-echo spin-echo sequence with TR optimization was assessed (3.0 T (1.2 s; 1.6 s) and 7.0 T (1.6 s; 2.0 s)). T2* relaxation was obtained by a gradient-echo sequence and MTC was prepared by a magnetization transfer-sensitized, steady-state free-precession approach. Statistical analysis-of-variance and coefficient-of-variation (CV) were prepared.
Results: Global T2-relaxation times were 44.1 ms (deep: 32.8 ms; superficial: 55.4 ms) at 3.0 T and 41.4 ms (deep: 34.3; superficial: 48.4 ms) at 7.0T. Whereas global values were significantly (p < 0.05) lower at 7.0T, zonal evaluation revealed a significantly less pronounced stratification at 7.0T (p < 0.05). T2*-relaxation times showed a roughly comparable trend at 3.0 T (global: 22.2 ms (deep: 17.8 ms; superficial: 26.6 ms)) compared to 7.0T (global: 17.9 ms (deep: 15.2 ms; superficial: 20.6 ms)). MTC, however, revealed lower values at 3.0 T (global: 28.4% (deep: 29.1%; superficial: 27.7%)) compared to 7.0T (global: 36.3% (deep: 34.1%; superficial: 38.5%)) (p < 0.05). CV as a marker of reproducibility showed lower values for 7.0T compared to 3.0 T.
Conclusion: The present study was to our knowledge the first time to directly compare the performance of biochemical T2, T2* and MTC imaging at 3.0 T and 7.0T. Lower T2- and T2*-relaxation times were expected; the differences in MTC and zonal variation have to be further studied.

B-013 14:18

Porcine patellar cartilages in vitro by means of trypsin digestion: 7.0TMR T1ρ weighted image and quantitative analysis

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Purpose: To evaluate changes in the T1ρ relaxation time from porcine patellar articular cartilages with or without trypsin digestion in vitro by means of T1ρ imaging and relaxation time map quantitative analysis.
Methods and Materials: T1ρ relaxation times were measured from porcine patellar cartilage. The samples (n = 20) were assigned to 2 groups. A group of right patellar samples (n=10) were immersed in PBS to serve as self-control group. The left patellar samples (n=10) were immersed in PBS with trypsin for 4 hours as treated groups. T1ρ-images were collected with a spin-echo sequence pre-encoded with a spin-lock pulse cluster and a spin-echo sequence on a 7.0T scanner. Using a home-built analysis program, T1ρ- maps were obtained and the cartilage from each sample was manually segmented by drawing regions-of-interest. This segmentation separated the patellar cartilage into four layers (superficial, middle, deep and calcified), which represented the superficial, transitional, radial, and calcified zones, respectively, to investigate regional differences of T1ρ in patellar cartilage.
Results: T1ρ relaxation in superficial layers (P < 0.05) increased significantly in samples after 4 hours trypsin digestion. However, T1ρ relaxation showed no difference on both deep and calcified layers in the control groups.
Conclusion: The T1ρ relaxation time changes at the articular cartilage following trypsin digestion, especially at the superficial layer, indicating T1ρ relaxation time is a sensitive and specific determination index; thus, T1ρ measurements could be used as non-invasive early evaluation method for cartilage disease.

B-014 14:27

Detection of degenerative cartilage disease: Comparison of high resolution morphological MR and quantitative T2 mapping at 3.0 Tesla

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Purpose: To determine the relationship between morphological changes of cartilage shown on high-resolution MRI and biochemical T2 relaxation in early stages of cartilage degeneration and to assess differences between T2 mapping at the beginning (point of time 1=PT1) and the end (PT2) of MRI examination.

Methods and Materials: 42 patients (13 females, 29 males, mean 37.6 years) with maximum cartilage defect grade of ICRS 2 were examined at 3 T. The femoral cartilage layer above the posterior horn of the meniscus was morphological graded on high resolution PD TSE sequence (voxel size 0.2x0.2x2 mm). T2 maps (at PT1 and PT2; time interval 40 min) were calculated from a multiecho spin-echo sequence. Quantitative T2 values were assessed by ROI analysis within the same anatomical region compared to morphological evaluation. Global T2 values and differences between zonal T2 values related to the respective grade of cartilage defect were determined using analysis of variance. Eleven patients underwent arthroscopy as reference.

Results: Mean T2 relaxations times increased significantly with increasing cartilage defect grade for PT1 (37.4, 41.9 and 45.5 ms for ICRS grade 0-2) and PT2 (p < 0.05); however, the mean T2 values were even more enhanced at PT2 (39.3, 44.5, 50.5 ms). Sensitivity, specificity and accuracy for morphological evaluation were 89, 100 and 92%.

Conclusion: Quantitative T2 mapping can be used as a diagnostic marker for early cartilage degeneration; however, the point of time when it is performed within the clinical MRI-protocol has to be considered. Zonal T2 variation is an inconclusive parameter for evaluation of cartilage defects.

B-015 14:36

Diagnostic performance of MR arthrography of cadaveric wrists at 3.0 T and 7.0T for the detection of articular cartilage abnormalities with open pathologic inspection as the reference standard

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Purpose: To prospectively evaluate the diagnostic performance of MR arthrography for the detection of articular cartilage abnormalities at 3.0 T and 7.0T in cadaveric wrists.

Methods and Materials: MR imaging was performed in nine cadaveric wrists from eight subjects (four right wrists, five left; three women, five men; mean age, 81) after the intraarticular administration of 1.5 and 7 ml gadoterate-meglumine (Guerbet, Roissy, France) into the radio-ulnar and the mid-carpal joint space, respectively. A 3.0 T and 7.0T MR unit (Phillips, Best, The Netherlands) and custom-build 8-channel wrist coils with an identical array design were used. The same imaging protocol was used for both systems and included intermediate-weighted and fat-saturated T2-weighted fast spin-echo sequences and T1-weighted spin-echo sequences. The articular cartilage surfaces of the wrists were evaluated for the presence of abnormalities by two radiologists. Open pathologic inspection was performed by a pathologist and a hand surgeon. Sensitivity, specificity, negative (NPV) and positive predictive values (PPV) were calculated for 3.0 T and 7.0T. McNemar test was used to assess differences in the diagnostic performance.

Results: In total, 172 cartilage surfaces were evaluated. Pathologic inspection revealed articular cartilage abnormalities in 51 of 172 (30%) surfaces. Sensitivity, specificity, NPV and PPV were 50, 75, 78, 46%, respectively, at 3.0 T, and 54, 67, 78, 40% at 7.0T. The diagnostic performance between 3.0 T and 7.0T was not statistically significant different (P=0.61).

Conclusion: The diagnostic performance of MR arthrography for the detection of articular cartilage abnormalities in cadaveric wrists was the same for 3.0 T and 7.0T.

B-016 14:45

Cartilage T2 and WORMS MR measurements predict changes in clinical parameters over a period of 2 years: Analysis of 217 non-symptomatic subjects from the osteoarthritis initiative

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Purpose: To study if asymptomatic subjects from the Osteoarthritis Initiative (OAI) with higher cartilage T2 relaxation time and higher whole organ magnetic resonance imaging scores (WORMS) determined in baseline 3 T knee MRI studies are more likely to develop increased pain, limited function and reduced physical activity after 24 months.

Methods and Materials: 217 individuals from the OAI without knee pain, BMI of 19-27 kg/m², 45-55 years of age and risk factors for knee osteoarthritis OA were studied with 3 T knee MRI (including intermediate-weighted fast-spin-echo and T2-mapping sequences), which was assessed by two musculoskeletal radiologists for the presence and grade of abnormalities using WORMS. Segmentation of the knee cartilage was performed and T2 maps were generated. These results were correlated with physical activity levels, pain and limited function using PASE, KOOS and WOMAC Scores at baseline and follow-up. Statistical significance was determined using a multi-regression model.

Results: Statistically significant correlations between patella cartilage T2 values (p=0.025), the severity and grade of cartilage lesions (p=0.047) versus changes in physical activity (using PASE) over time were demonstrated. Only subjects with higher T2 values than the median demonstrated a significant decrease in PASE (p=0.005 vs. p=0.9) and WOMAC values (p=0.03 vs. p=0.1). Meniscus lesions predicted changes in KOOS Scores (p=0.004).

Conclusion: T2 values and morphological knee abnormalities at baseline were able to predict clinical changes in physical activity and pain after 24 months. These findings suggest that subjects with higher baseline T2 values may be at greater risk for development of symptomatic knee OA.

B-017 14:54

Changes of knee cartilage T2 under physical activity: 24-month follow-up analysis of 182 non-symptomatic subjects from the osteoarthritis initiative

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Purpose: To study if asymptomatic subjects from the Osteoarthritis Initiative (OAI) with pre-existing knee abnormalities or high activity levels at baseline develop changes in T2 after 24 month.

Methods and Materials: 182 individuals from the OAI without knee pain (baseline WOMAC pain score=0 in both knees), BMI of 19-27 kg/m², 45-55 years of age and risk factors for knee osteoarthritis OA were studied using knee radiographs, 3 T knee MR examinations (including intermediate-weighted fast spin echo and T2 mapping sequences at baseline and after 24 month) and the Physical Activity Scale for the Elderly (PASE). MR images of the right knee were assessed by two musculoskeletal radiologists for the presence and grade of abnormalities. Cartilage segmentation of tibia, femur and patella was performed at baseline and follow-up to generate T2 maps. Statistical significance was determined using a multi-regression model.

Results: Cartilage T2 values increased significantly over time (44.52±2.31 vs. 45.88±2.46 ms: p < 0.0001). Subjects with cartilage abnormalities had higher T2 values at baseline (p=0.035) and at 24 month (p=0.006). Patient with higher PASE scales showed higher T2 values at baseline (p=0.01) and follow-up (p=0.0002) and a higher increase in T2 values over time compared to more sedentary subjects (p=0.03).

Conclusion: Pre-existing focal cartilage lesions and higher physical activity levels induce accelerated cartilage matrix changes as assessed with T2 relaxation times. These may be risk factors for the development of knee OA.

B-018 15:03

DTI and T2 changes in articular cartilage with progressive PG depletion

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Purpose: To study the changes in T2 and DTI induced by progressive depletion of the PG in articular cartilage.

Methods: Three cylindrical cartilage-in-bone samples were drilled from each of four human patellae ((28±23) y). Samples were halved. One half underwent histology with Safranin-O staining to depict the PG of the intact cartilage and the other half MRI at a 17.6-T scanner. MRI protocol included a multi-echo spin-echo sequence for T2 quantification (TR/TE=937.5/7 ms, echotrain=20, echospacing=7 ms, resolution=50x100 um) and a diffusion-weighted spin-echo sequence (TR/TE=937.5/13 ms, b-values=0, 550 mm²/s, 6 diffusion directions, resolution=50x100 um). After imaging, two samples were immersed in a low concentrated trypsin solution (0.1 mg/mL), and the third was kept as negative control. After incubation at 37 °C (6, 48, 72 and 96 h), samples were imaged again and underwent histology. ADC, FA, first eigenvector and T2 maps as well as histology were available from each sample before and after treatment.

Results: Increased ADC was observed with increased PG depletion. ADC increased from the articular surface to the bone-cartilage interface. A significant correlation (r²=0.86, P=0.006) was observed between the mean ADC and the PG loss. Changes in FA, the first eigenvector and T2 were comparable to the changes observed in the negative controls and did not correlate with the degree of PG depletion.

Conclusion: DTI has a great potential to detect early degeneration in OA, since it is sensitive both to the PG content (ADC) and to the collagen structure of cartilage (FA, first eigenvector). T2 is a biomarker for the collagen architecture of the cartilage.

B-019 15:12

Reproducibility of T2 mapping in healthy and osteoarthritic human tibial cartilage: Precise enough to detect true degenerative change?

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Purpose: T2 mapping is a promising tool for quantitative analysis of cartilage in osteoarthritis. However, systematic analysis of its reproducibility is only available for young healthy patellar cartilage.

Methods and Materials: The dominant knee of 24 (12 per young/elder) healthy volunteers/16 osteoarthritis patients were analysed with 3/2 consecutive measurements using a coronal multiecho-sequence (TR/TE/echoes/resolution 3000 ms/13.2 ms/8/0.6²x3 mm³) at 1.5 T. T2 maps were calculated pixel-wise (Levenberg-Marquardt). Global T2 was averaged for the complete cartilage plate per MRI-section, regional T2 was calculated for 8 ROIs per MRI-section resulting in 104/80 ROIs for the medial/lateral tibial cartilage plate. Test-retest reproducibility errors were calculated as root mean square average (RMSA) of the individual standard deviations (SD[ms]; absolute error) and coefficients of variation (CV=mean/SD[%]; relative error).

Results: Healthy global and regional reproducibility error was 7.9/14.5% (2.5/4.5 ms) for medial and 6.9/13.8% (2.2/4.2 ms) for lateral tibiae; in OA 7.2/12.1% (2.2/3.7 ms) for medial and 6.3/11.2% (2/3.5 ms) for lateral tibiae. No significant difference was observed between medial and lateral tibiae or between healthy subjects and OA patients. Healthy interindividual variability was 8.8% (2.8 ms).

Conclusion: Precision errors of tibial cartilage T2 were slightly higher than reported healthy patellar cartilage T2 precision errors, presumably related to lower cartilage thickness and increased partial volume effects. T2 reproducibility errors of both, healthy and diseased tibial cartilage were small compared to reported change in osteoarthritis (up to 180%) suggesting a good discriminatory power of the technique. The data may help to calculate sample size and least significant change when designing longitudinal and cross-sectional trials in osteoarthritis.

B-020 15:21

Presence of effusion, but not synovitis increases the risk of tibio-femoral cartilage loss in knees without osteoarthritis at 30-months follow-up: The multicenter osteoarthritis (MOST) study

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Purpose: Synovial activation, which is reflected on MRI as synovial thickening and joint effusion, is a common feature in knees with osteoarthritis (OA). The aim of the study was to evaluate if baseline (BL) synovial activation predicts cartilage loss longitudinally in the tibiofemoral (TF) joint in patients at risk for OA.

Methods and Materials: The Multicenter Osteoarthritis (MOST) Study is a longitudinal observational study of knee OA. MRI was performed at 1.0 T. MRIs were assessed semiquantitatively according to the WORMS system. Only knees without radiographic OA and without cartilage damage were included. A synovitis-surrogate of signal changes in Hoffa's fat pad, and effusion were both scored from 0-3. Presence of synovitis and effusion was defined as any grade ≥ 2. Knees with scores of either 0 or 1 were the reference. Logistic regression was used to estimate the risk of cartilage loss at 30 months follow-up. Adjustment was performed for possible confounders of future TF cartilage damage.

Results: 514 knees were included. At baseline, 43 knees showed synovitis and 53 presented with joint effusion. After adjustment, baseline synovitis was not associated with an increased risk of cartilage loss at follow-up (adjusted odds ratio 1.0 [95% CI 0.5-21). Knees with baseline effusion had an increased risk for cartilage loss (adjusted odds ratio 2.7 [95% CI 1.4-5.1].

Conclusion: Baseline synovitis does not predict cartilage loss, but joint effusion. Baseline effusion as a reflection of synovial activation seems to play a role predicting structural progression in early or pre-OA.

GI Tract

SS 101b

Esophagogastric disease

Moderators:
P.K. Prassopoulos; Alexandroupolis/GR
D.J.M. Tolan; Leeds/UK

also
EPOS

B-021 14:00

MR-fluoroscopy with high-speed kinetic sequences: Preliminary study in multiple swallowing disorders of oro-esophageal tract and gastro-esophageal junction

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Purpose: To evaluate the capability of high-speed kinetic MR sequences in defining upper and lower swallowing disorders.

Methods and Materials: 29 patients with various oro-esophageal and gastro-oesophageal disorders underwent MR examination on a 1.5 Tesla magnet with high performing gradients using Cine spoiled gradient echo sequences (Turbo-FLASH) on multiple oblique planes (Time resolution: > 5 images/sec). The patient has been studied in supine position, while swallowing contrasted yogurt. We evaluated visualization of oesophageal bolus transit, bolus transit-time, peristalsis, gastro-oesophageal junction patency and competency.

Results: MR-fluoroscopy imaged swallowing abnormalities in 27/29 patients: 3 upper motility disorder, 7 achalasia, 1 megaoesophagus, 2 para-esophageal Hjatal Hernia, 6 gastro-esophageal reflux (2 of those with sliding Hjatal Hernia), 7 after Nissen-fundoplication, and 1 after gastrectomy. MR findings well correlated with other different instrumental examination findings.

Conclusion: High-speed kinetic MR-fluoroscopy is a useful and complementary tool for evaluating oro-esophageal deglutition process and gastro-esophageal junction alterations. It is simple, rapid and well-tolerated, radiation-free and non-invasive tool able to evidence swallowing disorder, with no time of observation limit characteristic of tools employing ionizing radiations.

B-022 14:09

Dynamic MR imaging during bolus passage in the evaluation of hiatal hernias

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Purpose: To prospectively evaluate the accuracy of dynamic fast magnetic resonance imaging (MRI) in evaluating patients with hiatal hernias.

Methods and Materials: 20 patients (12 males and 8 females) with known hiatal hernias underwent MRI while swallowing in the prone position. Yogurt was spiked with Gadolinium chelate that was used as oral contrast material for this study. Haste, True-Fisp and Dynamic GRE sequences were acquired on a 1.5 T scanner. Two radiologists evaluated the visualization of esophageal bolus transit, identification and evaluation of the three dimensions of the hiatal hernias, and reflux at rest and during the Valsalva maneuver. The MR images were correlated with both barium studies and surgery (gold standard). The Friedman test and one-way analysis of variance were used for statistical analysis.

Results: MR evaluation was feasible in all patients. Dynamic MRI provided good image quality in all 20/20 patients. MR showed an accurate agreement with the gold standard in all patients in the evaluation of the size of the hernia and of the thickness of the wall. At rest the mean diameters of the hiatal hernias were 3.5 ± 2.1 cm in the axial, in the 4 ± 2 sagittal, and 3.8 ± 1.8 in coronal. During Valsalva maneuvers the dimensions of the hernias increased in 15/20 of the patients (75%). 8/20 patients (40%) had gastroesophageal reflux.

Conclusion: Dynamic MRI is an accurate method in assessing patients with hiatal hernias and is able to evaluate the morphologic and the functional changes.

B-023 14:18

Correlation of respiratory organ motion of the esophagus with skin surface motion in a porcine model

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Purpose: To quantify correlation of respiratory organ motion of the esophagus with skin surface motion in a porcine model with regard to using skin surface tracking for respiratory motion compensation in research, training and development of techniques for procedures in image-guided minimally invasive surgery, endoscopic resections, ablative procedures and radiation therapy.

Methods and Materials: Porcine model (n=10, 20-34 kg) under general anaesthesia with Hemoclips applied to the cervical, high/middle/lower thoracic and abdominal esophagus and skin markers to the thorax and abdomen. CT scans (64-row Siemens Somatom Sensation) were obtained in respiratory positions ranging from maximum inspiration to expiration. For segmentation of CT data, we used the Medical Imaging Interaction Toolkit MITK with threshold-based region-growing algorithms to extract coordinates of the gravity centers of esophageal and skin markers. Correlation of 3D respiratory motion of the esophageal and skin markers was analyzed using SPSS.
Results: Motion correlation using spearman's rank correlation coefficient r is significant between all skin markers and the middle/lower thoracic and abdominal esophagus (p < 0.05; 0.42<r< 0.82), significant for some skin markers and the upper thoracic esophagus (0.002<p < 0.13; 0.28<r< 0.54) and not significant for the cervical esophagus and any skin markers (0.15<p < 0.93; 0.018<r< 0.27).
Conclusion: In this Porcine model, skin surface motion can be used for tracking respiratory motion of only the middle/lower thoracic and abdominal esophagus with good correlation. The upper thoracic esophagus shows less correlation with breathing motion which may be explained by lesser magnitude of respiratory motion and more aortic arch motion. The cervical esophagus shows little motion and no correlation to respiratory motion.

B-024   14:27

also EPOS

**Detection of early gastric cancer on multidetector row CT:
Analysis of factors influencing the detection**
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Purpose: To assess the influence of endoscopic information on diagnostic CT performance for detecting EGC and to determine the factors influencing the visibility of EGC on air-distended stomach MDCT.
Methods and Materials: Eighty-six patients with surgically-confirmed EGC and who underwent air-distended stomach protocol CT scanning were included in our study. The CT protocol was composed of axial, 2D MPR, and surface-shaded volume-rendering images. Two radiologists twice reviewed the MDCT images, independently blinded and unblinded to the endoscopic information, to assess the influence of the endoscopic information for CT detectability. Final CT visibility was determined in consensus. To analyze the factors associated with the CT visibility of EGC, the endoscopic and histopathologic features of the visible and invisible EGCs were compared.
Results: The detection rate on unblinded review was significantly higher than on blinded review: 64.0% (55/86) and 57% (47/86) for reviewer 1 and reviewer 2, respectively, with the endoscopic information; and 43.0% (37/86) for both reviewers without endoscopic information (p=0.002 for reviewer 1, p=0.031 for reviewer 2). The depth of invasion and the tumor volume were the significant factors influencing the CT visibility of EGC (p=0.008 and 0.039, retrospectively). The CT visibility of T1a tumors was significantly lower than that of T1b tumors, i.e. 42.1% (24/43) for T1a and 57.9% (33/43) for T1b (p=0.04). Interobserver agreement was good on both blinded and unblinded review (weighted kappa values: 0.605 and 0.723, respectively).
Conclusion: The visibility of EGC on stomach MDCT is strongly influenced by the invasion depth and tumor volume. The diagnostic performance of air-distended stomach MDCT for revealing EGC was improved by providing endoscopic information.

B-025   14:36

Efficacy of HMDCT in differentiation between normal and pathologic wall thickening of the gastroesophageal junction line
N. Bastati-Huber, W.K. Matzek, S. Baroud, D. Muin, C.J. Herold, A. Ba-Ssalamah;
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Purpose: To differentiate normal from pathologic thickening of the gastro-esophageal wall using hydro multidetector computed tomography (HMDCT) in patients with and without gastric or distal esophageal cancer, using endoscopy and postoperative histopathological results as gold standard.
Methods and Materials: 170 patients, who underwent endoscopy and biopsy or surgical resection due to suspected gastric or distal esophageal cancer, were included. Contrast enhanced HMDCT scans were performed after gastric and esophageal distension was achieved using tap water and effervescent granulate. The images were reviewed by two radiologists in consensus determining gastro-oesophageal wall thickness, presence of stenosis, enlarged lymph nodes and assessing the morphology of the wall's outer border. The statistical analysis was performed using the Kruskal-Wallis test.
Results: In 66 of 170 patients with gastric or distal esophageal cancer, the tumor was located at the gastro-esophageal junction line. In these patients, the mean thickness of the gastro-esophageal wall was 13.5 ± 4 mm (min. 4 mm, max.

36 mm), compared to a mean of 7 ± 2 mm (min. 2 mm, max. 11 mm) in patients without a gastro-esophageal tumor. This difference was markedly statistically significant (p < 0.001). From 66 cancers, 49 tumors were associated with irregular outer borders, whereas 103 cases with no tumor showed smooth outer borders. The difference was, again, statistically significant (p < 0.001). The presence or absence of stenosis or enlarged peri-tumoral lymph nodes were not statistically significant parameters.
Conclusion: Gastro-esophageal junction wall thickening of more than 12 mm measured in HMDCT with irregular wall outer borders is indicative of gastro oesophageal tumor.

B-027   14:45

Efficacy of HMDCT in differentiation between normal and pathologic antral wall thickening of the stomach
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Purpose: The purpose of this study was to determine the normal and pathological thickness of the antral wall using hydro multidetector computed tomography (HMDCT) in patients with gastric or distal esophageal cancer using endoscopy and postoperative histopathological results as gold standard.
Methods and Materials: We included 170 patients (108 m/62 f, 27-89 y) who underwent endoscopy and biopsy due to suspected gastric or distal esophageal cancer. Contrast enhanced HMDCT scans were performed after gastric and esophageal distension using tap water and effervescent granulate. The images were reviewed by two radiologists in consensus to determine antral wall thickness, wall enhancement, presence of stenosis, enlarged lymph nodes and morphology of the outer border. The imaging findings were compared to endoscopical and histopathological results. Statistical analysis was performed using both descriptive and analytical methods (boxplots, frequency tables and Kruskal-Wallis tests, respectively).
Results: From a total of 170 patients, 47 showed a tumor located at the antrum. In these patients, the mean thickness of the antral wall was 15 mm±4, compared to a mean of 7 mm±4 in patients without antral tumor. This difference was statistically significant (p < 0.05). 20 of 47 tumor cases (42.6%) were associated with irregular outer wall borders. The presence or absence of stenosis or adjacent enlarged lymph nodes showed no significant association to the histopathological diagnosis.
Conclusion: Antral wall thickening of more than 13 mm, measured in HMDCT, is indicative of antral tumor, especially when combined with an irregular outer wall border.

B-028   14:54

also EPOS

Apparent diffusion coefficient: Potential imaging biomarker for predicting biological behavior of gastric cancer
L. Tang, X.P. Zhang, Y.S. Sun, K. Cao, Y. Cui, L.P. Qi; *Beijing/CN*

Purpose: To explore the correlation of apparent diffusion coefficient (ADC) with biological behavior of gastric cancer.
Methods and Materials: Diffusion-weighted magnetic resonance imaging (DW-MRI) was performed on 101 gastric cancer patients with a 1.5 T scanner. The parameters were: TR/TE, 2750/65 ms; matrix, 128×128; slice thickness, 5 mm; intersection gap, 1 mm; number of excitation, 4. The b values were 0, 1000 s/mm², and the MPG pulses were placed in three directions. A curved line was drawn to include the entire cancer signal as ROI and the ADCs were recorded. The differences of ADCs among various biological behavior indicators obtained from operative pathology (location, serosa infiltration, growth pattern, and pathologic differentiation) were analyzed. ROC curves were employed to assess the evaluation efficacy of ADCs.
Results: Ninety-seven gastric cancers demonstrated high signal to nearby gastric wall on DW-MRI. The ADCs of cancers infiltrated out of serosa were lower than those limited in gastric wall ($1.21×10^{-3}$ mm²/s±0.25 vs. $1.61×10^{-3}$ mm²/s±0.40, P < 0.05). Taken $1.45×10^{-3}$ mm²/s as cutoff value of ADCs, the AUC, sensitivity and specificity for the judgment of serosa infiltration were 0.830, 91.5 and 77.8%, respectively. The ADCs of diffuse-type gastric cancers were lower than those of confined-type ($1.12×10^{-3}$ mm²/s±0.27 vs. $1.45×10^{-3}$ mm²/s±0.31, P < 0.05). Taken $1.27×10^{-3}$ mm²/s as cutoff value of ADCs, the AUC, sensitivity and specificity for the judgment of diffuse infiltration were 0.792, 71.0 and 81.0%, respectively. No difference of ADCs was found among different locations (P> 0.05) and pathologic differentiations (P> 0.05).
Conclusion: DW-MRI can provide a surrogate biomarker for the quantitative evaluation of biological behavior of gastric cancer.

B-029 15:03

Application of 3.0 T MRI 3D-VIBE dynamic contrast-enhanced sequence in the diagnosis of proximal gastric carcinoma
B. Wu, J. Sun; *Chengdu/CN*

Purpose: To investigated the diagnostic value of 3.0 T MRI 3D-volumetric interpolated breath-hold examination (VIBE) sequence dynamic contrast-enhanced scan in the preoperative evaluation of PGC.
Methods and Materials: Forty-two consecutive patients with surgically and histologically confirmed PGC underwent preoperative 3.0 T MR imaging examination. Unenhanced two-dimensional T1- and T2-weighted images, gadolinium enhanced 3D-VIBE images in the early arterial, late arterial and portal venous phases followed by 2D T1-weighted images in the equilibrium phase were acquired. Imaging data were interpreted by two abdominal radiologists through consensus reading in blind manner, focusing on the assessment of the morphological type, the extent of tumor infiltration and the involvement of neighbouring blood vessels.
Results: 3D-VIBE images clearly depicted the normal gastric wall as consisting of four layers, which corresponded well to the histological layers. The 3D VIBE imaging determined grade correlated with the histopathological findings for 7 of 8 (87%) pT2 tumors, 26 of 28 (94%) pT3 tumors, and 5 of 6 (83%) pT4 tumors. The overall accuracy was 90%. 3D VIBE imaging also depicted the gross features of the tumor, presence of ulceration, and adjacent lymph node swelling. Involvement of the left or right gastric artery, the splenic vein and celiac trunk was shown more frequently on 3D VIBE than 2D T1-weighted enhanced images. The positive predictive value of 3D-VIBE (96%) for assessing tumor resectability was higher than that of 2D T1-weighted enhanced images (88%, P < 0.05).
Conclusion: 3D-VIBE sequence dynamic contrast-enhanced scan is a feasible and promising technique for tumor staging of PGC.

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

Chest

SS 104

Lung cancer: Perfusion assessment

Moderators:
W.F.M. De Wever; Leuven/BE
D. Hahn; Würzburg/DE

B-030 14:00

Solitary pulmonary nodule: Comparison of diagnostic capability between first-pass perfusion CT on 320-detector row CT and FDG-PET/CT
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Purpose: To directly compare diagnostic capabilities of quantitatively analyzed first-pass perfusion CT on 320-detector row CT with FDG-PET/CT in patients with solitary pulmonary nodules (SPNs).
Methods and Materials: 30 consecutive patients with 30 SPNs underwent chest first-pass perfusion CT, PET/CT, and microbacterial and/or pathological examinations. 30 SPNs were classified into two groups based on the final diagnoses: malignant SPN (n=19) and benign SPN (n=11). All perfusion CT were performed on 320-detector row CT system by using volumetric cine scan. For quantitative assessment of perfusion CT in each patient, blood flows were calculated by maximum-slope (mBF) and patlak-plot (pBF) methods. Blood volume was also determined by patlak-plot method (pBV). Then, mBF, pBF, pBV and SUV in each nodule were determined by ROI measurement, and compared between malignant and benign SPNs by Student's t-test. To compare diagnostic capabilities between quantitatively assessed perfusion CT and PET/CT and determine feasible threshold values, ROC analyses were performed. Finally, sensitivity, specificity and accuracy of each index were compared each other by using McNemar's test.
Results: mBF, pBF and SUV had significant difference between malignant and benign SPNs (p < 0.05). Area under the curves of mBF (Az=0.90) and pBF (Az=0.90) were significantly larger than that of pBV (Az=0.70, p < 0.05) and SUV (Az=0.70, p < 0.05). When feasible threshold values were adapted, sensitivities and accuracies of mBF and pBF were significantly higher than pBV and SUV (p < 0.05).
Conclusion: Quantitatively analyzed first-pass perfusion CT on 320-detector row CT is a more sensitive and accurate method than PET/CT in patients with SPNs.

B-031 14:09

Can dual energy CT evaluate contrast enhancement of ground-glass attenuation? A phantom study
T. Kawai, M. Hara, K. Shima, Y. Ozawa, Y. Shibamoto; *Nagoya/JP (tatsuyakawai@hotmail.com)*

Purpose: With the dual energy (DE) CT technique using two energies of X-rays, different materials can be distinguished based on their inherent X-ray attenuation coefficients. Contrast enhancement of pulmonary lesions with ground-glass attenuation (GGA) is usually difficult to evaluate with conventional techniques, but it might be possible by using the contrast-mapping image (CMI) obtained by the DE-CT technique. To address this issue, we conducted a phantom study.
Methods and Materials: Phantoms made of agarose gel and those made of hollow resin clay, containing various concentrations of iodine, were used to simulate soft tissue and GGA, respectively. They were scanned using a dual-source CT scanner (SOMATOM Definition) with a DE (80 and 140 kVp) mode. We examined the relationship between the iodine concentration and calculated iodine value of the regions-of-interest placed in the phantoms on CMI. In addition, we evaluated the influence of calcification on the apparent iodine value on CMI.
Results: There was an excellent correlation between the iodine value on CMI and the iodine concentration in the soft tissue models. Although the former tended to overestimate the latter in the GGA models, an excellent correlation was also achieved in the GGA models by modulating the parameters for calculating CT numbers of the materials on 80 and 140 kVp images. The iodine value increased with calcium concentration in both soft tissue and GGA models, but the phenomenon could be minimized by using modified parameters.
Conclusion: Under appropriate parameter settings, DE-CT could evaluate iodine concentration in GGA lesions.

B-032 14:18

Quantitative tumor perfusion assessment with 64-slice multidetector-row CT (MDCT): Evaluation before and after antiangiogenic chemotherapy
N. Tacelli, A.-L. Hachulla, M. Rémy-Jardin, A. Scherpereel, J.-J. Lafitte, J. Rémy; *Lille/FR (mremy-jardin@chru-lille.fr)*

Purpose: To evaluate whole lung tumoral perfusion before and after antiangiogenic chemotherapy.
Methods and Materials: Nine consecutive patients were prospectively enrolled in this study aimed at evaluating the therapeutic response to antiangiogenic chemotherapy indicated for lung adenocarcinoma (n=8) and malignant mesothelioma (n=1). Quantitative tumor perfusion was sequentially evaluated with 64-slice multidetector-row CT (MDCT) before (T0; n=9) and after chemotherapy (T1: n=9; T2: n=5) with an interval of 3 weeks between the therapeutic sessions. The CT parameters evaluated included: (a) the tumor height and diameter; (b) the tumoral blood volume (BV) and capillary permeability (CP), calculated using Patlak analysis.
Results: Whole tumor coverage (maximum mean height: 6.06 cm) was possible in all patients with generation of colored parametric maps of CP and relative BV as well as quantitative data. Comparing T0 and T1: (a) the mean (±SD) tumoral diameter was significantly smaller at T1 (T1: 4.4 ± 2.1 cm vs T0: 5.3± 2.1 cm; p=0.02); (b) the median value of the CP and BV adjusted to the tumor diameter were significantly lower at T1 (CP at T1: 7.77 vs T0: 9.99 mL/100 mL/min; p=0.0006) (BV at T1: 5.08 vs T0:9.61 mL/100 mL; p=0.04). Comparison of T0, T1 and T2 (n=5) showed a trend towards reduction of the tumoral BV while the CP was significantly reduced (p=0.002).
Conclusion: Whole tumor perfusion analysis shows restoration of tumoral vessel permeability and reduction of tumoral blood volume under antiangiogenic drugs, pieces of information previously not accessible in the in vivo monitoring of lung tumors.

B-033 14:27

Iodine and calcium content of artificial pulmonary nodules: Differentiation with dual energy computed tomography
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Purpose: To assess the usability of Dual Energy CT (DECT) for differentiation of iodine and calcium content in artificial pulmonary nodules.
Methods and Materials: 54 artificial nodules in a chest phantom were scanned with DECT. The nodules were nonenhanced or enhanced with iodine or calcium, with increasing concentrations. The Dual Energy ratio (DER) was calculated for each nodule.
Results: The mean maximum diameter of the 18 small nodules was 11.7 mm (standard deviation 0.43), 16.1 mm (0.47) of the 18 medium, and 29.94 mm (1.06) of the 18 large nodules. DER of small nodules were 1.59 (99% confidence interval 0.11) for nonenhanced, 2.23 (0.19), 1.71 (0.07), 1.83 (0.09), and 1.8 (0.04) for

iodine nodules with increasing concentrations, 1.73 (0.14), 1.49 (0.07), 1.47 (0.04) and 1.52 (0.02) for calcium nodules. DER of medium nodules were 1.34 (0.07) for nonenhanced, 1.91 (0.23), 1.76 (0.04), 1.82 (0.04) and 1.84 (0.02) for iodine nodules, 1.56 (0.11), 1.51 (0.03), 1.51 (0.02) and 1.53 (0.02) for calcium nodules. DER for large nodules were 1.11 (0.04) for nonenhanced, 1.87 (0.05), 1.83 (0.02), 1.8 (0.01) and 1.82 (0.01) for iodine nodules, 1.57 (0.07), 1.52 (0.03), 1.55 (0.02) and 1.53 (0.01) for calcium nodules. No overlap of 99%-CI was seen in medium and large nodules, whereas there was substantial overlap in small nodules.

Conclusion: The results show the ability of DECT to differentiate iodine and calcium in artificial nodules ≥16 mm. Further investigation of the influence of reconstruction parameters on attenuation measurement in DECT of smaller nodules is warranted.

B-034   14:36

Dual source perfusion CT for the monitoring of the effects of conventional and anti-angiogenetic chemotherapy in patients with advanced lung cancer: Initial experience

G. Serra, F. Fraioli, M.L. Mennini, C. Catalano, R. Passariello; *Rome/IT* (goffredo_serra@hotmail.it)

Purpose: To determine if perfusional-CT can evaluate the effects of chemotherapy and antiangiogenetic treatment in patients with non-small cell lung carcinoma (NSCLC) and if perfusional-CT and RECIST measurements obtained before and after therapy correlate.

Methods and Materials: 45 patients with unresectable NSCLC underwent perfusional-CT before and 40 days after chemotherapy and antiangiogenetic treatment. RECIST measurements and calculations of blood flow (BF), blood volume (BV), time to peak (TTP) and permeability (PS) were performed by two independent blinded radiologists. Baseline and post-treatment measurements were tested for statistically significant differences using the paired samples t-test (p < 0.05). Baseline and follow-up perfusion parameters of the neoplastic lesions were also compared basing on histopathological sub-classification and therapy response assessed by RECIST criteria using the independent samples t-test p < 0.05).

Results: Tumor histology was consistent with large cell carcinoma in 28%, adenocarcinoma in 44% and squamous cell carcinoma in 28% cases. Significant differences (p=0.001) were noted for BF and PS between baseline and post-treatment measurements; no significant changes were found for BV (p=0.3) and TTP (p=0.1). Significant differences (0.002<p < 0.007) between histological subtypes were demonstrated only for BV. On the basis of RECIST criteria, 8 (16%) patients were classified as PR, 2 (4%) as PD and the remaining 40 (80%) as SD. Among partial-responders a decrease of both BF and BV was observed, while in non-responders BF and BV were found to be increased.

Conclusion: Perfusional-CT can adequately evaluate therapy-induced alterations in NSCLC and perfusion parameters correlate with therapy response assessment performed with RECIST criteria.

B-035   14:45

Lung cancer early response to chemotherapy: Comparing performance of diffusion weighted MRI versus contrast-enhanced CT

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Purpose: To evaluate the ability of apparent diffusion coefficient (ADC) to help predict early response to chemotherapy in lung cancer.

Methods and Materials: Institutional review board approval was obtained; all patients provided informed consent. Over 18 months, 28 patients (21 men, 7 women, mean age 66.8 years) with pathology confirmed advanced NSCLC lung cancer (stage III and IV), underwent 3 CECT and MRI scans prior to, after first and third chemotherapy course. MRI protocol included T1, T2 and diffusion weighted (DW) sequences. Two radiologists independently recorded longest diameter measurements and apparent diffusion coefficients (ADCs) at each exam. CECT scans were used as a reference for tumor response according to RECIST. Final diagnosis based on both methods was made by consensus.

Results: 8 patients were not able to complete the study protocol (side effects or exitus). Reduction in tumor size was observed in 12 patients at second scan and in 4 more patients at third scan on both CECT and DW-MRI. An increase in mean ADCs was observed on DW-MRI in 16 patients already at second scan (p < 0.001), considering each histologic subtype and all tumors. Further increase in mean ADCs was documented between second and third scan (p < 0.001). No significant increase in mean ADC was documented in non-responders (4).

Conclusion: DW sequences and CECT evaluation of tumor size reduction is similar. ADC may detect early response to chemotherapy prior to tumor size reduction in lung cancer.

B-036   14:54

Research of DSCT perfusion imaging on solitary pulmonary nodules

G. Peng; *Guangzhou City/CN* (wdguiw@yahoo.com.cn)

Purpose: To evaluate significant differences of perfusion imaging for differentiating benign from malignant solitary pulmonary nodules by DSCT perfusion.

Methods and Materials: Twenty-two patients met the inclusion criteria of a solitary pulmonary nodule without calcification or fat at computed tomography. Twenty patients were examined successfully; 17 received a histologic diagnosis, and three received a diagnosis by means of observation over 2 years. Of these patients, there are 15 malignant nodule and 5 benign. Perfusion CT images were acquired 4 seconds posterior to injecting contrast agent (at a rate of 4 ml/s) for a total of 50 seconds. Diagnostic characteristics for differentiation were examined by using time-density curve and other parameters for blood volume, time to peak and permeability. Receiver operating characteristic curves were calculated to test the usefulness of these parameters.

Results: Frequency of malignancy was 75% (15 of 20 nodules). Malignant nodules showed stronger permeability with a higher time to peak and a faster slope (P < 0.001). Significant permeability was found only in malignant lesions (13 of 15 lesions). Sensitivity, specificity, and accuracy were 95.1, 87.3, and 94.4%, respectively, for time to peak; 91.4, 73, and 82.5% for blood volume; and 54, 90, and 72% for blood volume. When combined perfusion imaging and morphologic enhancement patterns, sensitivity increased to 100%.

Conclusion: The application of perfusion imaging and its CT perfusion software by DSCT perfusion can be helpful in the differential diagnosis of between malignant and benign solitary pulmonary nodules.

B-037   15:03

Tumor blood supply heterogeneity estimated by DCE-CT in NSCLC radiotherapy outcome prediction

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Purpose: Relative tumor blood volume (rTBV) as measurable with dynamic contrast enhanced (DCE) CT is an important parameter of tumor neo-vascularization influencing tumor growth, oxygenation and response. Our aim is to quantify heterogeneity of tumor blood supply using intratumoral lacunarity (TL) and rTBV and to clarify possible relationships between TL, rTBV, FDG uptake and radiotherapy outcome in non-small-cell lung cancer (NSCLC).

Methods and Materials: 24 patients with clinically inoperable NSCLC (stages I-IV) scheduled for radiotherapy were included. DCE-CT and FDG-PET were done with a Biograph 16 (Siemens). rTBV was determined by modified Patlak analysis using pixel-based software (FuncCT, Siemens). TL was evaluated from rTBV maps by means of a fixed grid box counting method using ten offsets for grid starting positions as implemented in FracLac for ImageJ. According to median TL and rTBV, patients were divided into four groups: low TL/low rTBV; low TL/high rTBV; high TL/low rTBV; and high TL/high rTBV. Comparison between groups and overall survival (OS, [days]) was performed using variance analysis (ANOVA).

Results: While high TL (1.68±0.07)/high rTBV (6.51±0.67 ml/100 ml) showed least favorable prognosis (median OS: 124 d), low TL (1.22±0.06)/low rTBV (3.97±0.58) translated into best prognosis (median OS: 680d). High TL (1.64±0.07)/low rTBV (3.16±0.45) and low TL (0.95±0.09)/high rTBV (9.48±0.88) demonstrated intermediate OS (519 d, 391 d), respectively. FDG uptake as quantified by SUVmax did not show additional prognostic information in our patients.

Conclusion: TL provided quantitative information about the spatial blood distribution in NSCLC. Combined assessment of TL and rTBV may improve outcome prediction.

B-038   15:12

The role of dynamic contrast-enhanced MRI in differentiating lung tumor subtypes

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Purpose: Dynamic contrast enhanced MRI (dCE-MRI) is able to measure tumor perfusion. The aim of this study was to correlate perfusion parameters of pulmonary tumors as measured by dCE-MRI with histological tumor classification.

Methods and Materials: dCE-MRI was performed in 86 patients with malignant lung tumors using 20 second intervals. Several dynamic perfusion parameters based on changes in signal intensity were calculated and correlated to the histological tumor classification. To evaluate which parameters allow a differentiation between lung tumor subtypes, logistic regression and ROC analysis were performed.

Results: The study cohort included 69 patients with non-small cell lung cancer (NSCLC), 15 patients with small cell lung cancer (SCLC) and 2 patients in which an exact histologi-

cal classification was not possible. A differentiation of NSCLC vs. SCLC was possible with the parameters tumor necrosis (p = 0.023), maximum contrast upslope (p = 0.009), and the time until the maximum contrast upslope was reached (p = 0.044). The area under the ROC curve was 83.9% (95%-CI: 73.5% - 94.3%). Within the NSCLC group, 24 tumors (34.8%) were classified as adenocarcinoma, 37 as squamous cell carcinoma (53.6%), and 2 as large cell carcinoma (2.9%). Six tumors remained unclassified (8.7%). The following parameters allowed a differentiation between squamous cell carcinoma and adenocarcinoma: beginning of relevant contrast uptake (p = 0.084), mean TTP (p = 0.056), and the time until the maximum contrast upslope was reached (p = 0.029). The area under the ROC curve was 90.7% (95%-CI: 83.4% - 97.9%).

Conclusion: Lung tumors show different enhancement kinetics in dynamic contrast-enhanced MRI. This may become helpful in distinguishing different tumor subtypes.

B-039   15:21

Diffusion weighted MRI and FDG-PET in nonsmall cell lung cancer (NSCLC): Does the apparent diffusion coefficient (ADC) correlate with the tracer uptake (SUV)?

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Purpose: To evaluate diffusion weighted MR imaging (DWI) as a new tool for quantitative tumor analysis in nonsmall-cell-lung-cancer (NSCLC) in comparison to standardized-uptake-values (SUV) as determined by positron emission tomography computed tomography (PET/CT).

Methods and Materials: Both DWI (TR/TE: 2000/66 ms; FOV: 425x298 mm; Matrix: 256; slice-thickness: 8 mm; b-values: 0 and 500 s/mm²; field-strength: 1.5 T) and PET/CT were performed in 34 consecutive patients with histologically verified NSCLC disease prior to the surgical resection or initiation of chemotherapy. By placing a Region-of-Interest (ROI) covering the entire tumor the mean (ADCmean), minimum (ADCmin) and maximum ADC (ADCmax) were determined by two independent radiologists. Furthermore, the relative ADCmin (rADCmin = ADCmin/ADCmean) and ADCmax (rADCmax = ADCmax/ADCmean) were assessed. Reading the PET/CT images calculation of the mean (SUVmean) and maximum (SUVmax) tumor metabolism as well as the relative SUVmean (rSUVmean) and SUVmax (rSUVmax) was performed in consensus. The results of DWI and PET/CT were intraindividually compared. For statistical analysis, Pearson`s correlation coefficient was assessed.

Results: Comparison of the ADCmin and SUVmax revealed an inverse correlation. Furthermore, the rADCmin and rSUVmax showed a high correlation which was statistically significant (r=0.923; p=0.021). In contrast, there was no correlation neither between maximum ADC values and minimum SUV (r=0.19; p=0.71) nor between mean ADCs and SUVs (r=0.33; p=0.48), regardless of absolute or relative quantitative analysis.

Conclusion: Minimum ADC values correlate with higher tumor metabolism as determined by PET/CT. As higher standardized uptake values are an established indicator of poor prognosis in lung cancer, DWI with ADC measurement might represent a new severity marker in these patients.

14:00 - 15:30   **Room F1**

Genitourinary

SS 107

Prostate and bladder cancer

Moderators:
A. Bianek-Bodzak; Gdansk/PL
A. Zubarev; Moscow/RU

B-040   14:00

Use of flair sequences for detection and local staging of bladder tumors with MRI

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Purpose: To increase the diagnostic accuracy of MRI in the detection and local staging of bladder tumors by using Fluid-attenuated Inversion Recovery (FLAIR) sequences.

Methods and Materials: 32 patients with bladder tumors detected by US underwent MRI using 0.5 and 1.5 T magnet. We performed SE T1-weighted, TSE T2-weighted and FLAIR sequences on axial scans. The contrast to lesion ratio was evaluated in all sequences. All the patients underwent cystoscopy with transurethral biopsy and 14 had subsequent cystectomy.

Results: In comparison with other sequences, FLAIR sequence was more sensitive in the detection of bladder neoplasms. This sequence demonstrates the hyperintense signal of bladder neoplasms from the filled bladder lumen with no signal. The sensitivity in the identification of bladder neoplasms was 100% with FLAIR sequences, 89.6% with TSE T2-weighted sequences and 86.2% with SE T1-weighted sequences. That was due to the higher signal to lesion ratio of the FLAIR sequences in comparison with the others. In fact, on FLAIR sequences the mean value of contrast to lesion ratio of bladder neoplasm was 33.1 while on SE T1-weighted sequences and TSE T2-weighted sequences was, respectively, 15.2 and 29.2. FLAIR sequences allowed the detection of small papillomas (less than 2 mm). TSE T2-weighted sequences were more sensitive than other sequences in the study of bladder wall infiltration.

Conclusion: FLAIR sequences were more sensitive than others in the detection of bladder neoplasms, thanks to their higher contrast to lesion ratio and can be very helpful in the visualization of small papillomas, especially when multifocal.

B-041   14:09

CAD-application in the automated analysis of dynamic prostate MRI: Diagnostic value of dynamic parameters and fusion to T2-images

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Purpose: Recently developed CAD-software allows a colour coded quantification of contrast enhancend MRI and a fusion of dynamic analysis with T2w-images. The study aimed to test feasibility and diagnostic value of CAD-application.

Methods and Materials: 123 histologically proven prostate lesions underwent dynamic prostate-MRI and CAD-application (Confirma, CADStream prostate 5.0) and blinded radiological analysis (1.5 T MRI; 0.2 mmol Gd-DTPA/kgbw, 3 ml/s flow). Initial wash in (highest peak within 25 sec)., peak uptake, wash out ratio, relative signal loss, relative signal increase from initial to peak uptake were calculated. T2w-images were analyzed. Histology, hormonal treatment, Gleason-Score, initial PSA-value were matched to dynamic analysis. CAD-cut offs for colour-coding were: wash in: 40%; wash in: 150%; wash in: 500%, wash out 5-15%; > 15%.

Results: Peak contrast uptake of malignant lesions with/without hormonal therapy (M1/M2) was 78.2/188.4%, 39.9% (benign; B) and 0% (scars, S). Wash out value was 75%(M1); 157.8% (M2); 34.6% (B) and 0%(S). Initial uptake was analyzed as 48.8% (M1); 173.9% (M2); 34.5% (B) and 0% (S). Ratio peak uptake vs. wash in differed significantly: M1:1.74 (prolonged lowered uptake), 1.13 (peak uptake similar to initial wash in); B:1.42. Relative signal loss from peak was calculated as 0.93 (M1), 0.84 (M2), 0.91 (B), i.e. the highest signal loss in M2. Matching of data was possible in all cases. Scars and bleeding did not enhance.

Conclusion: CAD-based analysis of automated dynamic analysis of prostate-MRI imaging is helpful to differentiate scars/relapse and malignancies/bleeding due to fusion with T2w data. Automated cut offs do not reflect the real enhancement. Untreated prostate cancer enhances very fast and strong followed by a wash out > 15%. Hormonal treatment reduces and prolongs enhancement.

B-042   14:18

Functional MRI (diffusion weighted and dynamic contrast enhanced imaging) in patients with low risk prostate cancer

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Purpose: To determine the value of T2-weighted, diffusion-weighted (DW) and dynamic contrast-enhanced MRI (DCE) to localise significant tumors in patients with low risk prostate cancer (PCa), with pathological examination of the radical prostatectomy specimen as a reference.

Methods and Materials: 72 patients (PSA level < 10 ng/ml, Gleason score < 6 and less than 33% positive biopsies) underwent a prostate MRI with an endorectal coil prior to radical prostatectomy. MRI searched areas with low intensity (FSE-T2W imaging) and/or a low apparent diffusion coefficient and/or abnormalities of 3 quantitative dynamic parameters (Ktrans, Kep, area under the Gadolinium curve 60 s after injection). A MRI score was used to localise tumor foci > 0.2 cc in 576 quadrants, 288 in the peripheral zone (PZ) and 288 in the transition zone (TZ).

Results: At pathological examination, tumor foci > 0.2 cc were present in 121 quadrants. A combined score of T2-W, DW and DCE imaging provided an area under of the ROC curve (AUROC) of 0.88 (sensitivity: 75%, specificity: 95%) for the PZ; versus 0.77, 72%, and 72% for T2W imaging alone (p < 0.001). For the TZ, the AUROC was slightly higher with a combined score of T2W and DW imaging (0.84, sensitivity: 89%, specificity: 84%, versus 0.81, 64% and 99% for T2-W imaging alone (p < 0.02). Per patient results showed 75 separate tumors > 0.2 cc in 60 patients (60/72, 83%). In 11 patients (11/60, 18%), the tumor was not detectable.

Conclusion: Functional MRI should be recommended in the work up of low risk PCa prior to contemplate therapeutic options such as active surveillance or focal therapies.

B-043 14:27

A new and accurate method to detect pelvic lymph node metastases

M. Triantafyllou, J.M. Froehlich, F. Birkhaeuser, M. Von Gunten, P. Vermathen, H.C. Thoeny; *Berne/CH (maria.triantafyllou@insel.ch)*

Purpose: To prospectively determine the diagnostic accuracy of DW-MRI after the administration of ultrasmall superparamagnetic iron oxide particles (USPIO) to detect metastases in normal sized lymph nodes of patients with bladder and/ or prostate cancer.

Methods and Materials: Fifty-two patients with histological proven prostate or bladder cancer underwent preoperative 3 T MRI 24-36 hours post USPIO including 3D high resolution T1- and T2-w as well as axial EPI DW-MRI (slice thickness 4 mm, b-values=0, 500, 1000 sec/mm^2, 6 acquisitions). Image analysis was performed prospectively prior to extended template lymphadenectomy on high b-value images on DW-MR images. Duration of image analysis was recorded. Round hyperintense structures corresponding to lymph nodes on morphological images were considered malignant. Results were compared to histopathology. Diagnostic accuracies were calculated both on per patient and per lymph node level.

Results: In 52 patients 2060 lymph nodes were resected. Fifty lymph node metastases were detected in 15 patients. Twenty lymph node metastases were missed. On a per patient level sensitivity was 73.3%, specificity 86.5%, PPV 68.7%, NPV 88.9% and diagnostic accuracy 82.7% whereas on a lymph node level sensitivity was 60%, specificity 99.5%, PPV 73.2%, NPV 99% and diagnostic accuracy 98.5%. Image analysis lasted 6 min per patient (range: 2-45 min).

Conclusion: DW-MRI after the administration of USPIO is a new and fast method to detect pelvic lymph node metastases even in normal sized nodes with a high accuracy.

B-044 14:36

Prediction of extracapsular extension and correlation with histologic gade in prostate cancer: Value of apparent diffusion coefficient

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Purpose: To evaluate the utility of apparent diffusion coefficient (ADC) in predicting extracapsular extension (ECE) in patients with prostate cancer, and to investigate correlations between ADC value and histologic grade of prostate cancer.

Methods and Materials: 167 men who received radical prostatectomy underwent diffusion-weighted MR imaging (DWI) at 3 T before surgery and were included in this study. ADC measurement of prostate cancer was retrospectively and independently performed by two radiologists on the basis of histopathological findings. For the prediction of ECE, ADC values and clinical variables (PSA level, Gleason score, clinical stage, greatest percentage of cancer in all biopsy cores, percentage of positive cores in all biopsy cores, perineural invasion) were evaluated. Additionally, a correlation between ADC and Gleason score was analyzed.

Results: At histopathologic findings, 21 (12.5%) patients had ECEs. At univariate analysis, ADC value, Gleason score, perineural invasion, greatest percentage of cancer in all biopsy cores and percentage of positive cores in all biopsy cores were associated with ECE (P < 0.05). Multivariate logistic regression analysis revealed that ADC value and greatest percentage of cancer in all biopsy cores (P = 0.034 and P = 0.045, respectively) were predictors of ECE. Spearman rank correlation showed a negative correlation between ADC value and Gleason score (rho = -0.432, P < 0.001) in prostate cancer.

Conclusion: Our results suggest that ADC value was a useful factor for the prediction of ECE in prostate cancer. Furthermore, ADC value had a negative relation with Gleason score in prostate cancer.

B-045 14:45

The use of direction information from DTI in the evaluation of prostate cancer

F. Schoth, F. Goerg, N. Kraemer, N. Peykan, M. Dadak, R.W. Günther, G.A. Krombach; *Aachen/DE (schoth@gmx.de)*

Purpose: Diffusion weighted imaging of the prostate is common; in this study, we assessed the diagnostic value of the direction information resulting from diffusion tensor imaging of the prostate

Methods and Materials: In 18 patients (mean age 67 years; range 54-74 years), we performed an MRI of the prostate at 3 Tesla (Archiva, Philips Medical Systems, Best, The Netherlands) combining an endorectal coil with a six channel surface coil. Additionally to our routine imaging (multiplanar T2/TSE, 3D-Spectroscopy, DCE) a DTI-sequence (Single-Shot SE-EPI, FOV 110x100x60 mm, Vox 1.7x1.7x3 mm, TE 64 ms, TR 3713 ms, B 1000) was performed for 32 directions. The results were compared with the histology either retrieved from prostateectomy or prostate biopsy which was found in 10 patients.

Results: The mean fractional anisotropy in the peripheral zone was 0.24+-0.08. A disturbance of the lateral orientation of the main diffusion direction in the peripheral zone was chosen as indicator of a carcinoma. The sensitivity/specificity of the reading of the DTI alone was 80/75%.

Conclusion: DTI of the prostate provides further information on the mircoarchitecture of the prostate gland in the peripheral zone and may help along with other criteria to further increase the sensitivity and specificity in the diagnosis of prostate cancer.

B-046 14:54

DW MRI vs dynamic MRI in diagnosis of prostate cancer: A prospective study

M.E.A.M. Abou-Elghar, I. Hekal, T. Mohsen, H. Refaie, T. El-Diasty; *Mansoura/EG (maboelghar@yahoo.com)*

Purpose: To compare the clinical feasibility of diffusion-weighted (DW) MRI Vs dynamic MRI in the diagnosis of prostate cancer.

Methods and Materials: 80 patients with PSA > 4 ng/ml (mean 30.9± 25 ng/ml; range 4.1-100) were prospectively included in our study, their age range 45-76 ys (mean 65.5±6) and the glesson sore range from 5 to 9. All patients were evaluated with MR imaging using surface coil. We started with axial T_2 weighted high resolution MR of the prostate, then DW MRI with b value 0 and 800 msec. The DWI MRI and ADC characteristics were analyzed and compared with qualitative dynamic MRI results. Using the final histopathological findings; the accuracy of DW and dynamic MRI in diagnosis of prostate carcinoma were evaluated.

Results: Among our patients, there were 70 patients with prostate cancer and 10 patients with BPH. DW MRI could detect prostate cancer in 66 patients while dynamic MRI could detect it in 60 patients. The agreement among DW, dynamic MRI and histopathological findings was excellent. The diagnostic performance of DWI and dynamic MRI in the identification of prostate cancer was: Sensitivity, 94 and 86%; specificity, 100% for both, the overall accuracy was 95 and 88%, respectively. The ADC value for the normal PZ 1.3± 0.37, for the CZ 1.58±0.1, for the cancer 0.79± 0.2

Conclusion: DW MRI is a reliable imaging approach for identification of prostate cancer with accuracy higher than dynamic MRI, but DW MRI is non-invasive, fast and less expensive technique.

B-047 15:03

Thin slice thickness (1 mm) 3D-T2-weighted MRI and local staging of prostate cancer

F.E. Cornud, M. Liberatore, F. Beuvon, D. Eiss, M. Rouanne, N. Barry de Longchamp, T. Flam; *Paris/FR (francois.cornud@imagerie-tourville.com)*

Purpose: To assess the accuracy of endorectal coil and high resolution 3D-T2-weighted MRI (voxel size: 0.64 mm^3) with a 1.5 Tesla magnet for local staging of prostate cancer.

Methods and Materials: 178 patients (mean age: 63±5.5) with a clinically localised tumor (clinical stage<T3) were evaluated. Mean PSA level and Gleason score were 9±5.5 ng/ml and 6.5±0.76, respectively. Based on PSA level and biopsy results, 72 patients were at low risk, 89 at an intermediate risk and 10 at high risk. The MRI sequence was a 3D T2 weighted sequence (SPACE) providing 224 1 mm thick slices covering the whole pelvis. MRI reading was performed in consensus by two experienced radiologists. A third radiologist was consulted in case of discrepancy. Multi Planar Reconstruction provided by the 3D acquisition was used in multiple plans to obtain an optimal accuracy.

Results: Extracapsular extension (ECE) was pathologically present in 39 patient (22%), established (extracapsular extension > 1 mm) in 25 cases (63%) and focal in 14 cases (36%) Seminal vesicle invasion (SVI) was present in 12 patients (7%), established in 11/12 cases. MRI detected 42% of ECE, but 84% (21/25) of established ECE and 83% of SVI (10/12). Sensitivity for detection of established pT3 stage was 85%. Specificity was 97, 97 and 97%, respectively, and accuracy was 94, 94 and 95%, respectively.

Conclusion: The 3D-T2W acquisition has the highest ever reported accuracy to detect established pT3 stage with an endorectal coil and a 1.5 Tesla magnet.

B-048 15:12

Noninvasive detection of pelvic lymph node metastases in normal sized nodes of patients with bladder or prostate cancer using diffusion-weighted MRI

M. Triantafyllou, J.M. Froehlich, F. Birkhaeuser, U.E. Studer, T. Binser, A. Fleischmann, M. von Gunten, P. Vermathen, H.C. Thoeny; *Berne/CH (maria.triantafyllou@insel.ch)*

Purpose: To prospectively determine whether diffusion-weighted MRI allows for the detection of metastases in normal sized pelvic lymph nodes in patients with prostate and/or bladder cancer.
Methods and Materials: Seventy-one patients with bladder and/or prostate cancer with normal sized nodes on cross-sectional imaging were examined on a 3 T MR unit. In addition to 3D T1- and T2-weighted images, axial EPI-DW-MRI of the pelvis with 3 b-factors (0, 500, 1000 s/mm^2) was acquired using a slice thickness of 4 mm without intersection gap. Qualitative and quantitative analysis of the images was performed. Round or oval, noncontinuous hyperintense structures on the images with a b-value of 1000 s/mm^2 corresponding to lymph nodes on morphology and ADC-value < 100x10^{-5} mm^2/sec, were considered malignant. Results were compared to histopathology.
Results: A total number of 2678 lymph nodes were resected. Histopathology confirmed lymph node metastases in 20 out of 71 patients. DW-MRI classified 32 patients as positive, 16 of 32 proved were false positive. In 4 patients, lymph node metastases were missed. DW-MRI yielded following accuracies on a per patient level: Sensitivity 80%, specificity 68.7%, PPV 50% and NPV 89.7%, and diagnostic accuracy 71.8%. All the metastases missed by DW-MRI were smaller than 2.5 mm on histology.
Conclusion: DW-MRI is a noninvasive, accurate and sensitive imaging method for the detection of lymph node metastases in urological tumor patients even in normal sized nodes with a high negative predictive value.

B-049 15:21

Computed tomography virtual cystoscopy versus conventional cystoscopy in the detection of urinary bladder cancer

S. Elangovan, V. Bhuvaneswari; *Puducherry/IN (elangovansundar@hotmail.com)*

Purpose: The non-invasive investigation of urinary bladder carcinoma by computed tomography (CT) virtual cystoscopy was evaluated, by us and compared with conventional cystoscopy.
Methods and Materials: Thirty consecutive patients of untreated or recurrent bladder carcinoma, suspected by either sonography or conventional cystoscopy were taken up for study. All patients underwent intravenous urography (IVU) with delayed multidetector CT (MDCT) of the bladder region. CT virtual cystoscopy images were obtained at a workstation using a volume-rendering algorithm and the number, size, location and morphologic features of lesions were noted. Subsequently, patients underwent conventional cystoscopy, and the findings were noted. The final diagnosis of the cases was established by histopathology.
Results: Eighty-eight lesions were seen in CT virtual cystoscopy and 92 in conventional cystoscopy. The lesions missed on CT virtual cystoscopy were less than 5 mm and sessile. Overall sensitivity and specificity of CT virtual cystoscopy for lesion detection were 95.6 and 100%, respectively, while for lesions less than 5 mm, the sensitivity was 86% and specificity 100%. Wilcoxon matched pair test showed a good correlation between virtual and conventional cystoscopy for maximum and minimum diameters of the lesion (p=0.77 and 0.36, respectively). Location of the lesions and their morphological characteristics were found to correspond by both methods.
Conclusion: CT virtual cystoscopy is an effective tool in the detection of urinary bladder tumors, especially those larger than 5 mm. When bladder lesion is less than 5 mm and sessile conventional cystoscopy is better than CT virtual cystoscopy.

14:00 - 15:30   **Room F2**

Breast

SS 102

Cutting edge in mammography

Moderators:
D. Flöry; Linz/AT
M.G. Wallis; Cambridge/UK

B-050 14:00

Consequences of digital mammography in population-based breast cancer screening: Initial changes and long term impact on referral rates

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Purpose: To investigate the referral pattern after the transition to full-field digital mammography (FFDM) in a population-based breast cancer screening program.
Methods and Materials: Preceding the nation-wide transition to FFDM in the Dutch screening program, a FFDM feasibility study was conducted at Preventicon screening centre. One team of screening radiologists was involved in reading both conventional and digital mammograms. Detection and referral rates for FFDM and screen-film mammography (SFM) were compared for first and subsequent screening examinations, using the Chi-square test. Furthermore, radiological characteristics of referrals in digital screening were assessed.
Results: A total of 312,414 screening exams were performed (43,913 digital and 268,501 conventional mammograms), of whom 4,473 women were referred (966 with FFDM). Overall referral rates were significantly higher with FFDM in both first and subsequent exams (p < 0.00). The referral rate in digital screening peaked in the first months after implementation. A high proportion of false-positive results was noted as a consequence of pseudolesions and increased detection of (benign) microcalcifications. The referral rate remained higher than in SFM and was accompanied by a significant increase in cancer detection (p = 0.01).
Conclusion: As a result of inexperience with digital screening images, implementing FFDM in a population-based breast cancer screening program may lead to a strong, but temporary increase in referrals. Dedicated training in digital screening for radiographers and screening radiologists is therefore recommended. Referral rates decrease and stabilise (learning curve effect) at a higher level than in conventional screening, yet with significantly enhanced cancer detection.

B-051 14:09

Comparison of microcalcification detection rates and recall rates in digital and analogue mammography

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Purpose: The aims of this research were to compare whether more micro-calcifications can be detected with digital mammography than with analogue mammography and to discover if digital mammography results in fewer recalls for assessment compared to analogue mammography.
Methods and Materials: 21,158 screening mammograms were included in the study, 10,024 acquired using Full Field Digital Mammography (FFDM) and 11,134 acquired on film during the transition of a busy screening centre from analogue to digital mammography. For each mammogram, data were collected on whether the woman had been recalled for further assessment because of mammographic abnormality, whether she had a stereo core biopsy, and if so, whether micro-calcifications had been detected in the biopsy. Chi-square tests and 95% confidence intervals were used to evaluate the results.
Results: 61.5% of women who had a core biopsy following digital mammography had microcalcifications detected, compared with 65.8% for analogue mammography but this difference was not significant (p=0.71), and the rates of detection of micro-calcifications in women screened by the two methods were similar. It was also found that the recall rate for assessment for mammographic abnormality for women screened digitally (6.07%) was significantly higher (p < 0.001) than the recall rate for those screened by analogue mammography (3.25%). The difference was 2.8%, with a 95% confidence interval 2.2 to 3.4%.
Conclusion: Digital mammography has a higher recall rate for assessment of mammographic abnormalities than analogue mammography, although digital mammography and analogue mammography have similar rates of detection of micro-calcifications.

B-052   14:18

Digital breast tomosynthesis (DBT): A multi-reader clinical performance study

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Purpose: To compare the clinical performance of one-view (MLO) DBT versus two-view (CC, MLO) mammography (MX); to assess the benefit of adding the cranio-caudal mammographic view alone (CC) to DBT, and of adding DBT to MX and ultrasonography (US).

Methods and Materials: 131 consenting patients with BIRADS 3 to 5 findings after screening or diagnostic MX and/or US completed a prospective evaluation with medio-lateral-oblique view DBT of the breast concerned. Findings were characterized by histological/cytological sampling or minimum 1-year follow-up. Retrospectively, seven breast radiologists blinded on clinical and pathological data reviewed the cases using five distinct reading tests: MX alone, 'MX+US', 'MX+US+DBT', DBT alone, 'DBT+MX (CC)'. Findings were classified according to BIRADS 1 to 5 categories, BIRADS 4-5 scores being considered positive for malignancy. Sensitivity, specificity and area under the ROC curve (AUC) of each modality were evaluated for individual readers and across all readers.

Results: Study population yielded 76 (58%) benign and 55 (42%) malignant cases. Reader concordance was good for all tests, highest for DBT+MX (CC) and DBT+MX+US. Overall, AUCs for 'MX', 'MX+US', 'MX+US+DBT', 'DBT', 'DBT+MC (CC)' were close: 0.69, 0.71, 0.73, 0.70, 0.72, respectively. DBT was found non-inferior to MX at 5% non-inferiority margin. 'DBT+MX (CC)' performed slightly better than the other tests at higher specificities, while 'MX+US+DBT' performed slightly better at lower specificities. Tests including DBT showed higher specificities but lower sensitivities.

Conclusion: Overall, DBT (MLO) was statistically not inferior to MX (CC+MLO). However, despite positive trends, DBT+MX (CC) was not found superior to MX, and MX+US+DBT not superior to MX+US.

B-053   14:27

Breast interval cancer in women at increased risk in a clinical-imaging surveillance program

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Purpose: To evaluate incidence, radiological and histopathologic features of breast interval cancer (BIC) in women at increased familiar risk for breast cancer.

Methods and Materials: 2,457 women considered at increased familiar risk for breast cancer were enrolled in a screening program and divided, depending on familiar history and BRCA status, in four risk categories: BRCA carriers, high, intermediated and slightly increased risk. Clinical breast exam (CBE), mammography (MX), ultrasound (US) and breast Magnetic Resonance (MR) were performed at periodic time interval depending on age and risk category. All patients performed CBE and US every six months.

Results: After a median follow-up of 15 years, 104 cancers were diagnosed, 24 of which (23%) were considered BIC. In 45.8% of cases BIC size ranged from 5 to 10 mm; 60.8% of BIC were detected in stage I with favorable prognostic features. The most of BIC were infiltrating carcinomas (95.8%) compared with screen-detected cancers. The diagnosis was made by US in 11 cases, by US and MX in 9 cases, by US and MR in 1 cases, by US, MX and MR in 2 cases, and only by CBE in 1 case (inflammatory cancer). The time interval from the last negative screening exam to diagnosis ranged from 3 to 11 months.

Conclusion: Our intensified screening program proved to be useful to detect BIC in women at increased familiar risk. We postulate that additional screening US every six months enables the depiction of smaller size and lower stage BIC.

B-054   14:36

also EPOS

Digital breast tomosynthesis versus digital mammography: Analysis of discordant cancer cases

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Purpose: To compare cross diagnostic information perception in missed cancers by digital breast tomosynthesis (DBT) or paired mammography (FFDM).

Methods and Materials: A blinded clinical performance study comparing two-view (CC, MLO) digital mammography versus one-view (MLO) DBT was conducted with six breast radiologists and a study sample of 376 breasts, with and without lesions. Cancer cases for which at least one of the six readers missed the malignancy (BIRADS score <= 3) with either DBT or FFDM, but found it with the other one,

were defined as "discordant". The discordant cases were retrospectively reviewed in consensus by three external readers, with DBT and FFDM images displayed side-by-side. Multiple lesions were treated as independent. The three readers had to localize each lesion on FFDM and DBT images, and rate differential diagnostic information perception on a 5-step Lykert scale, from -2 (DBT clearly inferior) to +2 (DBT clearly superior). Causes of inferiority or superiority ratings were captured from the readers' comments.

Results: Distribution of Lykert scale consensus ratings showed DBT inferior for 10, equivalent for 15 and superior for 13 of the 38 discordant lesions. Per lesion type, DBT was rated superior for 12 masses/distortions and 1 calcification cluster, equivalent for 12 masses/distortions and 2 calcification clusters, while FFDM was rated superior for 5 masses and 5 calcifications.

Conclusion: Overall perception of diagnostic information on missed cancers with DBT (MLO) or FFDM (CC+MLO) was found similar. Some masses seemed better depicted by DBT while some microcalcification clusters seemed better characterized by FFDM.

B-055   14:45

Specimen radiography using photon counting slit-scan tomosynthesis: Is it possible to improve evaluation of resection margins?

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Purpose: An important task of the radiologist in the setting of breast surgery is to evaluate the resection margins of surgical specimens. This is usually done by performing specimen radiography in one or two planes, depending on the surgical technique. Nevertheless, 2D mammography may miss a positive resection margin due to projection phenomena. The aim was to evaluate if tomosynthesis of specimen proposes resection margins better than 2D mammography.

Methods and Materials: Ten specimens from 10 patients (1 benign, 9 malignant) were examined by conventional 2D specimen radiography (Faxitron CR) and additional tomosynthesis (slit-scan technique, Sectra, Stockholm, Sweden). The tomosynthesis images were reconstructed with 3-mm slice thickness. The minimum border from tumor to resection margin was measured in 2D and in tomosynthesis images. The measured results of 2D and tomosynthesis specimen radiography were compared to histology, and results were tested with Chi-square test.

Results: The average difference between truth (minimum resection margin in histology report) and tomosynthesis results was 3.8 mm, the average difference for 2D imaging was 13.5 mm. Tomosynthesis did overestimate the difference in 6 cases, 2D imaging in 9 of 10 cases. One resection margin was positive in histology, and tomosynthesis as well as 2D imaging proposed this positive resection margin successfully. Chi-square test for the results was highly significant (p < 0.001).

Conclusion: As expected, our preliminary results show that tomosynthesis specimen radiography tends to be superior to 2D specimen radiography in principal, although the small number of cases does not allow any statistically significant conclusions regarding the visibility of hard-to-see lesions.

B-056   14:54

Mammography screening and radiation-induced breast cancer among women with a familial or genetic predisposition: A meta-analysis

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Purpose: Women with familial or genetic aggregation of breast cancer are often offered breast cancer screening outside the population screening program due to their high breast cancer risk and possibly young age of onset. However, the benefit of early tumour detection by mammography screening could be reduced by the risk of radiation-induced tumours. A meta-analysis on epidemiological studies was conducted and addressed the question how low-dose radiation exposure affects breast cancer risk among high-risk women.

Methods and Materials: A systematic search was conducted in Pubmed and EMBASE/Medline. The search strategy ´Breast neoplasms AND Mass screening OR Mammography OR neoplasms, radiation-induced" was combined with text words focusing on high-risk women. Pooled odds ratios (OR) were registered.

Results: In total, 47 articles were found of which 6 were selected by two reviewers. Four studies examined the effect of exposure to low-dose radiation among mutation carriers. Two studies researched the effect of radiation among women with a family history of breast cancer. Pooled OR revealed an increased risk of breast cancer among high-risk women due to low-dose radiation exposure (OR=1.5, 95% CI: 0.9- 2.4). Exposure before the age of 20 (OR=2.5, 95% CI: 1.9-3.2) or five or more exposures were associated with a higher radiation-induced breast cancer risk (OR=2.5, 95% CI: 1.6-3.9).

Conclusion: Low-dose radiation increases breast cancer risk among young women with a familial or genetic predisposition. A careful approach is needed when using low-dose radiation among high-risk women, and repeated exposures and exposure at young age should be avoided.

B-057 15:03

A new automated volumetric breast density measurement system confirms higher breast density associated with urban women

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Purpose: To provide objective confirmation of an earlier observation linking higher breast density with women resident in London, by use of an automated volumetric breast density (BD) measurement system applied to full-field digital mammography (FFDM).

Methods and Materials: 300 normal FFDM studies were retrospectively assessed for BD using an automatic volumetric breast density measurement system (Hologic, Quantra) and classified according to London or non-London residential addresses of the women by zip code. BD was evaluated by subjective radiologist review and Quantra (fibroglandular tissue cm^3, volume of breast, fibroglandular tissues %). Association of BD and area of residence was assessed.

Results: 165 women were resident in London and 135 women outside London. Average percent density volume was significantly higher in London (p = 0.02), with an average of 23% (SD 11%) vs 20% (SD 9%) before and after adjustment for age (p = 0.04). The difference was slightly stronger in women aged 50 years or more. Neither absolute dense volume nor total breast volume were related to area of residence. London women were significantly more likely to have a dense volume of 25% or higher (OR = 1.97, 95% CI 1.18-3.28, p = 0.009), with 37 vs 23% for non-London women. London women were more likely to have density in the upper three BIRADS categories according to subjective radiologist measurement (OR = 2.08, 95% CI 1.15-3.74, p = 0.02), with 86 vs 75% non-London women.

Conclusion: Automated volumetric analysis confirms the link between urban and higher breast density, identified by subjective radiologist classification.

B-058 15:12

Should CAD in mammography be used for prescreening or as a second reader?

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Purpose: To investigate the feasibility of decreasing the workload in screening mammography by using CAD for prescreening, allowing all cases with no CAD prompts to be disregarded.

Methods and Materials: 16,963 FFDM cases (280 cancers, 16,683 normal) were culled retrospectively from 6 facilities and run on a prototype CAD device (Siemens). The percentage of normal mammograms without CAD prompts was analyzed to determine the impact of prescreening on the workload, which could be substantial, since in screening mammography more than 99% of the cases are normal. Malignant cases without CAD prompts were evaluated to determine the missed cancer rate resulting from using CAD for prescreening rather than as a "second reader".

Results: The false mark rate in normal cases was 1.15. The CAD algorithm detected the cancer in 236 of the malignant cases (83.4%). In 7,167 of the cases (42.3%), no CAD prompts were generated. The percentage of normal cases with no CAD prompts was 42.9%, compared to 6.4% of the malignant cases. A large percentage (42%) of the 44 malignant cases missed by CAD had no CAD prompts.

Conclusion: Even though prescreening by CAD would decrease the workload by about 42%, it is not feasible with the current operating point of the CAD algorithm, since 6.4% of the cancers would be missed. However, additional operating points, resulting in a different balance between sensitivity and false mark rate, should be investigated since the current operating point was optimized for CAD as a "second reader" and not as a prescreening tool.

B-059 15:21

also EPOS

Identifying the most common deviations in mediolateral-oblique (MLO) mammograms classified as "moderate" before and after implementation of improvement initiatives

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Purpose: To determine number and variation of MLO mammogram deviations classified as "Moderate" at Full-Field Digital Mammograms (FFDM) in mammography screening.

Methods and Materials: Criteria of the Quality Assurance Manual for the Norwegian Breast Cancer Screening Program (NBCSP) include less than 22% mammograms classified as "Moderate". 1800 MLO mammograms from 3 periods (baseline, after

implementations of improvements and follow-up) in 2008 were evaluated. PGMI radiographers evaluated the FFDM in consensus meetings using the PGMI score (P=perfect, G=good, M=moderate, I=inadequate). The evaluation criteria were divided into subgroups in order to determine repeatedly deviations.

Results: MLO mammograms were classified as "Moderate" in 20, 24, and 18% in the three periods. Analysis of the subgroups showed two major deviations: A) No visualisation of the inframammary angle (73.3%) and B) Pectoral muscle not to the nipple level (23.6%). These two major failures occurred 73% (n=87), 71% (n=104), 76% (n=82) for A and 25% (n=30), 23% (n=33) and 23% (n=25) for B, respectively, in the three periods. Skin folds, nipple not in profile, and asymmetry occurred in only 4.1% of the MLO mammograms.

Conclusion: The number of "Moderate" MLO's is within the quality criteria of NBCSP. The number of failures regarding pectoral muscle to the nipple level is decreased. Adequate visualisation of inframammary angle did not improve showing that further improvement regarding this subgroup of the PGMI classification is a challenge in mammography screening.

14:00 - 15:30 **Room G/H**

Head and Neck

SS 108
Oncology and new imaging applications

Moderators:
N. Dfouni; Geneva/CH
S. Dzelzite; Riga/LV

B-060 14:00

Value of DWI-MR with single shot EPI vs Propeller (BLADE) using different sets of b-values for discrimination between most common parotid gland tumors

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Purpose: To evaluate ability to discriminate common parotid tumors using DWI-MR with single-shot EPI vs. Propeller (BLADE) and different settings of b-values.

Methods and Materials: 105 patients with parotid tumors < 2.5 cm in diameter underwent 1.5 T DWI-MR with single shot EPI and BLADE and different b-value settings (0/1000, 0/50/1000, 50/700, 0/990 mm^2/s). Statistical analysis of calculated ADC values were performed for obtaining Spearman's correlation values. ROC analysis was performed for both sequences and b-value settings to calculate sensitivity and specifity for obtaining optimal threshold values for discrimination of parotid tumors.

Results: 1. Threshold value 2.137 led to a sensitivity of 100% and specificity of 63% to discriminate between Carcinoma and Pleomorphic adenomas for BLADE DWI sequence with b-values 0/990 mm^2/s. 2. Threshold value 1.154 led to a sensitivity of 71.4% and specificity of 80% to discriminate between Carcinoma and Warthin Tumors for single shot EPI DWI with b-values of 0/1000 mm^2/s. 3. Threshold value 0.761 led to a sensitivity of 92.9% and specificity of 75% to discriminate between Carcinoma and Lymphoma for single shot EPI-DWI sequence with b-values of 0/1000 mm^2/s. BLADE-DWI images demonstrated less artefacts on overall but needed longer scanning time compared to ss EPI DWI.

Conclusion: ss EPI-DWI imaging seems to enable better discrimination of carcinomas, warthin tumors and lymphoma while BLADE DWI imaging better discriminates carcinomas and pleomorphic adenomas in parotid tumors. Acquisition time of BLADE-DWI is longer but the sequence is less susceptible to artifacts and can be recommended in patients with metal dental hardware.

B-061 14:09

Diffusion weighted MR imaging of parotid gland tumors at 3 T

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Purpose: The purpose of this prospective study was to identify the values of the apparent diffusion coefficient (ADC) with diffusion-weighted MR sequences in parotid gland tumors at 3 T.

Methods and Materials: Twenty-three patients (10 m, 13 f; mean age 52.3 years) with biopsy-proven parotid masses were examined on a clinical 3 T MRI with a 16-channel head and neck coil. In addition to conventional MR sequences, a diffusion-weighted sequence (DWIBS) in the axial plane was acquired using b-values of 0 and 800 mm^2/s. ADC (apparent diffusion coefficient) maps were calculated

automatically. The tumors' ADC values as well as the ADC value of the contralateral parotid gland were measured by region of interest (ROI). T-tests were performed.
Results: Histopathology revealed 11 pleomorphic adenomas, 5 Warthin tumors, 4 malignant tumors, 1 cyst, and 2 inflammatory masses (pseudotumors). Benign tumors showed a mean ADC value of 1.69 ± 0.45 (x10-3 mm²/s), which was thus significantly higher (p < 0.001) than mean ADC values of normal parotid tissue (1.04 ± 0.13 x10-3 mm²/s) or malignant tumors (1.01 ± 0.37 x10-3 mm²/s). The highest ADC values (1.7 ± 0.4) among all entities were found in pleomorphic adenomas. Warthin tumors showed a mean ADC of 1.37 ± 0.37.
Conclusion: With DWI, benign parotid tumors can be differentiated with more confidence from malignant entities. However, because of the considerable overlap of ADC values, further differentiation within the benign group is difficult.

B-062   14:18

Diffusion weighted MR imaging at 3 T in primary head neck squamous cell carcinoma (SCC)

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Purpose: The purpose of this prospective study was to compare and correlate the ADC (apparent diffusion coefficient) values derived from two different diffusion-weighted MR sequences in head and neck squamous cell carcinomas.
Methods and Materials: Twenty-seven consecutive patients (18 m, 9 f; mean age 55.5 years) with biopsy-proven ENT squamous cell carcinoma were examined on a clinical 3 T MR scanner. In addition to conventional MR sequences acquired with a 16-channel head and neck coil, two different types of diffusion-weighted sequences were obtained: DWIBS in the axial plane for the whole neck and a navigated EPI in the sagittal plane through the center of the tumor both using b-values of 0 and 800 mm²/s. The ADC maps were calculated automatically. The tumors' ADC values were measured with three standard-size ROIs and a large ROI. Two-way repeated measures ANOVA was used for group comparisons. Spearman rank correlation of ADC values was performed.
Results: The twenty-seven SCC had a mean ADC value of 0.911 (±0.137) with a standard-size ROI, and 0.937 (±0.169) with large ROI measurements with the DWIBS sequence. The tumors' ADC values were significantly (p < 0.001) higher when measured with the EPI: 1.07 (±0.214) and 1.095 (±0.212), respectively. We observed a high correlation between the measurements of the large ROIs and the mean values of the three standard-size ROIs for both sequences (DWIBS rho=0.96; p < 0.001; EPI rho= 0.95; p < 0.001).
Conclusion: Our findings suggest that different ADC reference values must be established for different diffusion-weighted sequences.

B-063   14:27

Can DW-MRI help in the detection of tumor in patients with laryngeal or hypopharyngeal cancers who have been treated with radiotherapy?

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Purpose: To assess the accuracy of Diffusion-weighted MRI (DW-MRI) in the differentiation of posttherapeutic changes and recurrent/residual tumor after radiotherapy of laryngeal or hypopharyngeal carcinoma.
Methods and Materials: Nineteen patients (median age: 58, age range: 49 - 81 y) with newly developed symptoms after radiotherapy for tumors of the larynx (n=17) and hypopharynx (n=2) were imaged on a 1.5 T MR unit. Axial T1- and T2-weighted sequences and axial DW-MRI with 6 diffusion gradient b-values (0-1000 sec/mm²) were performed followed by axial and sagittal T1-weighted post-contrast sequences. Visual analysis of the b=1000 images and the ADC map was done. Hyperintense signal on b=1000 images corresponding to hypointense signal on the respective ADC map was interpreted as tumor, whereas hyperintense signal on the b=1000 images and the ADC map was interpreted as posttherapeutic change. ADC values were also calculated. These results were compared with the histopathology.
Results: Out of nineteen patients, twelve patients had tumor recurrence as proven histopathologically. ADC values were lower for patients with tumor with a mean value of 109 mm²/s (range 69-112) as compared to those without tumor with a mean value of 184 mm²/s (range 133-232). DW-MRI correctly detected tumor recurrence in 11/12 patients and correctly identified all patients without tumor recurrence. One patient with tumor was classified as indeterminate visually and falsely negative according to the diffusion values.
Conclusion: This study suggests that DW-MRI is a promising noninvasive tool in differentiating between tumor tissue and post therapeutic changes in patients with laryngeal and hypopharyngeal tumors treated with radiotherapy.

B-064   14:36

DWI for assessment of post-treatment tumor response in head and neck squamous cell carcinoma 3 weeks after (chemo)radiotherapy

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Purpose: To evaluate diffusion-weighted imaging (DWI) for assessment of treatment response in head and neck squamous cell carcinoma (HNC) 3 weeks after chemoradiotherapy (CRT).
Methods and Materials: Twenty-nine patients with HNC underwent magnetic resonance imaging (MRI) prior to and 3 weeks after CRT, including T2-weighted and pre- and post-contrast T1-weighted sequences and an echo-planar DWI-sequence with 6 b-values (0 to 1000 mm²/sec), from which the apparent diffusion coefficient (ADC) was calculated.
Imaging was correlated to 2-years patient locoregional control. Clinical remission (CR) was defined as persistent complete tumour regression, tumour recurrence (TR) was defined as lesion progression confirmed by histopathology. ADC-changes 3 weeks post-treatment compared to baseline (%ΔADC) between responding and non-responding primary lesions and adenopathies were compared with a Mann-Whitney test. In a blinded fashion, the %ΔADC was compared to conventional MRI which used size-related and morphological criteria. Positive and negative predictive value (PPV, NPV) were compared between the %ΔADC and conventional MRI.
Results: The %ΔADC of lesions with TR was significantly lower compared to lesions with CR for both primary lesions (2.25 ± 0.3 versus 79.8 ± 41; p < 0.0001) and adenopathies (-2.25 ± 0.3 versus 79.8 ± 41; p < 0.0001). For primary lesions, the %ΔADC showed a PPV of 89% and NPV of 100%, compared to 60 and 90% for conventional MRI. For adenopathies per neck-side, the %ΔADC showed a PPV of 70% and NPV of 96%, compared to 33 and 79% for conventional MRI.
Conclusion: DWI with the %ΔADC 3 weeks after concluding CRT for HNC allows early response assessment, showing higher accuracy than conventional MRI.

B-065   14:45

Changes in perfusion CT of advanced squamous cell carcinoma of the head and neck treated during the course of concomitant chemoradiotherapy

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Purpose: To prospectively evaluate early changes in primary tumor perfusion parameters during concomitant cisplatin-based chemoradiotherapy of locoregionally advanced squamous cell carcinoma of the head and neck (SCCHN) and to evaluate their predictive value for response of the primary tumor to therapy.
Methods and Materials: Twenty patients underwent perfusion CT before and after completion of 40 and 70 Gy of chemoradiotherapy. Blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability surface area product (PS) of primary tumors were quantified. Differences in perfusion and tumor volume values during the therapy and between responders and non-responders were analyzed. Receiver Operator Characteristic (ROC) curves were used to assess predictive value of the baseline and follow-up functional parameters.
Results: The tumor volume at 40 Gy and at 70 Gy was significantly lower compared to baseline value (p = 0.014 and 0.007). In the 6 non-responders, measurements after 40 Gy showed a non-significant trend of increased BF, BV and PS values compared to the baseline values (p = 0.06). In 14 responders, a significant reduction of BF values was recorded after 40 and 70 Gy (p = 0.04 and 0.01), BV values showed a reduction after 40 Gy followed by a plateau after 70 Gy (p = 0.04). Baseline BV predicted short-term tumor response with a sensitivity of 60% and specificity of 100% (p = 0.01). After 40 Gy, BV was more significant predictor than BF and MTT.
Conclusion: In advanced SCCHN, the perfusion CT monitoring might be of predictive value for identifying tumors that may respond to the cisplatin-based chemoradiotherapy.

B-066   14:54

Tumor, nodal disease, and gross tumor volume of oral cancer evaluated by 18 F-fluorodeoxyglucose-PET/CT and MRI: Validation with histology

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Purpose: To evaluate the impact of adding combined 18 FDG-PET/CT to MRI for T and N staging of the oral and oropharyngeal cancer and calculation of the gross tumor volume (GTV) having the histopathology as reference standard.
Methods and Materials: PET/CT and MRI were performed in 80 patients with suspected oral cancer (55 primary tumors and 25 recurrent tumors) and nodal disease

(146 nodes). Statistical analysis included McNemar test, sensitivity, and specificity for the diagnostic modalities as well as comparison analysis for the calculated GTV. **Results:** There was no significant difference between the two modalities compared to the pathological findings regarding the detection of the disease (P=0.72). The sensitivity/specificity for tumor detection was 100/80% and 96.72/60% for MRI and PET/CT, respectively. The sensitivity/specificity for nodal metastases was 88.46/75% and 83.81/73.91% for MRI and PET/CT, respectively. In 18% of the cases, the MRI-based T staging resulted in an overestimation of the pathologic tumor stage. The rate for PET/CT was 22%. Both modalities showed 100% sensitivity for detection of the recurrent lesions. The mean GTV of the specimen was 16.6±18.6 ml, the mean GTV derived by MRI was 17.6±19.1 ml and by PET/CT was 18.8±18.1 ml (P=0.007 between the three methods).
Conclusion: Compared to MRI, FDG-PET/CT is not superior in the diagnosis and local staging of oral and oropharyngeal cancer. The GTV overestimation is a significant drawback of both modalities.

B-067 15:03

Tumormicrocirculation of head and neck lesions using elasticity and contrast agent imaging

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Purpose: Salivary gland neoplasms account for < 3% of all tumors. Most of them are benign and parotid gland is the commonest site. The aims of the study was to assess the use of conventional ultrasound, contrast enhanced ultrasound and elasticity in characterization of salivary gland tumors
Methods and Materials: In a retrospective study 15 patients with suspicion of salivary gland neoplasms were examined by conventional ultrasound, contrast enhanced ultrasound (CEUS) and elasticity. CEUS was examined with low MI-technique using 2.4 ml intravenous injection of SonoVue (Bracco, Italy) and using a multifrequency transducer 9 MHz (Siemens, Acuson, S 2000). All patients undergo surgical treatment and histology was proven as gold standard.
Results: According to conventional ultrasound 14 of the lesions were hypoechogenous and 1 was echofree; 4 showed irregular margins and 2 of these lesions were carcinomas. In 2 cases, we observed the presence of multiple locoregional formations in the lymph nodes. By using the elasticity the carcinomas appear softer in comparison to the pleomorphic adenoma, Warthin's tumor and Pseudotumors. In contrast-enhanced ultrasound the benign lesions enhanced in the time-intensity curves more in comparison to the carcinomas.
Conclusion: Preliminary results indicate that contrast-enhanced ultrasound in combination with elasticity imaging can provide useful information in characterisation of salivary glands tumors by allowing for a more precise vascular map of the lesions, as well as greater diagnostic accuracy using the elasticity imaging as an indication for the stiffness of the tumors.

B-068 15:12

Static and dynamic evaluation with MRI of larynx and oro-pharyngeal cavity in professional opera singers

M. Di Girolamo, G. Ruoppolo, E. Pandolfi, C. Mucciaccio, J. Sternberg, V. David;
Rome/IT (digirolamomarco@hotmail.com)

Purpose: To assess the anatomical configuration of phonetic organs by MRI in professional opera singers with different vocal range.
Methods and Materials: 26 professional opera singers were evaluated with MRI. We performed both static and dynamic study with MRI. The static study was performed at the level of larynx to evaluate the area of superior surface of vocal cord. In the dynamic study, the singers were asked to perform a prolonged vocalization at a comfortable tonality of the fundamental vowel a. We performed a Turbo Field Echo scan measuring the area of the mouth and pharyngeal lumen. These data underwent statistical evaluation using the Mann-Whitney U - test considering: 1) vocal tessitura; 2) size of the vocal cord; 3) area of the mouth and pharyngeal lumen during the utterance of the vowel a.
Results: The average size of the vocal cord was: 0.71 cm² for sopranos; 1.20 cm² for mezzosopranos; 1.58 cm² for tenors; 2.88 cm² for basses. The average area of mouth and pharyngeal lumen on midsagittal scan during the utterance of the vowel a was: 15.8 cm² for sopranos; 14.6 cm² for mezzosopranos; 23.6 cm² for tenors; 32.2 cm² for basses.
Conclusion: Our results demonstrate a correlation between the surface of the vocal cord and the configuration of vocal tract and the vocal tessitura of a singer. Long vocal cord and wide vocal tract are characteristic of singers with low-pitched voice types while short vocal cord and narrow vocal tract are characteristic of singers with high-pitched voice types.

B-069 15:21

Brown adipose tissue in FDG-PET/CT: Is there a correlation with adiposity and fasting glycaemia?

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P. Aschoff, C.D. Claussen, N. Stefan, C. Pfannenberg; *Tübingen/DE*
(Matthias.Werner@med.uni-tuebingen.de)

Purpose: Brown Adipose Tissue (BAT) represents a natural target for the modulation of energy expenditure and is easily detectable on FDG-PET/CT scans. Its correlation with age, sex, body-mass index (BMI) and fasting glycaemia was studied.
Methods and Materials: 5779 FDG-PET/CT examinations in 3604 individual patients were screened for BAT in the radiologists' report. Age-matched and study-date-matched controls were selected. Body weight/BMI and fasting glucose levels were determined on the examination day. Statistical significance was assessed using univariate and multivariate models and the likelihood-ratio chi-square test.
Results: BAT was documented by the radiologist in 110 patients, 78 women (70.9%) and 32 men (29.1%). 198 controls were included in the analysis. The prevalence of BAT decreased with increasing age, BMI, and fasting glycaemia. With regard to age, the percentage of BAT present was 61% for the lowest third, 28% for the middle third and 18% for the highest third (p < 0.001); for BMI, percentages were 56% (lowest), 32% and 18% (highest third) (p < 0.001). As for fasting glycaemia, percentages were 38/42/26% (p = 0.049). BAT was significantly associated with age and BMI in the multivariate model (p < 0.001), but was not related to glycaemia (p = 0.76).
Conclusion: Our data show a decrease of BAT prevalence with increasing age, BMI, and fasting glycaemia. There seems to be an independent correlation between BAT and BMI over a broad range of ages. However, unlike liver fat and visceral fat, BAT is not an independent regulator of glycaemia.

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

Vascular

SS 115

Imaging peripheral arterial disease

Moderators:
R. Schernthaner; Vienna/AT
W. Steinbrich; Basle/CH

B-070 14:00

Fingertip microangiography using synchrotron radiation toward prediction of diabetic angiopathy

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Purpose: The vascular endothelial dysfunction induced by acetylcholine (Ach) administration causes paradoxical vasoconstriction (PVC) in arterioles (20-200 μm in diameter) in the early phase of diabetic microangiopathy. However, the conventional angiography does not have enough spatial resolution (SPR: 100-200 μm) to visualize arteriole and, therefore, cannot be applied to predict a diabetic microangiopathy in the early phase to prevent lethal cardiovascular diseases.
Methods and Materials: In order to determine whether the fingertip synchrotron radiation (SR) microangiography has enough SPR to quantitate arteriolar diameter changes, and, whether an arteriolar PVC is characteristic observation for diabetic micronagiopahty, we analyzed diameter reduction as arteriolar branching, and compared the arteriolar diameter changes in the fingertips before and during Ach administration between control (n = 5) and Type I or Type II diabetic rats (n = 5).
Results: The fingertip SR microangiography visualized the arterioles with a diameter range of 30-300 μm and demonstrated diameter reduction as branching with a fixed ratio (r = 0.93, P < 0.004, y = 0.81 x +0.004 and r = 0.73, P < 0.001, y = 0.39 x +23.3; x and y: diameters of mother and bigger and smaller daughter segments). A vasodilatory reaction was induced by Ach (142.4 ± 61.9 to 190.9 ± 73.5, P < 0.05, n = 25) in the control, and, in contrast, PVC in the diabetic (201.6 ± 83.0 to 160.4 ± 67.9, P < 0.05, n = 37) rats. Histological angiopathy was noted only in the DM rats.
Conclusion: Fingertip SR microangiography predicted diabetic microangiopathy and could be useful for better determination of fixed combination in the treatment of metabolic syndrome in the early phase.

B-071 14:09

Gadobenate dimeglumine vs gadopentetate dimeglumine for peripheral MR angiography: Comparison with DSA

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Purpose: To prospectively compare 0.1 mmol/kg doses of gadobenate dimeglumine and gadopentetate dimeglumine in patients undergoing contrast-enhanced MR angiography (CE-MRA) of the peripheral arteries.

Methods and Materials: 96 adult subjects with suspected moderate-to-severe peripheral arterial occlusive disease (PAOD) were enrolled at 7 sites. Patients underwent 2 identical 1.5-T, 3-station, CE-MRA examinations from the aortic bifurcation to the lower leg with randomized 0.1 mmol/kg doses of gadobenate dimeglumine and gadopentetate dimeglumine. Diagnostic performance (sensitivity, specificity, accuracy, PPV, NPV) was determined in a subset of patients (n=31) that also underwent conventional DSA. The presence and extent of steno-occlusive disease on DSA images was determined on a segmental basis using a 4-point scale (1=stenosis ≤25%; 2=stenosis > 25-≤50% 3=stenosis > 50-99%; and 4=occlusion). Statistical analyses were performed using the Wilcoxon Signed Rank, McNemar, and Wald tests.

Results: A total of 397 segments were evaluated by DSA. Of these 397 segments, 270 (68.0%) had stenoses of ≤50% while 127 (32.0%) were had hemodynamically-relevant (> 50%) stenoses. All three blinded readers reported significantly (p≤0.0017) better diagnostic performance with gadobenate dimeglumine compared to gadopentetate dimeglumine, with increases of 11.0-18.1% in sensitivity, 4.4-9.3% in specificity, and 7.8-10.1% in overall accuracy. Readers also reported significantly (p≤0.0028) higher PPV and NPV with gadobenate dimeglumine, with differences ranging from 12.7 to 19.3% for PPV and 5.5-7.9% for NPV.

Conclusion: In patients with suspected PAOD referred for CE-MRA, use of 0.1 mmol/kg bodyweight gadobenate dimeglumine results in significantly better diagnostic performance than use of an equivalent dose of gadopentetate dimeglumine.

B-072 14:18

Conventional vs high relaxivity contrast agents for peripheral MRA: A dose comparison

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Purpose:: To evaluate the utility of standard dose high relaxivity (SDHR) gadolinium contrast for peripheral MRA (pMRA), and compare this to high dose high (~0.2 mmol/kg) relaxivity (HDHR) and high dose conventional relaxivity (HDCR) contrast.

Methods and Materials: 60 patients undergoing moving table pMRA for suspected PVOD received (20 each): 17 cc gadobenate dimeglumine (MultiHance; Bracco), 34 cc gadobenate dimeglumine, or 34 cc gadoteridol (ProHance; Bracco). Imaging (1.5 T) was performed using a prototype 18 channel coil and optimized sequence to maximize SNR while avoiding venous contamination. Upper/middle station scan times ranged from 5-12.5 sec; lower 45-60 sec. Arterial-to-muscle contrast ratios for each station were measured and corrected for TR/TE differences. Subjective image quality and venous enhancement were evaluated. Student t-test and Mann Whitney U tests were applied.

Results: All studies were diagnostic and high quality. Contrast ratio was uniformly higher for HDHR contrast, but only significant in the lower station. Interestingly, upper station HDHR image quality was significantly worse than the others despite its higher CR. This trend has been seen in other studies, where high dose gadobenate dimeglumine appears to decrease rather than improve MRA image quality. There was no significant contrast ratio or image quality difference between SDHR and HDCR; however, lower station venous enhancement was significantly less for SDHR.

Conclusion: Excellent quality pMRA can be achieved with standard dose gadobenate dimeglumine, with overall quality equivalent or better than double dose conventional contrast. Increasing HR contrast dose improves CR, but may not improve image quality.

B-073 14:27

MR imaging of pedal arteries and the soft tissue correlated with perfusion imaging in patients with diabetic foot syndrome (DFS): Preliminary results at 3 T

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Purpose: Reduced arterial perfusion, infection and osteomyelitis are common complications in patients with DFS. The aim of this study was to quantitatively measure pedal perfusion in patients with DFS using dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) and Gadofosveset as bloodpool contrast agent.

Methods and Materials: Measurements were performed at 3.0 T (Magnetom Trio, Siemens, Germany) using a 12-element head coil. Three healthy volunteers and 12 patients with DFS with and without peripheral arterial occlusive disease (PAOD) were examined. A centric-reordered SR-TurboFLASH pulse sequence, a CE-MRA, a T1 VIBE steady state MRA and fat suppressed T1 sequences were applied. Quantification of tissue perfusion was performed using the MMID4 model. Pathologic findings of pedal veasculature and soft tissue were correlated with the results of clinical investigation, ultrasound and percutaneous oxygen pressure measurement.

Results: Imaging of the foot was successfully carried out in all subjects. Patients showed varying blood flow depending on the underlying pathology. Patients with inflammation showed increased blood flow whereas patients without inflammation and co-existing PAOD showed decreased blood flow. Pathologies of pedal macrocirculation correlated well with clinical, as well as the detection of inflammation and osteomyelitis with histological findings.

Conclusion: Quantitative perfusion imaging based on Gadofosvest-enhanced dynamic MRI of the soft tissues in patients with DFS is possible. MRI with use of an intravascular contrast agent could be a tool to assess regional blood flow in the musculature, the pedal vasculature as well as pathologies of the soft tissue in patients with DFS.

B-074 14:36

Evaluation of the applicability and validity of MRI based 4D flow measurements for in-stent flow visualization and quantification in peripheral vascular stents

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Purpose: MRI based evaluation of in-stent lumen is known to be impeded by stent associated artifacts of varying severity. With the gaining importance of 4D flow analysis we aimed at assessing applicability and validity of MRI based 4D phase contrast (PC) flow measurements for the evaluation of in-stent blood flow in 17 commonly used peripheral stents.

Methods and Materials: 17 stents made of different materials and with diameters ranging from 5 to 8 mm were implanted in an MR compatible flow phantom. A CEMR angiography as well as 2D and 4D PC flow data sets were acquired with the stents arranged parallel and perpendicular to the main magnetic field (1.5 Tesla). In-stent visibility, peak velocity and flow volume were assessed and compared to outside the stent.

Results: In 16 of the tested stent types, flow pathlines within the stent lumen could be visualized. In-stent flow velocities determined by 4D PC, flow measurements were significantly overestimated for all stent types, with the degree of overestimation depending on stent material and design (range: 8-125%, p < 0.001). Severity of stent artifacts and associated reduction of measurable flow volume within the stent equally depended on stent type and varied with stent orientation relative to the main magnetic field (range of reduction: -78-+6%).

Conclusion: Feasibility of in-stent 4D flow visualisation and quantification heavily depends on stent type and stent orientation relative to the main magnetic field. Our results may serve as a data library helping to predict the applicability and validity of in stent flow measurements.

B-075 14:45

High-resolution steady state MR angiography of the peripheral arteries using gadobenate dimeglumine: A comparison with CT angiography

M. Anzidei, A. Napoli, B. Cavallo Marincola, P. Di Paoli, C. Catalano, R. Passariello; *Rome/IT (michele.anzidei@gmail.com)*

Purpose: To assess the diagnostic accuracy of first-pass (FP) and steady state (SS) contrast-enhanced MR angiography (CE-MRA) of the lower limb (below knee) peripheral arteries with Gd-BOPTA and to using 64-CT angiography (CTA) as reference standard.

Methods and Materials: 35 patients with symptomatic peripheral arterial disease (PAD) underwent CE-MRA of the peripheral arteries using a standard 3D spoiled GRE sequence and 0.1 mmol/kg of Gd-BOPTA. High resolution SS acquisitions (voxel 0.7 mm³) were obtained immediately after the routine acquisition of FP images. All patients subsequently underwent CTA. Three readers in consensus reviewed separate FP and SS CE-MRA datasets for quality of vessel visualization and then for the presence/absence of significant (> 50% vessel lumen narrowing) steno-occlusive disease. A fourth independent observer evaluated CTA images using similar assessment criteria. The diagnostic performance (sensitivity, specificity, positive and negative predictive values [PPV and NPV]) achieved with each dataset was determined and compared using McNemar's test. Agreement between FP and SS images was assessed using kappa statistics.

Thursday

Results: All datasets were considered to be of sufficient quality for subsequent elaboration. The sensitivity, specificity, PPV and NPV for the grading of stenosis was 90, 92, 91.1 and 91%, respectively, for the FP dataset, and 95, 95.4, 95 and 95.4%, respectively, for the SS dataset. Differences in the performance of FP and SS were statistically significant (p < 0.001). The agreement between was substantial (p = 0.93).

Conclusion: SS MRA imaging of the peripheral arteries with Gd-BOPTA is superior to conventional FP imaging for the evaluation of stenosis as compared to CTA.

B-076 14:54

Computed tomography angiography (CTA) in peripheral artery obstructive disease: Intention to diagnose study to evaluate the diagnostic performance of 64-CTA vs DSA; influence of plaque composition, reduced radiation dose and contrast medium volume

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Purpose: To evaluate the diagnostic performance of 64-slice Computed Tomography Angiography (CTA) for the detection of lower extremity artery stenosis using DSA as reference standard, to assess the influence of plaque composition, and to compare radiation dose and administered contrast medium volume.

Methods and Materials: 212 consecutive patients with disabling intermittent claudication underwent CTA and DSA of the infrarenal abdominal aorta and the in-flow and run-off arteries. CTA was performed as a primary test in all patients using a 64×0.6 mm detector configuration (Siemens), 110 ml of contrast medium (Iomeron 400 [400 mgI/ml] at 4 ml/sec) and 80 kV. The arterial bed was divided into 35 segments for analysis. Detected arterial stenoses were graded using a four-point scale (0-4: normal-occlusion; 5: aneurysm). Diagnostic performance (accuracy, sensitivity and specificity, positive predictive value [PPV], negative predictive value [NPV] and positive likelihood ration (PLR) were obtained with uninterpretable CTA results considered false negative for true positive DSA findings and false positive for true negative DSA findings. Significance was determined using Chi-square, McNemar and Wilcoxon rank tests as appropriate. To achieve 90% study power at an α level of 0.05, a sample size of 210 patients was required.

Results: A total of 7420 arterial segments were assessed in the 212 evaluated patients. Overall diagnostic performance is shown in the Table. The McNemar test confirmed non-significant differences between CTA and DSA in per-artery and per-region analyses (0.62<p < 0.87). A total of 6126 lesions were detected of which 3687 (64%) were calcified and 2439 (36%) non-calcified. The Chi-square test showed no significant difference in stenosis grading between the two groups (p> 0.05). The effective radiation dose for CTA (2.6±1.2 mSv) was significantly lower than that for DSA (3.8±4.8 mSv; p < 0.05). Likewise, significantly less contrast agent was administered for CTA (118±10.7 mL) than for DSA (148±4.5 mL; p < 0.001).

Conclusion: 64-slice CTA yields comparable diagnostic accuracy to that of DSA without influence of plaque composition and with reduced requirements for contrast medium and radiation dose.

B-077 15:03

also EPOS

The imaging quality comparison between bolus-triggering and test-bolus technique used in 64-slice spiral CT angiography of lower extremity arteries

C. Hu[1], L. Cui[2]; [1]Soochow/CN, [2]Nantong/CN (cuigeleili@126.com)

Purpose: To prospectively investigate the clinical value of multi-slice CT angiography (MSCTA) of lower limbs in patients with peripheral arterial occlusive disease (PAOD) using the test-bolus technique.

Methods and Materials: 44 consecutive patients with PAOD were prospectively randomized into two groups in the study. 18 subjects in Group 1 underwent CTA by bolus triggering method. In Group 2, 26 subjects underwent CTA by test-bolus technique. During scanning procedure in group 2, we calculated the bolus transit time to aorta (T_{AO}), popliteal arteries (T_{POP}) and aorto-popliteal bolus transit time (T_t) obtained through dynamic acquisition at their respective level, and immediately we set the delay time as T_{AO} and the scan time as double T_t. Two independent senior radiologists evaluated the quality of each arterial segment visualization based on 5 parameters (1. visible farthest branch, 2. clarity of vessels border, 3. presence of venous contamination, 4. grading of stenoses, 5. CT value at 4 arterial segments). To compare the quality of images between the both groups, χ^2 test and t test were used.

Results: Image quality of Group 2 demonstrated to be much superior over Group 1 (P < 0.01), especially in the image quality of infra-popliteal arteries. There was an excellent interobserver agreement for Group 2 (k> 0.80). Patients in Group 1 were found to be higher grade stenosis in infra-popliteal arteries (P < 0.01) in comparison with Group 2.

Conclusion: Adaptive method by using two low-dose test bolus injection contributes greatly to producing higher quality images than using bolus triggering technique in below knee arteries.

B-078 15:12

Time-resolved CT angiography of the lower leg in the diagnosis of peripheral arterial disease

W.H. Sommer, A. Helck, T.R.C. Johnson, M.F. Reiser, H.-C. Becker, K. Nikolaou; *Munich/DE (wieland.sommer@med.uni-muenchen.de)*

Purpose: To evaluate the accuracy of time-resolved CT-angiography (TR-CTA) of the lower-leg in patients with peripheral arterial disease (PAD).

Methods and Materials: 59 patients with known or suspected PAD underwent standard peripheral run-off-CTA (120 kV, scan-range: 130 cm, 100 ml Imeron400, Bracco, Italy) and an additional TR-CTA of the lower-legs. TR-CTA was performed on a 128-slice CT-Scanner (Somatom Definition AS+, Siemens Healthcare) with a continuous bidirectional table movement for time-resolved imaging. 12 low dose phases of the lower-leg were recorded (scan range: 27 cm, temporal resolution, 2.5 s, 80 kVp, 120 mAs, mean effective dose: 0.18 mSv, 50 ml contrast medium). Both in TR-CTA and standard-CTA, arterial enhancement and confidence of diagnosis were assessed on a 3-point-scale (1-3, 1=best). Additionally, the presence of significant stenoses (> 50%) was evaluated. All assessments were performed separately for 7 segments of each lower-leg (total of 840 segments). In 20 patients, reference imaging (MRA and/or DSA) was available for diagnostic comparison.

Results: Selecting the best out of 12 phases, TR-CTA showed a better arterial enhancement than standard-CTA (TR-CTA: 1.24±0.50; standard-CTA: 1.60±0.66; p < 0.0001). Diagnostic confidence was higher in TR-CTA (TR-CTA: 1.33±0.50; standard-CTA: 1.72±0.66; p < 0.0001). In 20 patients available for diagnostic comparison, 139 of 280 segments showed significant disease. Diagnostic accuracy for TR-CTA and standard-CTA of the lower-leg was 95.7 and 86.4%, respectively.

Conclusion: TR-CTA of the lower-leg leads to advantages of arterial contrast enhancement and avoids problems like venous overlay and early data acquisition before arrival of contrast agent. Furthermore, diagnostic accuracy and diagnostic confidence is highly improved as compared to standard-CTA.

B-079 15:21

Does the degree of arterial wall calcification influence the performance of run-off CTA and are cardiovascular risk factors predictors for compromising segmental calcifications?

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Purpose: To prospectively assess the influence of arterial wall calcifications on accuracy of run-off CTA and to analyze whether cardiovascular risk factors are predictors of compromising calcifications.

Methods and Materials: In 200 consecutive patients who underwent runoff CTA, calcifications were assessed in pelvic, thigh and calf arteries using a four-point scale. Fifty-nine patients with gold standard DSA were assessed on both modalities to estimate a threshold of compromising calcifications, defined as a decrease of sensitivity, specificity, PPV or NPV below the lower 95% confidence interval of the overall results. A regression analysis was performed to investigate a potential relationship between compromising calcifications and the presence of cardiovascular risk factors, advanced patient age and severe PAD.

Results: Highest Ca^{++}-Score was chosen as the cut-off for the regression analysis as a relevant decrease of specificity above the knee and of sensitivity, specificity, PPV and NPV below the knee was observed for both readers. In the pelvic and thigh arteries, severe PAD (Fontaine Stage $\geq$ III) showed the highest odds ratio for compromising calcifications (2.9), followed by those of diabetes mellitus (2.4), renal failure (2.1) and smoking (1.7). In the calf, renal failure (12.2) and diabetes mellitus (3.3) were the strongest predictors.

Conclusion: Diagnostic performance of CTA is significantly compromised by the presence of extensive arterial wall calcifications. Such calcifications are most often found in patients with diabetes mellitus and chronic renal failure, especially those undergoing chronic haemodialysis. They should therefore be considered for alternative vessel imaging, e.g. MRA or DSA, to avoid both time-consuming vessel assessment and inconclusive examination results.

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

Computer Applications

SS 105

Workflow, reporting and communication

Moderators:
E. Bellon; Leuven/BE
L. Faggioni; Pisa/IT

B-080　14:00

also EPOS

The role of key image notes in CT imaging study interpretation
S. Fan[1], Z. Xu[2], G. Teng[3], J. Wang[1], H. He[1]; [1]Linhai/CN, [2]Handzhou/CN, [3]Nanjing/CN (shufengfan@163.com)

Purpose: To investigate the role of CT key image notes (KIN) in CT imaging study interpretation.
Methods and Materials: 100 cases of consecutive CT examinations with the KIN application and 100 cases without were randomly selected to finish diagnostic report, and reinterpreted three months later by a separate group of radiologists, respectively. All results with or without KIN were interpreted, and reinterpreted three months later by a corresponding clinical group, respectively. Each group had three doctors, all experienced in PACS applications and approved by institutional board. We performed statistical analysis to determine the difference of the respective required time and the consistency of the interpretation of the CT images with KIN to without in PACS/RIS.
Results: The report time and reinterpreting time after 3 months were 8.77 ± 5.27 min and 5.23 ± 2.54 min vs 10.53 ± 5.71 min and 4.99 ± 1.70 min, respectively. Clinical interpreting and reinterpreting time after 3 months were 5.45 ± 2.33 min and 3.94 ± 1.60 min vs 4.69 ± 1.97 min and 2.97 ± 1.45 min, respectively. The primary report time using KIN was prolonged a little for the radiologists in CT department, while the interpretation time for the reports with KIN was reduced significantly in succeeding large numbers of medical process ($p < 0.01$). The consistency of the interpretation and reinterpretation between different doctors in different time were enhanced after the KIN application ($p < 0.01$).
Conclusion: CT report with KIN in PACS/RIS can help improve the quality and efficiency of clinical routine work.

B-081　14:09

Integration of interactive three-dimensional image post-processing software into radiology teaching for medical students:
A new way of learning radiological skills?
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Purpose: Three-dimensional radiological imaging and post-processing today form a vital part of many clinical specialties. The purpose of this study was to assess student's improvement in radiological knowledge and skills in a new hands-on radiology course using interactive three-dimensional post-processing software.
Methods and Materials: Each of the 25 participating clinical medical students had access to a workstation allowing for interactive viewing, oblique multiplanar reformations and three-dimensional volume rendering. Guided by an experienced radiologist, students had to create structured diagnostic reports for CT, MRI or PET/CT images of 14 representative clinical cases within seven teaching sessions. 128 multiple-choice questions were designed testing for knowledge on diagnostic workflow and technology (section A), diagnostic and interpretation skills using radiological images (B), and three-dimensional appreciation using standardised three-dimensional figures (C). Questions were randomly assigned to two tests (pre-/post-tests), each composed of 64 questions (A: 12; B: 36; C: 16). All students were tested prior and after the course.
Results: Wilcoxon signed rank test showed that students significantly improved in all sections. Test scores increased by 36.0% in A ($p < 0.0001$; 95% CI, 26.4-45.6%), by 18.1% in B ($p < 0.0001$; 13.7-22.5%), and by 11.3% in C ($p < 0.002$; 6.0-16.5%). This resulted in an overall improvement of 19.8% ($p < 0.0001$; 15.5-24.0%). Participants appreciated the high degree of independent work and interactivity and agreed that their future clinical practice would benefit from the course.
Conclusion: Integration of interactive three-dimensional post-processing workstations into teaching of students enhances radiological diagnostic skills and three-dimensional appreciation which are crucial skills for every day clinical practice.

B-082　14:18

also EPOS

Diagnostic imaging pathways (DIP) integrated into electronic requesting
R.M. Mendelson, D. Glance, D. Wong, P. Bairstow; *Perth/AU (richard.mendelson@health.wa.gov.au)*

Purpose: It is estimated that up to 30% of requests for diagnostic imaging (DI) are inappropriate. The implementation of clinical decision support (CDS) systems is one strategy to reduce inappropriate DI. The purpose of this presentation is to demonstrate the ongoing development of an online CDS and educational tool aimed at promoting appropriate and evidence-based DI integrated into electronic request entry (ERE).
Methods and Materials: DIP is freely available online (www.imagingpathways.health.wa.gov.au), providing CDS through over 130 interactive evidence-based pathways for common clinical scenarios. These describe the most appropriate sequence of imaging tests for that scenario. Each pathway is regularly reviewed and integrates the best available evidence (graded according to the Oxford classification) with a multidisciplinary consensus. Electronic links to on-line journal abstracts are provided. There are teaching points for each pathway, general information on IR and imaging modalities, and an extensive image gallery.
Results/Conclusion: For as long as CDS systems are 'stand alone' applications, achieving full compliance depends on continuous processes of education and enforcement. An understanding of why clinicians fail to follow recommended guidelines is required. In addition, CDS must be embedded into clinical workflow and ideally into electronic requesting. Such an application is being developed based around DIP as the CDS.

B-083　14:27

Upgrading from digital dictation to speech recognition: Worth the effort?
M. Soler[1], J. Garcia[1], S. Guirao[2]; [1]Esplugues/ES, [2]Girona/ES

Purpose: Measurement of report turn-around-time (TAT), voluntary adoption rates and workflow preferences at 17 bi-lingual Imaging Diagnosis Centres following the enhancement of a digital dictation system with speech-recognition.
Methods and Materials: TAT was acquired from 17 sites for about 50 radiologists and nuclear doctors over the period of 3 quarters. 186.000 reports were included in the evaluation. The reporting process was subdivided into four steps which were measured and compared individually: recording, editing, signing and preparation of the document set for the patient. Data were gathered per site as well as per imaging method. Statistical software was used to measure, compare and evaluate the results. Medical staff was aware of the measurements.
Results: Average TAT improvement was 10 hours. Greatest improvements with 4 hours reduction in report editing have been achieved in scyntigraphy and conventional radiology departments, while lowest effects could be measured for ultrasound department. There is a correlation between low-TAT and the predominant SR method; front-end SR achieved significantly better TAT than back-end SR. Voluntary adoption of SR achieved 85.1% within 7 months. Bi-linguality (Spanish/Catalan) showed no negative effects on TAT.
Conclusion: Front-end SR is significantly superior in terms of reducing report TAT to both - back-end SR and digital dictation. There is a trend towards the voluntary adoption of front-end SR, in most cases gradually via back-end SR. Editing of computer-recognized dictation has proven the least time-consuming factor within the reporting process, allowing to reject assumptions that front-end speech recognition is timely disadvantageous to radiologists.

B-084　14:36

also EPOS

Beyond RADPEER: The next generation of quality assurance
T.V. Myers, G. Ross, W. Shea, B. Hall, S. Kininmonth, D. Watts; *Cave Creek, AZ/US (tmyers@nighthawkrad.net)*

Purpose: To evaluate a new approach to Quality Assurance (QA) using a Medical Quality Score (MQS) that evaluates performance using both accuracy and quality of radiology reports.
Methods and Materials: The MQS is created during evaluation of peer-reviewed discrepancies as well as random evaluation of reports by our radiologists. The MQS is based on a total of 200 points possible per report. Raw peer-reviewed data is refined during a review process beginning with the NRS radiologist originating the report. A secondary review by an Internal Review Board (IRB) is performed with oversight provided by a Medical Director and Chief Medical Officer. Based on the review, a score is given for report accuracy, with the maximum being 120 points. During the review, report quality is also assessed in 6 specific areas with the pillars of an adequate report being pertinence, clarity and appropriate brevity. The 6 areas have different point values depending on the significance of the information described. A total of 80 points are available in this category.

Results: Providing QA feedback to radiologists that includes an MQS highlights the need for accuracy as well as clear communication to the clinicians who will receive the report. Many reports accurately reflected the primary findings, but did not present the data clearly and concisely. A discussion of the MQS, discussion of the report assessments and results obtained from using the MQS will be presented.
Conclusion: An MQS based QA program should replace the current systems in use for evaluating radiology reports.

B-085 14:45
Development of a novel web-based reporting performance assessment tool to support mentored training in PET/CT

A.R. Goldstone, C.N. Patel, F.U. Chowdhury, A.F. Scarsbrook; *Leeds/UK (tony.goldstone@gmail.com)*

Purpose: To describe an innovative web-based tool supporting competency based assessment and real-time collation of reporting performance data using freely available software.
Methods and Materials: A bespoke web-based resource was developed utilizing open-source software (Google Documents and Google Forms) to support PET/CT training. This consists of an online template which produces a formatted report and automatically assigns it to a mentor who provides feedback on performance using a web-based form. Data entered by both trainee and mentor automatically populate a personalised online logbook.
Results: During PET/CT reporting sessions trainees were assigned a mentor and encouraged to report scans independently using the web based template. Scans reviewed were either "live" cases or from a validated training archive. Each report was assessed by the mentor using the web-based feedback system. Any errors or learning points were reviewed by the trainee with their trainer. An electronic dashboard with live gauges of throughput, case-mix, overall reporting performance, reporting sensitivity and specificity was used to monitor progress and adapt to training needs.
Conclusion: A simple but effective web-based tool greatly enhanced training by facilitating detailed feedback and 100% audit of performance. This has the potential to allow robust documentation of competency-based training and accreditation in many other areas of radiology.

B-086 14:54
Performance and monitoring server for medical data

J. Hermen, A. Jahnen, S. Kohler, C. Moll, P. Plumer; *Luxembourg/LU (Johannes.Hermen@tudor.lu)*

Purpose: DICOM images contain image and header metadata. The latter can be used to answer statistical questions ranging from the technical to more management oriented questions. The Performance and Monitoring Server for Medical Data (PERMOS) is a flexible framework to process DICOM metadata.
Methods and Materials: PERMOS is implemented using a modern multi-tier architecture with scalability in mind. Based on the JBoss application server and other powerful open source tools, it provides functionality to acquire DICOM header metadata with several application dependent but manufacturer independent options. Data mining can be performed using application defined and interactive methods. The role based web interface is implemented using JBoss-seam, which interconnects the standard Java related technologies Java Server Faces, AJAX and Enterprise JavaBeans. The data are stored in a relational database to enable a fast and flexible access to the input data as well as the final results.
Results: The PERMOS environment provides a scalable web-based framework for evaluating DICOM header data. The user interface allows easy access to user and role constraint graphical data views. Depending on the application, data evaluation is possible in retrospective as well as in monitoring mode, which includes sending of e-mail alerts. The system is scalable and of high-performance to support numerous data sets.
Conclusion: The module concept is well suited to develop custom modules for a broad deployment. The provided tools support a fast and easy implementation of new aims. First available applications are dose calculations in computed tomography and digital mammography. Other applications are planned.

B-087 15:03
also EPOS
"Sharing is earning": Using a regional RIS-PACS to warrant best quality medical assistance for everyone

C. De Juan[1], J.M. Sevilla[1], J.M. Pinto[2], J. Jimenez[2], L. Gijón[1]; [1]*Guadalajara/ES*, [2]*Toledo/ES (mcjuans@sescam.jccm.es)*

Purpose: To demonstrate that the patient has been the great "winner" (as well as physicians and politicians) after the onset of a tele-radiology system through a very extent low crowded area with shortness of physicians and an excellent high technology devices setting.

Methods and Materials: The SESCAM (our public health care) corporative PACS system has been used for two and a half years to attend an 80.000 Km² area with 2.04 million population. A Virtual Radiology Centre (VRC) with 33 staff radiologists has been created for reporting about 25,000 studies performed at 9 hospitals and 11 primary health care centres. A statistical analysis of number, type and temporal distribution of studies reported by the VRC outside from the acquisition places, has been made, as well as the relative weight of them over the whole of studies from each health area.
Results: Mainly CT and MR studies, even emergency ones, have been reported between 15 and 90% (mean 35%) of all the studies performed, have been reported by the VRC mainly depending on hospitals and seasons.
Conclusion: In a high technologically supplied environment, sharing of human resources, which is mainly radiologists, by mean of PACS is an excellent way of increasing patient comfort and to warrant the best quality sanitary assistance for every patient, not depending on the distance from their houses to a first level hospital.

B-088 15:12
Development of an web portal for teleradiology via DICOM e-mail using open source software

B. Schneider[1], O. Heinze[1], K. Lederle[2], G. Weisser[2], B. Bergh[1]; [1]*Heidelberg/DE*, [2]*Mannheim/DE (benjamin.schneider@med.uni-heidelberg.de)*

Purpose: The Teleradiology/Emergency Medicine Network (TEN) in the Metropolitan Rhine-Neckar Region, which is based on the open DICOM E-mail standard, was expanded by developing a web portal functionality for "low-end" users.
Methods and Materials: The existing solutions for the TEN require a DICOM E-mail client (DEC) for data exchange with the servers and other partners. Installation and maintenance require technical knowledge and configuration. Especially low-frequented users like general practitioners (GPs) seldom made this effort and were hence "excluded" from the TEN. A web portal was developed for a secure, simple and economic transmission to address this issue and promote the expansion of the regional TEN.
Results: All components are based on Open Source Software (OSS). The portal itself was developed in Java, Java Server Pages (JSPs) and Servlets with a MySQL database running in the background. User administration was achieved with an LDAP server and the external DocCheck service. DICOM e-mail protocol is used for the data transmission. The web server is located within the DMZ (demilitarized zone) of the Heidelberg University Hospital; database and LDAP-server operate within the clinical network. Signature and encryption of all patient information was achieved by an applet. The integrated DocCheck service enables a registered physician to use the portal without prior registration. The architectural decisions, the functionality as well as the pros and cons will be presented and discussed.
Conclusion: The portal offers GPs the possibility to use the advantages of the TEN for free, without any effort and to connect to any partner.

B-089 15:21
Experiences integrating RIS/PACS into personal electronic health records (PEHR)

O. Heinze, B. Bergh; *Heidelberg/DE (oliver.heinze@med.uni-heidelberg.de)*

Purpose: To present concepts and implementation experiences of an automated integration of clinical imaging data into a personal electronic health record (PEHR), which is operated by the University Hospital Heidelberg in order to improve information exchange with partner hospitals, primary care centers and patients in the region.
Methods and Materials: A generic concept (GC) was outlined, based on IHE profiles and literature. For implementation this generic model was compared to the features and capabilities of the information system in place and adapted resulting in an implementation concept (IC).
Results: The GC could not be implemented as intended due to a lacking support of IHE profiles by existing IT systems and the IC substantially differed from the GC. The final IC was designed employing HL7 and DICOM messaging. As common basi, a centralized pull model was used and the IC was finally characterized by a highly complex message interaction involving all components. However, proprietary elements, a loss of functionality, restrictions for the inclusion of additional partners had to be accepted.
Conclusion: As for today the integration of imaging into PEHR cannot be solved satisfactory. Vendors of the involved IT systems have to build standard based solutions to implement generic concepts. On the other hand, a direct integration of RIS/PACS with PEHR demonstrated substantial benefits to traditional teleradiology since clinical workflows can be supported much better.

14:00 - 15:30　　　　　　　　　　　　　　　　**Room L/M**

Neuro

SS 111

Dementia and neurodegenerative disorders

Moderators:
A. Levinsson; Malmö/SE
Z. Merhemic; Sarajevo/BA

B-090　14:00

Early detection of conversion from mild cognitive impairment to dementia using DTI

B. Stieltjes, P. Thoman, K. Fritzsche, M. Essig; *Heidelberg/DE (m.essig@dkfz.de)*

Purpose: To evaluate the use of DTI for the early detection of conversion from MCI to AD. We present data of a longitudinal DTI study on 33 patients with memory complaints (15 AD, 18 MCI) and 15 healthy aged matched controls.
Methods and Materials: All subjects were clinically examined yearly using the mini mental state exam (MMSE). All patients and healthy controls underwent an MRI exam. The DTI-exam was performed on a 1.5 T scanner. SSEPI, parameters: TR/TE 4700/78, FOV 240 mm, matrix of 96x96, 50 axial slices, thickness 2.5 mm, 6 gradient directions and two b-values (0 and 1000 s/mm^2) and 10 averages. We measured at five different positions of the CC. Intra- and intrereader variabilities were evaluated. FA values of the different groups were compared to age-matched controls with analysis of variance.
Results: In the MCI group, 10 patients showed conversion and 8 patients did not show conversion. Intra- and interreader ICCs all exceeded 0.99. The largest difference in FA was found in the anterior body of the CC. Here, the FA was significantly lower in AD vs healthy controls and MCI vs healthy controls. When splitting the MCI group in conversion vs no conversion, the converted group showed a significantly lower FA than in the non-conversion group.
Conclusion: Based on FA values, we were able to discern between MCI converters and non-converters. This indicates that DTI of the CC can be used as a fast and reliable method for the evaluation of patients with early forms of AD.

B-091　14:09

Multimodality approach in diagnostics of Alzheimer's disease and mild cognitive impairment: Value of magnetic resonance spectroscopy, perfusion and diffusion tensor imaging of posterior cingulate gyrus

A. Zimny, P. Szewczyk, A. Czarnecka, M. Guzinski, E. Trypka, R. Wojtynska, J. Leszek, M. Sasiadek; *Wroclaw/PL (abernac@wp.pl)*

Purpose: To assess the usefulness of magnetic resonance spectroscopy (MRS), perfusion (PWI) and diffusion weighted (DTI) imaging in differential diagnosis between Alzheimer's disease (AD) and mild cognitive impairment (MCI) in posterior cingulate gyrus.
Methods and Materials: Thirty patients with AD (mean age 70 yrs, MMSE 18), 15 with MCI (mean age 65 yrs, MMSE 28) and 15 normal controls (mean age 68 yrs, MMSE 29.5) underwent MRS, PWI and DTI on 1.5 Tesla MR unit. In the region of posterior cingulate gyrus, metabolite ratios (N-acetylaspartate [NAA]/creatine [Cr], choline [Ch]/Cr, myoinositol [mI]/Cr, mI/NAA, mI/Ch), cerebral blood volume relative to cerebellum (rCBV) and fractional anisotropy (FA) values were obtained.
Results: Statistical analysis of PWI and DTI results showed significant differences between all subject groups with the lowest values of rCBV and FA in AD, intermediate in MCI and highest in the control group. In MRS only mI/NAA ratio was significantly different between the groups: highest in AD, intermediate in MCI and lowest in the control group. Comparison of the three MR methods showed similar high sensitivity of MRS and DTI in differentiating AD from the control group, the highest sensitivity of MRS in distinguishing AD from MCI and the highest sensitivity of DTI in differentiating MCI from the control group and similar but lower sensitivity of MRS and PWI.
Conclusion: DTI seems to be the method of the greatest, MRS of intermediate and PWI the lowest usefulness in diagnostics of AD and MCI.

B-092　14:18

Evaluation of changes in selected white matter tracts on diffusion tensor imaging (DTI) in patients with Alzheimer's disease and mild cognitive impairment

A. Zimny, P. Szewczyk, A. Czarnecka, M. Guzinski, E. Trypka, R. Wojtynska, J. Leszek, M. Sasiadek; *Wroclaw/PL (abernac@wp.pl)*

Purpose: The aim of this study was evaluation of selected white matter tracts damages in patients with Alzheimer's disease (AD) and mild cognitive impairment (MCI).
Methods and Materials: Thirty patients with AD (mean age 70 yrs, MMSE 18), 15 patients with MCI (mean age 65 yrs, MMSE 28) and 15 normal controls (mean age 68 yrs, MMSE 29.5) were enrolled in the study. All subjects underwent psychiatric examination and psychological tests. DTI examination (25 diffusion directions) was performed on 1.5 T MR scanner. Fractional anisotropy (FA) values were assessed by ROI method in middle cerebellar peduncles (MCP), inferior longitudinal fasciculi (ILF), inferior frontooccipital fasciculi, genu and splenium of corpus callosum, posterior limbs of internal capsules, superior longitudinal fasciculi (SLF) and posterior cingula (CG).
Results: In AD, significantly lower FA values (p < 0.05) were found in both ILF, IFO regions, in the left SLF and in CG compared to the control group, and only in CG compared to MCI. MCI patients showed statistically lower FA values in CG compared to normal controls.
Conclusion: DTI showed damage of selected association tracts in patients with AD (ILF, IFO, SLF and CG) and MCI (CG) when commisural, projectile and middle cerebellar tracts were preserved. DTI can be used to differentiate AD and MCI especially on the basis of FA values obtained from CG.

B-093　14:27

also EPOS

Spatial patterns of intrinsic brain activity in mild cognitive impairment and Alzheimer's disease: A resting-state functional MRI study

Z. Wang, C. Yan, C. Zhao, Z. Qi, W. Zhou, J. Lu, Y. He, K. Li; *Beijing/CN (wangzhiqun@126.com)*

Purpose: Using resting-state functional MRI, we were to investigate spatial patterns of intrinsic or spontaneous brain activity in patients with mild cognitive impairment (MCI) and Alzheimer's disease (AD).
Methods and Materials: 22 healthy elderly, 16 MCI and 16 AD subjects participated in the MRI scans. The pattern of intrinsic brain activity was measured by examining the amplitude of low-frequency fluctuations (ALFF) of blood oxygen level dependent signal during rest.
Results: There were widespread ALFF differences among the three groups in many regions. Both AD and MCI patients showed decreased activity mainly in the medial parietal lobe region, middle frontal gyrus, lentiform nucleus and cerebellum, and increased activity in the fusiform gyrus and superior frontal and parietal regions as compared to the healthy elders. Compared with MCI, the AD patients showed decreased activity in the medial prefrontal and parietal cortices, and increased activity in the medial temporal lobe region and some regions of lateral frontal and temporal cortices. Specifically, the most significant ALFF differences among the three groups appeared in the posterior cingulate cortex, with a reduced pattern from healthy elders, MCI to AD. Finally, we found cognitive performance of patients significantly correlated with ALFF changes in several regions.
Conclusion: We demonstrate for the first time that there is a specific pattern of ALFF in AD and MCI. Our results also suggest that the ALFF activity in the posterior cingulate cortex could be useful as an imaging-based marker for the diagnosis and monitoring of AD in clinics.

B-094　14:36

Cross-validation of voxel-based morphometry and automated volumetry on the example of Alzheimer's disease

L.R. Kozak, I. Gyuricza, T. Gyorke, L. Szidonya, J. Gyebnar, T. Kovacs, G. Rudas, P. Barsi; *Budapest/HU (lkozak@mrkk.sote.hu)*

Purpose: To investigate how voxel-based morphometry (VBM) and template-based automated volumetry results are related to each other, and also to correlate these measures with medial temporal lobe atrophy scoring (MTAS), and results of Mini Mental State Exam (MMSE) in Alzheimer's disease.
Methods and Materials: 20 AD patients (probable AD according to NINCDS-ADRDA) and 11 age-matched healthy controls were examined at 1.5 T with standard MRI protocol. Patients' average age was 74±11 years and their MMSE> 21 (mild dementia) at first examination. MMSE was performed at the time of MR examinations. MTAS was done bilaterally on the T2W coronal images, by expert neuro-radiologist. Automated volumetry and voxel-based morphometry was performed on 3D-MPRAGE images using SPM5. Automated volumetry consisted of brain

normalization, segmentation, gray matter parcellation according to AAL template (116 regions) and volumetric normalization to total brain volume. VBM was done using the optimized voxel-based morphometry algorithm. Group-wise comparisons and correlation analysis was performed.

Results: We found similar pattern of correlations with the two methods. The hippocampi (HC) and the temporal lobes (TL) showed the strongest correlations with MMSE, e.g. strong correlation between bilateral HC volumes and MMSE (left: r=0.7042, p < 0.001 right: r=0.6738, p < 0.001); strong correlation between MMSE and left TL volume (r=0.5976, p=0.001) and medium strong correlation on the right (r=0.4999, p=0.036).

Conclusion: Template-based automated volumetry is as efficient in describing local differences in cortical structure as VBM. In addition, while VBM is a somewhat abstract measure, automated volumetry provides a direct estimate of gray matter volume in any location.

B-095 14:45
Quantitative MR R2′ to study brain iron deposition in Alzheimer disease
W.-Z. Zhu; *Wuhan/CN (zhuwenzhen@hotmail.com)*

Purpose: To quantify brain iron levels in patients with AD using R2′ Relaxation Rate by comparison with postmortem iron concentrations, and to study the relationship between iron concentration and severity of cognitive impairment.

Methods and Materials: 30 normal volunteers, 15 AD patients and 15 age-and sex-matched healthy elderly control subjects participated in the study. All AD subjects were diagnosed as probable AD according to the criteria of NINCDS-ADRDA. All the MR images were obtained using a 1.5-T system (HDMR, GE) equipped with 8-channel phase array head coil. T2 mapping and T2* mapping were taken parallel to the AC-PC line to calculate R2′, R2′=R2*-R2.

Results: The findings demonstrate that there was a positive correlation between regional R2′and postmortem iron concentration in normal adults published by literature. In AD, brain iron level was increased in the bilateral hippocampus, basal ganglia areas, parietal cortex and dendate nucleus of the cerebellum (P < 0.05); however, no significant difference between AD and control subjects in bilateral sisubstantia nigra, red nucleus and frontal white matter. There was a strongly positive correlation between dementia and iron concentration measured in the bilateral parietal cortex and hippocampus in AD group (P < 0.05), especially the parietal cortex. The bigger the iron concentration, the severer is the recognition impairment.

Conclusion: Iron concentration of the parietal cortex can be used as a biomarker to evaluate in vivo the severity of dementia in AD subjects.

B-096 14:54
Usefulness of perfusion weighted MR imaging in the differential diagnosis of Alzheimer's disease and mild cognitive impairment
A. Zimny, P. Szewczyk, A. Czarnecka, M. Guzinski, E. Trypka, R. Wojtynska, J. Leszek, M. Sasiadek; *Wroclaw/PL (abernac@wp.pl)*

Purpose: Accurate diagnosis of Alzheimer's disease (AD) and mild cognitive impairment (MCI) is still a clinical problem. The aim of the study was to evaluate usefulness of perfusion weighted MR imaging (PWI) in the differential diagnosis of AD and MCI.

Methods and Materials: Thirty patients with AD (mean age 70 yrs, MMSE 18), 15 patients with MCI (mean age 65 yrs, MMSE 28) and 15 normal controls (mean age 68 yrs, MMSE 29.5) were enrolled in the study. All subjects underwent psychiatric examination and psychological tests. PWI was performed on 1.5 Tesla MR unit using Dynamic Susceptibility Contrast (DSC) method (i.v. contrast - 0.3 mM/kg, 5 ml/sec). Cerebral Blood Volume (CBV) measurements relative to cerebellum (rCBV) were assessed in hippocampi, temporoparietal and frontal cortices and posterior cingulate gyrus.

Results: In AD, significantly lower rCBV values (p < 0.05) were found in temporo-parietal and frontal cortices and in posterior cingulate gyrus compared to normal controls and only in cingulate gyrus compared to MCI. In MCI, significantly lower (p < 0.05) rCBV values were noticed in the left frontal cortex and posterior cingulate gyrus compared to normal controls.

Conclusion: Assessment of rCBV especially in the region of posterior cingulate gyrus can be a helpful tool in differential diagnosis of AD and MCI.

B-097 15:03
also EPOS
High resolution 3 T diffusion tensor imaging-based tractography for differential diagnosis of Parkinsonism
J. Furtner, G. Kasprian, K. Schnopfhagen, W. Pirker, D. Prayer; *Vienna/AT (julia.furtner@meduniwien.ac.at)*

Purpose: To determine whether high resolution diffusion tensor imaging (DTI)-based tractography is a reliable tool for differential diagnosis of progressive supranuclear palsy (PSP) and the Parkinsonian variant of multiple system atrophy (MSA-P).

Methods and Materials: 7 PSP and 3 MSA-P patients were included to examine the differences in connectivity of the the middle and the superior cerebellar peduncle as well as the transverse pontine fibers. Mean age and disease duration were 69 and 5 years in MSA-P and 71 and 5 years in PSP, respectively. A 3 Tesla MR-scanner was used for high resolution DTI with diffusion encoding in 32 directions and a voxel size of 2 x 2 x 2 mm. The tractography was scored visually by two blinded radiologists. Interobserver agreement was evaluated by the cohens kappa coefficient.

Results: We found that tractography in PSP showed a reduction of the superior cerebellar peduncle connectivity, which was profound in four, moderate in two and mild in one patients. Tractography in MSA-P patients showed a reduction of the middle cerebellar peduncle and the transverse pontine fibers, which was profound in two and moderate in one patient. The cohens kappa coefficient was 0.8214.

Conclusion: These results indicate that MSA-P and PSP present with a different pattern of abnormal cerebellar and brainstem connectivity, which can be visualized using high resolution DTI based tractography. Furthermore, these results suggest that high resolution DTI based tractography is a reliable and clinical feasible tool for differential diagnosis of atypical Parkinsonism.

B-098 15:12
Evaluation of basal forebrain atrophy in primary progressive aphasia using MRI
W.H. Flatz, A. Danke, N. Ackl, O. Dietrich, B. Ertl-Wagner, M.F. Reiser; *Munich/DE (radiologie.muenchen@gmail.com)*

Purpose: The objective of our study was to detect and evaluate neuron loss of cholinergic brain structures in Primary Progressive Aphasia (PPA) in vivo using image regression analysis and voxel-based morphometry.

Methods and Materials: 21 previously untreated patients suffering from Primary Progressive Aphasia and 18 healthy age-matched control subjects were examined in a prospective study. MRI was performed using a 1.5 T scanner acquiring primarily sagittal T1-weighted images (MPRAGE) and a proton weighted MRI sequence oriented perpendicular to the AC-PC-line (in-plane resolution 0.7 mm, slice thickness 3 mm). For the quantitative data analysis, we used an approach based on the combination of voxel-based morphometry and region of interest analysis (image regression analysis). Additionally, voxel-based morphometry of the cortex was applied.

Results: Significant decrease of signal intensity was found in the rostrolateral part of the magnocellular basal forebrain complex, corresponding to the location of the Nucleus subputaminalis (NSP, Ayala), in PPA patients relative to controls (p < 0.01) with an attenuated signal loss in the left NSP. The signal intensity in the anterior and intermediate part of left Nucleus subputaminalis was significantly correlated with grey matter volume loss of the left brain hemisphere, mainly in left temporal gyrii (p < 0.005).

Conclusion: Signal changes in the nucleus subputaminalis can be detected using image regression analysis based on MRI imaging. These findings may correspond to cholinergic neuron loss in nucleus subputaminalis ayala in primary progressive aphasia and may serve as a basis for future measurement of disease modifying effects of the pharmacological treatment of PPA.

B-099 15:21
Amyotrophic lateral sclerosis: Quantitative MR imaging
J. Keller, J. Vymazal, R. Jech, P. Ridzon, R. Rusina, P. Kulišták, H. Malíková, O. Keller; *Prague/CZ (jiri.keller@homolka.cz)*

Purpose: T2-hyperintensity within the pyramidal tract (mainly posterior internal capsule) and T2*-hypointensity in the motor cortex are commonly attributed to amyotrophic lateral sclerosis (ALS). Voxel-based morphometry (VBM) can prove white matter atrophy in ALS. We tested these and other MR findings in ALS patients in a quantitative way.

Methods and Materials: 31 patients fulfilling El Escorial criteria for definite ALS (mean age 61.6±8.5 (SD) years, disease duration 3-59 months) were included, 18 patients with limb-onset and 13 with bulbar-onset form of the disease. Disease severity was assessed using the ALS-FRS scale. The control group consisted of 30 healthy volunteers (59.7±10.2 years). A T2-relaxometry CPMG, T1 MP-RAGE, and 30-direction DWI sequences were employed at 1.5 T.

Results: We detected a significant increase in T2 for the frontal white matter (left p < 0.005, right p < 0.05) and for the caudate (left and right p < 0.005) in ALS patients compared to controls. No significant changes in T2 and PD were detected in the posterior part of the internal capsule. T2 in the frontal white matter correlated with age in patients and controls. VBM proved a significant correlation (p < 0.01, cluster-level adjusted) between the atrophy of the right white matter close to the central region and ALS-FRS. Correlation between FA and ALS-FRS was not detected in our data.

Conclusion: Our observation suggests that white matter atrophy may not correlate with diffusion changes, but correlates with limb component of ALS-FRS. T2 changes detected outside the motor system support the idea that ALS is a widespread neurodegenerative disease. Supported from: IGAMZCR, NS9654-4/2008, NR8491-3/2007, and NR8937-4/2006.

14:00 - 15:30   **Room N/O**

Molecular Imaging

SS 106

PET scanning vs novel MR techniques

Moderators:
F.M.A. Kiessling; Aachen/DE
S. Nazarenko; Tallinn/EE

B-100   14:00

Diffusion weighted imaging and vessel size imaging for assessment of treatment response to an anti-angiogenic therapy in a rat model of human breast cancer bone metastases

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(m.merz@dkfz-heidelberg.de)

Purpose: The aim of our study was to evaluate vessel size imaging (VSI) and diffusion weighted imaging (DWI) for early assessment of treatment effects upon anti-angiogenic therapy in experimental bone metastases.
Methods and Materials: We examined 18 nude rats bearing breast cancer bone metastases on days 30, 35, 45 and 55 after tumor inoculation in a flat panel equipped volume CT and a 1.5 T MRI scanner to measure osteolytic lesion sizes (OLS) and soft tissue components (STC) by volumetry. Treated animals (n=7) received sunitinib malate (SM) and were compared to untreated controls (n=11). HASTE sequences were used to calculate apparent diffusion coefficients (ADC) within bone metastases. T2 and T2* weighted images were acquired before and after the administration of ultrasmall supraparamagnetic ironoxide particles to determine mean vessel calibers (MVC) in skeletal lesions. All values were expressed as treatment over control ratios in percent (T/C%). For statistics, the Wilcoxon test was applied; p-values < 0.05 were considered significant.
Results: As compared to controls, animals treated with SM showed significantly reduced OLS and STC on day 45 (OLS: 35.3 T/C%; STC: 19.0 T/C%) and day 55 (OLS: 19.3 T/C%; STC: 10.5 T/C%). In animals of the treatment group, significantly increased ADCs were found on days 45 (145.5 T/C%) and 55 (148.2 T/C%) and MVCs were significantly larger from day 35 (148.7 T/C%) to day 55 (169.5 T/C%) when compared to controls.
Conclusion: MVC from VSI is a biomarker for early assessment of anti-angiogenic therapy response in experimental breast cancer bone metastases before changes in the morphology of these lesions become apparent.

B-101   14:09

The impact of 3 T whole body MRI in tumor staging: A comparison with whole-body FDG-PET/CT

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Purpose: To compare the accuracy of 3 T whole-body MRI (WBMRI) with PET/CT in staging different malignant diseases.
Methods and Materials: 60 consecutive patients with known primary tumors (colorectal, breast, kidney, lung cancer and lymphomas) underwent FDG PET/CT for tumor staging (GE Discovery ST 16). Imaging evaluation was performed for CT alone, PET + CT viewed side by side, and fused PET/CT data. WBMRI was performed with a 3 T system (Philips Achieva, Best, The Netherlands) with a body coil before and after administration of 20 ml of GD-DTPA at 2 ml/sec. Diffusion weighted imaging (DWIBS) was performed in all patients. Histopathology or clinical follow-up of 6 (± 2) month served as standards of reference.
Results: Fused PET/CT proved significantly more accurate in assessing the overall TNM stage compared to CT alone (p < 0.05), side-by-side CT + PET (p < 0.05). Diagnostic accuracy of N and M staging was not significantly different between PET/CT and WBMRI. Of all 60 patients, 54 (90%) were correctly staged with PET/CT, 42 (70%) with side-by-side CT + PET, 38 (63%) with CT alone and 52 (86%) with WBMRI. No statistically significant difference could be detected between PET/CT and CT + PET in assessing M-staging. Combined PET/CT had an impact on the treatment plan in 3 patients compared with WBMRI.
Conclusion: Dual-modality FDG-PET/CT is more accurate than CT alone and side-by-side CT + PET in staging different malignant diseases. WBMRI is an effective and fast method for staging cancer patients with similar accuracy compared with FDG-PET/CT.

B-102   14:18

Does DWI replace PET information? Evidence from computed tomography image fusion

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Purpose: To prospectively investigate the technical feasibility and diagnostic accuracy of fusion data from whole-body diffusion-weighted-imaging (wbDWI) and computed tomography (CT) for detection of metastatic malignancy with positron emission tomography (PET)/computed tomography (CT) as reference standard.
Methods and Materials: 33 patients (mean age 63±12 years; 10 women) with different malignant tumour disease were examined by PET/CT for clinical reasons and consented to undergo additional wbDWI at 1.5 Tesla. DWI was performed using a diffusion-weighted single-shot echo-planar-imaging sequence with short-tau Inversion-Recovery based fat-suppression under free-breathing. Images at b = 0 and 700 s/mm^2 were acquired and ADC maps were generated. Two radiologists independently assessed wbDWI without CT as well as wbDWI with fused wbDWI/CT images using a two-point visual scoring system to evaluate the probability of malignant tumour disease. Final diagnosis based on both methods was made by consensus of two the readers. PET/CT examinations were used as reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy for tumour detection were performed.
Results: In PET/CT, 181 malignant lesions in 30 patients were identified. Whole-body DWI/CT image fusion was technically successful and yielded diagnostic image quality in all examinations. Interobserver agreement for evaluation of wbDWI alone was κ=0.69 and for wbMRI/DWI fused images κ=0.67. Sensitivity, specificity, PPV, NPV, and accuracy of wbDWI/CT with image fusion were 81, 97, 91, 93, and 93%, respectively.
Conclusion: Whole-body DWI/CT image fusion is technically feasible in a clinical setting and allows assessment of malignant tumour disease with good sensitivity and excellent specificity.

B-103   14:27

Whole-body MRI with diffusion weighted imaging compared with whole-body FDG-PET/CT in the staging of lymphoma patients

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Purpose: The purpose of this study was to increase the knowledge using WB-MRI including WB-DWI (WB-MRI-DWI) for staging of lymphoma and to compare the results with FDG- PET/CT.
Methods and Materials: A total of 24 patients with a mean age of 47 years with histological proved malignant lymphoma (7 Hodgkin lymphoma (HL), 13 aggressive lymphoma and 4 indolent lymphoma patients) underwent both WB-MRI-DWI and FDG-PET/CT. The images were visually assessed according to designed definitions for both WB-MRI-DWI (T1WI, T2W-STIR, DWI) and FDG-PET/CT. Lymphoma staging (Ann Arbor staging system) given by each technique was compared.
Results: The staging was the same in 20 (83.3%) and different in 4 (16.7%) patients (1 aggressive lymphoma, 3 indolent lymphoma). Of the 20 patients with the same staging, 11 (55%) had stage IV by both techniques and the remaining 9 (45%) had stage I-III. No HL patients had different staging, one patient (aggressive lymphoma) had lower staging by WB-MRI-DWI compared with FDG PET/CT, and 3 patients with higher staging by WB-MRI had indolent lymphoma. All the extranodal sites (breast, thyroid, stomach, soft tissue, pleural effusion) in the non-Hodgkin lymphoma patients were detected by both techniques.
Conclusion: The WB-MRI-DWI seems accurate when compared to FDG-PET/CT in staging of aggressive lymphoma and HL. Staging given by WB-MRI-DWI seems more accurate in staging of indolent lymphoma probably due to low sensitivity of FDG-PET/CT in this type of lymphoma.

B-104   14:36

Role of diffusion-weighted MR imaging in evaluation of tumor regression grade after chemoradiation therapy for LARC: Comparison with 18 FDG-PET-CT findings

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Purpose: To assess the role of apparent diffusion coefficient (ADC) at DW-MRI in comparison with 18 FDG-PET-TC maximum standardized uptake value (SUVmax) imaging before and after chemo-radiation therapy in patients with locally advanced

rectal cancer (LARC), the histologic examination being the reference standard.

Methods and Materials: A total of 24 patients with biopsy proven primary rectal carcinoma underwent pelvic MR examination and 18 FDG-PET/CT prior and after treatment. MR scanning was performed on 1.5 T magnet (Philips Achieva) and comprised T2 Turbo Spin Echo multiplanar sequences; in addition, DW-imaging (b factor: 0 and 1000 mm²/sec) was also performed. The percentage decrease of SUV and ADC values from baseline to presurgical scan were assessed and correlated with pathologic response classified as tumor regression grade (Mandard's criteria; TRG 1=complete regression, TRG5=no regression).

Results: The primary tumor was detected in all the patients at both MR imaging and FDG-PET/CT, and after neoadjuvant therapy all patients were submitted to surgery. According to Mandard's criteria, sixteen tumors (71%) showed complete (TRG1) or subtotal regression (TRG2) and were classified as responders; eight tumors (29%) were classified as non-responders (TRG 3, 4 and5). In all patients, mean values of SUVmax in PET1 was higher than the mean value of SUVmax in PET2 (p < 0.001), whereas the mean ADC values was lower in RM 1 than RM 2 (p < 0.001), and a significant correlation of median decrease of values was found for ADC (ΔADC 70%) and SUV max (ΔSUV 67%) changes (p < 0.005). A significant correlation (linear regression) between ADC values and TRG's data was also found (p < 0.001).

Conclusion: MR with DW-images may be a complementary diagnostic tool in the follow-up of patients with LARC who underwent chemo-radiation therapy, by enabling differentiation of fibrosis from viable tumor tissue.

B-105   14:45

Whole-body diffusion-weighted MR imaging for staging patients with diffuse large B-cell lymphoma: A pilot study

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Purpose: To prospectively assess the value of whole-body diffusion-weighted (DW) magnetic resonance (MR) imaging for lesion detection and staging in patients with diffuse large B-cell lymphoma (DLBCL).

Methods and Materials: This study was approved by our institutional review board and all the patients gave their written informed consent. Fifteen patients (nine men, six women, mean age 48 years) underwent both whole-body DW MR imaging and PET/CT for pretreatment staging. Lymph node and organ involvement were evaluated by visual and quantitative image analysis, with measurement of the mean apparent diffusion coefficient (ADCmean) and maximum standardized uptake value (SUVmax). Agreement between the two imaging modalities was evaluated by calculating the kappa coefficient.

Results: A total of 296 lymph node regions in the 15 patients were available for analysis. DW MR findings matched PET/CT findings in 277 regions (94%). The agreement was excellent between the two methods (κ = 0.85, P <.0001). Eighty-two lymph node regions were positive in both modalities, with a mean ADCmean of 0.841 × 10⁻³ mm²/sec ± 0.353 (standard deviation) (range 0.431-2.523). The mean SUVmax was 9.2 ± 7.4 (range 1.5-26.3). The two modalities agreed on the presence of organ involvement on a per-patient basis in all 15 cases (100%). DW MR imaging helped to confirm hepatic involvement in one patient. Ann Arbor stages agreed in 14 patients (93%).

Conclusion: Whole-body DW MR imaging can potentially be used for lesion detection and staging in patients with DLBCL.

B-106   14:54

Whole-body DWI/MRI image fusion: Added diagnostic information and accuracy in comparison to PET/CT

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Purpose: To prospectively evaluate diagnostic accuracy of whole-body diffusion-weighted-imaging (DWI), whole-body magnetic resonance imaging (MRI), and DWI/MRI image fusion for malignant tumour detection with positron emission computed tomography (PET)/computed tomography (CT) as reference standard.

Methods and Materials: 30 patients (mean age 58±11 years; 9 women) suffering from varying gastrointestinal malignancies were examined by PET/CT, DWI, and MRI at 1.5-Tesla. Axial DWI and MRI images were acquired with a fat-signal suppressing (short-tau inversion-recovery) single-shot echo-planar-imaging sequence during free breathing and a fat signal suppressing steady state balanced gradient echo sequence, respectively. Two radiologists independently assessed DWI, MRI with and without DWI, and finally fused DWI/MRI images for the presence or absence of malignancy. PET/CT served as reference standard. Sensitivity, specificity, and accuracy were compared with McNemar-Test.

Results: PET/CT revealed 162 malignant lesions in 28 patients. Interobserver agreement for side-by-side analysis of DWI and MRI as well as for MRI/DWI fused image interpretation was good (κ=0.85; κ=0.76, respectively). Sensitivity, specificity and accuracy of DWI and MRI alone were 58, 94, 84% and 59, 97, 87%, respectively. Sensitivity, specificity and accuracy of DWI and MRI for side-by-side analysis without and with fused MRI/DWI images were 66, 96, 88%, and 71, 96, 89%, respectively. The tumour detection rate was significantly higher with additional consideration of fused DWI/MRI images compared to side-by-side analysis only (p < 0.02).

Conclusion: Whole-body DWI and MRI allows assessment of metastatic spread in patients with varying gastrointestinal malignancies. Whole-body DWI/MRI image fusion significantly improves the diagnostic accuracy in comparison to side-by-side evaluation alone.

B-107   15:03

also EPOS

Micro-MR imaging of hepatic tumors in H-ras 12V transgenic mice

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Purpose: This study was designed to evaluate characteristics of hepatic tumors in H-ras 12V transgenic mice using a 4.7 Tesla micro MR system.

Methods and Materials: Hepatocellular carcinoma (HCC) lines were established to create an insertion of the H-ras12V transgene under the control of the albumin enhancer/promoter. Six H-ras12V transgenic mice underwent T1-weighted imaging, Gd-EOB-DTPA enhanced T1-weighted imaging, and T2-weighted imaging when the mice were four, six, eight and nine months old. For imaging analysis, MR characteristics including size, number and signal intensity of tumors for each sequence were recorded. The MR images were correlated with the pathological examination findings.

Results: Four of six transgenic mice had six tumors when the animals were four months old. When all transgenic mice were six months old, all mice had liver tumors. The smallest tumor detected on micro-MR imaging was 400 μm. Of 67 tumors, 62 tumors were detected on Gd-EOB-DTPA enhanced T1-weighted images with fat saturation for mice nine months old. The majority of hepatic tumors showed high signal intensity on T1-weighted images without fat saturation and the high signal intensity was diminished on T1-weighted images with fat saturation. Pathologically, the tumors had a well-defined margin, a prominent fat component and a trabecular pattern without capsule, and the tumors were confirmed as hepatocellular adenomas (n = 32) and well-differentiated HCCs (n = 35).

Conclusion: Micro-MR imaging reflects characteristics of hepatic tumors in a live murine model. Gd-EOB-DTPA enhanced T1-weighted images are helpful to detect hepatic tumors in H-ras 12V transgenic mice.

B-108   15:12

Dynamic contrast-enhanced (DCE)-MRI for monitoring sorafenib effect on experimental prostate carcinomas

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Purpose: To investigate and quantify the anti-angiogenic effect of the multikinase inhibitor sorafenib on experimental prostate carcinomas in rats with DCE-MRI assays of endothelial permeability and tumor vascularity.

Methods and Materials: A total of 16 Copenhagen rats implanted with subcutaneous prostate carcinoma allografts (MLLB-2) were imaged at baseline and after a one-week treatment course of sorafenib via gavage by dynamic MRI at 3.0 T following enhancement with the prototype macromolecular contrast agent albumin-(Gd-DTPA). Quantitative MRI estimates of tumor microvessel permeability (endothelial transfer constant K^{PS}, 10^{-3} min⁻¹) and tumor vascularity (blood volume; %) were calculated using the PMI 0.4 software based on a two-compartment kinetic model.

Results: Sorafenib significantly suppressed endothelial permeability and blood volume in prostate carcinoma allografts over the treatment course of one week. In sorafenib-treated tumors (n=8), the transfer constant yielded a significant decrease in endothelial permeability from baseline to day 7 (K^{PS} baseline=0.62 ± 0.20, K^{PS} day 7=0.08 ± 0.09; p < 0.01). The blood volume in sorafenib-treated tumors decreased significantly over the treatment course (BV baseline=5.1 ± 1.0, BV day 7=0.56 ± 0.48; p < 0.01). No significant alteration of endothelial permeability or tumor vascularity was observed in the control group (n=8).

Conclusion: Sorafenib, a known inhibitor of angiogenesis in renal and liver cancer, significantly reduced endothelial permeability and tumor vascularity in a prostate cancer model as assayed by dynamic MRI enhanced with macromolecular contrast media. Pending further investigations, DCE-MRI enhanced with macromolecular contrast media may prove as a valuable tool for monitoring the anti-angiogenic effect of sorafenib on an individual patient basis.

B-109 15:21

Macromolecular versus small molecular MRI contrast media for monitoring anti-angiogenic drug effect of bevacizumab on experimental human melanoma xenografts

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Purpose: To compare macromolecular (MMCM) versus small molecular contrast media (SMCM) for their suitability to monitor anti-angiogenic effect of bevacizumab on experimental human melanoma xenografts in dynamic tandem MRI assays of endothelial permeability with consecutive application of MMCM and SMCM in the same experiment.
Methods and Materials: Subcutaneous human melanoma xenografts (MDA-MB-435) were implanted into 12 athymic rats and imaged by dynamic contrast-enhanced MRI at 2.0T. Measurements of endothelial permeability were performed using the MMCM prototype albumin-(Gd-DTPA)$_{35}$ with a molecular weight (MW) of 92 kDa rats followed by an injection of the SMCM Gd-DTPA with a MW of 0.6 kDa in the same experiment. Rats were imaged at baseline and 24 h after a single dose intraperitoneal injection of bevacizumab (1 mg) to generate quantitative MRI estimates of tumor microvessel permeability (K^{PS}; µl/min·100 cm³) using a 2-compartment kinetic model.
Results: Tumor endothelial permeability, assayed as the endothelial transfer coefficient K^{PS} decreased significantly (p < 0.05) from baseline to 24h after treatment using the MMCM albumin-(Gd-DTPA)$_{35}$ (31.5±14.7 vs. 0 µl/min·100 cm³). No significant effect on tumor endothelial permeability was detected in the second part of the experiment when using the SMCM Gd-DTPA for enhancement (13,000±6,900 vs. 19,300±5,500 µl/min·100 cm³, p> 0.05).
Conclusion: In tandem MRI assays of endothelial permeability, the MMCM albumin-(Gd-DTPA) showed to be superior to the SMCM Gd-DTPA for the detection of early anti-angiogenic effect of bevacizumab on experimental melanoma xenografts. In dynamic contrast-enhanced MRI assays of endothelial permeability, the molecular weight of the applied contrast agent seems to be of pivotal importance.

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

Cardiac

SS 103

Dose saving in cardiac CT

Moderators:
I. Mastorakou; Athens/GR
C. Saraiva; Lisbon/PT

B-110 14:00

New approach to cardiac CT using high pitch protocols

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Purpose: To evaluate high-pitch cardiac CT-protocols and to measure radiation dose and image quality both in an Alderson phantom and in a group of patients.
Methods and Materials: An Alderson Rando phantom was equipped with thermoluminiscent detectors and a cardiac CT scan was simulated using 1. high pitch protocol (Siemens Somatom Definition Flash; 2 x 100 kVp, pitch 3.4), 2. prospectively triggered scan (100 kVp, 128 x 0.6 mm, pitch 1.2;) and 3. retrospectively gated scan (100 kVp, XX mAs; ECG pulsing interval: 30-80% of R-R cycle, pitch 0.3). mAs settings were adjusted to achieve similar image noise in all three protocols. Effective radiation dose was calculated for all three scan types. 78 patients were examined with either of these protocols, depending on the heart rate: High-pitch protocol: 33 patients with regular heart rates < 65 bpm; prospective triggering: 29 patients with regular heart rates > 65 bpm; retrospective gating: 16 arrhythmic patients. Coronary arteries were assessed on a per-segment-basis as diagnostic or non-diagnostic.
Results: The dose determined with TLD measurements amounted to 1.21, 3.12 and 11.82 mSv, respectively, for the high pitch, the prospectively triggered and the retrospectively gated scan. The percentage of motion-free coronary artery segments was 98.6, 92.9 and 92.1%, respectively, for the three protocols.
Conclusion: High pitch scans for the coronary arteries lead to a high image quality of coronary artery segments, when used in patients with stable heart rates below 65 bpm. Compared to prospective triggering and retrospective gating, 61 and 90% of the dose can be avoided, respectively.

B-111 14:09

Reduction of the biological dose in coronary CT angiography using high-pitch spiral data acquisition with prospective ECG-triggering

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Purpose: The purpose of this study was to compare the effect of high-pitch spiral data acquisition with prospective ECG-triggering on the biological X-ray effects with commonly used low-pitch spiral scans.
Methods and Materials: Blood samples were obtained from 34 patients undergoing coronary CTA either using high-pitch spiral data acquisition (n=15; dual-source CT scanner, 38.4 mm collimation, 100-120 kV, 320-456 mAs/rot, pitch 3.2-3.4) or using a low-pitch protocol (n=19; dual-source CT scanner, 19.2 mm collimation, 120 kV, 330-438 mAs/rot, pitch 0.2-0.39, ECG-based tube current modulation). Blood lymphocytes were isolated, stained against the phosphorylated histone variant γH2 AX, and DNA double-strand breaks (DSBs) were visualized using fluorescence microscopy. Radiation dose to the blood was estimated by relating in vivo DSB levels to values of in vitro irradiated (50 mGy) blood samples.
Results: Total dose length product ranged from 101 to 237 mGy*cm in high-pitch and from 524 to 1283 mGy*cm in low-pitch scans (p < 0.0001). The median DSB level 30 minutes after exposure was significantly lower after high-pitch (0.04 DSBs/cell, range 0.02-0.10 DSBs/cell) compared to low-pitch scans (0.39 DSBs/cell, 0.22-0.71 DSBs/cell, p < 0.0001). Both DSB levels and radiation dose to the blood showed a significant correlation to the dose length product (r=0.82, p < 0.0001). The radiation dose to the blood was significantly reduced in the high-pitch (median 3.1, range 2.0-8.1 mGy) compared to the low-pitch group (median 26.9, range 14.2-44.9 mGy, p < 0.0001).
Conclusion: Prospectively ECG-triggered high-pitch spiral data acquisition can considerably reduce the biological X-ray effects in coronary CTA as compared to low pitch protocols.

B-112 14:18

also EPOS

Impact of CT images on clinical outcome of patients scheduled for catheter ablation of atrial fibrillation

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Purpose: To determine the impact of Computerized Tomography (CT) image integration into a 3D- mapping system on the clinical outcome of patients undergoing to Catheter Ablation for Atrial Fibrillation (AF).
Methods and Materials: 124 patients with AF underwent to CA. Ablation was guided by CT images integration in a 3D system in 80 (65%) patients while in 44 (35%), the procedure was performed without CT study. CA was considered successful if post procedure synus rhythm was noted in a 6 months follow-up period. All complications related to the cardiac structures and having reference to the procedure were registered.
Results: Arrythmia recurrence was lower in the CT group (34 vs 41%; P < 0.01). A significant reduction in fluoroscopy time was demonstrated in the CT group (CT group: 49 ± 27 min; 3D: 62 ± 20 min, P=0.03). The atrial characteristic most frequently associated with procedure failure resulted as significant atrial dilatation (> 110 ml; 90% of patients with AF recurrence) and the presence of a subtle (< 2.5 mm width) appendage ridge (55% of pts with AF recurrence). The number of complications was significantly lower among patients undergone to a preliminary CT (2.5 vs 23% p < 0.01). Most frequent problems were pericardial effusion (6%) and pulmonary vein ostia stenosis (4%).
Conclusion: CA guided by CT integration is associated with reduced fluoroscopy times, higher rate of procedure success compared with procedures performed without CT. CT can significantly lower the complications rate and can depict some atrial characteristic suggestive of post procedure atrial fibrillation recurrence.

B-113 14:27

also EPOS

Low-dose 320-row volume CT coronary angiography: Comparison of new "sub-mSv" and full-dose protocols

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Purpose: To assess the diagnostic possibilities and image quality of two scanning protocols: 120 and 100 kV prospective ECG-gated.
Methods and Materials: Coronary CT angiography with two different protocols was acquired from 70 patients (51 males, 19 females, 57.2±12.8 years, (BMI) 26.1±8.3). Patients were scanned on 320-detector row Volume CT scanner (Aquilion ONE). Scan parameters: Volume scan mode, gantry rotation 0.35 s, scan coverage

10-16 cm, prospective ECG-gating. For the first protocol, tube voltage was set to 120 kV and tube current 450 mA; for the second protocol, 100 kV and 200-570 mA (depending on BMI). Intravenous of 60 ml contrast medium (350 mgI/ml) with rate 5 ml/s was used. The density measurements (image noise, signal-to-noise ratio (SNR)) in aorta, LV, LM, proximal, middle and distal segments of LAD, CX and RCA, and radiation dose were calculated.

Results: Decrease of vessel density from proximal to distal segments CA without increasing of image noise and SNR for 120 kV protocol but with increasing SNR in distal segments for 100 kV protocol (for LAD SNR was 23.3±8.9 in proximal segments, 11.2±5.2 in distal, p < 0.001; for CX and RCA p=0.01). In 42% patients, no coronary artery lesion, 37% are non-significant stenotic lesions (< 50%), 21% with significant stenosis (> 50%). The mean radiation dose was 5.2±1.8 mSv for 120 kV protocol and 0.8±0.2 mSv for 100 kV protocol.

Conclusion: Reducing the tube voltage, BMI-dependent tube current and precise scan coverage detection reduce dramatically the radiation dose without significant image quality changes.

B-114 14:36

Low-dose CT coronary angiography with prospective ECG triggering: Feasibility in a large unselected population

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Purpose: Prospective electrocardiogram-triggering dramatically reduces radiation exposure for CT coronary angiography (CTCA) but requires heart rate control to obtain diagnostic image quality. The feasibility of prospectively electrocardiogram-triggered CTCA in daily clinical routine has therefore remained a controversially discussed issue. Our objective was to assess the feasibility of prospective electrocardiogram-triggering for achieving low dose CTCA in a large population.

Methods and Materials: We evaluated 612 consecutive patients referred for CTCA on a 64-slice CT scanner. Intravenous metoprolol (5-25 mg) was administered if necessary to achieve a target heart rate below 65 bpm. Radiation dose exposure was estimated based on the dose-length product. Image quality was assessed on a semi-quantitative four-point scale for each coronary segment.

Results: Forty-six (7.5%) patients deemed ineligible due to irregular heart rhythm (n=19), insufficient response to metoprolol (n=21), renal insufficiency (n=3), or inability to follow breath-hold commands (n=3). CTCA was successfully performed in 566 patients (BMI range 18-49 kg/m²), resulting in a mean effective radiation dose of 1.8±0.6 mSv (range 0.8-4.0 mSv) with a diagnostic image quality in 96.2% of segments. Intravenous metoprolol was used in 64.4% of patients. Incidence of non-diagnostic segments was inversely related to heart rate (r = -0.809, p < 0.001). Below a heart rate of 62 bpm - a cut-off determined by receiver operator characteristic curve - only 1.2% of coronary segments were non-diagnostic.

Conclusion: Low-dose CTCA by electrocardiogram-triggering is feasible in the vast majority of an every-day population. However, heart rate-control is crucial, as a heart rate of 62 bpm or below is favourable to achieve diagnostic image quality.

B-115 14:45

Small field of view at coronary CT angiography in step-and-shoot-mode at 256-slices CT: Effect on image quality, z-range and radiation exposure

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Purpose: To evaluate effect of a small vield of view at step-and-shoot CTCA technology with a wide detector on craniocaudal z-coverage per step, image quality and individual radiation exposure.

Methods and Materials: 52 consecutive patients underwent prospective ECG-gated coronary CT angiography at a 256 slices CT scanner (Brilliance iCT, Philips) using a standard step-and-shoot- data set of the heart (mean FOV 360 mm±45) and an alternative step-and-shoot-protocol with a mean FOV 239 mm±18. Craniocaudal z-coverage was defined in coronary reconstructions of raw data set. Image noise, signal-to-noise ratio and qualitative image parameters were assessed. Individual radiation dose exposure was estimated from the dose length product.

Results: Overall contrast opacification of the coronary arteries was considered to be excellent in both groups without significant differences and mean Hounsfield units of 296 and 329, respectively. Diagnostic image quality was achieved with both protocols in 91% (normal FOV) and 93% (small FOV) of coronary arterial segments. A smaller FOV leads to an increase of craniocaudal coverage of one CT scan step with reduction of the overlapping volume (r=-0.8788; p ≤ 0.0001). Radiation dose was significantly lower (p < 0.05) using a small FOV with 229 vs. 280 mGy*cm, respectively.

Conclusion: A small axial FOV in a step-and-shoot-protocol for CTCA with a wide detector CT leads to an increased z-coverage due to reduced overlap between single adjacent axial scan volumes. Consecutively, only two scan shots are necessary to image cardiac anatomy. Radiation exposure is effectively reduced without negative impact on diagnostic image quality.

B-116 14:54   also EPOS

Prospective versus retrospective ECG-gated dual-source CT for evaluating coronary stent: Comparison of image quality, diagnostic accuracy, and radiation dose

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Purpose: To compare the image quality, diagnostic accuracy and radiation dose in groups of patients who underwent stent implantation with prospective and retrospective ECG-gated Dual source CT (DSCT).

Methods and Materials: Sixty consecutive stent implantation patients (heart rates ≤70 bpm) who were scheduled for following up with conventional coronary angiography (CA) were referred for DSCT angiography. All patients were divided into two groups randomly (30 cases per group), and received either prospective or retrospective ECG-gated DSCT angiography separately. Effective radiation dose of two methods were calculated and compared. The image quality was estimated by two independent radiologists according to the score grading system, and the diagnostic accuracy for evaluating stent lumen was compared between CT angiography and conventional CA.

Results: There was no significantly difference in image quality between the two groups, and it demonstrated that 86.4% (51/59) stents with interpretable images in the prospective group, and 87.5% (49/56) in the retrospective group (P> 0.05). Comparative diagnostic accuracy were observed in prospective and retrospective CT angiography (the per-stent based sensitivity, specificity, positive and negative predictive value were 94.4 vs. 100%, 86.8 vs. 84.1%, 77.3 vs. 68.2%, and 100 vs. 97.1%, respectively). As for the average effective radiation dose, there was significant less in the prospective group than retrospective group (2.2±0.5 vs. 14.6±3.3 mSv, P < 0.01).

Conclusion: The prospective ECG-gated DSCT angiography could reduce effective radiation dose than that of retrospective method for evaluating coronary stent implantation, while maintaining image quality and comparative diagnostic accuracy in patients with heart rates ≤70 bpm.

B-117 15:03

Systolic acquisition of coronary dual-source computed tomography angiography: Feasibility in an unselected patient population

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Purpose: To determine the practicability and potential dose saving of an cardiac imaging algorithm incorporating a pulsing scheme applying systolic data acquisition in heart rates > 75 bpm using Dual-Source Computed Tomography (CT).

Methods and Materials: Consecutive patients clinically referred for coronary CTA underwent cardiac CTA using either a diastolic pulsing window (30-70%) or a narrow systolic pulsing window (150 ms at 250 ms) in heart rates > 75 bpm. Independent investigators determined image quality (1: Excellent to 5: unreadable) and effective radiation exposure was compared.

Results: Among all 101 subjects (mean age: 62±2 years, 59% male), the predicted decrease in the best reconstruction interval for diastolic phases was 12 ms per one bpm (95%-confidence interval: -13.5 to -11.2) and -1.9 ms for systolic phases (95%-CI: -3.2 to -0.62, p=0.004), independent of age, gender and BMI. The systolic pulsing strategy resulted in a significantly lower radiation exposure (4.97±2.3 vs. 9.38±5.5 mSv, p < 0.001 for systolic vs. diastolic, respectively), whereas there was no difference with respect to image quality or heart rate (p=0.65 and 0.74, respectively).

Conclusion: Our results suggest that a systolic window for tube current modulation represents a reliable tool to ensure high image quality at a significantly lower effective dose in patients undergoing routine cardiac CTA.

B-118 15:12

Diagnostic accuracy of dual-source CT for the assessment of coronary artery stenosis: Head-to-head comparison of the high pitch and the step-and-shoot mode

L.M. Desbiolles, P. Stolzmann, S. Baumüller, R. Goetti, G. Feuchtner, A. Plass, B. Marincek, H. Alkadhi, S. Leschka; *Zurich/CH* (lotus.desbiolles@usz.ch)

Purpose: To investigate the diagnostic accuracy of two low radiation exposure protocols for second generation dual-source coronary CT angiography (CCTA) for the diagnosis of significant coronary stenoses in comparison with catheter angiography (CA).

Methods and Materials: 100 patients underwent CCTA and CA. Patients with heart rates (HR)> 70 bpm and/or body mass index (BMI)> 30 kg/sqm were excluded. Patients were randomly assigned to two different low radiation exposure CCTA protocols (each 100 V/320 mAs): In group A (n=50), CCTA was performed in a prospectively ECG-gated step-and-shoot mode (SAS); in group B (n=50) CCTA was performed in an ECG-gated high-pitch mode (HP; pitch 3.4). All coronary segments were evaluated by two independent observers as depicted with diagnostic image quality or not and for the presence of substantial coronary stenosis. CA served as the standard of reference.

Results: There was no significant difference in age (p=0.72), BMI (p=0.41), and HR (p=0.66) between both groups. Diagnostic image quality was obtained in 98.4% (651/660) of segments in group A and in 98.9% (642/649) in group B. Sensitivity, specificity and positive and negative predictive values were 90, 97, 78 and 99% per segment and 94, 91, 85 and 97% per patient in group A; and 90, 98, 82 and 99% per segment and 94, 93, 89 and 97% per patient in group B. The effective radiation dose was 1.4±0.4 mSv in group A and 0.9±0.1 mSv in group B.

Conclusion: CCTA in the HP mode provides similar image quality and diagnostic accuracy for the assessment of coronary artery stenosis as the SAS mode at a radiation exposure reduction of 36%.

B-119   15:21

Sub-millisievert coronaries: Scan protocol selection, image quality, and patient dose in the first 85 coronary scans on a new dual source CT scanner

K.-T. Ho, C. Panknin; *Singapore/SG (kheng_thye_Ho@ttsh.com.sg)*

Purpose: Last year, a dual source CT scanner was introduced which offers a new coronary scan mode: A spiral scan with a high pitch of 3.4 [Flash] acquires the entire heart in ¼ of a second. We developed an algorithm for scan protocol selection, and evaluated the first 85 consecutive coronary scans for diagnostic quality and patient dose.

Methods and Materials: 85 consecutive patients (53 ± 11 years) referred for coronary imagings were scanned on the Somatom Definition Flash, Siemens Healthcare, Germany. All eligible patients were administered beta blockers to reduce the heart rate to below 65 bpm, and scanned with the Flash mode. Patients who could not tolerate or did not respond to beta blockers, but had a reasonably regular heart rate, were scanned with an axial/sequential scan mode. Patients with a high and irregular heart rate were scanned with a retrospectively gated spiral mode. All scans were evaluated for image quality, and the patient dose was recorded.

Results: All scans yielded diagnostic image quality for clinical patient management. 83 patients were scanned using the Flash scan mode, receiving an average dose of 0.90±0.39 mSv. The patient who was scanned with an axial scan mode received 1.6 mSv. The patient who had to be scanned with a spiral scan mode received 3.6 mSv.

Conclusion: The Flash scan mode yielded consistent diagnostic quality imaging of coronaries at a sub Millisievert dose. 98% of our patients were eligible for imaging with the Flash scan mode.

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

Interventional Radiology

SS 109

Musculoskeletal and biliary interventions

Moderators:
P. Almeida; Coimbra/PT
X. Buy; Strasbourg/FR

B-120   14:00

Height reconstruction and kyphotic angle correction in ultra high viscosity cement radiofrequency (RF) kyphoplasty

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Purpose: To evaluate whether the new ultra high viscosity cement kyphoplasty allows significant height reconstruction and kyphotic angle correction in osteoporotic fractures.

Methods and Materials: 20 kyphotic osteoporotic fractures (14 patients) were treated with RF kyphoplasty (DFine Inc., USA). Pre treatment X-ray, CT and MRI were obtained. RF kyphoplasty was performed under bi-planar X-ray guidance. Mean cement deposition was 5 cc. Post treatment X-ray and CT were obtained. Anterior vertebral height and kyphotic angle were measured. Wilcoxon rank sum test was performed.

Results: Measurable height reconstruction and kyphotic angle correction was achieved in 10/20 (50%) fractured vertebrae. Mean anterior height reconstruction was 4 mm (p < 0.002), mean kyphotic angle correction was 5.6° (p < 0.002).

Conclusion: RF kyphoplasty with ultra high viscosity cement facilitates significant height reconstruction and kyphotic angle correction in osteoporotic fractures.

B-121   14:09

also EPOS

Quantitative discomanometry: Correlation of intradiscal pressure values to pain reduction in patients with intervertebral disc herniation treated with percutaneous decompression

D.K. Filippiadis, A.D. Kelekis, D. Mavraganis, O. Papakonstantinou, E. Brountzos, N.L. Kelekis; *Athens/GR*

Purpose: To illustrate quantitative discomanometry's (QD) diagnostic efficacy and predictive character for discogenic pain evaluation through a prospective study that correlates intradiscal pressure values to pain reduction post intervertebral disc decompression (PDD).

Methods and Materials: During the last 3 years, QDs were performed on 34 patients with intervertebral disc hernias just prior to PDD. Under absolute sterilization and fluoroscopy control a mixture of normal saline:contrast medium (3:1) was injected at constant rate with a discmonitor which records volume and pressure values producing the relative P-V curve. Following QD, PDD was performed. Pain reduction and mobility improvement were recorded on 3, 12, 24 months with clinical evaluation and a Visual Analogue Scale (0-10 units) questionnaire.

Results: Mean value of Po (initial pressure required to inject 0.1 ml of the mixture inside the disc) was 20.5±18.5 psi, of Pmax (highest pressure value on the curve) was 76.6±46.8 psi, of Pmax-Po was 56.1±36.9 psi and of maximum injected volume (Vmax) was 2.8±2 ml. Mean values of pain were 7.5±1.9 VAS units prior to PDD, 2.9±2.4 VAS units at 3 months, 1.0±1.9 VAS units at 12 months and 1.0±1.9 at 24 months post PDD. Patients with > 75% (> 7 VAS units) pain reduction presented on QD a Vmax of 2.4±1.4 (p=0.045), a Pmax < 65 psi (p=0.018) and Pmax-Po < 47 psi p=0.038). No complication was noted.

Conclusion: QD is an efficient diagnostic technique for discogenic pain evaluation which might serve as a useful tool for proper patient selection concerning surgical or minimal invasive techniques for hernia's decompression.

B-122   14:18

Efficacy of percutaneous interspinous spacer in the treatment of neurogenic intermittent claudication due to lumbar spinal stenosis: Preliminary experience

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Purpose: Lumbar spinal stenosis (LSS) is a narrowing of the spinal canal: LSS degenerative type usually affects people aged over 50 years and causes several symptoms, in particular neurogenic intermittent claudication (NIC). The aim of this study is to provide the efficacy of a totally percutaneous interspinous spacer.

Methods and Materials: Fifteen patients (mean age 63.67±11.15, range 43-78) with NIC due to LSS were selected for implantation of percutaneous interspinous spacer. Diagnosis was confirmed by conventional X-ray, CT and MRI. Each procedure was performed using an Aperius PercLID system (Kyphon Medtronic). All devices were implanted under fluoroscopic guidance and with local anesthesia. Clinical evaluation and assessment of pain by mean of an Oswestry Disability Index (ODI, 0-100) test was performed before and one month after the procedure. We carried out also CT and MRI checks at one and six months.

Results: A total of 15 intervertebral spaces were treated in the 15 patients enrolled in the study. Baseline main ODI index was 49.98±23.49 while 1 month after procedure was 20.69±15.49 (p < 0.01, t-test). The 26.67% of patients reported no improvement 1 months after implantation, two patients (13.33%) poor improvement and nine patients (60.00%) good response (ODI score reduction => 50%), while 33.33% of patients were still on analgesic drugs (compared with 86.67% before treatment). No intraprocedural side effects, and one dislocation were reported after three days.

Conclusion: Implant of percutaneous interspinous spacer is an effective and safe procedure in reducing neurogenic intermittent claudication in patients with lumbar spinal stenosis.

B-123 14:27

Frequency and outcome of pulmonary polymethylmetacrylate embolism and local cement leakage during CT-fluoroscopy guided vertebroplasty in tumor patients

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Purpose: To evaluate the frequency and outcome of pulmonary polymethyl-metacrylate (PMMA) embolism and local leakage during CT-fluoroscopy guided vertebroplasty of tumor patients.
Methods and Materials: During 12/2001-06/2009, 332 vertebrae with painful osteolyses or pathologic fractures were treated with percutaneous vertebroplasty (PV) in 232 patients (96 men; 136 women; 62±12 y) under conscious sedation. Both, needle placement and PMMA injection were monitored under intermittent and continuous CT-fluoroscopy (120 kV; 15-25 mA; single slice and 4-/16-/128-row MDCT), respectively. Patients having undergone conventional radiography (CR) or computed tomography (CT) of the chest after PV due to their underlying tumor disease were selected for this retrospective study. Presence and location of PMMA pulmonary embolism were evaluated by two readers. CT scans of the spine performed after PV were analyzed with respect to local cement leaks (intradiscal, paravertebral, intraspinal, needle pathway). Patient charts were reviewed for clinical follow-up.
Results: 155/232 patients (66.8%) treated in 221 vertebrae had undergone chest imaging (66 CR/89 CT; median time interval: 20 d) after PV. 12 patients (7.7%) showed peripheral PMMA embolisms (10 upper, 4 lower, 3 middle lobe). Mean injected cement volume in patients without/with PMMA embolism was 3.8±1.5/3.2±0.7 ml, respectively. 160 local PMMA leaks were detected in 125/221 vertebrae (56.6%). Ratio of intradiscal, paravertebral, intraspinal and needle pathway leaks was 34.4/31.2/26.9/7.5%. Percentage of basivertebral/segmental vein leaks was 20.6/25.6%. All patients remained asymptomatic during 1-year follow-up.
Conclusion: Given a high local cement leakage rate detectable with CT, PMMA embolism during CTF guided PV of tumor patients is an infrequent complication without clinical consequences.

B-124 14:36

Impact of CT guided bone biopsy on treatment choice in patients with breast cancer metastases

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Purpose: Treatment of metastatic breast cancer is based upon the tumor receptor status. Little is known about changes in estrogen (ER), progesterone (PR) and HER2 receptor from primary to metastatic cancer. We evaluated the impact of computed tomography-guided biopsy of bone metastases on treatment choice.
Methods and Materials: Seventy-six patients with bone metastases were assessed with a CT-guided bone biopsy. ER, PR and HER2 status of these samples were assessed and compared with primary breast cancer.
Results: Fourteen samples were not diagnostic. A discordance for ER was seen in thirteen patients (21%): three (4.8%) showed a change from receptor negative primary tumor to an ER-positive metastasis, while ten patients (16.2%) switched from ER-positive to ER-negative. The PR expression changed in 26 patients (42%): two (3.2%) from negative in the primary tumor to positive in the metastasis, whereas twenty-four (38.7%) switched from positive to negative. Her2 status was evaluated only in forty-eight patients (77.5%), and sixteen (33.3%) showed changes: three (6.3%) changed Her2 status from positive to negative and in thirteen (27%) vice-versa. Three (3.9%) patients had complications: a retroperitoneal hematoma that required a night of hospitalization and two episodes of neurological impairment due to analgesia that disappeared after four hours of clinical observation.
Conclusion: This study showed a significant receptor discordance rate between primary and bone metastatic tumors. Bone biopsy is a safe and a well-tolerated way to obtain tissue to reassess the receptor status. This can lead to the best treatment option in patients with metastatic breast cancer.

B-125 14:45

CT-guided oxygen-ozone chemiodiscolysis: One-year follow-up in different types of disc disease

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Purpose: Oxygen-ozone (O_2-O_3) chemiodiscolysis is a simple procedure for the treatment of degenerative disc disease. Indications are not clearly codified. Our aim is to compare the results of chemiodiscolysis in in all types of disc disease in order to optimize the indications.

Methods and Materials: We reviewed all O_2-O_3 chemiodiscolysis performed in our institution from June 2005 to June 2008. Characteristics of disc disease were retrospectively reviewed with a RIS-PACS system and classified according to the international nomenclature; discography was not performed. All patients completed Oswestry pain questionnaire at the moment of intervention, 6 months and one year. Pain improvement for each type of disc disease was assessed and results were compared.
Results: Results from 295 procedures were evaluated. We excluded post-operative patients. Follow-up data of 257 patients were available: 98 extrusions (10 with free fragment), 79 protrusions, 38 bulging, 42 cases of disc disease associated with severe spondylosis. At one year, clinical success was 86% in extrusions, 83% in protrusions, 40% in bulgings and 59% in the spondylosis group. No significant difference was observed between extrusions and protrusions. A significant difference was present for bulging discs and severe spondylosis. The use of NSAIDS decreased in 75% of patients.
Conclusion: O_2-O_3 chemiodiscolysis is effective. Best results are observed in isolated extrusions or protrusions without severe spondylosis; results in bulging discs were usually weak. Disc extrusion is not a contraindication. Accurate patient selection is important to improve results.

B-126 14:54

Effect of percutaneous vertebroplasty upon changes in load distribution during standing and walking situations: Clinical experience and preliminary results

D.K. Filippiadis, A.D. Kelekis, T. Spyridopoulos, C. Vergadis, E. Brountzos, N.L. Kelekis; *Athens/GR*

Purpose: To illustrate the effect of percutaneous vertebroplasty (PV) upon changes in load distribution between the two feet during standing and walking situations of patients with vertebral fractures.
Methods and Materials: During last year, 30 patients (mean age 75±15 years) with vertebral fractures were prospectively evaluated on an electronic baropodom-eter (150 cm length). Load distribution between right and left foot during standing and walking was recorded and compared prior and the day after PV with the use of Matched-pairs and Signed-Ranks (T test). Under anesthesia and fluoroscopic control, PV was performed with the use of 11-13G needles and PMMA was injected inside the vertebral bodies. Computed tomography scan assessed implant position and distribution post treatment.
Results: Mean value of load distribution difference between right and left foot prior to percutaneous vertebroplasty was 6.35% upon standing and 14.6% upon walking. Mean value of load distribution difference between right and left foot the day after PV was 4.62% upon standing and 10.4% upon walking. Comparison between these data presented a mean value of 1.73% (p < 0.09) for standing (passive) and a mean value of 3.86% (p < 0.05) for walking (dynamic) situations.
Conclusion: Effect of percutaneous vertebroplasty upon load distribution is statistically significant (p=0.05) during dynamic (walking) situation. The instability factors which accompany and are responsible for the dynamic nature of walking constitute equilibrium more difficult for patients with painful vertebral fractures. PV apart from the already known effect upon pain reduction seems to be efficient on the improvement of equilibrium as well.

B-127 15:03

A comparative analysis of PTFE-covered and uncovered stents for treatment of malignant extrahepatic biliary obstruction

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Purpose: To compare the efficacy and safety of PTFE (polytetrafluoroethylene)-covered and uncovered stents in patients with malignant extrahepatic biliary obstruction.
Methods and Materials: From March 2006 to December 2008, 59 consecutive patients who underwent PTFE-covered stent placement were prospectively studied. These data were compared with data obtained by retrospectively studying 58 consecutive patients who underwent self-expanding uncovered stent placement from March 2003 to February 2006.
Results: According to the Kaplan-Meier analysis, the cumulative stent patency of covered stents (median, 544 days; 95% CI, 458-631 days) was statistically higher than that of uncovered stents (median, 403 days; 95% CI, 310-495 days) (p=0.026). There was no significant difference in the patient survival (p = 0.256), with median survival being 140 days (95% CI, 110-170 days) in the covered stent group and 166 days (95% CI, 140-192 days) in the uncovered stent group. The two groups also did not significantly differ in terms of complication rate (p = 0.717), with 8.5% (5/59) in

the covered stent group and 5.2% (3/58) in the uncovered stent group. Two patients in the covered stent group developed stent migration compared with no patient in the uncovered stent group, with this difference being not significant (p = 0.496).

Conclusion: PTFE-covered stents were significantly superior to uncovered stents in terms of patency for treatment of patients with malignant extrahepatic biliary obstruction. In addition, there was no significant difference in patient survival and complication rate between the PTFE-covered and uncovered stent group.

B-128   15:12

Cutting balloon angioplasty and simultaneous percutaneous large profile multiple plastic stents for biliary anastomotic strictures after liver transplantation

F. Boyvat, U. Ozyer, A. Harman, C. Aytekin, M. Haberal; *Ankara/TR (boyvatf@yahoo.com)*

Purpose: To evaluate the management of biliary anastomotic strictures with simultaneous multiple percutaneous plastic stents for complicated liver transplants.
Methods and Materials: Between 2001 and 2009, 239 liver transplantations (192 living donor, 47 cadaveric) were performed at our centre. 7 patients with recurrent biliary anastomotic stenosis in whom prior balloon dilation and single plastic stent placement had failed and 11 patients with biliary anastomotic strictures with no previous intervention were included in this study. The patients were 11 females and 9 males, ages ranged from 4 to 62 years (mean age: 27). Percutaneous biliary drainage was performed then, 2 to 3 times, sequential dilation with cutting and conventional balloon was performed, then, two plastic stents were placed percutaneously through one tract (percutaneous tracts were between 8 and 14 F). The size of the two plastic stents were 16 F (n=5), 20 F (n=10), 24 F (n=3) and 28 F (n=1).
Results: The median indwelling stent period was 4.8 months (10 days-8 months). In three patients, plastic stents were removed endoscopically at 10 days, 3 months and 4 months because of cholangitis. In 12 patients, no cholangitis or obstruction were observed and stents removed at 6 months. Stent free follow-up of these patients were 11 months. In 4 patients, internal stents are still present without any obstruction.
Conclusion: This technique enables large profile internal stent placement through a single small percutaneous hole. This technique has a high success rate and decreases the number of interventions and also the cost of the procedure.

B-129   15:21

Comparison of the short-term effect of percutaneous transhepatic biliary drainage by one and two catheters in the type II~IV malignant hilar bile structions

J. Mao; *Guangzhou/CN (herodoc@sina.com)*

Purpose: To compare the short-term effect of PTBD by one with two catheters in patients with type II~IV MHBS.
Methods and Materials: The data of 79 patients with type II~IV MHBS undergoing PTBD were analyzed. One catheter (group A) or two catheters (group B) were used for draining. Drainage was defined as clinically effective if serum bilirubin decreased by greater than 30% in a week. All the patients were divided into two layers according to stricture classification, and the influence of PTBD by one catheter and two catheters were compared, respectively.
Results: PTBD was clinically effective in 59 of the 79 patients, ineffective in 20. There were no statistically significant differences in the baseline characteristics (such as sex, mean age, type of hilar structure, hepatocirrhosis, and so on) between the groups A and B. There were no statistically significant differences in the short-term effect between the two different draining methods in both type II and type III~IV (P value was 0.069 and 0.722, respectively). The layer OR value was 5.429 and 1.364. There was no statistically significant difference in the short-term effect between the two different draining methods after excluding the contribution of the layer factor ($\chi2$ =3.136, P=0.074).
Conclusion: The short-term effect of PTBD to the patients with type II~IV MHBS has nothing to do with the use of one or two catheters.

Friday, March 5

10:30 - 12:00   Room B

Musculoskeletal

SS 410

Shoulder and upper limb

Moderators:
M. Bachmann Nielsen; Copenhagen/DK
S.H. Khan; Blackburn/UK

B-130   10:30

Post-operative CT arthrography using MDCT in patients with SLAP repair: Imaging findings with clinical correlation

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(kyung8404@gmail.com)

Purpose: To evaluate the post-operative imaging findings on CT arthrography of the shoulder after SLAP repair using MDCT and to correlate them with clinical findings.
Methods and Materials: CTA using 16 or 64 MDCT was performed in 152 patients at postoperative 1 year after SLAP repair. Image analysis was done by two musculoskeletal radiologists and an orthopedic surgeon. Findings of the post-operative labrum were categorized into three patterns: type 1 - intact labrum, tightly sutured to the glenoid; type 2 - a shallow labral defect on less than 3 coronal slices between 12 to 2 o'clock direction; type 3 - superior labral defect extending from anterior to posterior including biceps anchor, i.e. recurrent SLAP. Correlation was done between imaging and clinical findings, such as VAS scores, range of motion, and subjective discomfort or instability using linear by linear association.
Results: Type 1 was seen in 92/152 (60.5%) cases, type 2 in 32/152 (21.0%) cases - usual post-operative sublabral hole left by the orthopedic surgeon. Type 3 was found in 28/152 (18.4%) cases. Patients had symptoms in 32/92 (34.7%) of type 1, in 13/32 (40.6%) of type 2, and in 14/28 (50%) of type 3. In 3 cases, second look arthroscopy was done with concordant findings with CTA. However, there was no significant difference between CTA and clinical findings (p > 0.05).
Conclusion: CT arthrography findings after SLAP repair could be categorised into three; type 1 and 2 were regarded as post-operative changes, whereas type 3 was regarded as recurrent SLAP. However, clinical findings did not correlate with post-operative findings.

B-131   10:39

Tears at the rotator cuff footprint: Prevalence and imaging characteristics with clinical correlation in 305 MR arthrograms of the shoulder

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Purpose: To evaluate the prevalence, imaging characteristics and anatomic distribution of rotator cuff (RC) tears involving the humeral insertion of the supraspinatus (SSP) and infraspinatus (ISP) tendon with MR arthrography (MR-A) of the shoulder.
Methods and Materials: MR arthrograms obtained in 305 patients were retrospectively reviewed by two radiologists in consensus. Particular-sided supraspinatus tendon avulsions (PASTA), concealed interstitial delamination lesions (CID), bursal-sided tendon avulsions (reverse PASTA) and full-thickness tears (FT) at the humeral tendon insertion were depicted. Anatomic locations were determined and depths of tears were classified according to Ellman (Grade I-III).
Results: 110/305 patients showed tears of the RC, including 63 patients with 68 footprint tears. 29/34 PASTA were predominantly located at the SSP with 20/34 involving the anterior ISP. 17/34 PASTA were grade I lesions. The majority of CID (13/23) occurred at the posterior SSP and 20/23 were classified as grade I or II. 9 FT were detected at the SSP and 2 reverse PASTA were found. 5 lesions were located at the ISP or SSP/ISP transition zone. There was no statistical correlation between types of footprint lesions and anatomic location (p = 0.317), overhead-sports activity (p = 0.553), history of trauma (p = 0.962), or associated lesions (p = 0.769).
Conclusion: Tears at the SSP footprint are common findings, whereas ISP lesions are rare. Although the majority of lesions are articular-sided, a concealed type of tear is a representative lesion. PASTA tends to be located more anterior than CID, but types of tears cannot be correlated to anatomic location, associated pathology or clinical data.

B-132   10:48

Swinging of the long head of the biceps tendon (LHBT) within the pulley: A 3 T MR-motion analysis

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Purpose: In the last decade, attention was raised regarding the role of the long head biceps tendon in shoulder pathologies of throwing/overhead athletes. Some authors hypothesize that extreme movement of the LHBT leads to injury of the rotator cuff which has not been proven yet in-vivo. Therefore, the study aim was the evaluation of the kinetic-amplitude and direction of the LHBT within the pulley system and proximal bicipital sulcus performing a 3 T-MRI- throwing motion analysis under isometric-load- and no-load-conditions.
Methods and Materials: A prospective study was performed on a 3 T-MRI-scanner. A T2-weighted-3D-sequence in three specific positions of throwing motion under no and isometric 5N loading conditions was performed of the dominant shoulder. Measurements were performed in high (140°)-abduction/external-rotation (HABER), medium (110°)-abduction/external-rotation (MABER) and 45°-flexion/internal rotation (AFIR). Multiplanar rotational reconstructions along the LHBT in the sulcus allowed the localization of LHBT including the degree of motion in the three most proximal slices.
Results: 8 healthy volunteers (age: 25-34 yrs) were enrolled. Load application led to anterior deviation of LHBT within the sulcus in all positions except from the most proximal slice of the most extreme HA-BER-shoulder position and the most distal slice of the AFIR-position showing a posterior deviation of the LHBT.
Conclusion: Our findings support the thesis that pulley lesions result from movements of the LHBT especially in extreme positions of throwing/overhead athletes. These results need further evaluation in larger study-cohorts, focus of ongoing studies. This in-vivo MR-examination might enable the evaluation of patients with dedicated pulley-lesions and rotator-cuff-lesions to furthermore support our theory in future.

B-133   10:57

Rotator interval lesions, MR arthrographic findings and prevalence with rotator cuff tendon tears

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Purpose: To examine the relation and association of abnormalities involving the rotator interval and its contents to the rotator cuff tendon tears using MR arthography.
Methods and Materials: 75 patients with painful arc syndrome underwent MR arthrography, (anterior aproach) followed by arthroscopic maneuvers; 43 men and 32 women. Age: 19 - 74 years (mean: 49.3 Y). Arthroscopic procedures were done within 3 months from the MRI date. MR arthroscopic criteria of rotator interval lesion, extraarticular contrast agent leak that fills an anatomic space such as the subcoracoid space due to defects in the rotator interval capsule. Tears may extend to involve the subscapularis tendon or may occur as an extension of injury from the adjacent rotator cuff. In chronic settings, the rotator interval capsule and ligaments may be thickened and scarred with associated synovial hypertrophy or attenuated.
Results: The surgically confirmed rotator interval injuries were associated with rotator cuff tendon tears: Supraspinatus: 96%, Infraspinatus: 31%, Subscapularis: 46%. In patients with rotator interval injuries, the PPV for a tear of the rotator cuff tendons: Supraspinatus: 95%, Infraspinatus: 79%, Subscapularis: 60%. Patients with rotator interval injuries were more likely to have supraspinatus (p < 0.009) and subscapularis tendon tears (p < 0.0001) than those who have no rotator interval tears. Patients with rotator cuff tears had higher prevalence of rotator interval injuries than those patients without cuff tears (p = 0.04).
Conclusion: Rotator interval injuries are statistically more associated with rotator cuff tears.

B-134   11:06

Assessment of bone quality within the tuberosities of the osteoporotic humeral head: Relevance for anchor positioning in rotator cuff repair

C. Kirchhoff, V. Braunstein, S. Kirchhoff, A. Imhoff, S. Milz, S. Hinterwimmer; *Munich/DE*

Purpose: Tears of the rotator-cuff are highly prevalent in patients older 60 years, thereby, presenting a population also suffering from osteopenia/osteoporosis. In-Bone-Suture-fixation depends on the holding-strength of the anchoring-technique, whether bone-tunnel or suture-anchor is selected. Because of osteopenic/osteoporotic bone-changes, suture-anchors in elderly patients might pull out resulting in repair-failure. The study-aim was to analyze the bone-quality within the tuberosities of the osteoporotic humeral-head using high-resolution-quantitative-computed-tomography (HR-pQCT).

Methods and Materials: Thirty-six human cadaveric-shoulders were analyzed using HR-pQCT (Scanco Medical, Switzerland). The mean bone-volume to total-volume (BV/TV) and trabecular bone-mineral densities (trabBMD) of the greater tuberosity (GT) and lesser tuberosity (LT) were determined. Within the GT, six volumes-of-interest (VOIs), within the LT two VOIs and one control-volume within the subchondral-area beyond the articular surface were set.
Results: Comparing BV/TV of the medial to the lateral row significantly higher values were found medially (p < 0.001). The highest BV/TV with 0.030±0.027% was found in the posteromedial portion of the GT (p < 0.05). Regarding the LT-analysis, no difference was found comparing superior (BV/TV: 0.024±0.022%) and inferior (BV/TV: 0.019±0.016%) portion. Analyzing trabBMD, equal proportions were found. An inverse-correlation with a correlation-coefficient of -0.68 was found regarding BV/TV of the posterior GT-portion and age (p < 0.05).
Conclusion: Significant regional differences of trabecular microarchitecture were found in our HR-pQCT study. The volume of highest bone-quality resulted for the posteromedial aspect of the GT. Moreover, a significant correlation of bone-quality within the GT and age was found, while the bone-quality within the LT seems to be independent from it.

B-135   11:15

Evaluation of findings in sonoelastography in fatty atrophy in rotator cuff compared to magnetic resonance tomography
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Purpose: To evaluate SonoElastography (SEL) in diagnosing fatty atrophy in rotator cuff tears compared to Magnetic Resonance Tomography (MRT).
Methods and Materials: 20 patients (mean age: 59 years) with Supraspinatus (SSP) or Infraspinatus (ISP) tendon rupture were included, using a MRT grading modified according to Goutallier. SEL shows tissues with different elasticity in different colors, from red (soft) to blue (hard). SEL was graded as grade 1 = < 25% red colouring, grade 2 = 25-50% red colouring, grade 3 = 50-75% red colouring, and grade 4 = > 75% red colouring.
Results: MRT grade 1 in SSP was found in 5 patients (26.3%), grade 2 in 10 patients (52.6%), grade 3 in 3 patients (15.8%), and grade 4 in 1 patient (5.3%). SEL showed 6 patients (31.6%) with grade 1, 9 patients (47.4%) with grade 2, 3 patients (15.8%) with grade 3, and 1 patient (5.3%) with grade 4 with R = 0.946 (P ≤ 0.001). In MRT of the ISP, grade 1 was found in 16 patients (84.2%), grade 2 in 1 patient (5.3%) and grade 4 in 2 patients (10.5%). SEL showed 16 patients (84.2%) with grade 1, and 3 patients (15.8%) with grade 2 with R = 0.228 (P > 0.05). Overall correlation for SSP and ISP was R = 0.744 (P ≤ 0.001).
Conclusion: SEL demonstrates to be comparable to MRT in detection of fatty atrophy in SSP. Furthermore, SEL was helpful to assess muscle tissue with respect to elasticity and loss of elasticity in atrophied muscles.

B-136   11:24

The value of ultrasound (US) in finger osteoarthritis: Evaluation of sonographic criteria in therapeutic follow-up
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Purpose: To assess the value of sonography in finger osteoarthritis (OA) depicting the morphological alterations of joint thickening and hyperemia over the course of five times intraarticular injection of hyaluronic acid (HA). Pain, measured by numeric rating scale (NRS), was correlated.
Methods and Materials: 33 patients (28 female, 5 male, mean age: 64 yrs). suffering from finger OA were included and underwent USs examination and a weekly intraarticular injection of HA for 5 weeks. Joint pain was measured by using NRS (NRS: 0 - 100). To evaluate pain, intraarticular synovial thickening, effusion and number of vessels, a follow-up was made after 3 months. Ultrasound (US) images were taken in B-mode for joint thickening measurements and power Doppler US was applied in order to detect the presence of blood vessels.
Results: The number of treated finger joints added up to 78. The NRS-score in session 1 was significantly higher than in session 5, and so were the joint thickening measurements and hyperemia; (p < 0.0001). Follow-up showed that pain was lower (mean 32.08) than in session 5 (mean 28.33), joint thickening measurements were higher (mean 14.62) than in session 5 (mean 13.42) and also the number of vessels was higher (mean 1.53) than in session 5 (mean 1.42).
Conclusion: We conclude that both sonographic criteria of joint thickening and hypervascularity were feasible in the longitudinal evaluation of HA injected finger joints. These sonographic criteria may be further useful for lingitudinal evaluation of finger osteoarthritis.

B-137   11:33

The role of imaging in the evaluation of peripheral nerve in systemic sclerosis (scleroderma)
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Purpose: Patients affected by scleroderma may complain of sensory disturbances especially in the hands. To study the imaging features of upper limb nerves in patients affected by scleroderma (SSc).
Methods and Materials: Twenty-five patients affected only by SSc were prospectively evaluated with high-resolution US and magnetic resonance (MRI) or computer tomography (CT) when necessary (2 patients). Median and ulnar nerves were evaluated bilaterally. Nerve conduction studies were performed in the symptomatic patients (n=10). Results of imaging studies were correlated with disease duration, autoimmunity and immunosuppression. Nerves of SSc patients were compared with a control group of 90 patients matched for age and body mass index.
Results: The prevalence of sensory disturbances revealed by clinical examination was 40%. In symptomatic SSc patients (n=10), US evaluation revealed nerve abnormalities in 70% of cases (n=7/10). N=2 had a carpal tunnel syndrome. N=5 had cubital tunnel syndrome. In two of them, CT and MR were necessary to identify the compressed nerve at the level of the elbow due to the presence of calcifications. There was no association between the presence of an entrapment neuropathy and disease duration, autoantibodies and immunosuppression.
Conclusion: Ultrasound, CT and MR may detect nerve abnormalities in 70% of SSc patients complaining of neurologic disturbances in the hands. The results of imaging studies support the hypothesis of a vascular dependent neuropathy in SSc.

B-138   11:42

Nerve density, a new parameter to evaluate peripheral nerve pathology on ultrasound: Comparison between normal volunteers and patients
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Purpose: To quantitatively evaluate peripheral nerve echogenicity on ultrasound.
Methods and Materials: A software that quantifies the ratio between the hypoechoic and hyperechoic areas of peripheral nerves on ultrasound was developed. We called this value nerve density. US images of peripheral nerves were obtained with a high-frequency probe (17-5 MHz). Images of 82 different patients (age range, 35-81 years; mean 55 years) with different pathologies were analyzed: 40 normal median nerves (40 images), 20 patients with carpal tunnel syndromes (40 images), 20 patients with neurofibromas (40 images), and 1 patient with intraneural lipoma (3 images). A semi-quantitative evaluation with intra and inter-observer agreement was performed blindly by three radiologists. Then, a complete automatic evaluation was performed with no need of intra and interobserver evaluation.
Results: With the semi-automated method mean intra-observer agreement was good K=0.65. Inter-observer agreements was good as well (reader 1 vs reader 2: k =0.72; reader 2 vs reader 3: k= 0.80; reader 3 vs reader 1: k= 0.72). Differences among value of nerve density in normal nerves, carpal tunnel syndrome, neurofibromas and lipoma were statistically significant (p < 0.0001).
Conclusion: Nerve density evaluated on ultrasound can be used to differentiate pathological conditions affecting peripheral nerves.

B-139   11:51

Anatomical study of the pisotriquetral joint ligaments using ultrasonography
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Purpose: The aim of this study was to demonstrate that ultrasonography may allow a precise assessment of the primary stabilisers of pisotriquetral joint (pisohamate, pisometacarpien and ulnar pisotriquetral ligaments).
Methods and Materials: This study was initially undertaken in 8 cadavers. Metal markers were placed in the ligaments using ultrasonographic guidance, followed by the dissection of the wrists. Then, high-resolution ultrasonography was performed in 30 volunteers for the analysis of the presence, appearance and thickness of the ligaments.
Results: At dissection, the metal markers were located in the ligaments or immediately adjacent to them, confirming that they were correctly depicted using ultrasonography. The three ligaments could also be identified in each volunteer. The optimal positioning of the probe and the dynamic maneuvers of the wrist allowing the strain of these ligaments could be defined. No significant changes in the appearance and thickness of the ligaments could be observed.
Conclusion: The three ligaments stabilizing the pisotriquetral joint can be identified using ultrasonography. Further studies are now required to know whether this knowledge may be useful in the assessment of pain involving the ulnar part of the wrist.

Friday

Abdominal Viscera (Solid Organs)

SS 401a

Improving measurements in liver diffuse disorders

Moderators:
C.D. Claussen; Tübingen/DE
B. Guiu; Dijon/FR

B-140   10:30

Comparison of acoustic radiation force elastography and liver biopsy for the assessment of liver fibrosis in patients with chronic liver disease

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Purpose: To test the capability of a new non invasive tool (virtual touch imaging quantification) in evaluating liver stiffness, in patients with chronic liver disease.
Methods and Materials: A total of 60 patients with different degrees of liver fibrosis (histologically proven and classified according to Knodell) and 58 healthy subjects (controls) with no history of liver disease, underwent US examination integrated with velocity elasticity analysis. Virtual touch imaging was performed by two operators using intercostals approach with a S2000 unit (Siemens, Erlangen, Germany) using a 4C1 convex probe. The velocity values obtained, representing liver stiffness, were compared with pathology and with controls by statistical analysis. Possible independent variables (body mass index, and demographic data) were also analyzed.
Results: The mean value of velocity in healthy subjects was 1.23 m/s (SD: 0.09): the mean value of velocity in patient with fibrosis was 2.06 m/s (SD: 0.68), the differences were statistically significant (Mann-Whitney test=0.0001). The mean value of velocity in patients with fibrosis (F4) was 2.55 m/s. The values correlate with the different stages of fibrosis (Kruskal-Wallis test=0.001). The AUROC of liver stiffness was 0.9. Neither body mass index nor demographic variables affected the results.
Conclusion: Acoustic radiation force based shear waves velocity quantification provides accurate measure of liver stiffness.

B-141   10:39

also EPOS

Non-invasive detection of liver fibrosis: Comparison of MR elastography with diffusion weighted MR imaging

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Purpose: Comparative evaluation of MR Elastography (MRE) and Diffusion Weighted Imaging (DWI) for the detection of hepatic fibrosis.
Methods and Materials: MRE and DWI were performed in 12 normal healthy volunteers and in 25 patients (chronic liver disease-19 and liver tumour-5). DWI was performed with a free breathing technique (TR/TE 5000-6000/91 ms, matrix 160 x 160, 5 mm thickness, b=0.500). MRE was performed with modified phase-contrast gradient-echo sequences with TR/TE=100/27 ms, matrix 96 x 256, 4 x 10 mm slices, interslice gap 5 mm. The apparent diffusion coefficient (ADC) maps were generated on workstation and the system automatically generated elastograms. Regions of interest (ROI) were drawn on the elastograms and ADC maps excluding large vessels, liver edges, and artifacts wherever possible and every attempt was made to match the ROIs on ADC maps and elastograms. Mean stiffness values in kPa and mean ADC values were derived for each subject and tabulated. Receiver Operating Curve (ROC) analysis was performed to determine the area under curve (AUC) for accuracy of MRE and ADC for detection of liver fibrosis.
Results: ROC analysis showed that AUC/sensitivity/specificity for MRE (cut off, > 2.48 kPa) and DWI (cut off, < 121.63 x 10^{-3} mm^2/s) were 0.99/95.6%/93.3% and 0.84/78.3%/86.7%, respectively. The accuracy of MRE was significantly better than DWI (p=0.035). For detection of clinically significant fibrosis (METAVIR >F2) MRE performed significantly better than DWI (AUC, 0.97 (95% CI, 0.88, 100) vs. 0.79 (95% CI, 0.63, 0.90), P=0.005).
Conclusion: Our study results show that MRE is more accurate than DWI for detection of liver fibrosis.

B-142   10:48

also EPOS

Effect of intravenous gadolinium on estimation of liver stiffness with MR elastography

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Purpose: To evaluate the effect of intravenous gadolinium enhancement on estimation of liver stiffness with MR elastography (MRE).
Methods and Materials: Liver MRI and MRE were performed in 24 subjects for various clinical indications (suspected fibrosis/cirrhosis-11, neoplasm-7, chronic liver diseases -6). The MRE sequence was performed before (pre-Gd MRE) and after the administration of intravenous gadolinium as per liver MRI protocol, immediately after the 5 minute delayed phase (post-Gd MRE) in the same session. MRE was performed with modified phase-contrast gradient-echo sequences with TR/TE=100/27 ms FOV=30-46 cm, 4 x 10 mm slices, gap 5 mm). The sequence automatically generated elastograms. Mean stiffness values of the liver parenchyma were measured by an experienced reader and by placing at least three large circular regions of interest in each of the four slices and a mean value in kilopascals (kPa) obtained. At histology, fibrosis was present in 19 patients and there was no fibrosis in 5 patients. The pre-Gd MRE and post Gd MRE liver stiffness values were compared for significant differences.
Results: An excellent correlation existed between the mean stiffness values measured on pre-Gd MRE and post-Gd MRE (R=0.98, p < 0.001). Receiver operating curve analysis showed similar AUC/sensitivity/specificity for both pre-Gd MRE and post-Gd MRE (99.5/94.7/100 (> 2.83 kPa), p < 0.01 and 99.9/95/100 (> 2.91 kPa), p < 0.01, respectively) for detection of fibrosis.
Conclusion: Our study results show administration of intravenous gadolinium has no significant influence on estimation of liver stiffness value with MRE and does not appear to affect diagnostic performance of the test for fibrosis detection

B-143   10:57

3D-liver MR perfusion imaging with the MS-325 blood pool agent to assess liver fibrosis

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Purpose: To prospectively evaluate estimated-perfusion parameters for liver fibrosis diagnosis with histological findings using MR-imaging at 1.5 T.
Methods and Materials: Fifty patients (mean age, 51.8 ± 14.7 years) with chronic liver diseases were prospectively enrolled. Four patients were scored F0, three were scored F1, four were scored F2, one was scored F3 and three were scored F4 according to METAVIR classification. MR-dynamic acquisition was performed with a 3D VIBE T$_1$w sequence and parallel imaging. Parameters were adjusted for high temporal resolution imaging (1 sec) with suitable SNR. Contrast agent used, MS-325, is highly bound to HSA at clinically concentration involving an increase of r$_1$ relaxivity and molecular weight. MR-acquisition started simultaneously with contrast agent injection (1 mL.sec^{-1} injection rate; 0.12 mL.kg^{-1} posology) and was continuously performed in free breathing during 2 minutes. Due to respiratory motion; image volumes were coregistered by an automatic rigid image translation-based method. Liver perfusion was modeled by a dual-input-one-compartment model and quantitative perfusion parameters (Arterial and Portal blood flow, Hepatic Perfusion Index (HPI), Mean Transit Time (MTT) and Regional Blood Volume (RBV)) were obtained using an in-house developed software using Matlab.
Results: HPI and portal blood flow were found relevant parameters to discriminate F2, F3 and F4 METAVIR stage (p < 0.05). MTT and total blood flow allowed to discriminate F3 and F4 METAVIR stage (p < 0.05). Arterial blood flow allowed to discriminate only clinical significant fibrosis (stage ≥F2) (p < 0.05).
Conclusion: HPI and portal blood flow could be relevant indicators for the clinical monitoring in patients with chronic viral hepatitis.

B-144   11:06

Differentiation of intermediate stages of liver fibrosis from minimal liver fibrosis with perfusion CT

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Purpose: To prospectively assess the ability of perfusion CT to differentiate minimal from intermediate fibrosis in naïve patients with chronic hepatitis C.
Methods and Materials: Fifty-two patients with naive hepatitis C infection underwent perfusion CT and percutaneous liver biopsy on the same day. Portal, arterial and total liver perfusion, mean transit time, distribution volume for the right and left liver were measured. Liver samples were analysed according to METAVIR score

and fibrosis area was determined. Differences in quantitative perfusion parameters between patients with minimal and intermediate fibrosis were tested.

Results: In patients with intermediate fibrosis (F2-3) compared to patients with minimal fibrosis (F1), the portal venous and total liver perfusion were significantly decreased (87 ± 27 mL.min^{-1}.100 mL^{-1} and 107 ± 31 mL.min^{-1}.100 mL^{-1} versus 138 ± 112 mL.min^{-1}.100 mL^{-1} and 169 ± 137 mL.min^{-1}.100 mL^{-1}, p = 0.042 and 0.02, respectively) and the mean transit time was significantly increased (16 ± 4 versus 13 ± 5 s, p = 0.025). At multivariate analysis, only the mean transit time was an independent factor (odds ratio: 1.18, confidence interval: 1.02-1.37, p = 0.030). The receiver operating curve analysis showed that a mean transit time threshold of 13.4 s allowed discrimination between minimal and intermediate fibrosis with a sensitivity of 71% and a specificity of 65%.

Conclusion: Perfusion changes occur early during fibrogenesis in chronic hepatitis C infection and can be detected with perfusion CT. Perfusion CT may help to discriminate minimal from intermediate fibrosis. Mean transit time appears to be the most promising perfusion parameter to discriminate between different fibrosis stages.

B-145 11:15

Imaging modalities for the detection of hepatic steatosis with histopathology as the reference standard: A systematic review

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Purpose: To systematically review the existing literature for evidence on the accuracy of imaging modalities in detecting hepatic steatosis.

Methods and Materials: The Medline, Embase and Cochrane databases were systematically searched. Inclusion was considered for studies addressing the diagnostic accuracy of ultrasonography (US), CT, MRI or MR-Spectroscopy (MRS) for detecting hepatic steatosis with histopathology as the reference standard. Two reviewers independently extracted methodological data using the QUADAS-tool and data on imaging criteria, histopathological criteria and diagnostic accuracy.

Results: Of 4935 articles retrieved, 156 were considered potentially relevant and 34 finally fulfilled the inclusion criteria. US was evaluated in 18 papers, CT in 9, MRI in 10 and MRS in 4 with respective study populations of 2457, 1309, 508 and 173 individuals comprising various underlying conditions. The QUADAS-tool showed that most methodological discrepancies between papers regarded operator blinding, time-interval between liver biopsy and diagnostic imaging (range 0-270 days) and reproducibility of index and reference tests. For all imaging modalities, criteria for both histopathological grading and assessment of steatosis showed substantial heterogeneity. Moreover, CT and MRI methods varied greatly. Meta-analysis was therefore precluded. MRS showed best results for discriminating between different degrees of hepatic steatosis. For detecting < 33% steatosis, sensitivity/specificity ranged between 90-100/71-100% for MRS, 56-100/60-100% for MRI, 60-97/78-100% for US and 67-100/42-100% for CT and for detecting < 10% steatosis between 86-100/79-96% (MRS), 88-94/88-100% (MRI), 64-100/43-100% (US) and 92-98/28-87% (CT).

Conclusion: MR-Spectroscopy shows best discriminative accuracy for detecting hepatic steatosis. However, literature shows poor consensus regarding methodology and data reporting.

B-146 11:24

also EPOS

Fat quantification with dual energy CT: Comparison of 3-material decomposition dual energy CT analysis and MRI in phantoms of varying fat-iodine contrast content

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Purpose: MRI has been used for quantification of fat in tissue. Dual energy analysis with DSCT can characterize tissue component even on post-contrast study. The objective of our phantom study was to compare the ability of dual energy CT with MRI for quantification of fat content with/without contrast medium (CM).

Methods and Materials: Phantoms of varying fat-water or fat-CM content were constructed adding the surfactant to water or diluted CM (50 or 100 HU) with the following composition; olive oil only, water, and four emulsions containing 10, 20, 30 and 40% amount of olive oil. These phantoms were scanned by DSCT (SOMATOM Definition) with dual energy acquisition (140 and 80 kV). First, iodine contribution was eliminated by 3-material decomposition. Then, a lipid magnitude map was calculated based on negative shift of CT values on 80 kV image using water and olive oil as references of 0 and 100% lipid, respectively. The phantoms were also scanned with 1.5 T MR scanner with a low-flip-angle in- and out-of- phase imaging to calculate fat fraction. The lipid magnitude of each phantom evaluated with dual energy CT was compared to those of fat fraction by MRI.

Results: On the basis of regression slope and intercept, dual energy lipid magnitude map showed good correlation with fat fraction in fat-water phantoms (slope,

intercept, R^2; 1.01, -3.8%, 0.99, respectively), as well as fat-CM phantoms of 50 HU (0.97, -4.9%, 0.99) and 100 HU (0.94, -4.4%, 0.99).

Conclusion: Dual energy analysis with DSCT could quantify fat content either in water or diluted CM as same as MRI.

B-147 11:33

Absolute quantification of liver fat by MRI fat volume fractions in comparison to histopathology

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Purpose: To evaluate a new approach to absolutely quantify the liver fat content by fat volume fractions derived from MRI (FVF$_{MRI}$) using a surface-coil sensitivity correction in comparison to histopathology (FVF$_{HISTO}$) demonstrating the reference standard.

Methods and Materials: Twenty-four adults (11 women; 13 men; mean age, 54 ± 15 years) underwent hepatic 1.5-Tesla MRI with a single-breathhold 3D spoiled dual gradient-echo sequence and surface-coil sensitivity correction prior to clinically indicated biopsy. FVF$_{MRI}$ was calculated for each voxel in a region of interest in the in/out-of-phase and fat-only images as the fraction of signal intensity divided by global maximum fat-signal intensity after automated segmentation. FVF$_{MRI}$ and FVF$_{HISTO}$ were established in thirty-nine liver segments and statistically analyzed.

Results: Mean FVF$_{HISTO}$ was $10.3\pm11.5\%$ (1.0-36.0%). FVF$_{MRI}$ derived from in/out-of-phase (r=0.88) and fat-only images (r=0.89) were significantly (p < 0.001) correlated with FVF$_{HISTO}$. Mean measurement biases of FVF$_{MRI}$ and FVF$_{HISTO}$ were $6.1\pm7.6\%$ for in/out-of-phase and $5.1\pm8.5\%$ for fat-only images, respectively. The mean measurement bias of FVF$_{MRI}$ from fat-only images was significantly (p < 0.01) reduced as compared to FVF$_{MRI}$ from in/out-of-phase images.

Conclusion: Absolute liver fat content can be quantified accurately by FVF$_{MRI}$ with surface-coil sensitivity correction compared to FVF$_{HISTO}$. Fat-only images significantly reduce the measurement bias as compared to in/out-of-phase images.

B-148 11:42

In vivo quantification of liver fat content in non-alcoholic and alcoholic fatty liver rat models: Comparison between in-phase/opposed-phase MR imaging and ^{1}H MR spectroscopy with correlation of pathology

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Purpose: To investigate the values of ^{1}H MR spectroscopy (^{1}H-MRS) and gradient dual-echo T$_1$W in quantifying liver fat in rat models of both nonalcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD) with correlation of pathology.

Methods and Materials: 120 SD male rats were randomly divided into the control (n_0 = 20) and three experimental groups. The hepatic steatosis models (n_1 = 30) were fed with high-fat diet, the alcoholic hepatic steatosis models (n_2 = 30) with concentration 55% ethanol, and the mix models (n_3 = 40) with both. At the baseline, 4th, 8th and 12th week, at least 6 or more rats were selected randomly among the groups to receive dual-echo T$_1$W imaging and ^{1}H-MRS of the liver on 3.0 T MR. The rats were sacrificed and the liver specimens were evaluated for histopathological grades of steatosis. Fat Index (FI) for dual-echo T$_1$W and Relative Lipid Content (RLC) of ^{1}H-MRS were measured. Statistical analysis was performed for the correlation between the measured values and the histopathologic grades of steatosis.

Results: Both FI and RLC were correlated linearly with pathologic findings (P < 0.01, r = 0.54-0.96). RLC (r = 0.89-0.96) showed much closer correlation with pathology than FI (r = 0.54-0.85) in all rat models. For FI, the differences between normal, mild, and moderate steatosis were not significant (P > 0.01), while RLC demonstrated significant differences between normal and each grades of steatosis (P < 0.01).

Conclusion: In vivo, ^{1}H-MRS and dual-echo T^{1}W can quantitatively evaluate both NAFLD and AFLD in rat models. ^{1}H-MRS is more accurate and reliable for discrimination of different grades of liver steatosis.

B-149 11:51

Influences affecting water suppression and shimming of proton hepatic MR spectroscopy at 3.0 T

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Purpose: We aimed to evaluate influences affecting water suppression (WS) and shimming of in vivo proton MR spectroscopy in human liver at 3.0 T.

Methods and Materials: 71 subjects with no history of liver disease and with normal liver function test results for evaluating nonhepatic disease or fatty liver were included in this study. (1) Using Pearson correlation or Spearman correlation, we determined factors associated with successful prescan adjustments shimming and

effective WS separately. (2) Student's t test for unpaired data or Wilconxon rank sum test was used to compare participant factors between two groups (WS>= 90% and WS< 90 %, Water FWHM> 20 Hz and Water FWHM<= 20 Hz) separately.

Results: (1) There were significant negative correlations between the WS and height (r=-0.247, P=0.038), weight (r=-0.376, P=0.001), age (r=-0.256, P=0.031), BMI (r=-0.295, P=0.013) and liver lipid content (rs=-0.587, P < 0.001). There was a significant positive correlation between the water suppression and shimming effect (r=0.536, P < 0.001). There were significant negative correlations between the shimming effect and age (r=-0.244, P=0.041), liver lipid content (rs=-0.266, P=0.025). (2) We found the effective WS group has lower height (t=-4.454, P < 0.001), lower weight (t=-3.377, P < 0.001), lower BMI (t=-2.710, P=0.011), less liver lipid content (Z=-4.025, P < 0.001,) and more beneficial shimming effect (t=-5.250, P < 0.001). We found the effective shimming group has higher WS (t=-3.926, P=0.001) and content with less liver lipid (Z=-3.452, P=0.001).

Conclusion: Hepatic steatosis exerts an adverse effect in water suppression and shimming, and obese subjects were less likely to complete successful prescan adjustments.

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

Chest

SS 404

Lung cancer imaging: Detection

Moderators:
C. Engelke; Göttingen/DE
R. Polverosi; Padova/IT

B-150   10:30
Correlation between growth of lung adenocarcinoma showing localized ground-glass opacity on thin-section CT and molecular biomarkers
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Purpose: To retrospectively identify natural progression of peripheral lung adenocarcinoma showing localized ground-glass opacity (GGO) on thin-section CT and correlate with biomolecular changes.

Methods and Materials: A retrospective review was carried out on 25 patients with lung adenocarcinomas smaller than 3 cm, in which tumor growth could be evaluated using thin-section CT prior to surgery. The CT observation period ranged from 112-2333 days. Two thoracic radiologists evaluated tumor growth by analyzing GGO type (pure or mixed), increases in size, and tumor doubling time (Tdt). Immunohistochemistry of the p53 protein and molecular analysis of the epidermal growth factor receptor (EGFR) were performed.

Results: Tumor sizes increased in 19 cases (76%) during the observation period with the Tdt greater than 241 days. The 19 cases were classified into 4 patterns: persistent pure GGO (n=8), change from pure to mixed GGO (n=3), mixed GGO with growth of solid component (n=4), mixed GGO with growth of GGO component (n=4). The remaining 6 cases (24%) showed pure GGO without any interval changes. The p53 staining was negative in all 14 cases with pure GGO, while 6 (55%) of 11 mixed GGO cases showed positive p53 staining (P < 0.01); all the 6 cases demonstrated appearance or growth of the solid component. EGFR mutations were found in both pure (36%) and mixed (45%) GGO lesions.

Conclusion: Lung adenocarcinomas showing localized GGO lesion grow slowly and often possess EGFR mutations. Interval changes of solid component may be related to p53 inactivation.

B-151   10:39
Short term feedback does not help radiologists to use CAD for the detection of intrapulmonary nodules more effectively
D.W. De Boo[1], F. van Hoorn[1], J. van Schuppen[1], L. Schijf[1], M.J. Scheerder[1], N.J. Freling[1], O.M. Mets[1], M. Weber[2], C.M. Schaefer-Prokop[3]; [1]*Amsterdam/NL,* [2]*Vienna/AT,* [3]*Amersfoort/NL (d.w.deboo@amc.uva.nl)*

Purpose: Previous studies have shown that readers have difficulties to differentiate true positive (TP) from false positive (FP) candidates when using computer-aided detection (CAD) in chest radiography. Therefore the potential of CAD is underestimated. Purpose of this study was to assess whether short term feedback helps readers to increase their performance using CAD.

Methods and Materials: 140 patients; 56 with one CT proven focal lesion and 84 negative controls were divided into four subsets that were matched for presence and conspicuity of lesions, age and sex. The four subsets were read in different order by 6 readers of vastly varying experience (1->15 years). Presence of lesions,

their localization and diagnostic confidence using a 5 point ROC scale were scored without and with the availability of a commercially available CAD (xLNA Enterprise, Philips). All readers received individual feedback on his/her results after the reading of each subset.

Results: CAD had a stand-alone performance of 59% with an average of 1.9 FP per image. When comparing sessions 1+2 with sessions 3+4 we found a general increase of sensitivity for both reading without and with CAD (65%-70% and 66%-70%, respectively). The rate of accepted FP slightly decreased (10 vs 6) while the amount of dismissed TP remained unchanged (15 vs 14).

Conclusion: Short term feedback does not significantly increase the ability of readers to differentiate between true and false positive candidate lesions in order to use CAD more effectively. Variations of reader behavior seem to be the determinant factor.

B-152   10:48
CAD system integrated in a PACS used as concurrent reader: Sensitivity and reading time in detection of solid lung nodules
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Purpose: To compare sensitivity and reading time in detection of solid lung nodules on MDCT chest screening examinations with and without a CAD integrated in PACS as concurrent reader.

Methods and Materials: Two experienced chest radiologists reviewed 50 chest MDCT screening exams of asymptomatic smokers and identified solid uncalcified nodules (diameter: 2-30 mm) in consensus without CAD (reference standard). Two homogeneous groups were created (A and B) on the basis of patient characteristics and nodule number. Group A exams were analyzed by a resident (reader 1) using as concurrent reader a CAD system (LMS, Median Technologies) integrated in PACS and by another resident (reader2) without CAD. Group B exams were evaluated with CAD by reader 2 and without CAD by reader 1. For each exam reading time, location and diameter of nodules were reported. Sensitivity and reading time with CAD were compared to sensitivity and reading time without CAD.

Results: 150 nodules were identified by reference standard. Sensitivity of readers with CAD and without CAD was, respectively, 82 and 75%, without a statistically significant difference (p = 0.14). When nodule diameter was equal or greater than 4 mm sensitivity with CAD raised (94%) with a significant difference (p = 0.03). Reading time was shorter using CAD (9 minutes and 25 seconds vs 10 minutes and 54 seconds) with a significant difference (p = 0.004).

Conclusion: A CAD system used as concurrent reader significantly reduces reading time in lung nodule detection and increases sensitivity for nodules equal or greater than 4 mm.

B-153   10:57
Subsolid lung nodules verified by CT: Are they detectable by CAD on digital chest radiographs?
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Purpose: To evaluate the ability of CAD to detect on chest radiographs, CT-verified subsolid nodules that may indicate premalignant changes or adenocarcinoma.

Methods and Materials: 47 digital chest-radiographs with pathologic verification of lung lesions were retrospectively correlated to CT by two independent expert readers, who identified and marked on the radiographs 34 nodules [5-30 mm] and 30 masses. Fifty-seven lesions were characterized as solid (31 nodules) and 7 as subsolid (3 nodules). The expert readers assigned each lesion a visibility-score, using a three-grade scale (1=least visible). All chest radiographs were then analyzed by a prototype CAD-algorithm (Siemens) that marked suspicious lesions. CAD prompts not corresponding to findings marked by the expert radiologists were considered false.

Results: The CAD algorithm detected 47 of the 64 lung lesions (73.4%), with a false mark rate of 1.4. The detection sensitivity for masses was significantly higher than for nodules (83.3 vs. 64.7%; p < 0.05). CAD sensitivity for solid and subsolid lesions was not significantly different (73.7 vs. 71.4%; p=0.46) although the mean visibility score of the subsolid lesions was significantly lower (1.3 vs. 1.9; p < 0.04). Within the solid findings, detection sensitivity for masses (84.6%) was significantly higher than for nodules (84.6 vs.64.5%; p < 0.04). The same trend was found in subsolid findings with no significant difference (75.0 vs. 66.7%; p=0.43).

Conclusion: CAD has the potential to assist radiologists in detecting even subsolid lung lesions on chest radiographs, despite their significantly lower visibility. Lesion size (masses vs. nodules) impacted CAD sensitivity more than lesion type (solid vs. subsolid).

B-154 11:06

Impact of computer-aided detection on observer detection of solid pulmonary lesions in chest radiography

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Purpose: To evaluate the added value of a commercially available computer-aided detection system (CAD) for the detection of solid pulmonary lesions in elder patients with increased anatomical noise.

Methods and Materials: 114 patients (mean age 62 y) were retrospectively selected; 60 patients showed 101 CT proven solid pulmonary lesions (5-15 mm, mean 10 mm). Increased anatomical background was present in 66%. Lesion conspicuitiy was judged as subtle to very subtle in 60%. All digital two-view chest radiographs were read by three inexperienced (< 1.5 y) and three experienced readers (> 10 y) without and with CAD as second reader (xLNA Enterprise, Philips) in two separate reading sessions. Sensitivity was calculated on per lesion basis, the false positive rate (FP/FP+TP) was calculated per patient.

Results: CAD showed a stand-alone sensitivity of 47% (47/101) while producing an average of 1.7 false positive per image. Mean sensitivity increased with CAD for inexperienced readers (38 vs. 45%, p < 0.05) but remained unchanged for experienced readers (50 vs. 51%). FPR did not significantly increase for both groups. Agreement between CAD and readers was lower than among readers (mean κ 0.24 vs. 0.43). Pooled over all readers, 33% of true positive CAD candidates were dismissed. False positive candidates by CAD induced 33% of all detrimental rating differences.

Conclusion: CAD detects different lesions than radiologists and improves the sensitivity of inexperienced readers for the detection of solid pulmonary lesions. Since a considerable number of true positives were dismissed and false positives were accepted, there is room for further improvement of reader performance with CAD.

B-155 11:15

Pulmonary nodules: Post-contrast volumetric variation at different CT scan delays

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Purpose: To assess the effects of intravenous iodinated contrast material and different Computed Tomography (CT) scan delays on automated volume calculation of lung nodules.

Methods and Materials: A pre-contrast and five identical post-contrast MDCT scans (LightSpeed16, General Electric; 0.625 mm slice-thickness; injection rate: 2 mL/sec, 2 mL/kg of body weight) at 30, 60, 120, 180 and 300 seconds delays were performed in 35 patients with single lung nodule through each nodule. Informed consent was collected from all patients. Dedicated software (ALA Single, General Electric) was used to retrospectively calculate pulmonary nodule volume for each CT scan; nodule attenuation (H.U). was also reported for each CT scan. Differences between pre-contrast and post-contrast volumes were analyzed by Wilcoxon signed rank test. Post-contrast volume ratio was calculated as the ratio between post-contrast and pre-contrast nodule volume.

Results: Post-contrast volumes were significantly larger than pre-contrast (p < 0.05) for all the timing delays but at 30 seconds. No significant differences were found among volumes measured at different post-contrast delays. Median volume ratios between post- and pre-contrast ranged from 1.04 to 1.07 and within different post-contrast delays ranged from 0.99 to 1.03. We did not find any significant association of post-contrast volume ratio with diameter, site, shape, pre-contrast density or post-contrast density ratio (p> 0.05).

Conclusion: We recommend comparing volume of pulmonary nodules obtained from CT examinations only if they are all performed with or without contrast material whilst nodule volume obtained from enhanced CT performed with different scan delays are comparable.

B-156 11:24

Impact of a CAD prototype on the detection of acute pulmonary embolism used as second reader for off-hours CTPA studies

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Purpose: To assess the impact of a computer assisted detection (CAD) prototype on observer performance for detection of acute pulmonary embolism (PE).

Methods and Materials: Six observers of varying experience evaluated 209 CTPA scans (158 negative, 51 positive) consecutively obtained during off-hours. Observers were asked to rate their diagnostic confidence without and with CAD as second reader using a 9 point scale ranging from 1 (definitely no PE), 5 (inconclusive scan) to 9 (definite PE). Reading time was measured with and without CAD. Reader data and CAD lesions were compared with an independent standard established by two readers and a third chest radiologist in case of discordant results. Statistical evaluation was performed using logistic regression and Pearson correlation.

Results: With CAD, there was a significant increase of sensitivity (p=0.014) without significant change of specificity. Out of 6x209 evaluations, CAD was beneficial in 24%, with correction of diagnosis in 29 and increase of confidence in the correct diagnosis in 270 cases. CAD was detrimental in 2%, with change towards the wrong diagnosis in 11 and decrease of confidence in the correct diagnosis in 18 cases. The number of inconclusive ratings remained constant (38 vs 36). Reading time was on average extended by 22% with CAD. There was a significant correlation between the average extra reading time and number of FP lesions (p < 0.001).

Conclusion: At the expense of increased reading time, CAD has the potential to increase reader sensitivity and confidence for the diagnosis of PE without loss of specificity.

B-157 11:33

Reinterpretation of 200 consecutive non-small cell lung cancer (NSCLC) presentations: Stage migration and implications of the proposed international association for the study of lung cancer (IASLC) TNM classification

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Purpose: To compare the current TNM UICC 6th edition (UICC6) staging and the new proposed IASLC staging in a clinical setting, to determine: 1. TNM reclassification patterns, 2. Stage migration, 3. Therapeutic implications.

Methods and Materials: Consensus re-interpretation of staging MDCT studies of 200 consecutive confirmed NSCLC cases by three expert thoracic radiologists was performed. Corroboratory clinical evidence was used to determine staging under the current (UICC6) and proposed revised (UICC7) TNM staging classifications. T and M descriptor migration, staging group changes and potential implications for previous operability thresholds (Stage IIIA/IIIB) were evaluated.

Results: In the interim analysis of the first 166 consecutive examinations, Stage IIIB classified patients decreased by 61.5% using UICC7 (39 vs 15); however, Stage IV increased by 24% (75 vs 93 both, p < 0.01, single sample t-test). Overall Stage IIIA or lesser disease improved from 30.7 to 34.9% (p < 0.01). UICC7 results in a significant increase in T3 and reduction in T4 classified disease (27.1 vs 9.0%, 56.2 vs 28.9%, respectively, both p < 0.01). Under UICC7, M1 designated disease increases significantly (45 vs 56%, p < 0.01) of which 75% is M1a disease.

Conclusion: In clinical practice, IALSC reclassification of ipsilateral nodules (T3 or T4) and effusions (M1a) results in more patients classified as having metastatic or T3 disease but less with T4 or stage IV disease and nominally more with "operable" stage IIIA or lesser disease.

B-158 11:42

CT-fluoroscopy guided vs multislice CT biopsy mode guided lung biopsies: Accuracy, complications and radiation dose

H. Prosch, M. Schilling, E. Eisenhuber, A. Stadler, E. Schober, G. Mostbeck; *Vienna/AT (helmut.prosch@wienkav.at)*

Purpose: To retrospectively compare CT-fluoroscopy guided biopsies of lung lesions with multislice CT-biopsy mode guided biopsies regarding diagnostic accuracy, frequency of complications and radiation doses.

Methods and Materials: Data on 124 consecutive CT-fluoroscopy guided lung biopsies and 132 consecutive multislice CT-biopsy mode guided lung biopsies were reviewed. All biopsies were performed in coaxial needle technique using a 18G cutting needle. CT-fluoroscopy guided biopsies were performed on a Siemens Emotion 6 CT scanner, multislice CT-biopsy mode guided biopsies were performed on a Siemens Emotion 16 CT scanner.

Results: The two groups did not differ significantly in lesion size (median 2.2 vs. 2.3 cm), depth of the lesion, age of the patients, sex and distribution of the lesions. The sensitivity was 92 and 91%, the specificity was 97 and 96%, the accuracy was 93 and 92%, the positive predictive value was 99 and 99%, and the negative predictive value was 81 and 72%, respectively. The mean CT dose index (CTDI) was 422 mGy in the CT fluoroscopy group and 36.3 mGy in the CT biopsy mode group (p < 0.001). A pneumothorax was observed in 30 and 32.5% of the patients. Chest tube placement was necessary in 4 and 13% of the patients, respectively.

Conclusion: Biopsies using the multislice CT biopsy mode are performed with dramatically lower CTDI levels compared to CT-fluoroscopy guided biopsies. While the sensitivity, specificity, accuracy and the positive predictive values of both procedures are comparable, biopsies using the multislice CT-biopsy mode have a lower negative predictive value and a threefold rate of chest tube placements.

Friday

B-159 11:51

Region growing segmentation for micro-CT quantification of multifocal lung adenocarcinoma in SPC-raf transgenic mice

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Purpose: SPC-raf transgenic mice develop genetically induced disseminated lung adenocarcinomas allowing examination of carcinogenesis and evaluation of novel treatment strategies. A post-processing algorithm allowing in-vivo assessment of the multifocal tumour load is presented and the capability to evaluate progress demonstrated in a follow-up study.
Methods and Materials: Non contrast-enhanced micro-CT of the lungs (80 kV, 450 µA, 0.094 mm reconstruction voxel size) was obtained without respiratory gating in 10 SPC-raf transgenic mice. Region-growing segmentation (20-40 seed points, threshold tolerance 2%) of the aerated lung was performed (algorithm 1). Intra- and interobserver-variability were assessed. Segmentation values were correlated to histopathology. The performance of another region growing segmentation (algorithm 2) applying nonlinear diffusion filtering was compared. In SPC-raf transgenic (n=9) and control (n=3) animals, follow-up examinations were performed every 4 weeks for 14 months and tumor load was quantified.
Results: A micro-CT quantification algorithm for diffuse lung adenocarcinoma was established. Segmentation results showed good correlation to histopathology. Overall intra-observer reliability for algorithm1 was 5.1%. Inter-observer variability was 6.5%. Comparison of algorithm 1 with algorithm 2 using a 2-factorial variance analysis did not show significantly better reliability values for algorithm 2. In the follow-up study, a significant decrease in aerated lung volume - correlating to tumor load - could be seen in the SPC-raf transgenic mice, while no relevant changes were noted in the control group.
Conclusion: The presented algorithm allows in-vivo quantification of tumor load and progress in SPC-raf transgenic mice for the evaluation of novel treatment strategies.

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

Interventional Radiology

SS 409a

Peripheral vascular interventions

Moderators:
P.E. Andersen; Odense/DK
G. Markose; London/UK

B-160 10:30

Prospective study to evaluate the safety and efficacy of repeated arterial closure using the AngioSeal device in patients with hepatic malignancy undergoing transarterial chemoembolization (TACE)

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Purpose: To evaluate the safety and efficacy of repeated arterial closure within a gap of 4-5 weeks using AngioSeal device in patients undergoing TACE.
Methods and Materials: The institutional review board approved the study and all patients gave informed consent. Included were 412 patients (mean age: 60, 213 males and 199 females) who underwent percutaneous closure of the femoral artery with the AngioSeal device. We prospectively evaluated the method of hemostasis, number of arterial closures and patients' bleeding profile. Patients were examined before discharge and 4-5 weeks after the procedure for complications. reclosure of the femoral artery with an AngioSeal device was used at the time of repeated punctures. Efficacy was defined by the ability to obtain satisfactory hemostasis (with complete hemoststis within 2 minutes of deployment) and safety was assessed by the absence of vascular complications.
Results: There were a total of 1166 closures with the AngioSeal device: 96 patients had single closure and 316 had repeated closures. Of the 1166, there were six closure failures in the single puncture group (success rate=93.75%) and four closure failures in the repeat closure group (success rate=98.74%) in whom hemostasis was achieved by manual compression. The overall success rate of AngioSeal device closure was 99.2%. Complications related to device deployment include minor hematomas (9 patients, 2.1%), infection (1 patient, 0.2%), one clinically occult 1.4 cm false aneurysm (0.2%) and one medium-sized hematoma (0.2%).
Conclusion: The repeat use of AngioSeal closure device within 4-5 weeks is safe and effective in patients undergoing TACE.

B-161 10:39

Repeated closure of the femoral venous puncture sites after transpulmonary chemoperfusion using the AngioSeal device in patients with lung malignancy

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Purpose: To evaluate the safety and efficacy of repeated use of AngioSeal device in femoral vein punctures during transpulmonary chemoperfusion.
Methods and Materials: The study was approved by the institutional review board and informed consent was obtained from all patients. Included were 55 patients (40 males, 15 females, mean age 57.6 years) who underwent repeated percutaneous closure of the femoral vein after chemoperfusion treatment of lung malignant tumors with the AngioSeal device. The number of repeat closures ranged from one to six, with a mean of three closures/patient. Data were prospectively collected with technical outcome and complication rates serving as endpoints.
Results: AngioSeal device deployment was attempted 371 times in 55 patients and was successful 368 times (99.2%).10 patients had single closure and 45 patients had repeated closures. The 6-F device was used in all patients after use of 5-F sheaths. Of the vascular sealing using AngioSeal, there were two closure failures in the single puncture group (success rate of 80%) and one closure failure in the repeat puncture group (success rate of 97.8%) in which hemostasis was achieved by manual compression without the need for further therapy. No complications were noted in our patient group except in one case in whom minor oozing was noted after the device deployment and no late venous bleeding was observed.
Conclusion: In patients undergoing transpulmonary chemoperfusion requiring venous access, the repeated use of 6 Fr AngioSeal within 4-5 weeks to seal the femoral vein is safe and feasible.

B-162 10:48

Endovacsular management of symptomatic varicose veins with LASER ablation

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Purpose: Venous insufficiency due to varicose veins causes great discomfort and considerable morbidity to the patients. The reported prevalence of the varicose veins is about 4.5% and it is estimated that 41% of all women will suffer from abnormal leg veins by the time they are in the 50s. The purpose is to treat symptomatic lower limb venous Varicosities.
Methods and Materials: Prospective study for 2 years. Interventional radiology, no of patients 150. In 150 patients, 200 limbs were treated with Biolitec LASER ablator with Optical power 10 watts and wavelength of 1465 nm with pulse mode in two year duration. The laser fiber introduced in to the superficial venous system generates thermal energy to cause ablation of respective veins. Perforators and superficial venous tributaries are also ablated in the similar way. Graded compression stockings were advised to the patients as an essential part of therapy in early post laser ablation period.
Results: In our study, high occlusion rate (100%) of treated veins on follow-up Doppler ultrasound treatment. Significant improvements in skin changes with high ulcer healing rates (98%) are observed. Significant pain relief was seen in all patients. In our series, no major complications were observed however minor complications like regional inflammatory changes (12%) and cellulitis (4%) at puncture sight were seen, which have responded to the medications
Conclusion: LASER ablation is a minimally invasive, safe and effective OPD treatment to treat symptomatic varicose veins because 100% occlusion rate and high ulcer healing rate with significant pain relief.

B-163 10:57

The difference of filtering efficiency between infra- and supra-renal implant of two vena caval filters

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Purpose: To compare filtering efficiency among two different inferior vena caval filters depending on the filter position in an vitro model.
Methods and Materials: Guenther tulip filter (GTF) or OptEase filter (OEF) was positioned into an in vitro vena caval model (25 mm I.D). below or above renal venous ostia (13 mm I.D). Clot emboli made from 3.5% polyacrylamide gel of varying sizes (5x15, 5x10, 5x5 mm) were introduced into a constant flow of 44% glycerin solution, and the frequency of successful captures by the filters was recorded. Two phantom position/flow sets were applied; the horizontal position simulating rest (total 2 L/min, 0.4 L/min in each renal vein) and the vertical position simulating exercise (6.5, 0.6 L/min correspondingly).

Results: In the horizontal set, infraneal GTF captured 65, 55, 60% of each 5x15, 5x10, 5x5 mm clot emboli, while suprarenal GTF trapped 30, 25, 25% of each clot emboli. On the other hand, infrarenal OEF captured 65, 50, 65% and suprarenal OEF trapped 70, 55, 50% of each clot emboli. Suprarenal GTF diminished the filtering efficiency significantly ($p < 0.05$) as compared with infrarenal GTF, while OEF showed stable filtering effect independent of the filter postition. In the vertical set, the ratios of each size of captured clots were 55, 45, 30% by infrarenal GTF, 25, 15, 15% by suprarenal GTF, 70, 50, 40% by infrarenal OEF and 40, 30, 30% by suprarenal TEF without significant differences.

Conclusion: For suprarenal implant, OEF seems to be more suitable than GTF concerning filter efficiency in vitro.

B-164   11:06

Two-year interim results of the Zilver® PTX® global registry

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Purpose: This is an interim report on clinical evaluation of the performance of the Zilver® PTX® Drug-Eluting Stent (Cook Medical) in the above-the-knee femoro-popliteal artery (SFA).

Methods and Materials: A multi-center, multi-national registry is ongoing to evaluate the performance of the Zilver® PTX® Drug-Eluting Stent in the SFA in 791 patients. Follow-up includes evaluation of stent integrity, event-free survival (EFS) and freedom from target lesion revascularization (TLR).

Results: The complex lesions treated included approximately 24% restenotic lesions (with 63% of these being in-stent restenoses), 38% total occlusions and 22% long lesions (> 15 cm). The average lesion length was 9.9 ± 8.2 cm, the average percent diameter stenosis was $85 \pm 17\%$, and an average of 1.9 Zilver® PTX® stents were used per lesion. Follow-up is currently available at one year for 718 patients (818 lesions) and at two years for 375 patients (427 lesions). Results to date in this complex patient population indicate that, at one year, stent integrity (freedom from fracture of even a single stent strut) was maintained in 98.4% of stents, the EFS rate was 87%, and 89% of lesions were free from TLR. At two years the EFS rate was 80% and freedom from TLR was 82%.

Conclusion: These interim results indicate excellent device integrity, no safety concerns, and favorable effectiveness with the Zilver® PTX® Drug-Eluting Stent in the SFA.

B-165   11:15

Percutaneous approach to severe ischemic hand disease: Technical aspect and results

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Purpose: Ischemic disease of hands is a rare pathology. With the exception of post traumatic occlusions, the most part of cases are due to chronic atherosclerotic disease, associated to severe renal failure and diabetes, and embolic events. We report our experience with endovascular approach focusing on technical aspects and results.

Methods and Materials: In a single-center retrospective clinical analysis from January 2008 to March 2009 we collected 8 patients with critical hand ischemia (6 male and 2 female). All patients were symptomatic for pain and 3 patients present ulcers to distal fingers. 3 patients had occlusion of radial and ulnar arteries, 2 had occlusion of the radial artery and severe stenosis of the ulnar artery and patients had obstruction of the ulnar artery with severe stenosis of the radial artery. All patients were treated by an antegrade omeral puncture. In 6 patients, an antegrade approach was succesful. In 3 patients, a combined antegrade and retrograde radial to ulnar and in 1 patient ulnar to radial approach was performed passing through the palmar arch.

Results: Successful recanalization was obtained in all patients (100%). Symptomatic improvement was obtained in all patients. A complete resolution of ulcers was obtained in all patients. Mean TcPO2 increased from a basal mean value of 6.3 to 54.6 mmHg.

Conclusion: In selected cases, percutaneuous angioplasty may be considered the best approach to treat hand ischemia.

B-166   11:24

Subintimal angioplasty for superficial femoral artery TASC II D lesions in critical limb ischemia: Outcomes with and without stenting and value of stent position for secondary patency after subintimal channel occlusion

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Purpose: In a prospective, double arm, non randomized, single center consecutive series of subintimal angioplasty (SIA) with selective stent placement for superficial femoral and popliteal artery TASC II D lesions, critical limb ischemia patients' data were analyzed with regard to immediate outcome and follow-up success.

Methods and Materials: SIA was successful in 398 patients of 406 critically limb ischemia (98%). Stents were released in the subintimal channel in 83 patients (21%) after suboptimal SIA.

Results: Primary patency at one year follow-up was 79.5 and 66.7%, respectively, in patients treated with and without stent (p=0.02). 1 year follow-up secondary patency was 87.5 and 92.0% in patients treated with and without stent (p=NS). Re-occlusions occurred in 147 patients treated by SIA alone (47%) and 27 patients treated by SIA and stent (32%) (p=0.02). Successful recanalization rate was higher for patients treated by SIA alone (95%) compared to patients in who a stent was released (81%) (p=0.04). Feasibility of stent recanalization was higher in patients treated by a stent released in contact with the true lumen (p=0.02).

Conclusion: SIA is a feasible and effective primary treatment for patient with critical limb ischemia due to TASC II D superficial femoral and popliteal artery lesions. Use of stent in subintimal angioplasty improved primary patency compared to SIA alone treatment. Stent position affects the technical approach for possible future recanalization after stent occlusion.

B-167   11:33

Alternative techniques for below-the-knee recanalization: Procedural and clinical results from a single center experience

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Purpose: Percutaneous arterial recanalization with PTA is becoming cornerstone of treatment of below-the-knee vascular peripheral disease. Nonetheless, successful recanalization is not always obtained with traditional antegrade approaches. Recently, new alternatives techniques have been introduced to recanalize these cases not treatable with antegrade approach. We report our results focusing on anatomical indications technical aspects and rationale of these new approaches.

Methods and Materials: In a single-center retrospective clinical analysis, from January 2005 to March 2009, we collected 1554 patients with critical limb ischemia for complex lesions of the popliteal and infrapopliteal vascular territory. In 184 patients (12%), traditional antegrade revascularization failed and alternative techniques were adopted. Of these subgroups, 56 (4%) limbs were treated with transpedal retrograde approach, in 44 (3%) patients a pedal to plantar and 30 patients a plantar to pedal retrograde revascularization was performed. A trans-collateral angioplasty and retrograde revascularization was suitable in 54 patients.

Results: Successful recanalization was obtained in 181 patients (98%) with alternative techniques. Adjunctive popliteal stenting was performed only in 9 patients for suboptimal angioplasty results. Only two retroperitoneal bleeding and 12 minor complications were registered. Limb salvage rate at 1 year follow-up was 99%. All patients obtained an immediate improvement of clinical status.

Conclusion: High failure rate for antegrade revascularization is reported in literature. Most of these patients are considered at risk for surgical approach. Alternative techniques may be useful in these cases to obtain a significant improvement of symptoms with a safe and feasible technique.

B-168   11:42

Treatment of arterial steal syndrome in liver transplant recipients

F. Boyvat, A. Harman, U. Ozyer, C. Aytekin, M. Haberal; *Ankara/TR (boyvatf@yahoo.com)*

Purpose: To describe the effect of splenic or gastroduodenal artery embolization in liver-transplant patients with arterial steal syndrome.

Methods and Materials: Between 2001 and 2009, 239 liver transplantation (192 living donor, 47 cadaveric) were performed at our centre. 23 liver transplant patients, fifteen men and eight women, ranging in age from 3 years to 64 years with graft ischemia, were diagnosed, based on clinical, laboratory, ultrasonographic, and angiographic findings. To determine diagnostic criteria, steal syndrome was defined as diminished hepatic arterial flow caused by a shift of hepatic arterial flow to splenic or gastroduodenal artery. Patients with established hepatic artery stenosis or thrombosis were excluded from this study. Treatment consisted of coil

Friday

embolization of the mid-splenic (n= 13), gastroduodenal artery (n= 3), both mid-splenic and gastroduodenal artery (n=1) and embolization of mid-splenic artery with Amplatz plug device (n=6). Biochemical parameters were checked at 1st, 7th and 30 days postprocedure.

Results: 22 patients improved clinically within 24 hours of the procedure with significant change in the biochemical and clinical parameters. No biochemical or clinical improvement was seen in one patient. Before treatment, mean ALT, AST, and total bilirubin levels were 151.08, 83.12 and 7.18 U/L, respectively. Posttreatment 1st day mean ALT, AST, and total bilirubin levels were 102.67, 63.11, and 5.56 U/L, respectively. Follow-up biochemical parameters and graft functions were remained normal in 22 patients.

Conclusion: Conventional angiography has a critical role for the diagnosis and also treatment of arterial steal after liver transplant.

B-169   11:51

Developing the role of a non-surgical vascular specialist

N. Das; *Bristol/UK (neelan.das@gmail.com)*

Purpose: In order to constructively work with vascular surgeons developing angiographic skills, interventional radiology (IR) trainees need to become more clinically involved in the care of their patients. We created a pilot hybrid training post for IR trainees to achieve this. Formalised, combined surgical and IR training posts within the UK are being discussed. We describe our experience of this 4 month pilot.

Methods and Materials: We obtained the agreement of our local radiologists and vascular surgeons, designing a timetable to meet both interventional and surgical training needs. The IR trainee participated in the radiology on call rota.

Results: In 4 months (September 2008 to January 2009), the trainee performed 39 first operator vascular surgical procedures, assisted in 3 carotid endarterectomies, one renal transplant and developed wire and catheter skills exceeding Royal College of Radiology requirements. In 10 outpatient clinics, from primary referral to post procedure follow-up, the trainee independently reviewed 40 patients demonstrating a representative sample of the vascular disease spectrum. The trainee also participated in two vascular surgical ward rounds and a multidisciplinary meeting per week. With a surgical colleague training in IR, closer, working relationships developed, and the IR trainee had more ownership of his patients.

Conclusion: We have shown that integrated clinical training for IR trainees is feasible, at no additional cost. It results in more efficient patient management and closer interdisciplinary working between two specialities which may merge in the future. The next step is to formalise this training throughout the UK and Europe.

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

Breast

SS 402

Combined approach of breast imaging

Moderators:
B. Allgayer; Lucerne/CH
E.M. Fallenberg; Berlin/DE

B-170   10:30

Diagnostic accuracy of mammography, ultrasound, and MR imaging for the evaluation of suspected breast cancer recurrence after mastectomy with implant reconstruction

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Purpose: To prospectively assess the accuracy of X-ray mammography, ultrasound and MRI in evaluation of local cancer recurrence in patients who underwent mastectomy with implant reconstruction.

Methods and Materials: 76 patients with suspected breast cancer local recurrence after mastectomy with implant reconstruction based on clinical examination and conventional imaging underwent breast-MRI at 1.5 T. Imaging was performed in the axial plane using a T2-weighted STIR sequence and 3D dynamic T1-weighted gradient-echo sequence acquired before and after administration of 0.1 mmol/kg c.a. The lesions identified were evaluated histologically. The diagnostic performance of breast-MRI relative to ultrasound and X-ray mammography was evaluated in terms of sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV).

Results: MRI identified 56/56 recurrent cancers, while X-ray mammography and ultrasound identified 49/56 and 50/56 lesions. There were no false positive findings on MRI while X-ray mammography and US determined 15 and 10 false positive

lesions. Breast-MRI provided more accurate assessment of tumor size than mammography and ultrasound. Sensitivity and specificity values were 100% for breast-MRI (vs. 89 and 57% for X-ray mammography, and 88 and 67% for ultrasound), while the overall accuracy was 100% (vs. 71 and 69% for X-ray mammography and ultrasound). The PPV and NPV for breast-MRI were 100% compared to 76 and 23% for X-ray mammography and 83 and 26% for ultrasound.

Conclusion: Breast-MRI is the most reliable technique to detect local recurrence after mastectomy with breast implant reconstruction.

B-171   10:39

Near-infrared imaging of breast cancer with high temporal resolution using the contrast agent indocyanine green

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Purpose: To investigate early and late enhancement characteristics of a fluorescent dye (Indocyanin Green, ICG) with a prototype near-infrared (NIR) scanner to differentiate between malignant and benign breast lesions. Work in progress.

Methods and Materials: Eighteen patients were scanned before, during and after intravenous administration of ICG on a prototype near-infrared tomography system (NIRx GmbH, Berlin, Germany) that allows for scanning the whole breast with high temporal resolution of up to two complete volumes per second using parallel detection (32 detectors). Datasets were analyzed for early and late enhancement with different mathematical models (general linear model, GLM, and curve-fitting-methods) to differentiate between benign and malignant lesions.

Results: Histology revealed 13 malignant and 5 benign lesions. On NIR-imaging, 9 malignant lesions exhibited markedly different enhancement characteristics compared to the surrounding breast tissue and thus were demarcated at high contrast. Among these cancers, three invasive ductal carcinomas with diameters smaller than 1 cm showed pronounced enhancement on NIR-imaging. One case of a fibroadenoma and two cases of mastopathic featured a similar early enhancement.

Conclusion: Analyzing early enhancement of ICG can facilitate discrimination between malignant breast lesions and non-diseased tissue at high contrast. More refined mathematical models for analyzing late ICG-enhancement are needed and currently deployed to reveal different interactions between ICG and tissue in benign and malignant lesions.

B-172   10:48

How safe is it to not biopsy or follow-up women under 30 with likely fibroadenomas?

R. Sinnatamby, K.A. Taylor, P.D. Britton, M.G. Wallis; *Cambridge/UK (kathryn.taylor@addenbrookes.nhs.uk)*

Purpose: Breast cancer is infrequent in women < 30 years; in our practice (400 new cancers per annum), we would expect to see one every 1-2 years. Focal masses are most commonly BIRADS 3, and most prove to be fibroadenomas (FA). Hitherto, we have always confirmed this by needle biopsy prior to discharge. We wished to devise a safe holistic protocol to avoid both biopsy and follow-up in these lesions but also avoid missing cancers.

Methods and Materials: A protocol to allow non-biopsy of likely FAs (BIRADS 3 on ultrasound) in women < 30 was devised to include mandatory imaging and clinical criteria: ellipsoid shape, complete pseudocapsule, smooth outline, fewer than four gentle lobulations, correlation with benign clinical score (E2) and no significant family history. This protocol was retrospectively tested against all solid breast lesions presenting in women < 30 from 2000 to 2008.

Results: During the study period, 499 solid lesions were found in women < 30. All had undergone triple assessment including core biopsy. 11 were clinically ± sonographically suspicious (E 3 or 4; BI-RADS 4). These proved to be 9 cancers and 2 phyllodes tumours. Applying the new protocol, all failed to meet criteria for non biopsy. The remaining 479 lesions were clinically benign (E2) and BI-RADS 3 on ultrasound. Biopsy confirmed FAs in all.

Conclusion: Applying our protocol, no cancers would have been missed during the eight year period. We therefore propose that it is a safe practice to not biopsy or follow-up women < 30 who meet these specific criteria.

B-173 10:57

Borderline breast lesions: Comparison of underestimation rates of malignancy after 14-gauge core needle biopsy versus 11-gauge vacuum probe

V. Londero, C. Zuiani, A. Linda, C. Zanatta, R. Girometti, M. Bazzocchi; *Udine/IT (londero.viviana@aoud.sanita.fvg.it)*

Purpose: To compare the malignancy underestimation rates in case of percutaneous diagnosis of borderline (B3) breast lesions at 14-Gauge core-needle-biopsy (CNB) and at 11-Gauge vacuum-assisted-biopsy (VAB).
Methods and Materials: The histologic results of 4764 imaging-guided needle biopsies of the breast performed over a 10-year period were retrospectively reviewed. 300 borderline breast lesions -151 benign papillomas, 88 radial sclerosing lesions (RSL), 46 lobular neoplasia (LN), 15 atypical ductal hyperplasia (ADH)- diagnosed at sonographically-guided 14-Gauge CNB (76%) or at stereotactically-guided 11-Gauge VAB (24%) were identified. On average, 5 cores (range 4-7) were obtained with CNB and 12 cores (range 7-18) with VAB. Biopsy variables were reviewed and correlated with surgical excision or imaging follow-up (> 24 months). Device-specific and lesion-specific underestimation rates of malignancy were calculated. Fisher's exact test was used for statistical analysis (statistically significant: p-value< 0.05).
Results: Surgical excision was performed on 237 (79%) lesions: 178 (75%) were benign, 21 (9%) atypical and 38 (16%) cancers. The remaining 63 (21%) lesions were unchanged at the 2-year follow-up. Overall malignancy underestimation rate at percutaneous breast biopsy was 12.7% (29/228) at 14-gauge CNB under sonographic guidance and 12.5% (9/72) at 11-gauge VAB under stereotactic guidance [p=0.254]. Based on excision histology or follow-up, lesion-specific underestimation rates were: benign papillomas: 14-gauge CNB 11% (15/139), 11-gauge VAB 0% (0/12) [p=0.610]; RSL: 14-gauge CNB 6% (4/63), 11-gauge VAB 4% (1/25) [p=1.000]; LN: 14-gauge CNB 40% (8/20), 11-gauge VAB 23% (6/26) [p=0.333]; ADH: 14-gauge CNB 33% (2/6); 11-gauge VAB 22% (2/9) [p=1.000].
Conclusion: In case of percutaneous diagnosis of borderline breast lesions (B3), significant sampling error occurs regardless of the core-biopsy device.

B-174 11:06

Interpretation of automated breast scanning (ABS) with and without knowledge of mammographic findings: A reader performance study

P. Skaane[1], R. Gullien[1], F. Stoeblen[2], R. Schulz-Wendtland[3], M. Sandhaug[4], E.B. Eben[1], T. Nyborg[1], M. Seland[1], E. Rostad[1]; [1]*Oslo/NO*, [2]*Essen/DE*, [3]*Erlangen/DE*, [4]*Fredrikstad/NO (per.skaane@ulleval.no)*

Purpose: To compare interpretation of ABS with and without knowledge of mammography.
Methods and Materials: 114 breasts examined with digital mammography and ABS (SomoVu™ Automated 3D Breast Ultrasound System, U-Systems inc., Siemens Healthcare) were interpreted by 5 radiologists experienced in breast imaging using BIRADS assessment categories 1-5. ABS only was offered in the first and ABS plus mammography (without report) in the second reading session six weeks later. Indication for mammography included assessment of screening abnormalities (n=64), palpable lump (n=35), surveillance of BCT (n=11), and others (n=4). Material consisted of 38 cancers and 76 benign/normal, including 16 benign tumors. Reading environment differed for the readers. ROC analysis was used for performance measurement.
Results: The mean size (on histology) for all cancers was 16.2 mm, for screening-detected invasive cancers 13 mm and for palpable tumors 21 mm. The area under the ROC curve (Az value) for the 5 radiologists for ABS interpretation without and with knowledge of mammography was: reader A 0.592-0.744; reader B 0.740-0.947; reader C 0.759-0.823; reader D 0.670-0.688; and reader E 0.904-0.923. There was considerable interobserver variability. For combined ABS-mammography reading, sensitivity varied from 50 to 97% and specificity from 33 to 96%.
Conclusion: ABS is a promising technology as shown by high diagnostic performance for some of the readers. All radiologists improved their performance when using combined ABS-mammographic interpretation. Considerable interobserver variability indicates that interpretation environment, ABS reading protocol, and learning curve are important aspects when introducing this new technology.

B-175 11:15

Initial experience of an automated breast volume scanner for the identification and diagnosis of breast cancer

D.-A. Clevert, K. Hellerhof, T. Schlossbauer, M.F. Reiser; *Munich/DE (Dirk.Clevert@med.uni-muenchen.de)*

Purpose: To evaluate the performance of an automated-breast-volume-scanner (ABVS) versus conventional hand-held-ultrasonography (HH-US) by comparing lesion visibility.
Methods and Materials: Scanning breast ultrasound was performed on 53 breasts in 27 patients in addition to mammography or MRI. Using automated scanning parameters, three to five views were taken of each breast by trained radiologists, using the Siemens ACUSON S2000™ ABVS ultrasound system. Imaging of the lesions using the ABVS was performed with a 14L5BV transducer and compared with visibility of these same lesions using HH-US with a 13 MHz transducer. All lesions were classified according to BI-RADS assessment.
Results: A total of 27 patients were successfully examined. Median patient age was 53 years (range 13-80). Median ABVS scanning time was for each breast 8.2 minutes (range 3-15), interpretation time was 7.4 minutes (range 3-18). In 17 patients, HH-US depicted 25 lesions which were confirmed by the ABVS. There were 7 carcinomas and 18 benign lesions (4 fibroadenomas, 1 peripheral papillomas, 8 cystic lesions, 5 post surgical scars). No benign lesion was classified as BI-RADS 5 with ABVS or HH-US. All breast cancers were found with the ABVS and correctly classified as BI-RADS 4 or 5. There was good agreement regarding BI-RADS classification of HH-US and ABVS. The size of all lesions ranged from 5 to 35 mm (median 17 mm).
Conclusion: These preliminary results suggest that images made with the automated breast volume scanner (ABVS) allow detection of solid and cystic lesions and their BI-RADS classification with a high reliability in comparison to HH-US.

B-176 11:24

also EPOS

Supplemental use of optical diffusion breast imaging for differentiation between benign and malignant breast lesions

J. Moon[1], H. Kim[2], H. Shin[2]; [1]*Anyang, Gyeonggi-do/KR*, [2]*Seoul/KR (geenie-m@hanmail.net)*

Purpose: To prospectively evaluate of the diagnostic accuracy of optical diffusion breast imaging in patients who underwent conventional ultrasound and then underwent surgery or biopsy.
Methods and Materials: We performed optical diffusion breast imaging after conventional ultrasound in 61 lesions. All patients underwent ultrasound-guided core needle biopsy or surgery. Two radiologists reviewed morphology and BIRADS category on conventional ultrasound and also reviewed diffusion features on supplemental optical diffusion imaging. Surgery and biopsy results served as reference standard. We compared the diagnostic accuracy including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) between the results of conventional ultrasound and the supplemental use of diffusion optical imaging to conventional ultrasound.
Results: Of the 61 lesions, forty-four lesions were malignant and 17 lesions benign. Conventional ultrasound gave a sensitivity of 97.9%, specificity of 21.4%, PPV of 80.7%, and NPV of 75.0%, whereas the supplemental use of optical diffusion imaging to conventional ultrasound gave a sensitivity of 95.8%, specificity of 46.2%, PPV of 86.8%, and NPV of 75.0%, respectively. The supplemental use of optical diffusion imaging decrease the benign biopsy results in 36.3% (4/11).
Conclusion: The optical diffusion breast imaging might be an adjunctive tool to increase the diagnostic accuracy of the conventional ultrasound in differentiating malignant from benign breast lesions.

B-177 11:33

Ultrasound-guided bipolar radiofrequency ablation of breast cancer in inoperable patients

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Purpose: Radiofrequency ablation (RFA) is a promising, minimally-invasive modality to treat small breast cancer (BCA). In most studies, cancers were surgically excised shortly after RFA. We present six patients with high risk of general anesthesia and surgery when diagnosed with BCA, and RFA performed instead of surgery.
Methods and Materials: Ultrasound-guided bipolar RFA was performed under local analgesia in six women aged 63-85 years. They had core-biopsy proven T1-2N0M0 grade I or II 1.0-2.7 cm invasive ductal cancers, with positive estrogen receptor status. Four tumors were > 2 cm, and three 10-12 mm in diameter. Patients had high-risk of general anesthesia and surgery because of severely impaired cardiac function, advanced age, associated diseases (acute myeloid leukemia-AML, diabetes, hypertension, depression) and/or refused surgery.
Results: Six tumors in five patients were completely ablated, without recurrence during 9-49 months follow-up. One superficially located cancer was partially ablated; the patient died after two months from myocardial infarction. Patient with AML and BCA had infection of treated breast after 4 months and delayed mastectomy during AML remission, without cancer on histopathology; she died of leukemia 42 months after RFA. Four patients are well, without complications.
Conclusion: Ultrasound-guided percutaneous RFA under local analgesia is an effective alternative to surgery for BCA < 3 cm in patients with high-risk for surgery or who refuse surgery.

B-178 11:42

also EPOS

Breast cancer detection: Radiologists' performance using mammography with and without automated whole-breast ultrasound

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Purpose: Radiologist reader performance was compared for breast cancer diagnosis using mammography alone and mammography with automated whole-breast ultrasound (AWBU).
Methods and Materials: Screenings for non-palpable breast malignancies in women with radiographically dense breasts with simultaneous mammograms and AWBU were reviewed by 12 radiologists who were blinded to the diagnoses; half the studies were abnormal. Readers first reviewed the 102 mammograms. ACR BIRADS and DMIST likelihood ratings were recorded with location information. Readers then reviewed the mammograms and AWBU together with the knowledge of their previous mammogram-only evaluation. We compared reader performance across screening modalities using jackknife alternative free-response receiver operating characteristic (JAFROC). Analogous to the Receiver Operator Curve (ROC), JAFROC defines a figure-of-merit (FOM) for area under the curve defined as the probability that a cancer on an abnormal image is scored higher than a falsely-marked location on a normal image. Higher FOM indicates improvement in reader performance.
Results: Reader-averaged FOM was higher for mammography plus AWBU compared to mammography alone by BIRADS (0.783 versus 0.671; p < 0.001) and likelihood scores (0.789 versus 0.674; p < 0.001). Averaged across readers, callback was recommended for 55% of cases by mammography only and 68% of cases by mammography plus AWBU (p < 0.001). However, the probability of cancer given a callback, i.e. positive predictive value, was similar for mammography only (58%) and mammography plus AWBU (60%).
Conclusion: Adding AWBU to mammography improved the breast cancer detection for women with dense breasts.

B-179 11:51

Dual-time-point PET/CT to discriminate between physiologic and metastatic axillary lymph nodes?

S. Hahn, T. Heusner, A.R. Stahl, A. Bockisch, M. Forsting, G. Antoch; *Essen/DE (steffen.hahn@uk-essen.de)*

Purpose: To assess whether dual-time point PET/CT may be able to differentiate benign from malignant axillary lymph nodes in breast cancer (BC) patients.
Methods and Materials: 20 BC patients (mean age: 50±15 years) underwent FDG-PET/CT. The SUVmax of non-tumorous and metastatic axillary lymph nodes was measured at time points T1 (60 min after intravenous FDG injection) and T2 (90 min). The differences in the SUVmax at time points T1 and T2 were compared between the two groups (physiologic lymph nodes and metastatic lymph nodes) and assessed for statistical significance by Wilcoxon´s Test (p < 0.05). Histopathology served as the reference standard.
Results: The mean SUVmax in the physiologic group (n=20 lymph nodes) rose from 0.9 (±0.1) at time point T1 to 1 (±0.1) at time point T2. In the metastatic group (n=7 lymph nodes), the mean SUVmax increased from 5.3 (±3.5) at time point T1 to 7.2 (±5.6) at time point T2. The SUVmax at T1 and the increase in SUVmax from T1 to T2 were significantly higher in the metastatic group than in the physiologic group (p=0.028).
Conclusion: Compared with non-tumorous lymph nodes, metastatic lymph nodes demonstrated both a higher SUVmax at 60 min and a significantly higher increase in the SUVmax over time. Dual-time point PET/CT seems to be a sufficient tool to differentiate benign from malignant lymph nodes.

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

Head and Neck

SS 408

New insights on orbital, thyroid and parathyroid pathology

Moderators:
P.-Y. Marcy; Nice/FR
K. Zelenak; Martin/SK

B-180 10:30

Real-time ultrasound elastography in the differential diagnosis of benign and malignant thyroid nodules

V. Cantisani, E. Marotta, E. Medvedeieva, U. D'Ambrosio, P. Ricci, R. Passariello; *Rome/IT (vito.cantisani@uniroma1.it)*

Purpose: To assess the clinical value of real-time ultrasound elastography in differentiating benign from malignant thyroid nodules.
Methods and Materials: Fifty-three thyroid nodules in 41 consecutive patients were examined (21 women, 20 men, mean age ± SD, 49 ± 9.3). Elastosonography was performed by a real-time, free-hand technique, using Toshiba Aplio XG with a 9 MHz wide band transducer. All patients were also examined by grey scale high frequency ultrasound and color Doppler and underwent Thyroidectomy. Issue stiffness on ultrasound elastography was scored from 1 (low stiffness over the entire nodule) to 5 (high stiffness over the entire nodule and surrounding tissue). The standard reference was histopathology in all patients.
Results: On real-time ultrasound elastography, 38 of 41 benign nodules (92%) had a score of 1 to 3, whereas 10 of 12 malignant nodules (95%) had a score of 4 to 5 (P <.001), with sensitivity of 95%, specificity of 92%, a positive predictive value of 76%, and a negative predictive value of 95%. The predictivity of ultrasound elastographic measurement was independent of the nodule size.
Conclusion: The preliminary results of the present study show that real-time ultrasound elastography is a feasible tool in the characterization of thyroid nodules, more accurate than color-Doppler sonography.

B-181 10:39

Contrast-enhancement of the anterior eye segment in patients with retinoblastoma: Correlation among clinical, MR imaging and histopathological findings

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Purpose: Abnormal anterior eye segment (AES) contrast-enhancement is recognized in a substantial number of retinoblastoma-affected eyes. We retrospectively investigated the histopathologic basis of AES contrast-enhancement on MR images in retinoblastoma.
Methods and Materials: Pretreatment contrast-enhanced MR images were obtained from 42 children with retinoblastoma. Forty-two enucleated eyes were included in this study and AES-enhancement was evaluated, using a three point score and these data were correlated with clinical, MR imaging and histopathological findings. Additionally, 14 specimens were immunohistochemically analyzed for CD-31, vascular endothelial growth factor (VEGF) and Flt-1 (VEGF-receptor-1) expression. Statistical correlations with AES-enhancement were assessed by using a linear-by-linear association test and univariate and multivariate ordinal regressions.
Results: Degree of abnormal AES-enhancement was moderate in 15 (36%) eyes and strong in 14 (33%) eyes, whereas 13 (31%) eyes showed normal AES-enhancement. In multivariate analysis, degree of AES-enhancement showed statistically significant correlations with iris surface vessel count (P=0.05) and optic nerve invasion (P=0.04) in the enucleated eye and with tumor volume (P=0.02) as detected on MR imaging. No significant associations between AES-enhancement and VEGF expression in the iris were observed. Flt-1 (P=0.04) staining in iris stroma and iris angiogenesis as detected with CD-31 staining (P=0.009) both yielded a statistically significant positive correlation with abnormal AES-enhancement.
Conclusion: Degree of abnormal AES-enhancement on MR imaging in retinoblastoma reflects angiogenesis in the iris. AES-enhancement is also a hallmark of advanced retinoblastoma, as its degree correlates with tumor volume and optic nerve invasion.

B-182 10:48

Role of diffusion-weighted imaging in the diagnosis and follow-up of ocular adnexal lymphomas

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Purpose: 1) To assess the accuracy of Apparent Diffusion Coefficient (ADC) in diagnosis of Ocular Adnexal Lymphomas (OALs); 2) to investigate whether variation of ADC values could constitute a reliable biomarker of OALs response to therapy.
Methods and Materials: ADC values of normal orbital structures were obtained from 18 healthy volunteers. 38 patients carrying 46 (8 bilateral) pathology-proven OALs underwent serial magnetic resonance examinations of the orbits with gadolinium (mean 3 + 2.3 examinations with a follow-up of 441 + 474 days). Before gadolinium injection, diffusion weighted (DW) sequences were acquired (b=700, thickness=3 mm, sense reduction factor=3.8) and ADC maps were calculated. Mean ADC values before and after treatment (doxycycline, chemotherapy or radiotherapy) were compared. 58 patients suffering from other orbital diseases (20 primary non-OAL tumors, 15 benign expansive lesions, 12 inflammatory lesions, 11 metastasis) underwent the same imaging protocol.
Results: At baseline, ADC values of OALs were significantly lower than those of normal orbital structures (p < 0.05) and other orbital diseases (p < 0.001). A threshold value of 775×10^{-6} mm^2/s allowed 96% sensitivity and 93% specificity in OALs differential diagnosis. After treatment, significant increase of ADC values (p=0.002) accompanied and in 3 cases even preceded volumetric reduction of the lesion. Conversely, a further reduction of ADC values was observed in patients who experienced disease progression (p=0.008).
Conclusion: DWI allowed to recognize the extension of OALs within healthy orbital tissues and showed 94.4% accuracy in OALs diagnosis. Moreover, changes in ADC values represent an additional helpful tool for monitoring the outcome of therapy.

B-183 10:57

The application of magnetic resonance diffusion tensor imaging in ischemic optic neuropathy at 3.0 T

P. Qi[1], D. Shi[1], Y. Dai[2], M. Wang[1]; [1]Zhengzhou/CN, [2]Shanghai/CN (zd4507@126.com)

Purpose: To evaluate the value of magnetic resonance diffusion tensor imaging (MR-DTI) in detecting ischemic optic neuropathy.
Methods and Materials: MR-DTI was performed on 18 patients who suffered from unilateral ischemic optic neuropathy and 24 healthy adults using 3.0 T MRI (TimTrio, Siemens Medical Solutions, Malvern, PA). Fractional anisotropy (FA), apparent diffusion coefficient (ADC), eigenvalue1 (E1), eigenvalue2 (E2),relative anisotropy (RA),volume ratio (VR), value of ischemic optic nerves, contralateral unaffected nerves and optic nerves of control group were measured and compared.
Results: The mean values of FA, ADC, E1, E2, RA, VR of ischemic optic nerves were 0.259 ± 0.057, $1510\pm85\times10$-6, $1884\pm139\times10$-6, $1476\pm302\times10$-6, 0.216 ± 0.049, 0.919 ± 0.023 mm2s-1, respectively. The corresponding mean values of contralateral unaffected nerves were 0.574 ± 0.018, $1025\pm67\times10$-6, $1661\pm103\times10$-6, $962\pm182\times10$-6, 0.548 ± 0.026, 0.624 ± 0.030 mm2s-1, respectively. The mean values of FA, ADC, E1, E2, RA, VR of optic nerves of control group were 0.585 ± 0.020, $935\pm133\times10$-6, $1654\pm157\times10$-6, $752\pm118\times10$-6, 0.561 ± 0.026, 0.617 ± 0.048 mm2s-1, respectively. The ADC, E1, E2, VR values of affected nerves were all higher than those of unaffected nerves and control nerves (P < 0.001), but both FA, RA values were lower than those of unaffected nerves and control nerves (P < 0.001).
Conclusion: MR-DTI is a sensitive and reliable method in detecting ischemic optic neuropathy.

B-184 11:06

Role of orbital color Doppler ultrasound (OCDU) in the non-invasive diagnosis of dural fistulas using digital subtraction angiography (DSA) as gold standard

M. Cellina, M. Venturini, C. Losio, F. Simionato, S. Bianchi Marzoli, A. Del Maschio; *Milan/IT (cellina.michaela@hsr.it)*

Purpose: Several case reports showed dilation and flow changes of Superior Ophthalmic Vein (SOV) with OCDU in case of carotid-cavernous-sinus-fistulas, generally hemodinamically significant. Our aim was to evaluate OCDU in the diagnosis of dural fistulas, often characterized by a low-flow, in a relative large number of patients, using DSA as the gold standard.
Methods and Materials: Twenty-seven symptomatic consecutive patients (exophthalmos and/or hyperemia) were enrolled and submitted to a complete ophthalmologic examination, OCDU and DSA. Both eyes (54 total eyes) were studied with OCDU (ATL-Philips HDI-5000; 5-12-MHz linear-probe), performed by the same operator blinded to the DSA finding. Patients were studied in supine position with

closed eyelids. Positive diagnosis of dural fistula with OCDU was based on the finding of SOV with reversed, arterialized, and low resistance (RI< 0.5) blood flow. Sensitivity, specificity, PPV, NPV, and accuracy of OCDU were calculated using DSA as the gold standard.
Results: Sensitivity, specificity, PPV, NPV, and accuracy of OCDU were as follows: 83, 84, 84, 83 and 84%, respectively.
Conclusion: OCDU is a sensitive technique in the non-invasive diagnosis of dural fistulas. In case of clinical suspect, OCDU can represent the first choice technique to non-invasively diagnose (and monitor) a dural fistula with ophthalmic involvement.

B-185 11:15

Charcoal suspension tattoo localization under ultrasound guidance for neck cancer recurrences from thyroid cancer

L. Chami, D. Hartl, N. Lassau, E. Girard, S. Bidault, M. Chebil, M. Schlumberger, J. Travagli; *Villejuif/FR (chami@igr.fr)*

Purpose: The high sensitivity of ultrasound and thyroglobulin blood level allow early detection of nonpalpable neck recurrences in thyroid cancer patients follow-up. Intraoperative localization of small lesions in previously dissected necks is a surgical challenge.
Methods and Materials: Prospective study of 26 patients with 43 nonpalpable neck recurrences of thyroid cancer. Malignancy was suspected by cytology in 18 lesions, FDG uptake in 3, iodoine scintigraphy in 3, thyroglobuline blood level and ultrasound findings in 19.Charcoal suspension was injected (1- 4 ml) under ultrasound guidance 1-15 days preoperatively by using a 25 gauge fine needle. Tolerance, intraoperative charcoal localization and usefulness in lesions detection were analyzed.
Results: Mean lesions size was 10.3 mm (min 4; max 25). Injection was well tolerated in 23 patients (88.5%), not performed in 1 deep lesion. Surgery removed all lesions: 37 malignant, 6 benign. Charcoal was found in or just next to 37 lesions (86%) and allowed intraoperative lesions localization in 25 (60.5%) difficult cases (small size, location, fibrosis).
Conclusion: Ultrasound-guided charcoal tattooing is safe, well-tolerated and easy for localization of nonpalpable recurrences in previously operated neck.

B-186 11:24

Diagnostic performance of thyroglobulin measurement with indeterminate range from fine needle aspiration washout fluid

Y.-M. Sohn, E.K. Kim, J. Kwak, H. Moon, M. Kim; *Seoul/KR (sonyumee@naver.com)*

Purpose: We intended to validate diagnostic performances with previously suggested the threshold values in a large series of LN with indeterminate value of fine needle aspiration (FNAB)- Tg ranging 0.2-100 ng/ml and, further, to determine the most appropriate threshold value of FNAB-Tg in indeterminate range of Tg measurements.
Methods and Materials: This study was a retrospective study and institutional review board approval was waived. Ninety-five lymph nodes with indeterminate value of FNAB-Tg ranging 0.2-100 ng/ml in ninety two patients were included in this study. They underwent FNAB and FNAB- Tg in suspicious metastatic cervical lymph nodes of papillary thyroid carcinoma and performed surgery. The diagnostic performances in multiple Tg levels (0.7, 1, 5, 10, 20, 50) were evaluated to compare with FNAB cytology by using sensitivity, specificity and accuracy with area under the curve (AUC) analysis.
Results: Forty-two lymph nodes were positive for metastasis and fifty-three lymph nodes were negative. FNA-Tg ranged from 0.22 to 90.9 ng/ml in metastatic lymph nodes (mean; 34.3 ± 33.3 ng/ml) and 0.20 to 56.7 in nonmetastatic lymph nodes (mean; 4.9 ± 11.1 ng/ml). The most excellent diagnostic performance was displayed in 5 ng/ml of FNAB-Tg with area under the curve of 0.76, sensitivity, specificity, accuracy, 69.0, 83.0, 76.8, respectively.
Conclusion: We recommend the following cutoff values for FNA-Tg levels: 5 ng/mL to differentiate benign from metastatic lymph nodes of thyroid carcinoma through our study with a large series with the indeterminate range (0.2-100 ng/ml) of FNAB-Tg.

B-187 11:33

Usefulness of ultrasound with elastography to predict the malignant thyroid nodules

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Purpose: The aim of this prospective study is to investigate: 1. the effectiveness of elastography to evaluate the differentiation between benign and malignant thyroid nodules, and establish characteristics of quality and quantity of elastography of

thyroid nodules. 2. To check elastography as an alternative to biopsy of thyroid masses, comparing the results obtained by surgical biopsy or FAN.

Methods and Materials: We used an Acuson.s. 2000 (Siemens, Erlangen, Germany) ultrasound equipped with multifrequency linear probes 18.9 MHz, 9.4 MHz multifrequency linear and elastography program grayscale and color. Finally, echo-guided biopsy of the thyroid nodule. We studied: Distribution and percentage of elasticity of the thyroid nodes, classifying in 5 different patterns. Pattern 1: no or very small area hardness (blue), pattern 2: hardness 45%, pattern 4: hardness peripheral and central areas of softness, pattern 5: area of hardness (red) occupying the entire thyroid node.

Results: Of the 30 patients, 26.6% had tumoral infiltration (9 patients): - 6 patients (20%) were classified as pattern 5- pattern 4, and 100% were malignant thyroid tumors in the biopsy. - 10 patient (33.3%) were classified as pattern 3 of whom 3 patients presented tumoral infiltration in the biopsy. - 14 (46.6) were classified as pattern 2 - pattern 1. In all, the FAN vs biopsy was negative for APE.

Conclusion: The use elastography increases the sensitivity of the biopsy in the prediction of infiltration thyroid node and improving accuracy of ultrasound. It even could be used as noninvasive diagnosis of tumoral disease and could substitute the biopsy.

B-188 11:42

Clinical utility of ultrasound and Tc⁹⁹ᵐ-Sestamibi SPECT/CT for pre-operative localisation of parathyroid adenomas in patients with primary hyperparathyroidism

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(chirag_patel@totalise.co.uk)

Purpose: To assess the accuracy of ultrasound and parathyroid scintigraphy using single-photon emission computed tomography/computed tomography (SPECT/CT) in pre-operative localisation of parathyroid adenomas in patients with primary hyperparathyroidism suitable for minimally-invasive parathyroid surgery.

Methods and Materials: 63 consecutive patients with biochemical evidence of primary hyperparathyroidism referred for pre-operative localisation of parathyroid adenoma proceeded to surgery in the same institution. All patients underwent high-resolution ultrasound and Technetium-99m-Sestamibi scintigraphy with planar and SPECT/CT imaging. The accuracy of pre-operative imaging was compared to surgical/histological findings as the reference standard.

Results: 59 patients had solitary adenomas, 3 patients had multiglandular hyperplasia and 1 patient had multiple adenomas confirmed histologically. 35 solitary adenomas were identified pre-operatively with ultrasound (64%) and 53 with SPECT/CT (90%). Ultrasound and SPECT/CT findings were concordant in 35 cases (59%). 3 adenomas were found with ultrasound alone and 18 adenomas with SPECT/CT alone. 51 of 56 adenomas localised with combined ultrasound and SPECT/CT were found at the expected sites during surgery. Combined ultrasound and SPECT/CT have an overall sensitivity of 95% and accuracy of 91% for the pre-operative localisation of parathyroid adenomas.

Conclusion: The combination of ultrasound and SPECT/CT has incremental value in accurately localising parathyroid adenomas over either technique alone and optimises selection of patients suitable for minimally-invasive surgery.

B-189 11:51

4D-MDCT: A radiologic imaging technique for anatomical localization and diagnosis of parathyroid tumors

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Purpose: To describe a high resolution, anatomically localizing imaging technique for identification of parathyroid adenomata using multiphase, contrast enhanced 4D-MDCT.

Methods and Materials: Four phase contrast enhanced CT was performed in 38 patients with biochemically proven hyperparathyroidism, complicated by associated thyroid disease, Multiple Endocrine Neoplasia type I or type II. Dynamic, sequential helical scanning was performed from the carina to the maxillary teeth, prior to contrast (phase 1), 25 seconds after injection of 120 ml Ioversol 320 at 4 ml/sec into an ante-cubital vein (phase 2), and 30 and 45 seconds after the end of the second and third phases, respectively. Standardized multi-oblique, volumetric and perfusion analysis was performed on an Advantage Windows Workstation (ADW4.4) using MIP, VR and CTp analysis protocols. All patients underwent surgical neck exploration with removal of parathyroid adenoma providing correlative pathology as the gold standard.

Results: In 38 patients, 4D-MDCT identified 52 potential parathyroid lesions. Of these, surgery confirmed 43, resulting in a positive predictive value of 83%. CT identified 9 potential lesions that were in fact normal parathyroid glands, a false

positive rate of 17%. Surgery identified 5 lesions that CT did not. Thus, sensitivity of 4D-MDCT was 90% in this group. There were 6 ectopic lesions, 2 in the mediastinum, 3 in the upper neck and 1 at the site of implantation into the sternocleidomastoid muscle from prior surgery.

Conclusion: 4D-MDCT is a valuable imaging method for the diagnosis and localization of parathyroid adenoma prior to surgery.

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

Cardiac

SS 403a

MDCT to assess coronary artery disease: New techniques, new insights

Moderators:
A.H. Mahnken; Aachen/DE
A.M. Taylor; London/UK

B-190 10:30

Low-dose CT and cardiac MR for the diagnosis of coronary artery disease: Accuracy of single and combined approaches

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Purpose: To prospectively compare the diagnostic performance of low-dose computed tomography coronary angiography (CTCA) and cardiac magnetic resonance imaging (CMR) and combinations thereof for the diagnosis of significant coronary stenoses.

Methods and Materials: Forty-three consecutive patients with known or suspected coronary artery disease underwent catheter coronary angiography (CA), dual-source CTCA with prospective electrocardiographygating, and k-space and time broad use linear acquisition speed-up technique accelerated cardiac CMR (1.5 Tesla). The following tests were analyzed: 1) low-dose CTCA, 2) adenosine stress-rest perfusion-CMR, 3) late gadolinium enhancement (LGE), 4) perfusion-CMR and LGE, 5) low-dose CTCA combined with perfusion.CMR, 5) low-dose CTCA combined with late gadolinium-enhancement, 6) low-dose CTCA combined with perfusion-CMR and LGE. CA served as the standard of reference.

Results: CA revealed > 50% diameter stenoses in 68/129 (57.7%) coronary arteries in 29/43 (70%) patients. In the patient-based analysis, sensitivity, specificity, NPV and PPV of low-dose CTCA for the detection of significant stenoses were 100, 92.9, 100 and 96.7%, respectively. For perfusion-CMR and LGE, sensitivity, specificity, NPV, PPV, and accuracy were 89.7, 100, 82.4, and 100%, respectively. In the artery-based analysis, sensitivity and NPV of low-dose CTCA was significantly ($p < 0.05$) higher than that of perfusion-CMR and LGE. None of the combinations of low-dose CTCA and perfusion-CMR and/or LGE did improve diagnostic performance when compared to low-dose CTCA alone.

Conclusion: Taking CA as standard of reference, low-dose CTCA outperforms CMR with regard to sensitivity and NPV, whereas CMR is more specific and has a higher PPV than low-dose CTCA.

B-191 10:39

Dual energy CT versus cardiac MRI for determining myocardial infarct size

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Purpose: Previous studies have shown that delayed enhancement CT can detect myocardial infarction, although CT systematically underestimates infarct size compared to cardiac MRI (cMRI). We evaluated whether delayed enhancement dual-energy CT (DECT) enables more accurate quantification of myocardial infarction.

Methods and Materials: 26 patients with suspected ischemic heart disease underwent DECT (Definition, Siemens) six minutes after injection of 120 mL of 370 mgI/mL Ultravist™ (Bayer). Data were analyzed using the Perfusion Blood Volume™ application (Siemens). All patients also underwent 1.5 T (Avanto, Siemens) cMRI 15 minutes after the injection of double-dose Magnevist™ (Bayer) using phase sensitive inversion recovery sequences. Two blinded, independent observers performed segmental evaluation for myocardial iodine/gadolinium uptake compatible with infarct and performed planimetric measurements of infarct size. The percentage of infarct area per section (PIS) along with the ratio of infarct to the total area of myocardium (infarction fraction-IF) were calculated.

Results: Delayed enhancement cMRI showed gadolinium uptake indicating infarction in 72/442 myocardial segments. At Receiver Operating Characteristics analysis, the mean Area Under the Curve of the two observers for detection of myocardial

infarct at delayed enhancement DECT was 0.92 on a per-segment level and 0.91 on a per-patient level. Interobserver agreement was excellent (k=0.85). Linear regression analysis revealed a close, linear correlation between cMRI and DECT for determining the percentage of infarct area per section (y=1.2x+0.6, R=0.9), as well as the infarction fraction (y=1.1x+2.3, R=0.88).
Conclusion: Delayed enhancement DECT has high accuracy for the detection of myocardial infarction and correlates well with delayed enhancement cMRI for determining infarct size.

B-193 10:48

Usefulness of 64-slice CT in the planning of ablation of ventricular tachycardia late after myocardial infarction
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Purpose: The aim of our study is to evaluate the accuracy of 64-slice CT to detect the geometry of the myocardial infarction scar, using 2D and 3D reconstructions. Its use in ablation procedures may facilitate the electrophysiological procedures providing preliminary indication to guide mapping.
Methods and Materials: 32 patients (mean age 61±15.4) underwent 64-slice CT heart examination. These patients, affected by monomorphic ventricular tachycardia late after myocardial infarction, were waiting for a heart ablation. All the patients had an ICD (Implanted Cardiac Defibrillator). We compared the obtained data from CT with the results of electrophysiological mapping study CARTO, to evaluate the concordance between the two techniques.
Results: CT permitted the correct highlighting of the post-infarction scar as a myocardial hypoattenuation area (mean 56.53 ± 19.3 vs. 131.4 ± 20.5 HU; P < 0.0001) in all the patients. Mean wall thickness in diastole of the infarcted regions was 4.3 ± 1.11 mm against mean wall thickness in the healthy areas of 8.24 ± 1.3 (P < 0.0001). Mean wall thickness in systole (normality range 12-14 mm) was 6.23 mm ± 1.46 (P < 0.0001). Comparing CT data with the result of CARTO, using potential values of < 1.5 mV as cut off, we observed that the areas of morph structural alteration (reductions in thickness and density) predicted the low voltage areas in 28 of the 32 patients.
Conclusion: Initial results indicate that CT could help the ablation procedure. In fact, accurately predicting the localization of the scar and its extension, electrophysiological mapping studies can be directly concentrated in the zone of the scar and the surrounding area, therefore allowing a drastic reduction of the duration of the procedure and of the complications.

B-194 10:57

Multislice computed tomography coronary angiography predicts long-term outcome in patients with suspected or known coronary artery disease
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Purpose: To assess the long term prognostic value of multislice computed tomography coronary angiography (CCTA) in patients with known or suspected coronary artery disease (CAD).
Methods and Materials: 899 patients (478 males, 421 females, mean age 59.3±10.1 years) who underwent CCTA due to suspicion of obstructive CAD were followed-up for 1164±355 days for adverse cardiac events (cardiac death, vascular death, nonfatal myocardial infarction and nonfatal stroke). CCTA was assessed for the presence, luminal narrowing severity, location, and type (non-calcified, mixed or calcified) of coronary atherosclerotic plaques. Clinical and CCTA data were related to outcome. Cox proportional-hazards model was applied in a stepwise forward fashion to identify predictors of follow-up events. The risk of a variable was expressed by a hazard ratio (HR) with corresponding 95% confidence interval (CI).
Results: Coronary plaques were found in 638 patients. Cardiac events occurred in 48 patients (23 cardiac deaths, 5 fatal strokes, 17 myocardial infarctions and 5 nonfatal strokes). Independent predictors of adverse events were age (HR 1.06; 95%CI: 2.02-22.82; p=0.001), prior stroke (HR 4.8; 95% 2.08-11.08; p=0.001), prior MI (HR 1.94; 95%CI: 1.05-3.58; p=0.04), segments with plaque (s) (HR 1.14 per segment; 95%CI 1.01-1.28; p=0.03) and segments with mixed plaque (s) (HR 1.28 per segment; 95%CI: 1.01-1.63; p=0.04). 5-year event free survival was 99% for normal coronary arteries, 94% for nonobstructive plaque (s) and 92% for obstructive plaque (s) (p < 0.001).
Conclusion: CCTA predicts outcome in patients with suspected or known CAD. This technique may stratify patients into low, intermediate and high risk group for adverse cardiac events.

B-195 11:06

High-pitch dual-source CT angiography of the thoracic and abdominal aorta: Do we get the coronary arteries for free?
R.P. Götti[1], S. Baumüller[1], G. Feuchtner[1], P. Stolzmann[1], C.A. Karlo[1], H. Alkadhi[2], S. Leschka[1]; [1]*Zurich/CH*, [2]*Boston, MA/US (RobertPaul.Goetti@usz.ch)*

Purpose: To prospectively evaluate the average heart rate and heart rate variability required for diagnostic imaging of the coronary arteries in high-pitch dual-source CT-angiography of the thoracic- and thoraco-abdominal aorta.
Methods and Materials: 100 consecutive patients (18 women, age 68±13 years) underwent clinically indicated CT-angiography of the thoracic (n=33) and thoraco-abdominal aorta (n=67) on a 128-slice dual-source CT scanner in an ECG-synchronised high-pitch data acquisition mode. No beta-blockers were given. Image quality of coronary arteries was graded by two independent and blinded readers on a 3-point scale. The average heart rate and heart rate variability prior to data acquisition were noted. Effective radiation doses were calculated.
Results: Interobserver agreement in grading image quality of the 1414 coronary segments was good (κ=0.68). Diagnostic image quality was found in 1375/1414 segments (97.2%) in 83/100 patients (83%). In 17% of patients, at least one coronary segment was non-diagnostic. Average heart rate and heart rate variability (each p < 0.05) were significantly higher in patients with at least one non-diagnostic coronary segment compared to those without. All patients with an average heart rate < 63 bpm and heart rate variability < 1.2 bpm had diagnostic image quality of all coronary segments. Effective radiation doses were 2.3±0.3 mSv for thoracic and 4.4±0.5 mSv for thoraco-abdominal CT-angiography, the average scan times were 0.88±0.06 and 1.67±0.15 sec, respectively.
Conclusion: In patients with an average heart rate < 63 bpm and a heart rate variability < 1.2 bpm, high-pitch dual-source CT-angiography of the thoraco-abdominal aorta delivers diagnostic visualization of the coronary arteries at a low radiation dose.

B-196 11:15

Low dose high-pitch spiral acquisition 128-slice dual-source computed tomography for the evaluation of coronary artery bypass grafts
R.P. Götti[1], G. Feuchtner[1], S. Baumüller[1], P. Stolzmann[1], H. Scheffel[1], L.M. Desbiolles[1], B. Marincek[1], H. Alkadhi[2], S. Leschka[1]; [1]*Zurich/CH*, [2]*Boston, MA/US (RobertPaul.Goetti@usz.ch)*

Purpose: To assess the performance of prospectively ECG-synchronized dual-source computed tomography (DSCT) in high-pitch spiral acquisition mode for the evaluation of coronary artery bypass grafts (CABG) in short- and long-term follow-up after surgery without heart rate control.
Methods and Materials: 50 consecutive patients (47 men, age 69.6±9.6 years) underwent 128-slice DSCT angiography of the chest after CABG surgery in a prospectively ECG-synchronized high-pitch spiral acquisition mode (pitch factor 3.2; 100 kV tube voltage, 0.28 s rotation time). 25 patients were evaluated within 3 months after surgery (median 6 days; range, 2-75 days) and 25 patients > 1 year after surgery (median 7 years; range, 1-16 years). No heart rate control was performed. Image quality of the proximal anastomosis, graft body, distal anastomosis, and native post-anastomotic coronary artery were graded by two independent readers on a 3-point scale (1=excellent, 2=good, 3=poor/non-diagnostic). Effective radiation dose was calculated.
Results: Mean HR was 76±19 bpm and HRV was 2.9±5.4 bpm. Median scan time was 0.9 s (range, 0.76-1.17 s). 125 CABG (54% arterial grafts) and 465 vessel sections were analyzed. 12 grafts were occluded. Diagnostic image quality was obtained in 462/465 (99.4%) sections. Image quality was excellent in 397 (85.4%), moderate in 65 (14.0%) and non-diagnostic in 3 (0.6%) sections. All 3 non-diagnostic sections were distal anastomoses impaired by motion artifacts. Effective radiation dose was 2.3±0.3 mSv.
Conclusion: High-pitch prospectively ECG-synchronized thoracic CT angiography provides excellent image quality for the evaluation of CABG in patients without heart rate control at a low radiation dose of 2.3 mSv.

B-197 11:24

Coronary artery stenosis: What is the best cut-off value for predicting hemodynamic relevance by CT coronary angiography?
O.F. Donati[1], P. Stolzmann[1], H. Alkadhi[2], L.M. Desbiolles[1], S. Baumüller[1], S. Leschka[1], B. Marincek[1], H. Scheffel[1]; [1]*Zurich/CH*, [2]*Boston, MA/US (odonati@gmx.net)*

Purpose: To prospectively determine the best cut-off value in prediction of hemodynamic relevance of coronary artery stenosis as depicted by low-dose computed tomography coronary angiography (CTCA).

Methods and Materials: Fifty-two patients (mean age, 64±10 years) scheduled for conventional coronary angiography (CA) underwent cardiac magnetic resonance (CMR) at 1.5-T and dual-source CTCA using prospective ECG-triggering the same day. Diagnostic performance of CTCA and CA to detect myocardial ischemia was evaluated with CMR as the standard of reference. The best cut-off value to predict the hemodynamic relevance of stenosis by CTCA was determined from receiver operator characteristics analysis (ROC).

Results: CTCA revealed > 50% stenoses in 148/807 (18.3%) segments, corresponding to 83/156 (53.2%) coronary arteries in 34/52 (65.4%) patients. CMR revealed ischemia in 18/832 (14.2%) myocardial segments corresponding to the territories of 60/156 (38.5%) coronary arteries in 31/52 (56%) patients. ROC showed equal diagnostic performance for low-dose CTCA and CA with an area under the curve of 0.83. The optimal cut-off value was determined at stenosis of > 60% for detection of hemodynamically relevant stenosis in CTCA. Using this cut-off value, sensitivity, specificity, NPV and PPV to predict hemodynamic relevance by CTCA were 100, 83, 100, and 88% on a per-patient basis and 88, 73, 83 and 81% on a per-artery analysis, respectively.

Conclusion: Diagnostic performance for predicting the hemodynamic relevance of coronary artery stenosis with low-dose CTCA is optimized by considering a cut-off value of > 60%.

B-198   11:33

Adenosine stress dual energy CT of the heart for diagnosing myocardial ischemia and viability compared with cardiac MRI and SPECT
B. Ruzsics, P. Zwerner, S. Chiaramida, J. Abro, P. Costello, U.J. Schoepf; *Charleston, SC/US (ruzsics@musc.edu)*

Purpose: To evaluate dual energy CT (DECT) including rest-, stress-, and delayed-enhancement imaging for diagnosing fixed/reversible myocardial ischemia and viability compared with cardiac MRI (cMRI) and SPECT-myocardial perfusion imaging (MPI).

Methods and Materials: We prospectively enrolled 30 patients with known or suspected coronary artery disease who underwent: 1) Adenosine stress/rest SPECT-MPI; 2) Contrast (Magnevist, Bayer) enhanced adenosine stress/rest perfusion and delayed enhancement cMRI (1.5 T Avanto, Siemens); and 3) Contrast (Ultravist) enhanced, retrospectively ECG-gated adenosine stress/rest and delayed enhancement DECT. In each patient, all three DECT data sets were analyzed for blood pool deficits and delayed enhancement. Two independent, blinded observers evaluated SPECT-MPI, cMRI and DECT for fixed/reversible ischemia and cMRI and DECT for delayed enhancement.

Results: All patients (7 female, mean age 61 years) were successfully imaged with all three modalities without adverse events. 493 myocardial segments were analyzed of which 91 were abnormal at cMRI. Interreader agreement for detection of fixed/reversible ischemia and delayed enhancement at DECT was moderate to excellent (k=0.8/0.8-k=0.8). Compared with cMRI, DECT and SPECT-MPI had 92% (92%) sensitivity, 96% (97%) specificity, and 95% (95%) accuracy for detecting myocardial segments with fixed ischemia, respectively. Reversible ischemia was detected with 100% (100%) sensitivity, 100% (90%) specificity, and 100% (92%) accuracy by DECT and SPECT-MPI. Compared with cMRI, DECT detected myocardial segments showing delayed enhancement with 82% sensitivity, 97% specificity, and 95% accuracy.

Conclusion: Compared to cMRI as the reference standard, DECT shows good agreement for delayed enhancement and equal or better performance than SPECT-MPI for detection of myocardial ischemia.

B-199   11:42

Myocardial bridging of the left anterior descending coronary artery: Depiction rate and morphology at dual-source CT coronary angiography
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Purpose: We evaluated the depiction rate and the morphological features of myocardial bridging (MB) of the left anterior descending (LAD) coronary artery by dual-source computed tomography coronary angiography (DSCT-CA).

Methods and Materials: A total of 1353 patients who underwent DSCT-CA were reviewed retrospectively for MB of the LAD. The length and depth of the MBs were analyzed. MBs were classified as superficial and deep bridges with respect to the depth (≤1 or > 1 mm) of the tunneled segment of the LAD. Superficial bridges were subdivided into complete and incomplete type according to the full or partial encasement of the LAD with left ventricular myocardium. Patients diagnosed with MB on DSCT who had prior conventional coronary angiography (CCA) were re-evaluated for the presence of MB.

Results: Among the 1275 patients (78 were excluded), 557 MBs were found in 536 patients (42%). The superficial MB was seen in 66.1% (368/557) and the deep MB

was seen in 33.9% (189/557) of all tunneled LAD segments. The complete type of superficial MB was seen in 34.8% (128/368) and incomplete type was seen in 65.2% (240/368). The mean length of a tunneled segment for superficial MB was 16.4±8.6 mm. The mean length and depth of a tunneled segment for deep MB were 27.6±12.8 and 3.0±1.4 mm, respectively. 30 out of 1275 patients, in whom MB was identified on DSCT, were found to have correlative CCA studies, retrospectively and MB was detected in 10% (3/30).

Conclusion: The prevalence of MBs of the LAD in this patient group was 42%. DSCT-CA allows for accurate anatomical evaluation of MB.

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

Vascular

SS 415

Imaging of visceral and renal arteries

Moderators:
K. Katsanos; Patras/GR
T. Sancak; Ankara/TR

B-200   10:30

Preliminary experience of contrast-enhanced ultrasound with high mechanical-index in the diagnosis of renal artery stenosis
W. Wang, B. Huang, C. Li, W. He; *Shanghai/CN*

Purpose: To evaluate the value of contrast-enhanced ultrasound (CEUS) with high mechanical index (MI) in the diagnosis of renal artery stenosis (RAS).

Methods and Materials: Twenty-one patients suspected of RAS including 3 patients after renal transplantation were studied with CEUS. Ultrasound contrast agent SonoVue (1.0 ml) was used and MI was set at about 1 when the CEUS was performed with GE E8 ultrasound instrument. All patients were examined with conventional color Doppler sonography and CEUS. The diagnostic results of ultrasound were compared with those of intravenous digital subtraction angiography (DSA), CT angiography (CTA) and MR angiography (MRA).

Results: Hemodynamically significant RAS was confirmed in 15 patients in whom abdominal aorta stenosis was also found in 2 cases. Color Doppler ultrasound failed in detecting the main renal artery in 3 patients while the technical successful rate of CEUS was 100%. Moreover, the presence of RAS was excluded in 2 of the 3 cases. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of color Doppler sonography were 85.7, 57.1, 80, 66.7 and 76.2%, respectively, on the condition that diagnostic threshold of RAS was defined that the peak systolic velocity of the main renal artery was greater than 180 cm/s; those of CEUS were 100, 66.7, 88.2, 100 and 90.5%, respectively.

Conclusion: CEUS with high MI can improve the imaging of renal artery and depict the margin of the vascular lumen directly and clearly. Therefore, it may be more helpful in the diagnosis of RAS.

B-201   10:39

Dynamic CTA of the renal artery in patients after kidney transplantation: Potential of significant reduction of iodinated contrast material
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Purpose: To evaluate the potential of dynamic CTA of the renal artery with regard to reduction of iodinated contrast material.

Methods and Materials: 15 patients with renal graft dysfunction received a dynamic computed tomography angiography (CTA) protocol using a 128-slice CT-scanner with continuous bi-directional table movement, allowing to cover a scan range of 18 cm within 1.5 sec. Repeated scans of the renal vessels were performed every 3.5 s such that pre-contrast, arterial and venous phases were covered. The amount of contrast medium used was 30 ml at a flow rate of 5 ml/s; subsequently, 100 mL saline were injected at a flow rate of 3 ml/s. The mean attenuation in the renal and iliac artery was assessed.

Results: Mean attenuation in the iliacal artery was 412 HU (range: 339 - 545 HU, standard deviation: 60), in the renal artery 402 HU (range: 317 - 503 HU, standard deviation: 57). The renal arteries were all assessable for stenosis, and the renal veins were all assessable for thrombosis or compression.

Conclusion: Dynamic CTA of the renal artery due to improved dispersion of the contrast bolus enables an adequate depiction of renal vessels using only 30 ml iodinated contrast medium, which especially is beneficial for patients with severely impaired renal function.

B-202 10:48

Contrast-enhanced MR angiography utilizing parallel acquisition techniques in renal artery stenosis detection

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Purpose: Significant renal artery stenosis (RAS) is a potentially curable cause of renovascular hypertension and/or renal impairment. It is caused by either atherosclerosis or fibromuscular dysplasia. Correct and timely diagnosis remains a diagnostic challenge. MR angiography (MRA) as a minimally invasive method seems to be suitable for RAS detection; however, its diagnostic value widely differs in the literature (sensitivity 62-100% and specificity 75-100%). The aim of our prospective study was to compare the diagnostic value of contrast-enhanced MRA utilizing parallel acquisition techniques in the detection of significant RAS with digital subtraction angiography (DSA).

Methods and Materials: A total of 78 hypertensive subjects with suspected renal artery stenosis were examined on a 1.5 Tesla MR system using a body array coil. Bolus tracking was used to monitor the arrival of contrast agent to the abdominal aorta. The MRA sequence parameters were as follows: TR 3.7 ms; TE 1.2 ms; flip angle 25 degrees; acquisition time 18 s; voxel size 1.1 mm×1.0 mm×1.1 mm; centric k-space sampling; parallel acquisition technique with acceleration factor of 2 (GRAPPA). Renal artery stenosis of 60% and more was considered hemodynamically significant. The results of MRA were compared to digital subtraction angiography serving as a standard of reference.

Results: Sensitivity and specificity of MRA in the detection of hemodynamically significant renal artery stenosis were 90 and 96%, respectively. Prevalence of RAS was 39% in our study population.

Conclusion: Contrast-enhanced MRA with high spatial resolution offers sufficient sensitivity and specificity for screening of RAS.

B-203 10:57

Renal MR angiography: Multicenter intraindividual comparison of gadobenate dimeglumine and gadofosveset trisodium

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Purpose: To prospectively compare gadobenate dimeglumine and gadofosveset trisodium for contrast-enhanced MR angiography (CE-MRA) of the renal arteries.

Methods and Materials: 38 subjects with renal vascular disease underwent CE-MRA with 0.1 mmol/kg gadobenate dimeglumine followed at 3-12 days by CE-MRA with 0.03 mmol/kg gadofosveset. Identical T1w SPGR sequences were used to acquire first-pass (FP) coronal images during breath-hold. In 16/38 patients additional steady-state (SS) images were acquired with gadofosveset. DSA was performed in 34 patients. Three blinded readers evaluated images for detection of significant (≥51%) renal artery stenosis compared to DSA and calculated sensitivity, specificity, accuracy, PPV, and NPV. Findings were compared using McNemar and Wald tests; diagnostic preferences were evaluated using the Wilcoxon Signed Rank test; and reader agreement (kappa [κ]) was determined.

Results: Gadobenate dimeglumine performance was consistently superior to gadofosveset (sensitivity: 76-87 vs 68-76%; specificity: 92-99 vs 91-94%; accuracy: 89-96 vs 86-90%; PPV: 70-94 vs 65-76%; NPV: 94-97 vs 92-94%). Significant superiority for gadobenate dimeglumine was noted by two readers for specificity (P≤0.02), accuracy (P≤0.005), and PPV (P≤0.018). SS images after gadofosveset provided no additional benefit. Three-reader agreement was excellent (κ=0.776-0.855). The readers preferred gadobenate dimeglumine in 11, 17, and 13 patients and gadofosveset in 5, 4, and 5 patients. 2/38 [5.3%] patients report AE after gadofosveset and none after gadobenate dimeglumine.

Conclusion: Better reader preference and diagnostic performance were obtained with 0.1 mmol/kg gadobenate dimeglumine vs 0.03 mmol/kg of the intravascular blood pool agent gadofosveset for CE-MRA of the renal arteries.

B-204 11:06

Non-contrast-enhanced renal MRA using inflow-enhanced, inversion-recovery at 3 T

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Purpose: To evaluate the utility of an inflow-enhanced, inversion- recovery balanced steady state free precession (bSSFP) based non-contrast-enhanced MRA (NCE MRA) for assessment of renal arteries at 3 T.

Methods and Materials: After institutional review board approval, 21 consecutive patients with suspected renal artery or renal transplant artery disease received NCE and CE MRA at 3 Tesla. Parameters of the bSSFP based NCE MRA sequence include: TR/TE/TI=5.1/2.5/1300 msec, BW=±125 kHz, FOV=340x272 mm², 54 slices, matrix=256x256 with 2.0 mm slices for true spatial resolution of 1.32x1.06x2.0 mm³, interpolated to 0.7x0.7x1.0 mm³, scan time = 3:18 min. Two expert cardiovascular radiologists, who were blinded to any patient information or imaging study, assessed the renal vasculature on the NCE MRA. Consensus reading of the CE MRA including any available patient information was used as the reference standard. Cohen's Kappa statistics was used to determine the degree of agreement between CE MRA and NCE MRA.

Results: NCE MRA and CE MRA images of renal vasculature and transplant renal vasculature were successfully obtained in all cases. 18 accessory renal arteries and 3 renal transplant arteries were identified. Image quality was rated excellent in 83%. Third degree branch vessels were identifiable in 78%. Cohen's statistics revealed high degrees of agreement between CE MRA and NCE MRA with kappa values of 0.95 and 0.88 for the two individual readers.

Conclusion: This study demonstrates the feasibility of this inflow-enhanced, inversion-recovery renal NCE sequence to evaluate the renal vasculature at 3 T. The NCE MRA sequence produced consistent results and demonstrated good correlation with CE MRA and DSA.

B-205 11:15

Non-contrast-enhanced renal MRA using inflow-enhanced, inversion-recovery bSSFP: Validation against DSA in swine

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Purpose: To evaluate the utility of an inflow-enhanced, inversion- recovery balanced steady state free precession (bSSFP) based non-contrast-enhanced MRA (NCE MRA) to detect and quantify renal artery stenoses in a porcine study.

Methods and Materials: Following Animal Care and Use Committee protocol approval, bilateral RAS were surgically created in 12 swine under general anesthesia. DSA was used as gold standard for quantification of the degree of stenosis. NCE-MRA of the renal arteries was performed at 1.5 Tesla. Parameters of the bSSFP based NCE-MRA sequence include: TR/TE/TI=4.2/2.1/1400 msec, BW=±125 kHz, FOV=36 cm², 54 slices, matrix=512x512 with 2.0 mm slices for true spatial resolution of 1.4x1.4x2.0 mm³, interpolated to 0.7x 0.7x1.0 mm³, scan time=4-5 min). Three expert cardiovascular radiologists evaluated the degree of stenosis and the image quality independently. Severity of RAS was confirmed by planimetry using DSA data.

Results: NCE-MRA images were successfully obtained in all cases. Pearson correlation coefficients for the severity of stenosis in NCE-MRA vs DSA were 0.72, 0.51, and 0.76 for the three readers. There was a slight tendency to overestimate the degree of stenosis with NCE-MRA as compared to DSA (mean bias 0.11, range 0.04 to 0.25). 3rd degree renal branch vessel were depicted in 87.5% on the NCE-MRA. Image quality was rated excellent with substantial noise being found in only 2% of the NCE-MRA studies. In no cases did noise interfere with image interpretation.

Conclusion: This study demonstrates the feasibility of this NCE-MRA technique to evaluate severity of renal artery stenosis in an animal model with good correlation between NCE-MRA and DSA.

B-206 11:24

A new look at vasculature: Non-enhanced renal MR angiography at 7 Tesla

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Purpose: The aim of this study was to evaluate the feasibility of non-enhanced MRA of the renal vasculature and to assess the best imaging sequence out of 2D and 3D FLASH imaging and TOF-MRA.

Methods and Materials: In vivo non contrast-enhanced MR examinations were performed in 10 healthy volunteers on a 7T whole-body MR-system (Magnetom 7T, Siemens Healthcare), utilizing a custom-built 8-channel transmit/receive radiofrequency body-coil for image acquisition. After RF-shimming and sequence modification, the following breath-hold sequences were obtained: 1) 2D FLASH; 2) 3D FLASH, 3) 2D TOF-MRA. Overall image evaluation with regards to the delineation of the renal arterial vasculature was performed by two radiologists using a three-point-scale (3=very good, 2=moderate, 1=poor vessel delineation). CNR of the aorta, proximal right and left renal artery in correlation to adjacent psoas major muscle was measured for all sequences.

Results: In general, T1w GRE imaging at 7T provides an inherently high signal of arterial vasculature. TOF MRA showed best scores in qualitative (mean 2.8) and quantitative analysis (CNR 33.5), due to its excellent delineation of vasculature and good background-suppression. 2D FLASH imaging enabled a slightly better depiction of vasculature (mean 2.6) than 3D FLASH imaging (2.4) due to its superior fat saturation and superior spatial resolution.

Conclusion: All three sequences showed a moderate to good delineation of vasculature, underlining the capability and clinical impact of a non-enhanced angiographic application at 7T, e.g. in case of renal insufficiency. TOF MRA demonstrated its diagnostic superiority and potential due to a very good vessel-to-background differentiation.

B-207   11:33

Contrast-enhanced renal MR angiography at 7 Tesla: A feasibility trial

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Purpose: The aim of this study was to evaluate the feasibility of contrast-enhanced MRA of the renal vasculature.
Methods and Materials: In vivo contrast-enhanced MR examinations were performed in 6 healthy volunteers on a 7T whole-body MR-system (Magnetom 7T, Siemens Healthcare), utilizing a custom-built 8-channel transmit/receive radiofrequency body coil for image acquisition. After RF shimming and sequence modification 3 dynamic 3D FLASH sequences (TR/TE: 2.98/0.97, non-interpolated voxel size 1.04 x 1.49 x 1.59 mm³, acquisition time 21 sec). were obtained. For dynamic imaging Gadobutrol (Gadovist®, Bayer Schering Pharma) was injected intravenously at a dosage of 0.1 mmol/kg body weight using an automated injector (EMPOWER MR®, EZEM). SNR and CNR were measured pre and post contrast in the aorta, the proximal right and left renal artery in correlation to the adjacent psoas major muscle. Qualitative analysis with regards to the delineation of the pre-contrast and post-contrast renal arterial vasculature was performed by two radiologists using a five-point-scale (5=excellent, 4=good, 3=moderate, 2= poor, 1= non diagnostic).
Results: T1w GRE sequences provided an inherently high signal intensity of vasculature, yielding a good overall pre-contrast arterial delineation (mean 3.55). Nevertheless, post-contrast images provided an improved delineation (mean 4.89) and also revealed strong signal increase in SNR and CNR measurements (mean pre-contrast SNR 32.9/CNR 12.25; mean post-contrast SNR 52.8/CNR 21.6).
Conclusion: 7T DCE MRA is feasible, yielding already a strong pre contrast signal of the renal vasculature. The high T1 signal can be increased after the intravenous administration of gadolinium.

B-208   11:42

Initial results of hepatic MR angiography at 7 Tesla

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Purpose: We aimed to evaluate the feasibility of MR angiography (MRA) of the hepatic vessels at 7 Tesla. The secondary aim was to evaluate the effect of intravenous gadolinium for the depiction of hepatic vessels.
Methods and Materials: A custom-built 8-channel transmit/receive radiofrequency body coil was used for image acquisition on a 7T whole-body MR system (Magnetom 7 T, Siemens). In vivo MR examinations were performed in 9 volunteers (age range 24-39 years) in supine position. A 3D T1w gradient-echo sequence (TR/TE = 2.9 ms/1.0 ms; TA = 27 sec) was acquired before and at 20, 70, 120 and 240 sec after intravenous gadolinium administration. Conspicuity of hepatic arteries, hepatic veins and portal veins was rated based on a 4-point scale (1=poor contrast; 4=excellent contrast).
Results: The 7T examinations were feasible in all 9 volunteers. Pre-contrast T1w images revealed moderate conspicuity of hepatic arteries (mean value 2.3) and good conspicuity of the portal veins (mean value 3.0), while hepatic veins showed poor contrast (mean value 1.7). Highest contrast for the hepatic arteries was found at 20 sec after gadolinium (mean value 3.3), for the portal veins at 70 sec (mean value 3.7) and for the hepatic veins at 120 sec (mean value 3.7).
Conclusion: Our results demonstrate the feasibility of 7T MRA of the liver vasculature. While hepatic arteries and portal veins can already be depicted on pre-contrast T1w images, gadolinium administration must be considered mandatory to assess the hepatic veins.

B-209   11:51

Non-contrast in flow inversion recovery (IFIR) MR angiography of the abdominal visceral arteries

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Purpose: To assess the ability of a 3D respiratory-triggered magnetic resonance angiography (MRA) non-contrast acquisition, In Flow Inversion Recovery (IFIR) to evaluate the visceral arteries of the abdomen using a gadolinium-enhanced acquisition (Gd-MRA) as the standard of reference.

Methods and Materials: This IRB-approved HIPAA-compliant retrospective study entailed a search of our clinical database for patients who underwent both IFIR (TR=4.2 ms TE=2.1 ms, FA=70, slice thickness=2 mm, matrix 256x256, ASSET=2) and a Gd-MRA (LAVA/LAVA-XV; TR=3.6-3.9 ms, TE=1.7-1.9 ms, FA=10-15, slice thickness=3 mm, matrix 256x192) of the abdomen between October 2008 and August 2009, on a 1.5 T MR scanner (GE Signa HDx) with phased-array coils. Randomized and de-identified images were independently scored by 2 reviewers in 11 anatomic segments for image quality and diagnostic confidence using a 5-point scale, and for the presence of arterial stenosis.
Results: 304 arterial segments imaged on both IFIR and Gd-MRA were assessed in 14 patients (11 women, 3 men; mean age 56.5 [25-74]). There were no statistical differences in the scores for the supra- and infrarenal aorta, SMA, celiac, and proximal or middle renal artery. Diagnostic quality and confidence IFIR scores for the intrarenal arteries were superior to those of Gd-MRA (p < 0.001). Evaluation of the IMA was superior on Gd-MRA (p < 0.001). The sensitivity, specificity, and positive and negative predictive values of IFIR for detection of arterial stenosis were 70, 91, 57, and 94%.
Conclusion: For evaluation of abdominal visceral arteries, IFIR provides a) equivalent quality and confidence, b) high negative predictive value and c) improved visualization of the intrarenal arteries compared to Gd-MRA.

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

Neuro

SS 411

Multiple sclerosis and white matter disorders

Moderators:
P. Papanagiotou; Homburg/DE
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B-210   10:30

Multivoxel HMRS and volumetric MRI study in patients with clinically isolated syndrome

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Purpose: In multiple sclerosis, H-MRS studies have established a decreased NAA in the NAWM. Likewise, recent monovoxel spectroscopic studies showed a similar aspect in patients affected by a clinically isolated syndrome (CIS). Our aims were to investigate cerebral atrophy and metabolic alterations in CIS patients by the use of multivoxel H-MRS and to assess T2 lesion burden and dissemination in space according to MacDonald MRI criteria.
Methods and Materials: Multisequence imaging (T1 EG 3D, T2 FSE, T2 FLAIR, T1 SE-gadolinium) and multivoxel H-MR spectroscopy (1.5 T, TE 136 ms) were performed in 27 CIS patients and 18 controls. Lesion load, MacDonald MRI criteria, cerebral volumes using Sienax and SepInria software and metabolite ratios (NAA/Cr, NAA/Cho and Cho/Cr) in NAWM and NAGM were determined.
Results: Compared to controls, a decrease of cerebral volume (-1.7%, p=0.045) and an increase of ventricular volume (+42 %, p=0.002) were seen in the CIS group. Cerebral atrophy was correlated with grey matter (GM) atrophy. In NAWM, there was a lower ratio of NAA/Cr in the CIS group (-6.4%, p=0.030) whereas no reduction in the NAGM was observed. NAA/Cho ratio in NAGM was correlated with T2 lesion burden (r=0.45, p=0.017). NAA/Cho ratio in NAWM was correlated with GM atrophy (r=0.46, p=0.014).
Conclusion: Our study confirms axonal damage and GM atrophy in CIS patients. Correlation between NAA/Cho ratio in NAGM and T2 lesion load and between NAA/Cho ratio in NAWM and GM atrophy suggests a mechanism of wallerian degeneration rather than a primitive involvement of GM.

B-211   10:39

Application of an MRI perfusion weighted imaging (PWI) technique in patients with clinically isolated syndrome converted to multiple sclerosis (CIS-conv): Increased perfusion in white and deep gray matter compared to the non-converted CIS patients

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Purpose: To investigate possible hemodynamic differences among: a) the CIS patients that have converted to clinically definite MS (CIS-conv), b) those that remain CIS 2 years after the first MRI exam.
Methods and Materials: 30 patients with CIS (17 CIS-conv) were studied at a 1.5 T MR scanner. A dynamic susceptibility contrast PWI technique was applied and absolute val-

ues of regional Cerebral Blood Volume (rCBV) and regional Cerebral Blood Flow (rCBF) were estimated. Normal appearing white matter of the CIS (NAWM-CIS=104) and the CIS-conv (NAWM-CISconv=136), and, also, the thalami, caudate nuclei, putamen, genu and splenium of the corpus callosum of the CIS (THAL-CIS=26, CAUD-CIS=26, PUT-CIS=26 and CALL-CIS=26) and the CIS-conv (THAL-CISconv=34, CAUD-CISconv=34, PUT-CISconv=34 and CALL-CISconv=34) were measured. The rCBV and rCBF values of the different estimated regions were compared with student's t-test.

Results: NAWM-CISconv is characterized by significantly higher rCBV and rCBF values compared to the respective values of NAWM-CIS (p=0.022 and 0.01, respectively), while the rCBV values of THAL-CISconv and PUT-CISconv are significantly higher compared to the respective values of THAL-CIS and PUT-CIS (p=0.04 and 0.006, respectively). There is no significant difference between the rCBV and rCBF values of CAUD-CISconv and CAUD-CIS (p=0.15 and 0.6), or between CALL-CISconv and CALL-CIS (p=0.08 and 0.52).

Conclusion: NAWM, basal ganglia and thalami of CIS-conv patients are characterized by increased rCBV values compared to the patients that remain CIS 2 years afterwards. This finding suggests that diffuse perivascular inflammation of the white and deep gray matter in patients with CIS predisposes the evolution to clinically definite MS.

B-212 10:48

also EPOS

Hypercho-turbo spin-echo versus turbo spin-echo and 12-channel versus 32-channel head coil: MR imaging of multiple sclerosis at 3 T

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Purpose: Detection of demyelinating lesions in patients with multiple sclerosis benefits from improved signal to noise-ratio (SNR). The purpose of this study was to quantitatively and qualitatively assess the detection of demyelination lesions by hyperTSE in comparison with conventional turbo spin-echo (TSE) sequences using a 12-channel and a 32-channel head coil at 3 T.

Methods and Materials: In 50 patients with proven multiple sclerosis, identically centered and oriented TSE and hyperTSE images with adapted acquisition parameters for equal T2-contrast were acquired on a 3 T system (Magnetom Verio, SIEMENS, Germany) using a 12-channel and a 32-channel head coil. ROI-analysis was performed of signal intensities of demyelinating lesions, cortex, basal ganglia, NAWM, CSF and background noise. SNR-ratios and CNR-ratios were calculated. Image quality, lesion conspicuity and artifacts were qualitatively evaluated.

Results: Mean percentage difference of SNR of demyelinating lesions between TSE and hyperTSE sequence were 289% for the 12-channel head coil (p < 0.005) and 662% for the 32-channel head coil (p < 0.005). The significantly increased SNR for the hyperTSE and the 32-channel head coil was also observed for the other ROIs (p < 0.005). The visual rating of the images showed improved image quality for the 32-channel head coil and a better detection of the lesions using the hyperTSE sequence.

Conclusion: HyperTSE sequences are superior to TSE sequences for the detection of demyelinating lesions in multiple sclerosis. Imaging restrictions imposed by SAR limitations at 3 T are reduced by this technique.

B-213 10:57

Regionally distinct white matter lesions do not contribute to regional gray matter atrophy in patients with multiple sclerosis

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Purpose: To determine to what extent T1- and T2-regional lesion volumes (RLVs) contribute to total and/or regional gray matter (GM) atrophy in multiple sclerosis (MS).

Methods and Materials: We studied 110 (67 relapsing-remitting and 42 secondary-progressive) MS patients. SABRE program was used to parcel the brain into 13 regions per hemisphere: occipital, 6 frontal regions, and 2 regions for each of the following: temporal, parietal, basal ganglia/thalamus. Total and regional GM fractions (GMFs) were determined in each region to correct for intraregional size variability. Partial correlations were used to determine associations (holding the converse constant) among RLVs, GMF, and regional GMFs (p < 0.001 to avoid Type 1 error).

Results: Partial correlations between RLVs and regional GMFs (controlling for total GMF) for the total MS group were not significant for any of the 26 regions. Partial correlations between RLVs and total GMF (controlling for regional GMF) for the total MS group were significant in 9 of 26 regions for T2 (largest r = right lateral inferior frontal, -.45) and 5 of 26 regions for T1 (largest r = right inferior parietal, -.45).

Conclusion: Results suggest a model whereby a distinct generalized disease process accounts for GM atrophy better than regionally distinct Wallerian degeneration.

B-214 11:06

Gray matter and white matter atrophy in a large cohort of multiple sclerosis patients: Relation to MRI parameters and impact on clinical disability

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Purpose: 1) To measure gray matter (GM) and white matter (WM) atrophy across different disease phenotypes in a large cohort of multiple sclerosis (MS) patients; 2) to identify magnetic resonance imaging (MRI) parameters that determine GM and WM atrophy; 3) to study GM and WM atrophy as explanatory variables of clinical impairment.

Methods and Materials: MRI data of 95 clinically isolated syndrome (CIS), 657 relapsing remitting (RR), 125 secondary progressive (SP) and 50 primary progressive (PP) MS patients from three centers (GeneMSA consortium) were obtained. Disability was assessed with the expanded disability status scale (EDSS). GM and WM volumes, normalized for head size, were determined, together with T2-hyperintense and T1-hypointense lesion volumes. Data were analyzed using ANCOVA and multiple regression.

Results: GM atrophy, corrected for age, sex and center effects, was more prominent in RR patients (0.80±0.05 L) than in CIS patients (0.82±0.05 L), and accumulated further in SP patients (0.77±0.05 L). In contrast, WM atrophy in SPMS was comparable to RRMS. Black hole volume was a stronger predictor than T2 lesion load for both GM atrophy (beta=0.26; p < 0.001) and WM atrophy (beta=0.15; p=0.001). GM atrophy, and not WM atrophy, was an independent predictor of clinical disability.

Conclusion: Our study shows that GM atrophy grows increasingly in progressive MS, while WM atrophy seems to be relatively constant. GM atrophy explains clinical disability better than WM atrophy. Black hole volume in the WM predicted GM atrophy, which indicates that WM axonal damage is at least partially responsible for the GM volume loss in MS.

B-215 11:15

Early changes in resting state functional MRI networks in multiple sclerosis

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Purpose: We questioned whether in MS functional changes can be found in rest, and in what phase of the disease. Therefore, resting state fMRI networks were compared between patients with symptoms suggestive of MS (clinically isolated syndrome; CIS), relapsing remitting (RR) MS patients and healthy controls.

Methods and Materials: MRI data of fourteen CIS patients, 31 RRMS patients and 41 controls were acquired at 1.5 T, and analyzed using FMRIB's Software Library. Resting state fMRI data were non-linearly registered to standard space, and analyzed using an independent component analysis (ICA). Eight meaningful resting state networks were identified in our subjects, and compared between the three groups with non-parametric permutation testing, using threshold-free cluster enhancement to correct for multiple comparisons. Additionally, measures of structural damage were assessed. Grey and white matter volume, normalized for head size, was measured for each subject. Diffusion tensor measures were voxel-wise compared between groups using tract-based spatial statistics (TBSS).

Results: CIS patients showed increased co-activation in six networks, including the default mode network and working memory networks, compared to controls or RR patients. No significant resting state connectivity differences were found between RR patients and controls. Normalized grey matter volume and fractional anisotropy were decreased in RR patients compared to controls, no atrophy or diffusivity changes were found for the CIS group.

Conclusion: Functional changes of resting state networks are already found in CIS patients and are lost in MS patients with advancing disease and increasing brain damage.

B-216 11:24

F-MRI in the evaluation of motor activation in patients with multiple sclerosis and fatigue

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Purpose: To evaluate the patterns of motor cortical-subcortical activation in patients with multiple sclerosis (MS) suffering from fatigue.

Methods and Materials: 12 right handed MS patients with relapsing-remitting form were enrolled in the study. 6 patients (female, mean age=38.5, mean EDSS=1.75), with fatigue and 6 patients (5 females, 1 male, mean age=36.3, mean EDSS=1.5) without fatigue. In all patients, the presence and severity of fatigue were rated using

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the Fatigue Severity Scale (FSS). Brain MRI scans were obtained using a 1.5 T magnet. At first, a conventional protocol including PD/T2, FLAIR and SE T1 weighted sequences was applied. Functional MRI images were acquired using an EPI f-MRI sequence (TR/TE=2586/45 ms, flip angle=90°, slice thickness=4 mm, gap=0, 30 slices, 144 dynamics) during a motor right hand finger-tapping task. The obtained results were compared between the two groups. Significance was set at p < 0.05.
Results: The patients suffering from fatigue show a statistically significant higher activation compared to those without fatigue at the level of the primary motor and premotor areas bilaterally, in the thalami bilaterally and in the ipsilateral (right) cerebellum.
Conclusion: The f-MRI evaluation of brain activation during a motor task in patients with MS and fatigue could be a useful tool in understanding the pathophysiology of MS-related fatigue.

B-217 11:33

Diffusion tensor imaging and T_2 relaxometry in primary Sjogren syndrome
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Purpose: Involvement of the central nervous system has been reported in primary Sjogren syndrome (pSS). Changes in T_2 relaxation time (T_2) and micro-structural changes have never been studied in patients with pSS. Our purpose was to evaluate brain involvement in patients with pSS using diffusion tensor imaging and T_2 relaxometry on a voxel by voxel basis.
Methods and Materials: 32 patients with pSS (aged 64.56±15.6 years, disease duration 10.5±5.75 years) and 18 age-matched controls were studied using: a) multi-slice, spin-echo planar diffusion weighted (TE=131 msec, TR=9807 msec, matrix size=112 x 128, thickness=3 mm, FOV=230 mm, max b-value=700 sec/mm²) and b) multi-echo T2-weighted (TR=2200 sec, TE=32-112 sec, thickness=5 mm, gap=0.5, acquisition matrix=156, reconstruction matrix=256) sequences. Differences in fractional anisotropy (FA) and T_2 between groups were assessed by applying a voxel-based analysis using the Statistical Parametric Mapping 5 (SPM 5) software.
Results: In patients with pSS, decreased FA index was observed in the fusiform gyrus, the inferior occipital gyrus, the cuneus, the cingulum gyrus and the posterior cerebellar lobe when compared to controls. Increased T_2 time was observed in patients with pSS when compared to controls in areas throughout the whole brain involving mainly the white matter (P < 0.05, corrected for multiple comparisons).
Conclusion: Increased T2 time, suggestive of brain atrophy, and decreased FA index, suggestive of degeneration along axonal pathways, were observed in patients with pSS when compared to controls. Vasculitis or an immunologically mediated mechanism may be at the base of these changes.

B-218 11:42

Tract based spatial statistics on diffusion tensor imaging in neuropsychiatric systemic lupus erythematosus reveals localized involvement of white matter tracts
B.J. Emmer, I.M. Veer, G.M. Steup-Beekman, T.W.J. Huizinga, M.A. van Buchem, J. van der Grond; *Leiden/NL (b.j.emmer@lumc.nl)*

Purpose: The aim of this study is to determine whether there are differences between SLE patients and healthy controls in white matter integrity, using tract based spatial statistics (TBSS) on diffusion tensor imaging (DTI) data. Of specific interest is whether possible differences are located in the limbic system or are, in contrast, more scattered throughout the brain.
Methods and Materials: 13 SLE patients (age 48 years; range 32-61), diagnosed according to the American College of Rheumatology (ACR) revised 1982 criteria for SLE, and 20 healthy controls (age 44 years; range 21-61) were included in this study. DTI was performed on a 3.0-T scanner. Fractional anisotropy (FA) maps were calculated for each patient. To compare the FA maps, TBSS was used. TBSS projects the FA data into a common space through the use of an initial approximate non-linear registration followed by projection onto an alignment invariant tract representation (mean FA skeleton). This approach does not require any spatial smoothing of the FA data. The cluster results were corrected for multiple comparisons across space and a threshold of significance of 0.05 was used.
Results: Our results suggest reduced integrity of the white matter of tracts in the frontal lobe, the fasciculus uncinatus, the fornix and the internal capsule SLE.
Conclusion: The fact that white matter tracts between limbic structures are involved is in line with previous findings of selective damage in the amygdala in humans and studies indicating selective damage in the hippocampus in a mouse model of cerebral SLE.

B-219 11:51

MRI derived vasogenic edema severity correlates with aquaporin 4 expression in a rat hydrocephalus model
T. Tourdias, I. Dragonu, Y. Fushimi, M. Deloire, C. Boiziau, B. Brochet, C. Moonen, K. Petry, V. Dousset; *Bordeaux/FR (thomastourdias@yahoo.fr)*

Purpose: Hydrocephalus features include ventricular dilatation and periventricular edema due to transependymal resorption of cerebrospinal fluid (CSF). Aquaporin 4 (AQP4), a water channel protein located at the blood-brain barrier, might facilitate the removal of this excess of water from the parenchyma into the blood. First, we hypothesize a link between AQP4 expression and the severity of hydrocephalus. We further hypothesize that movements of water through AQP4 could affect apparent diffusion coefficient (ADC) measurements.
Methods and Materials: Communicating inflammatory hydrocephalus was induced in 45 rats, and at various stages, magnetic resonance imaging (MRI) was used to measure CSF volume and periventricular ADC, with immunostaining being used to determine periventricular AQP4.
Results: We found an up-regulation of periventricular AQP4 in hydrocephalic rats that was strongly correlated with both CSF volume (Pearson=0.87, p < 0.00001) and periventricular ADC (Pearson=0.85, p < 0.00001). AQP4 were first located on astrocyte endfeet, but later on the whole membrane of astrocytes that became hypertrophic in the most severe and chronic hydrocephalic rats.
Conclusion: These results show that AQP4 expression follows an adaptative profile to the severity of hydrocephalus and associated periventricular edema, which is probably a protective response mechanism. They also suggest that ADC, on top of informing about cell sizes and interstitial bulk water, might also indirectly reflect quantitative water channel expression.

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

Abdominal Viscera (Solid Organs)

SS 401b

Biliary imaging: Problems and answers

Moderators:
J. Dormagen; Oslo/NO
K. Tsampoulas; Ioannina/GR

B-220 10:30

Segmental liver hyperintensity in malignant biliary obstruction on diffusion-weighted MR imaging: Associated MR imaging findings and relationship with liver function tests
H.H. Tam[1], D.J. Collins[2], T. Wallace[1], G. Brown[1], A. Riddell[1], D.-M. Koh[1]; [1]*Sutton/UK*, [2]*Belmont/UK*

Purpose: Segmental liver hyperintensity can be observed in malignant biliary obstruction on diffusion-weighted MR imaging (DW-MRI). We describe MR imaging findings associated with this sign, and evaluate whether DW-MRI segmental hyperintensity has any relationship with liver function impairment.
Methods and Materials: The DW-MRI, T1-weighted, T2-weighted, Gd-EOB-DTPA enhanced T1-weighted images in 21 patients with hepatic malignancy, who demonstrated biliary obstruction and segmental hyperintensity on DW-MRI (b = 0-750 s/mm²), were retrospectively reviewed by two readers blinded to clinical results. DW-MRI hyperintense liver segments were recorded as hypointense, isointense or hyperintense to normal liver on T1/T2-weighted imaging; and whether enhancement was normal or diminished after contrast. The mean ADC value (x10⁻³ s/mm²) of DW-MRI hyperintense segments, normal liver and tumour were compared using Student t-test. The frequency of MR findings were corroborated with serum liver function tests.
Results: The imaging finding most frequently associated with segmental DW-MRI hyperintensity were T1-hyperintensity (10/21), T2-hyperintensity (19/21) and diminished enhancement after contrast (15/21). Tumours showed significantly lower mean ADC compared with liver (1.23 ± 0.08 vs 1.42 ± 0.05 x 10^{-3}; p = 0.013). Segments showing concomitant T1 hyperintensity had lower mean ADC than liver (1.30 ± 0.05 vs 1.42 ± 0.06 x 10^{-3}; p = 0.023). All patients (10/21) with concomitant T1 and DW-MRI segmental hyperintensity showed impaired liver function with elevated alanine transferase in 8/10 (p = 0.030, Fisher's exact test).
Conclusion: Concomitantly high T1 and DW-MRI signal in liver segments was associated with lower ADC values and abnormal liver function tests, which may reflect underlying cellular swelling. This sign may help to identify patients at risk of hepatocellular impairment from biliary obstruction.

B-221 10:39

Differentiation of intraductal-growing type from nodular-type cholangiocarcinomas on biliary MR imaging with MR cholangiography
J.E. Kim, J.M. Lee, S.H. Kim, S.H. Kim, J.Y. Lee, J.K. Han, B.I. Choi; *Seoul/KR (wldmsrla80@hanmail.net)*

Purpose: To describe the MR findings of intraductal growing, (IDG)-type cholangio-carcinoma (CC) and to identify the features that differentiate it from other similarly presenting nodular-type CCs.
Methods and Materials: Our institutional review board approved this retrospective study. Thirty-nine patients with surgically and pathologically proven IDG-type (n = 19) and nodular-type CCs (n = 20) who had undergone preoperative, gadolinium-enhanced MRI with MR cholangiography were included in this study. Analysis of the MR findings included determination of the shape, enhancement degree, and pattern of the tumor, outer caliber of the tumor-bearing segment, as well as the presence of tumor multiplicity, dilatation of the upstream and downstream bile ducts, bile duct wall thickening adjacent to the tumor, and adjacent organ invasion. The signal intensity of each lesion and of the liver during the dynamic phases and the lesion to liver contrast-to -noise ratio (CNR) were measured.
Results: Significant factors for differentiating IDG-type CCs from nodular-type CCs included a papillary or irregular polypoid shape, no constriction of the tumor-bearing segment, hypoenhancement of the tumor to liver during the equilibrium phase, tumor multiplicity, upstream and downstream bile duct dilatation, and no bile duct wall thickening adjacent to the tumor (P < 0.05). When at least two of these six categorical variables were used in combination, the sensitivity and specificity for diagnosing IDG-type CC were 95% (18/19) and 70% (14/20), respectively.
Conclusion: Using specific MR features, IDG-type CC can be differentiated from nodular-type CC with a high degree of accuracy on biliary MRI with MRCP.

B-222 10:48

Value of contrast-enhanced sonography in the diagnosis of peripheral intrahepatic cholangiocarcinoma
C. Li, B. Huang, W. Wang, H. Ding; *Shanghai/CN*

Purpose: To characterize the contrast-enhanced ultrasound (CEUS) findings of peripheral intrahepatic cholangiocarcinoma (PICC) and to access the usefulness of CEUS in the diagnosis of this disease.
Methods and Materials: Retrospectively analyze 46 patients (20 men, 26 women, mean age 58 years) with PICC who underwent both preoperative CEUS and patho-logic study. All patients underwent both conventional and enhanced sonography. Sonographic examinations were performed with Technos DU8 and Philips IU22 ultrasound instruments with low mechanical-index gray scale contrast imaging. Ultrasound contrast agent SonoVue (2.4 ml) was used. For each lesion, the enhancement features were documented and analyzed by two doctors.
Results: During the hepatic arterial phase, the majority (n=43, 93.5%) of PICC lesions showed hypervascularity while three (6.5%) showed hypovascularity comparing to the liver parenchyma on CEUS. Then, all lesions presented isoechoic or hypoechoic in the portal phase and parenchyma phase. Of all hypervascular lesions, twenty-one (21/43, 48.8%) lesions showed diffused enhancement and 22 (51.2%) lesions showed rim-like or thick band-like enhancement. There were 62.8% (27/43) lesions showing progressive dendritic and concentric filling of the contrast agent and 83.7% (36/43) lesions showing heterogeneous enhancement. All lesions displayed clearer margin on CEUS than on conventional gray scale ultrasound. The diagnostic accuracy of CEUS was 80.4% if the diagnostic features included early wash-in and wash-out, progressive dendritic enhancement and/or heterogeneous enhancement.
Conclusion: There are some specific findings on CEUS which are useful in the diagnosis and differential diagnosis of PICC.

B-223 10:57

Gallstones on ultrasound: Are always a benign lesion?
E. Vranou, S.P. Deftereos, M. Pitiakoudis, S. Foutzitzi, P.K. Prassopoulos; *Alexandroupolis/GR (evranou@yahoo.gr)*

Purpose: To underline the possibility of an occult gallbladder cancer that may be hidden or overlooked by the presence of gallstones/cholecystitis.
Methods and Materials: The study comprised 886 consecutive patients who were admitted to the emergency room with intense right upper quadrant pain and referred for immediate imaging evaluation over a period of 24months.
Results: Ultrasonography (US) disclosed gallbladder stones in 467 (52.7%) patients. The suspicion of coexisted malignancy was posed in 26 of the patients with gallstones/cholecystitis. Focal gallbladder wall thickening coexisted polypoid intraluminal mass of irregular shape, and/or presence of "tissue" around or near

the gallstones were the main imaging findings arising the suspicion of malignancy. Surgical removal and histopathological analysis of the pathologic gallbladders confirmed the presence of cancer in 12/26 patients. In the remaining 14 cases, final diagnosis was benign polyps (n=3), chronic cholecystitis (n=3), adenomyosis (n=1), mural changes due to cholecystitis (n=7). On the contrary, two patients with gallstones and no US malignancy evidence presented small neoplasms on histopathology. Ultrasonography had positive predictive value of 0.63, negative predictive value of 0.99, sensitivity 85%, specificity 97% and an overall accuracy 46% in the diagnosis of occult gallbladder cancer among patients with gallbladder stones.
Conclusion: Gallbladder cancer, especially "flat type", may be hidden or overlooked by the presence of gallstones/cholecystitis on US examination. Radiologists should be alert and analyze the diagnostic images in detail and keep informed the surgeon in the presence of suspicious US findings for a more thorough investigation and possible operation adjustment, i.e. modified laparoscopic approach or open technique.

B-224 11:06

Compound analysis of gallstones using dual energy CT: Results in an anthropomorphic phantom model
R.W. Bauer[1], J. Schulz[1], B. Zedler[1], M. Kerl[1], T. Lehnert[1], T.G. Graf[2], T.J. Vogl[1]; [1]*Frankfurt a. Main/DE*, [2]*Forchheim/DE (ralfwbauer@aol.com)*

Purpose: The potential of dual energy computed tomography (DECT) for the analysis of gallstone compounds in an anthropomorphic phantom model was investigated. The main goal was to find parameters that can reliably define high percentage (> 70%) cholesterol stones without calcium components.
Methods and Materials: Thirty-five gallstones were analyzed. Each stone was put into a plastic specimen container (5.5 x 3.3 cm) filled with formalin functioning as artificial gallbladder. Containers were put into a 32 cm water phantom that contained porcine abdominal organs and spine to simulate patient noise. Scans were performed with 14 x 1.2 mm collimation and tube voltage/current of 140 kV/83 mAs (tube A) and 80 kV/340 mAs (tube B). ROI-measurements were performed in sectors with different appearance on CT images and compared to results of infrared spectroscopy (IRS) which was performed for chemical analysis.
Results: ROI-measurements were performed in 43 sectors in 33 gallstones. 2 pure cholesterol stones could not be detected. Sectors containing > 70% of cholesterol and no calcium component on IRS (n = 20) could be identified with 85% sensitivity and 100% specificity. These sectors showed typical attenuation of 4±14 HU at 80 kV and 29±11 HU at 140 kV and were significantly (p < 0.001) different from sectors with different chemical composition.
Conclusion: Dual energy CT allows for reliable differentiation of gallstone components with > 70% cholesterol and no calcium in this anthropomorphic phantom model. Non-detection of some pure cholesterol stones was the major limiting factor in this study.

B-225 11:15

Evaluation of dilated bile duct structures using the hepatobiliary MR contrast agent Gd-BOPTA
R. Seidel, R. Dabew, P. Fries, A. Buecker, G. Schneider; *Homburg/DE (drrolandseidel@schlau.com)*

Purpose: To assess the diagnostic impact of the hepatobiliary (hb) MR contrast agent Gd-BOPTA on the evaluation of relevant bile duct stenosis on the basis of benign or malignant disease.
Methods and Materials: 106 patients with benign or malignant disease demonstrating dilated bile ducts were prospectively investigated by MR imaging, including unenhanced T2w HASTE and RARE sequences. Contrast enhanced non- and fat suppressed T1w FLASH 2D sequences were performed immediately and 60 minutes (hb) after i.v. administration of 0.05 mmol/kg BW Gd BOPTA (Bracco Diagnostics, Princeton, NJ). Dilatation of bile duct structures (CBD, LHD, RHD) was measured on T2w images. Biliary CM excretion was investigated by a subregional analysis and expressed as an excretion score (ES). Results were correlated with the bilirubin level and underlying benign or malignant disease (linear regression analysis, pearson correlation and student t-test).
Results: The extent of bile duct dilatation did not correlate significantly with the bilirubin level (r=0.16, p=0.093). The correlation between bilirubin level and ES presented a significantly negative values with r=-0.41 (p < 0.001) for all bile duct systems and r=-0.31 (p=0.0012) for dilated bile duct subsystems respectively. Hb CM detection was significantly reduced in patients with malignant disease (r=-0.19, p=0.045).
Conclusion: Bile duct morphology alone is not a reliable predictor for functional aspects of bile duct stenosis. The detection or absence of hb CM gives additional functional information in case of biliary obstruction. Hb imaging is also useful for a better differentiation between benign and malignant disease causing bile duct obstruction.

B-226 11:24

Detection of biliary stenoses in patients after liver transplantation: Is there a different diagnostic accuracy of MRCP depending on the type of biliary anastomosis?

S. Kinner, A. Dechêne, L. Umutlu, S.C. Ladd, G. Gerken, T.C. Lauenstein; *Essen/DE (Sonja.Kinner@uni-due.de)*

Purpose: Two different forms of biliary anastomosis can be created in patients undergoing liver transplantation: (a) bilio-enteric anastomoses or (b) choledocho-choledochostomy. The aim of this study was to assess the accuracy of MR cholangiopancreatography (MRCP) for the depiction of biliary stenoses in liver transplant patients depending on the type of biliary anastomosis.
Methods and Materials: 30 liver transplant patients with clinical suspicion of biliary stenosis were studied (each 15 with bilio-enteric anastomosis/choledocho-choledochostomy). MRCP was performed on a 1.5 T scanner (Magnetom Avanto, Siemens) including 2D single shot RARE, 2D T2w HASTE and 3D high-resolution navigator corrected sequences. Presence of: (a) anastomoses stenoses (AST) and (b) ITBL (ischemic type biliary lesions) were assessed. Percutaneous transhepatic cholangiography (PTC) or endoscopic retrograde cholangiopancreatography (ERCP) was performed within 48 hours after MRCP and served as the standard of reference.
Results: In patients with bilio-enteric anastomoses, sensitivities of MRCP for the detection of AST and ITBL amounted to 27 and 43%, respectively, with specificity values of 25 and 50%. In patients with choledocho-chledochostomy, sensitivities (AST: 80%, ITBL: 89%) and specificities (AST: 80%, ITBL: 67%) were significantly higher.
Conclusion: Biliary complications after liver transplantation can be accurately detected by MRCP in patients having undergone choledocho-chledochostomy. However, the diagnostic value of MRCP is far lower if liver transplantation was performed utilizing a bilio-enteric anastomosis. This is probably due to the less exact depiction of the anastomosis in the bowel wall. Thus, it is crucial to know the type of biliary anastomosis before choosing the adequate diagnostic procedure.

B-227 11:33

also EPOS

Role of magnetic resonance cholangiography (MRC) in the detection of biliary complications after orthotopic liver transplantation (OLT)

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Purpose: Biliary complications still constitute one of the leading causes of morbidity and graft dysfunction in patients undergone OLT. The aim of this study was to evaluate the role of MRC in the detection of biliary complications after OLT.
Methods and Materials: 78/201 patients who underwent OLT with clinical suspected biliary complications were evaluated by 1.5 T-MR with surface coil. Axial FFE-T1-w, axial-coronal SS-T2-w, axial SE-T2-w with fat-sat, radial cholangiography 2D-SE breath hold and coronal 3D-TSE SS were performed. Diagnostic confirmation of biliary complications was obtained by endoscopic retrograde cholangiography (ERCP) (13), percutaneous transhepatic cholangiography (PTC) (20), ultrasonography (10), CT (2), and 11 had also surgical confirmation. Sensitivity, specificity, positive and negative predictive values and accuracy of MRC were calculated.
Results: In 44/78 patients, MRC detected biliary complications: 42 strictures (37 anastomotic, 5 intrahepatic), 4 sludge, 5 bilomas and 3 stones. In 25/37 cases of anastomotic strictures pre-anastomotic dilatation of biliary tract was also shown. In 4 cases, PTC showed intrahepatic (1), bilio-enteric (1) strictures, sludge (1) and biloma (1) not detected with MRI. In 2 cases, MRC showed intrahepatic and bilio-enteric anastomotic strictures not confirmed by other modalities. The sensitivity, specificity, positive and negative predictive values and accuracy of MRC in detecting biliary strictures were respectively 93, 94, 97, 89 and 94%.
Conclusion: MRC is a reliable technique to visualize the biliary anastomosis and to depict biliary complications after OLT and it should be routinely performed in OLT recipients with clinical suspected biliary complications.

B-228 11:42

Preoperative assessment of longitudinal extent of bile duct cancers using MDCT with multiplanar reconstruction and minimum intensity projections: Comparison with MR cholangiography

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Purpose: To compare the performance of MDCT, including multiplanar reformation (MPR) and minimum intensity projection (MinIP) images, with that of MDCT combined with MR cholangiography (MRC) in the preoperative evaluation of the longitudinal extent of biliary cancer.
Methods and Materials: 27 patients (20 males, 7 females) with surgically proven bile duct cancer and who had undergone preoperative MRC and triple-phase

MDCT, were included. Two abdominal radiologists independently evaluated two image sets, the MDCT with MPR and MinIP images and the combined image set of axial MDCT with MRC, at a 4-week interval, regarding the longitudinal extent of the biliary cancer. The results were compared with the surgical and pathology findings.
Results: The areas under the receiver operating curve of the MDCT image set and the combined image set with MRC for predicting the involvement of the biliary secondary confluences or the intrapancreatic segment were 0.938 and 0.923 for reviewer 1, 0.839 and 0.836 for reviewer 2, respectively. The differences were not statistically significant for either image set or for either reviewer (p=0.625 and 0.937 for each reviewer). The sensitivity and specificity of the MDCT image set for detecting tumor involvement of biliary secondary confluences or intrapancreatic segment were also similar for both reviewers to those of the combined set with MRC (P > 0.05). Interobserver agreements of both reviewers were excellent (weighted kappa values of 0.80 and 0.81).
Conclusion: MDCT with MPR and MinIP images showed comparable diagnostic performance to that of combined MDCT with MRC for predicting the longitudinal extent of bile duct cancer.

B-229 11:51

Diagnostic value of Gd-EOB-DTPA-enhanced MR cholangiography for evaluating the bile duct anatomy in living liver donor candidates

M. Lee, J. Lee, H. Kim, S. Kim, J. Han, B. Choi; *Seoul/KR (aurabird@gmail.com)*

Purpose: To evaluate the diagnostic performance of Gd-EOB-DTPA-enhanced, T1 weighted MR cholangiography (T1W-MRC) for evaluating the biliary anatomy and to determine whether the addition of T1W-MRC to 3D T2-weighted-MRC (3D-T2W-MRC) can improve the diagnostic accuracy of preoperative MRI for evaluating the biliary anatomy.
Methods and Materials: Forty-nine, living liver donor candidates who underwent unenhanced MRI, 3D-T2W-MRC, and Gd-EOB-DTPA-enhanced MRI before surgery were included in this study. Two, abdominal radiologists independently evaluated each of the three image sets, i.e. T1-MRC, 3D-T2W-MRC, and combined T1- and 3D-T2W-MRCs, regarding image quality and visualization of segmental intrahepatic ducts; they also assessed the accuracy and confidence for possible types of biliary variation. Multiple sessions of nonparametric, 2-way analysis of variance followed by multiple comparisons were performed for every category.
Results: Regarding the accuracy of biliary variation, adding Gd-EOB-DTPA-enhanced, T1W-MRC to 3D-T2W-MRC (87~89%) showed a tendency for improved performance compared with either T1W-MRC (81~82%) or 3D-T2W-MRC (81~82%) alone, although the difference was not statistically significant (p=0.441, and 0.449). However, the reviewers' confidence for biliary variation was significantly higher with the combined interpretation of T1W and 3D-T2W-MRC than using an interpretation of T1W-MRC or 3D-T2W-MRC alone (p < 0.05). Regarding ductal visualization, both 3D-T2W-MRC and T1W-MRC showed a similar performance except that the left, second-order, ductal branches were better visualized on 3D-T2W-MRC than on T1W-MRC.
Conclusion: The addition of Gd-EOB-DTPA-enhanced T1W-MRC to T2W-MRC significantly improved the diagnostic confidence of the reviewers regarding biliary variation, but showed only a slight improvement of their accuracy for detecting ductal variation.

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

Cardiac

SS 403b

Cardiac MRI in cardiomyopathies and myocarditis

Moderators:
M. Grothoff; Leipzig/DE
A.J.B.S. Madureira; Porto/PT

B-230 10:30

Ventricular myocardial dysfunction in systemic sclerosis with cardiac magnetic resonance imaging: Correlation with pulmonary fibrosis and cardiac biomarkers

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Purpose: To evaluate the use of cardiac MR (CMR) in evaluating ventricular dysfunction and presence of myocardial fibrosis in patients with SS and to correlate these appearances with symptom scores, pulmonary fibrosis and cardiac biomarkers.
Methods and Materials: Eighteen patients with SS underwent CMR and high-resolution chest CT (HRCT), cardiac biomarkers (NT-proBNP) and quality of life

measures (SF-36 and systemic sclerosis health assessment). Ten age and gender-matched control subjects underwent CMR. CMR was evaluated for functional LV and RV parameters and for the presence, location and extent of delayed enhanced (DE) myocardium. High-resolution CT was scored for the changes of pulmonary fibrosis.
Results: Right ventricular ejection fraction correlated significantly with % fibrosis of myocardium (R = 0.63, p < 0.01), extent of pulmonary fibrosis (R = 0.57) and extent of ground glass opacities (GG) (R = 0.53) (p < 0.05 for both). Significant correlations were also found between % fibrosis of myocardium and extent of pulmonary fibrosis (R=0.59, p < 0.05) and extent of GG (R = 0.58, p < 0.05). NT-proBNP correlated significantly with number of myocardial segments with DE (R = 0.64, p < 0.05). No correlations were found between quality of life scores and either cardiac CMR or HRCT variables. Linear regression revealed the extent of pulmonary ground-glass opacities to be the only independent predictor of % of myocardial fibrosis (R2 = 0.61, p < 0.0001).
Conclusion: CMR detects myocardial fibrosis in SS. In those in whom cardiac biomarkers are elevated or pulmonary fibrosis is present, CMR may be a useful test to detect early-stage myocardial fibrosis.

B-231 10:39

Cardiac magnetic resonance in patients with Chagas´ disease
N.B. Lochocki, L. Santamarina Zubizarreta, L.C. Dragonetti, A.E. Buzzi, E. Eyheremendy; *Buenos Aires/AR (nadialochocki@hotmail.com)*

Purpose: Chagas´ disease (CD), also called American trypanosomiasis, is endemic in Latin America and is one of the main causes of arrhythmias, heart failure and sudden death. Our purpose is to describe the clinical applications of cardiac magnetic resonance (CMR) in CD.
Methods and Materials: We evaluated 22 seropositive patients with CD (mean 56 years old), 7 females and 15 males without history of myocardial infarction and a low risk of coronary artery disease (CAD). Patients signed an approved consent form. All underwent cine and late gadolinium CMR on a 1.5 T Somatom Symphony (Siemens - Erlangen- Germany). A gradient-echo (steady-state free precession) was used for LV function evaluation, and an inversion-recovery prepared gradient-echo was used 10 to 20 minutes after intravenous bolus of 0.01 mmol/kg of gadolinium-DTPA. We evaluated different parameters: 1) systolic and diastolic dimensions of the LV and RV, 2) focal or global function, 3) measurement of the septum, 4) valves abnormalities, and 5) tissue characterization with myocardial fibrosis (hyper-enhancement).
Results: The parameters of ventricular measurements were abnormal in 66% for the LV and 50% for the RV. The segmental analysis indicates the LV apex and inferolateral regions as preferable sites for function abnormalities (55%) and myocardial fibrosis was detected in 44% of the patients. Ventricular aneurysms were present in 38%.
Conclusion: CMR offers a wide variety of imaging tools to evaluate precisely morphology, function and tissue characterization of cardiac chambers besides the crucial information of the functional status of the heart in CD.

B-232 10:48

Myocardial edema as the sole marker of acute injury in Tako-Tsubo cardiomiopathy (TT-CMP): A cardiovascular magnetic resonance (CMR) study
I. Iacucci, M. Francone, M. Mangia, F. Vullo, M. Pagliaro, C. De Meo, C. Catalano, R. Passariello; *Rome/IT*

Purpose: The main hallmark of TT-CMP disease is characterized by a transitory ischemia with completely reversible regional contractile dysfunction involving apical segments and with no angiographic signs of coronary artery disease. The acute inflammatory and reversible nature of myocardial damage suggests that tissue edema may be a relevant marker of disease.
Methods and Materials: Nine patients with clinical and angiographic diagnosis of TT-CMP underwent CMR in the acute phase (mean 2.4 days) and at 4 months follow-up. In all patients, a standard acquisition protocol including TSE T2-weighted short-tau inversion recovery (T2w-STIR), cine-SSFP and delayed enhancement (DE) imaging post-Gd-BOPTA were acquired. Images were visually analyzed for presence of edema and late enhancement data were correlated with regional dysfunction assessed with cine-SSFP.
Results: In all patients, T2-STIR images showed the presence of a homogeneous diffuse hyperintensity reflecting tissue edema, entirely involving the mid-apical segments and perfectly matching with the area of regional dysfunction; no cases of DE were observed. At follow-up, complete regression of edema was observed in all cases with a significant recovery of regional and global LV function (ejection fraction from 48.7 to 59.8%).

Conclusion: Myocardial edema is a feature of acute TT-CMP likely reflecting the acute inflammation and vasoactive phenomena associated with the syndrome and could be used as a marker of disease severity. CMR allows its detection non-invasively.

B-233 10:57

To assess the diagnostic role of CMRI and contrast media delayed enhancement technique (DE) in the evaluation of early cardiac involvement in patients suffering from systemic sclerosis (SSc), without cardiac symptoms
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Purpose: The aim of our study is to evaluate clinical utility of CMRI to assess cardiac abnormalities in patients with diagnosis of Systemic Sclerosis (SSc) based on the international criteria, without symptoms and sign (ECG and echocardiographic) of cardiac involvement.
Methods and Materials: 14 patients (all females, mean age 54.7) underwent MRI (1.5 T, GE HD). We used an 8 channel phased array dedicated coil. Cine steady state MRI sequences with parallel imaging in 4-chambers view and short axis view were obtained at first. After baseline acquisition, was administered 0.2 mmol/kg dose of contrast media (Gd-DTPA) and 15 minutes later IR-FSE sequences, in 4-chambers and short axis view, had been acquired using appropriate TI (DE). We analyzed MR images by Segment® software analysis, and distribution of DE.
Results: We observed delayed hyper-enhancement in 6 out 14 (42.8%) patients; in 4 out 6 patients (66.6%). DE pattern of distribution was linear and restricted to the internal share of the myocardial wall, saving subendocardium and subepicardium. In 2 out 6 patients (33.3%), pattern had nodular shape, less widespread. Volume analysis showed RV-EDV= on average 78.8 ml, and RV-EF= on average 43.6%, quite inferior than normal range, in relation to subclinical cardiac involvement initially confined to right ventricle, linked to an increased rigidity.
Conclusion: CMRI-DE revealed signs of cardiac involvement in a significant share of patients suffering from SSc without cardiac symptoms; in consequence, it could be a non-invasive diagnostic method to detect early cardiac involvement in subclinical phase of disease.

B-234 11:06

Prognostic value of fibrosis assessed by cardiac magnetic resonance imaging in familial dilated cardiomyopathy
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Purpose: About 20-50% of patients with idiopathic nonischemic dilated cardio-myopathy (NICMD) have a form called familial dilated cardiomyopathy (fDCM). Myocardial fibrosis, detected by CMR as late gadolinium enhancement (LGE), predicts adverse cardiac outcomes in NICMD. The proportion of fDCM is low/nonspecified in majority of studies. Objective: To evaluate presence/pattern of LGE in fDCM and relate with the composite endpoint of death, hospitalization (cardiac causes) and malignant ventricular arrhythmias.
Methods and Materials: We prospectively evaluated 24 patients (14 males) with fDCM. Mean (standard deviation (SD)) age was 47 (12) years-old. Clinical parameters, plasma BNP, and CMR study (Siemens Magneton Trio) were obtained and ventricular volumes, ejection fraction (EF), ventricular mass (SSFP sequences), LGE evaluated.
Results: During 9 (2) months median follow-up, 21 (87%) patients were in sinusal rhythm, 14 (58%) in NYHA class I, 9 (38%) had left bundle branch block (LBBB), 7 (29%) had a family history of sudden death and 19 (79%) were under beta-blockers and ACEI/ARA. Time since diagnosis was 8.7 (5) years. Mean BNP was 286 (398) pg/ml, mean LV-EF 37 (14)%, mean LV end-diastolic volume 132 (52) l/m^2, mean RV-EF 48 (9)%, mean RV end-diastolic volume 86 (9) ml/m^2. LGE was found in 6 (25%) patients (midwall-striae (n=4), subepicardial (n=1) and focal LGE (junction between RV-LV) (n=1)). No relationship was observed between BNP, LV/RV EF, ventricular volumes, age, time since diagnosis, LBBB and LGE. Occurrence of the composite endpoint was observed in 4 patients, which was statistically related with LGE (p=0.011).
Conclusion: LGE, present in 25% of patients with fDCM, was associated with adverse cardiac outcomes. LGE identification constitutes a valuable tool for risk stratification in fDCM.

B-235 11:15

Left ventricular non compaction in adults: Relationship between clinical features and MRI characteristics of compacted and non compacted myocardium

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Purpose: The left ventricular non compaction (LVNC) is a rare aetiology of heart failure that occurs as a result of the interruption of the normal compaction of the myocardium during embryonic life. The aim of the study was to assess the relationship between clinical features and MRI parameters of compacted and non-compacted myocardium.

Methods and Materials: 39 patients presenting a LVNC defined on MRI criteria (end diastolic ratio of non-compacted to compacted myocardial thickness > 2.3) were included. The following data were collected: clinical features (absence of symptom, heart failure, dysrrythmias and thromboembolic events), and MRI parameters including number of non compacted segments, non-compaction score (NCS), left ventricular (LV) volumes, LV ejection fraction (EF) and compacted myocardial mass (CMM).

Results: Thromboembolic events were significantly more frequent (p=0.02) in patients with the highest CMM (114±31 versus 80±25 g,). A higher incidence of dysrrythmias (p=0.03) was present in patients with the most severe NC score (28.4±9 versus 22.1±9). CMM was closely related to LV dysfunction measured by EF (r=-0.365, p=0.02) and Telediastolic Index (r=0.754, p < 0.001). No relationship was demonstrated between non-compaction parameters and LV dysfunction.

Conclusion: In LVNC, clinical features are related to both compacted and non-compacted myocardium. LV dysfunction is related to compacted myocardium. This suggests that LVNC is a disease involving the whole LV myocardium.

B-236 11:24

Measurement of trabeculated left ventricular mass using cardiac magnetic resonance imaging in the diagnosis of left ventricular non-compaction

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Purpose: To describe a method for measuring trabeculated left ventricular (LV) mass using cardiac magnetic resonance imaging (CMR) and to assess its value in the diagnosis of left ventricular non compaction (LVNC).

Methods and Materials: Between January 2003 and 2008, we prospectively included 16 patients with LVNC. During the mean period, we included 16 patients with dilated cardiomyopathy (DCM), 16 patients with hypertrophic cardiomyopathy (HCM), and 16 control subjects. LV volumes, LV ejection fraction and trabeculated LV mass were measured in the 4 different populations using a 1.5 T MR scan and steady state free precession cine sequences.

Results: The percentage of trabeculated LV mass was almost 3 times higher in the patients with LVNC (32±10 %), compared to those with DCM (11±4 %; P < 0.0001), HCM (12±4 %, P < 0.0001), and controls (12±5 %; P < 0.0001). A value of trabeculated LV mass above 20% of the global mass of the LV predicted the diagnosis of LVNC with a sensitivity of 93.7% (95% CI: 71.6%-98.8%) and a specificity of 93.7% (95% CI: 83.1-97.8%; κ = 0.84).

Conclusion: The method described is reproducible and provides an assessment of the global amount of LV trabeculation. A trabeculated LV mass above 20% of the global LV mass is highly sensitive and specific for the diagnosis of LVNC.

B-237 11:33

Myocardial fibrosis evaluation by MRI late enhancement technique in patients with CAVD

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Purpose: Arrhytmogenic Right Ventricle Cardiomiopathy (CAVD) is characterised by a progressive replacement of myocardium by fibro-fatty tissue that induces both global and regional kinetic abnormalities and sudden death. The aim of our study was to evaluate the role of MRI late enhancement technique as a non-invasive tools in the diagnosis of fibrosis in patients with CAVD.

Methods and Materials: Twenty-seven patients (17 males; 10 females; mean age 31.5 years) were enrolled; 18 out of 27 had a diagnosis of CAVD based on Task Force criteria, 9 out of 27 had only a clinical souspicious of CAVD. All of them had a previous MRI positive for diskinetic myocardial alterations. All patients underwent MRI (1.5 T GEHD) performed by an 8 channel phased-array dedicated coil. At first IR-FSE and Steady State sequences had been acquired; after standard examination 0.2 mmol/kg dose of contrast media had been injected and 15 minutes later an IR-FSE sequence had been acquired using appropriate TI.

Results: In 9 out 18 patients (50%) with a CAVD, diagnosis based on Task Force criteria late enhancement technique showed enhancement in diskinetic areas. In 3 out of 9 positive patients, a myocardium biopsy had been performed in diskinetic areas; in all cases, biopsy were positive for fibrosis.

Conclusion: Non-invasive diagnosis of both fatty and fibrous intramyocardial replacement seems to be possible by MRI late-enhancement technique. MRI findings show a very good correlation respecting with histopathology findings; these data suggest a possible diagnostic role of late enhancement MRI in terms of prediction of disease evolution.

B-238 11:42

CMR assessment of gadolinium kinetics in acute myocarditis: Insight for a new imaging protocol

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Purpose: Delayed contrast enhanced CMR imaging protocols for the diagnosis of myocarditis are inspired from ischemic disease imaging protocols, in which contrast kinetics might be different. The aim of this study was: 1) to compare the kinetics of gadolinium in myocarditis and myocardial infarction and 2) to establish a delayed contrast enhanced CMR imaging protocol adapted to gadolinium kinetics in myocarditis.

Methods and Materials: Ninety-nine patients were prospectively included, 17 patients with acute myocarditis and 12 with acute myocardial infarction. All patients underwent a 1.5 T CMR examination. Look-Locker sequences were acquired before and after administration of 0.2 mol/kg Gd-DOTA repeatedly during 14 min. The longitudinal relaxation rate (R1) from enhanced myocardium, normal myocardium and left ventricular blood were measured. Delayed contrast enhanced CMR images were acquired at 5, 10 and 15 min after contrast injection. Signal noise ratio (SNR) and contrast noise ratio (CNR) were measured and a qualitative image analysis was performed on a four points scale.

Results: A faster decline in R1 value was measured within the area of myocardial enhancement in myocarditis compared with myocardial infarction. Myocarditis patients showed a significant decrease in CNR and SNR values as a function of time, whereas in myocardial infarction, there was no significant difference between time points. In myocarditis image quality was better at 5 min compared with 15 min.

Conclusion: In acute myocarditis, delayed contrast enhanced MR images acquired 5 min after contrast injection provide higher SNR, CNR and image quality compared with later time points.

B-239 11:51

Myocardial parameters related to sytolic anterior motion of the mitral valve in hypertrophic cardiomyopathy studied by MRI

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Purpose: Left ventricular (LV) outflow tract obstruction in hypertrophic cardiomyopathy (HCM) is an important prognosis factor and results from a complex interaction between many variables including systolic anterior motion (SAM) of the mitral valve. However, SAM is inconstant and our aim was to analyse LV parameters related to its presence.

Methods and Materials: 49 patients with HCM defined on MRI criteria (end diastolic thickness > 15 mm) were included. The clinical status and following LV parameters were collected: end diastolic volume (EDV), end systolic volume (ESV), mass, ejection fraction (EF), ratio mass/EDV, segmental thickness and thickening, delayed enhancement. Patients were divided in two groups according to the presence of SAM and the collected parameters were compared.

Results: SAM was present in 21 patients (SAM group) and absent in 28 patients (control group). No differences were observed between the two groups for EDV, ESV, mass, ratio mass/EDV, segmental thickness, delayed enhancement and clinical status. The only related parameters to SAM were EF (0.70±0.12 vs 0.65±0.12; p=0.032) and postero lateral segmental thickening (0.38±0.08 vs 0.33±0.10; p=0.021).

Conclusion: SAM in HCM is more frequently observed in patients with the highest values of LV systolic function (EF) and regional thickening of postero lateral segments. This suggests that an increased LV contractility could be one of the mechanisms involved in the occurrence of SAM in HCM.

10:30 - 12:00   Room Q

Interventional Radiology

SS 409b
Endovascular treatment of liver tumors

Moderators:
M.F. Reiser; Munich/DE
M. Reiter; Vienna/AT

B-240 10:30

Liver, gastrointestinal and cardiac toxicity in intermediate hepatocellular carcinoma treated with PRECISION TACE with drug-eluting beads: Results from the PRECISION V randomized trial

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Purpose: To evaluate the toxicity focussing on hepatic, gastrointestinal and cardiac parameters following PRECISION TACE with DC Bead™ versus conventional transarterial chemoembolization (cTACE) in the treatment of intermediate-stage hepatocellular carcinoma (HCC).
Methods and Materials: This prospective, randomized, multicentre study was conducted under best practice trial management and authorized by local institutional review boards. Informed consent was obtained. 212 patients (185 men/27 women; mean: 67 years) were randomized to be treated with DC Beads™ or cTACE. The majority of both groups presented in a more advanced stage. Safety was measured by rate of adverse events (South West Oncology Group criteria) and changes in laboratory parameters. Cardiotoxicity was assessed by means of left ventricular ejection fraction (LVEF) in MRI or echocardiography. The results of the two groups were compared using the chi-square test and Student`s t-test.
Results: Mean maximum alanine transaminase increase in the DC Bead group was 50% in the cTACE group (p < 0.001) and 59% for aspartate transaminase (p < 0.001). For bilirubin, mean increase was 5.30 ± 15.13 vs. 13.53 ± 73.89 µmol/L. Concerning gastrointestinal disorders, 120 adverse events (AEs) occurred in 57/93 (61.3%) patients in the DC Bead group vs. 114 in 49/108 (45.4%) in cTACE. Concerning hepatobiliary disorders, serious AEs occurred in 8/93 (8.6%) vs. 11/108 (10.2%) patients. LVEF showed an increase in the DC Bead group by $+2.7 \pm 10.1$ percentage points and a small decrease by -1.5 ± 7.6 in the cTACE group, p=0.018.
Conclusion: PRECISION TACE is safe, even in more advanced HCC patients. Serious liver and cardiac toxicity were significantly lower in the DC Bead group.

B-241 10:39

Reduced quality of life associated adverse events in intermediate hepatocellular carcinoma patients treated with PRECISION TACE with drug eluting beads: Results from the PRECISION V randomized trial

M.B. Schernthaner[1], R. Lencioni[2], K. Malagari[3], T.J. Vogl[4], F. Pilleuil[5], A. Denys[6], A. Watkinson[7], J. Lammer[1]; [1]Vienna/AT, [2]Pisa/IT, [3]Athens/GR, [4]Frankfurt a. Main/DE, [5]Lyon/FR, [6]Lausanne/CH, [7]Exeter/UK

Purpose: To evaluate the extent of quality of life (QoL) associated adverse events (AEs) following PRECISION TACE with DC Bead compared with conventional transarterial chemoembolisation (cTACE).
Methods and Materials: 201 intermediate HCC patients were treated with DC Bead (PRECISION TACE) or conventional TACE (cTACE) with doxorubicin in the PRECISION V clinical study. 93 patients were treated with DC Bead and 108 Patients with cTACE every 2 months and followed up for 6 months. AEs were classified according to the South West Oncology Group criteria. QoL associated AEs were defined as alopecia, constipation, nausea, vomiting, pyrexia, chills, asthenia, fatigue, and headache.
Results: The biggest difference in QoL associated AEs was for alopecia: 2 patients (2.2%) for DC-Bead versus 21 patients (19.4%) for cTACE. For other clinical symptoms, constipation (n=10; 10.8% vs. n=13; 12%), vomiting (n=10; 10.8% vs. n=14; 13.0%), pyrexia (n=16; 17.2% vs. n=26; 24.1%), chills (n=1; 1.1% vs. n=5; 4.6%), and headache (n=2; 2.2% vs. n=8; 7.4%) showed lower incidence in the DC Bead group versus cTACE. Nausea, n= 15; 13.9% (n=15; 16.1%) and fatigue, n=6; 5.6% (n=13; 14.0%) were lower for cTACE. Total dose of doxorubicin was on average 35% higher in the DC Bead group.
Conclusion: Although patients in the DC Bead group received a higher doxorubicin dose, less QoL associated AEs were reported for this group. Alopecia, the most obvious outward sign of toxicity, was only reported in a tenth of DC Bead patients. Thus, PRECISION TACE with DC Bead improves quality of life associated adverse events.

B-242 10:48

Prospective randomised comparison of chemoembolization with doxorubicin eluting beads (DEB-TACE) and bland embolization with bead block for hepatocellular carcinoma (HCC)

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Purpose: To evaluate the added role of the chemotherapeutic in transarterial chemoembolization (TACE) of intermediate stage hepatocellular carcinoma (HCC). The issue is of major importance since as suggested by recent evidence hypoxia of the tumor are potent stimulators of angiogenesis and there are not many papers supplying level one evidence confirming the value of the chemotherapeutic. The hypothesis was that since DEB (Drug Eluting Bead)-TACE allows a standardized and reproducible TACE, the comparison with bland TACE can readily reveal the potential value of the chemotherapeutic.
Methods and Materials: Two groups were randomised in this prospective study: group A-treated with doxorubicin DEB-TACE (n=41) and group B (n=43)-treated with bland embolization. Patients were BCLC stage B, randomized for tumor diameter. Patients were embolized at set time intervals (2 months) with maximum 3 embolizations. Tumor response was evaluated using the EASL criteria and a-fetoprotein levels.
Results: At 6 months in the DEB-TACE group, complete response was seen in 11 (26.8%) and in 6 patients (14%) in the bland embolization group; partial response was achieved in 19 patients (46.3%) and in 18 (41.9%) patients in the DEB TACE and bland embolization, respectively. Time to progression (TTP) was longer for the DEB TACE group (42.4 ± 9.5 and 36.2 ± 9.0 weeks) at a statistically significant level (p=0.008).
Conclusion: DEB-TACE presents better local response and longer TTP than bland embolization with Bead Block. However, survival benefit has to be addressed in future papers to better assess the clinical value.

B-243 10:57

Effect of underlying hepatic diseases on tumor response during transarterial chemoembolization in patients with hepatocellular carcinoma

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Purpose: To determine the effect underlying hepatic diseases (hepatitis B, hepatitis C and hemochromatosis) on tumor response during transarterial chemoembolization (TACE) in patients with hepatocellular carcinoma (HCC).
Methods and Materials: 85 patients [60 males and 25 females, average age, 63 years (range: 46-84 years)] were treated by repetitive TACE [mean, 4.19 sessions (range: 2-11) using (mitomycin C 8 mg/m², Lipiodol, Embocept) with four weeks interval in between the sessions]. 64.7% of patients had liver cirrhosis. MRI studies were retrospectively evaluated by two radiologists. They evaluated the response according to Response Evaluation Criteria In Solid Tumors (RECIST), based on the largest diameters of liver lesions. Readers also assessed percent of tumor necrosis and enhancement pattern to contrast media.
Results: 27.06% of patients showed partial response, 52.94% stable disease and 20% progressive disease. Tumor response since X^2, 0.95 for 2 degree of freedom was read to $2.056 < 5.599$ in cirrhotic patients compared with non-cirrhotic patients. No significant difference was found at a 0.05 level. The competitive evaluation of patients with HBV, HCV and hemochromatosis showed the same results (X^2, 0.95 with 4df was read to $9.113 < 9.488$). There was significant difference for existence of these underlying hepatic diseases, because X^2, 0.95 for 2df was read to $18.825 > 5.991$.
Conclusion: Interestingly, no statistically significant difference after repetitive TACE in response was noted in patients with cirrhotic and non-cirrhotic liver. However, the presence of hepatitis B, hepatitis C and hemochromatosis was shown as a statistically significant factor for tumor response.

B-244 11:06

Palliative treatment of liver metastases of gastric cancer: Comparative evaluation of two transarterial regional chemotherapy protocols

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Purpose: To evaluate the efficacy of transarterial chemoembolization (TACE) using different drug combinations in the treatment of liver metastases of gastric cancer concerning local tumor control and survival.
Methods and Materials: 19 patients (mean: 64 years; range, 37-81) with unresectable hepatic metastases of gastric cancer were repeatedly treated with TACE in 4-week intervals. In total, 101 chemoembolizations were performed (mean: 5 sessions/patient). 63.2% showed multiple metastases, 5.3% 1 metastasis, 10.5%

Friday

2 metastases, and 21% 3-4 metastases. Local chemotherapy protocol was mitomycin (8 mg/m²b.s). (n=11) and mitomycin with gemcitabine (n=8). Embolization was performed with lipiodol and starch microspheres for vessel occlusion. Tumor response was evaluated by MRI. Change in size was calculated and response was evaluated according to RECIST. Survival rates from the first diagnosis and the first TACE session were calculated to obtain median survival (Kaplan-Meier).
Results: Local tumor control showed stable disease in 57.9% and progressive disease in 42.1%. During therapy, the clinical situation changed: 13 patients (68.4%) were treated palliatively, and 6 patients (31.6%) symptomatically. 1-year survival post-TACE was 43%, 2-year survival was 31%. Median survival from the time of diagnosis was 29.2 months (Kaplan-Meier); and from the start of TACE treatment 10 months. Median survival after TACE with mitomycin was 12.9 months, with combined mitomycin and gemcitabine 8 months. Median survival time of the palliative group was 10.8 months, and of the symptomatic group 8 months.
Conclusion: TACE is a safe minimal-invasive treatment for patients with liver metastases of gastric cancer, with no significant difference for the two chemotherapy protocols.

B-245 11:15

Liver metastses of neuroendocrine tumors: Treatment with hepatic transarterial chemotherapy using two therapeutic protocols

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Purpose: To retrospectively determine the effectiveness of hepatic transarterial chemotherapy using two therapeutic protocols - mitomycin C alone and combined mitomycin C and gemcitabine - on local tumor control and survival rate in patients with liver metastases from neuroendocrine tumors.
Methods and Materials: In this retrospective study, 48 patients (range, 37-77 years; mean: 61.1 years; SD: 10.3) with liver metastases from neuroendocrine tumors underwent repeated selective hepatic artery chemotherapy using mitomycin C alone (group 1: 18 patients with 182 sessions; mean 10.11 sessions/patient) or combined mitomycin C and gemcitabine (group 2: 30 patients with 312 sessions; mean 10.4 sessions/patient) with 4-week intervals between treatment sessions.
Results: Both treatment protocols were well tolerated by all patients. Only minor side effects occurred in both groups, and no major complications developed. Local tumor control evaluation according to the RECIST criteria revealed the following for group 1: partial response, 11.1%; stable disease, 50%; progressive disease 38.9%. RECIST criteria for group 2 indicated partial response in 23.33%, stable disease in 53.34%, and progressive disease in 23.33%. The survival rate from initial diagnosis to the fifth year for group 1 was 11.11% and for group 2, 46.67%. The median survival time from the initial diagnosis of group 1 was 38.67 months, whereas in group 2 it was 57.1 months.
Conclusion: Transarterial hepatic chemotherapy using mitomycin C and gemcitabine can be an effective therapeutic protocol for controlling local metastases and improving survival time in patients with hepatic metastases from neuroendocrine tumors.

B-246 11:24

also EPOS

Side effects of trans-arterial chemoembolization with microspheres versus lipiodol in the treatment of unresectable hepatocellular carcinoma:
Work in progress

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Purpose: To assess the safety and the incidence of side effects of TACE using HepaSphere compared to traditional procedure, using Lipiodol, for HCC.
Methods and Materials: 59 patients with unresectable HCC (AASLD guidelines) were enrolled for treatment by selective TACE. In 30 patients, the standard procedure was applied and in 29 the treatment with HepaSphere was used. All patients presented conventional recruitment criteria for TACE. Traditional procedure consists in intra-arterial somministration of Lipiodol emulsion with Epirubicin, followed by gelatine sponge particles. HepaSphere are loaded with Epirubicin solubilised in NaCl and non-ionic isotonic contrast medium (Iomeron 350). Patients were monitored in the 2 days following chemoembolization.
Results: Post Emboliztion Syndrome (PES) was registered in 44% of patients treated with HepaSphere and in 73% of them treated with Lipiodol: The difference was not statistically significant. A statistically significant difference was observed comparing four groups of patients (Lipiodol or HepaSphere, previously embolized or not); in particular, patients not previously embolized treated with Lipiodol displayed a higher frequency of PES (86.7%) than those treated with Hepasphere (45%) or patients previously embolized treated with either drug (42.9%).
Conclusion: Having undergone a previous embolization can be considered a positive prognostic factor, in terms of developing PES. HepaSphere treatment shows a better safety profile than Lipiodol treatment. However, a larger cohort of patients is necessary to confirm this result and to establish prognostic criteria.

B-247 11:33

Comparison of concurrent chemo-radiation therapy and hepatic arterial infusion chemotherapy in patients with portal vein thrombosis related to hepatocellular carcinoma

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Purpose: We compared retrospectively therapeutic efficacy and safety of concurrent chemoradiation therapy (CCRT) and hepatic arterial infusion chemotherapy (HAIC) in patients with portal vein thrombosis (PVT) related to hepatocellular carcinoma (HCC).
Methods and Materials: Between January 2004 and May 2009, 41 patients with PVT related to HCC were enrolled in this study. CCRT group (n = 20) was performed with a total of 4500 cGy over 5 weeks followed by 2 cycles of HAIC. In HAIC group (n = 21), 5-Fu, Cisplatin and Leukovorin were administered consecutively 5 days every 3 weeks. CT was performed after 2 cycles of HAIC and concurrent radiotherapy to evaluated therapeutic efficacy. Data regarding to tumor response, survival and complication were analyzed by Fischer exact test and Kaplan-Meier method with log rank test for inter-group comparison.
Results: Mean follow-up period was 176 days in CCRT group and 161 days in HAIC group. There was no statistical difference in age, causes of liver cirrhosis, Child-Pugh score, AFP level and tumor stage between each group. The CCRT group achieved better response rate (disease progression: 15%, partial response: 60%, stable disease: 25%) than the HAIC group (disease progression: 47.6%, partial response: 28.6%, stable disease: 23.8%) (p = 0.025). Six months' survival rates were 44.8% in CCRT group, and 33.3% in HAIC group (p = 0.082). Complication was not significantly different in both groups on statistics.
Conclusion: Even though CCRT achieved better tumor response rate than HAIC, it did not affect improvement of survival rate in patient with PVT related to HCC.

B-248 11:42

Diagnostic accuracy of angiography-based CT-like imaging when assessing for extrahepatic arterial shunting before selective internal radiation therapy (SIRT)

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Purpose: To assess the diagnostic accuracy of angiography-based CT-like imaging for detection of extrahepatic shunting in patients undergoing preparation for selective internal radiation therapy (SIRT).
Methods and Materials: 30 patients (mean age: 64 ± 13 y) with hypervascularized hepatic tumors underwent hepatic angiography with coilembolisation of all gastrointestinal collaterals followed by 99mTc-macroaggregated albumin (MAA) SPECT/CT to prepare for SIRT. Before injecting the MAA via a microcatheter from the intended treatment position, an angiography and a CT-like image sequence (XperCT™, Philips Healthcare) of the upper abdomen were acquired with contrast media application through the microcatheter (2 ml/second, 14 ml). In bilobar disease or variant anatomy, each tumor-supplying artery was injected. Angiographies and XperCT™s were performed from 48 microcatheter positions followed by MAA injections and MAA-SPECT/CT. MAA-SPECT/CT served as the reference standard to determine the accuracy of XperCT™ for detection of extrahepatic shunting not visualised on angiography.
Results: In patients negative for extrahepatic arterial shunting on angiography, CT-like imaging with XperCT™ detected extrahepatic arterial shunts in 4 patients. In correlation with MAA scanning, CT-like imaging was true-positive in 3 patients, false-positive in 1 patient, true-negative in 24 patients, and false-negative in 2 patients. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of CT-like imaging for the detection of otherwise occult extrahepatic shunting were 60, 96, 75, 92, and 90%, respectively.
Conclusion: CT-like imaging adds additional information to angiography when assessing SIRT-patients for extrahepatic arterial shunting. The overall low rate of extrahepatic shunting missed on arteriography may be further reduced by CT-like imaging.

B-249 11:51

90Yttrium-microsphere-radioembolization of symptomatic, unresectable neuroendocrine hepatic metastases

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Purpose: To evaluate safety and survival outcomes of radioembolization with 90Yttrium-microspheres in symptomatic patients with unresectable liver metastases from neuroendocrine tumors.

Methods and Materials: Twenty-five patients with a mean age of 61 years and treatment-refractory liver metastases from neuroendocrine tumors underwent single session, whole-liver radioembolization utilizing 90Yttrium-resin-microspheres. After treatment, tumor response was assessed by magnetic-resonance-imaging using the Response-Evaluation-Criteria in Solid Tumors (RECIST)-criteria, laboratory and clinical toxicities, tumor marker levels, interference of clinical symptoms and survival. **Results:** The median activity delivered was 1.58 GBq. Imaging follow-up using RECIST-criteria at three month follow-up demonstrated partial response, stable disease and progressive disease in 20.8, 75 and 4.2%, respectively. In 95.8% the liver lesions appeared centrally necrotic or hypovascular. The median follow-up time was 12.1 months with 24/25 patients still being alive. The median decrease of tumor marker levels was 54% (Chromoganin A) and 33% (Serotonin), respectively. There were no acute or delayed toxicities according to the Common Terminology Criteria for Adverse-Events higher than grade 2. No radiation induced liver disease was noted. An improvement of clinical symptoms was observed in 23 of the patients three months after treatment. During follow-up, 4 patients showed progressive liver disease at 2.2, 7.0, 9.3 and 34.1 months.
Conclusion: Single-session, whole-liver radioembolization with 90Yttrium-microspheres is a safe and effective treatment option in patients with otherwise treatment-refractory liver metastases from neuroendocrine tumors. Anti-tumoral effect is supported by good local tumor control, decrease in tumor marker levels and improvement of clinical symptoms. Further investigation is warranted to prove survival benefit.

14:00 - 15:30	Room A

Abdominal Viscera (Solid Organs)

SS 501a

Insights into liver tumor's treatment

Moderators:
G.G. Karmazanovsky; Moscow/RU
M. Krokidis; Iraklion/GR

B-250   14:00

Clinical value of CT/MR-US fusion imaging for radiofrequency ablation of hepatic nodules
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Purpose: To investigate clinical values of CT/MR-US fusion imaging for radiofrequency ablation of various types of hepatic nodules.
Methods and Materials: Fifty-one nodules (42 HCCs and 9 metastasis; mean diameter, 16 mm (5-49 mm)) of 37 patients who had undergone percutaneous radiofrequency ablation using fusion imaging were included in this study. In 24 of 51 nodules, fusion imaging was used for identification of tumor margin and creation of sufficient safety margin (5 mm) using GPS markers during RFA (Group I). In three inconspicuous, 10 invisible, and eight postablated nodules on US, fusion imaging was used for accurate targeting (Group II). In six nodules surrounded by similarly looking nodules, fusion imaging was used for exact identification (Group III). For fusion, MR or CT images were used in 16 and 21 patients, respectively. The number of reablation and the rates of local recurrence and complication within 3 months were calculated.
Results: In group I, three of 24 nodules (13%) were reablated due to incomplete safety margin. In group II, four of 21 nodules (19%) were reablated due to wrong targeting (n=2) and incomplete safety margin (n=2). In group III, there was no reablation. There was no local recurrence within 3 months from the treated lesions. As complications, one bile duct injury occurred after ablation of a 49 mm nodule in the caudate lobe.
Conclusion: Fusion imaging was an efficacious tool to overcome the limitation of US-guided RFA such as safety margin issue, sonographically inconspicuous or invisible nodule issue, and confounding nodule issue.

B-251   14:09

Image fusion with volume navigation of contrast enhanced ultrasound CEUS with computed tomography CT or magnetic resonance imaging MRI for postinterventional control after transcatheter arterial chemoembolisation TACE of hepatocellular carcinomas HCC: First results
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Purpose: The assessment of the microcirculation and perfusion after TACE with new real time imaging fusion technique of MDCT or MRI with CEUS in comparison to postinterventional follow-up.
Methods and Materials: After TACE, an image fusion of CEUS with MDCT or MRI of the liver before TACE was performed in 20 patients (18 men, 2 women; age 29-75 years) with HCC to evaluate the residual tumor vascularisation and perfusion of the tumor lesions. Image fusion with CEUS was compared with the result at the end of TACE, with post TACE MDCT (non-enhanced CT within 24 hours) and with follow-up MDCT (enhanced CT after 6 weeks) after embolisation.
Results: The postinterventional volume navigation image fusion of MDCT or MRI with CEUS showed differences in the evaluation of residual tumor perfusion compared to other modalities. The correlation between the perfusion result at the end of TACE and image fusion with CEUS was 0.42, the difference was significant. The correlation between the perfusion result of non-enhanced MDCT and image fusion with CEUS was 0.50, the difference was significant. The correlation of perfusion at the end of TACE and follow-up CT after 6 weeks was 0.17, the difference was significant. The correlation between fusion of CEUS with CT/MRI and follow-up MDCT was 0.64, the difference was not significant.
Conclusion: The fusion of CEUS and CT or MRI shows a better evaluation of the microcirculation and the residual tumor perfusion at an earlier point of time than usual modalities of therapy control.

B-252   14:18

CT perfusion, MR diffusion-weighted and contrast-enhanced US in the assessment of the response to anti-angiogenetic treatment in patients with multifocal liver lesions
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Purpose: To define the capability of CT-p, MR-DWI and CEUS in the assessment of the response to antiangiogenetic treatment of multifocal liver lesions in comparison to conventional imaging.
Methods and Materials: 35 patients with multifocal liver lesions (15 HCC, 20 mets) underwent CT-p, DWI (before and after 90 days) and CEUS (before and after 15, 30 and 90 days) CT-p and DWI. CT-p blood flow (BF), blood volume (BV), mean transit time (MTT) and permeability (PS) and apparent diffusion coefficient (ADC) for DWI were assessed. A specific perfusion software was used for CEUS. Spearman's coefficient was used to define the correlation between CT-p, DWI and CEUS as well as between CT-p, DWI, CEUS and conventional imaging.
Results: All patients successfully completed the diagnostic protocol. A complete response was documented in two patients with metastatic lesions; a significative reduction in size (> 1.5 cm) and perfusion was observed in 18 metastatic patients; no significative response was detected in patients with HCC disease. Spearman's coefficient revealed excellent correlation between CT-p, DWI and CEUS measurements, before and both 3 and 6 months after treatment (R (s) = 0.7; p < 0.0001). Conventional imaging did not correlate well with CT-p, DWI and CEUS for the 3 months follow-up (R (s) = 0.1; p> 0.05), while there was a good correlation for the 6 month follow-up only for CT-p and DWI (R (s) = 0.68; p> 0.0001 - for CEUS R (s) = 0.9; p> 0.05).
Conclusion: CEUS, CT-p and DWI can successfully identify the outcome of anti-angiogenetic treatment in patients with multifocal liver lesions.

B-253   14:27

Intra and inter-observer reproducibility for measurement of lesions according RECIST 1.1 and 1.0: How and why we sometimes go wrong
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Purpose: To compare intra- and inter-observer variabilities in tumor response and lesion measurements according to the 2009 (1.1) and 2000 (1.0) versions of RECIST.
Methods and Materials: A retrospective reading evaluating tumor measurements and treatment response according to the two versions of RECIST was performed

Friday

by two radiologists for 76 patients with mRCC under anti-angiogenic therapy with at least two CT examinations during the follow-up in our institution. Intra- and inter-observer agreements of response were performed using the Kappa coefficient (K) and of lesion measurements using the Bland and Altman method.

Results: A good concordance was obtained on the evaluation of response according to RECIST 1.0 and 1.1 (K = 0.73 and 0.80 for intra-observer; 0.74 and 0.73 for inter-observer agreements). The detection of new lesions was the least reproducible (K=0.6). The median difference between the measurements of the two observers was 9-13 mm for a median longest diameter of 27 mm. In 19 cases (3%), lesions had a difference of measurements between observers > 10 mm resulting in differences in classification of response in 7 patients (9%). We identified three types of causes which could result in discordance for the agreement of measurement of lesions: intrinsic variability in measurements, anatomic locations which should be avoided, and intercurrent events resulting in impossibility of measurement.

Conclusion: Radiologists must carefully choose lesions to be measured and not hesitate to exclude some of them secondarily if they become unmeasurable to reduce variability between measurements and increase reliability of response evaluation.

B-254 14:36
Evaluation and follow-up of liver metastases with lesion volumetry
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Purpose: To evaluate the performance of a software solution for semi-automated volumetry and follow-up of liver metastases and to investigate its impact on the RECIST.

Methods and Materials: 70 liver metastases of colorectal carcinoma in 18 patients with a total of 54 CT-scans were included. With at least two follow-up exams per patient, 178 lesions were evaluated. For each lesion, two readers (R1, R2) manually measured the longest axial diameter (LAD) and determined the volume after manual lesion delineation. In addition, LAD and volume were calculated by a semi-automatic software. Volumes obtained by both methods were compared for each lesion. RECIST was used to evaluate treatment response in each follow-up using the sum of the measured LADs as well as the sum of the automated calculated volumes.

Results: 90% of all the cases were classified as 'good' or 'average' of which 60% were 'good'. For lesions with a 'good' semi-automated segmentation, mean volume difference between the manual (average of volume measured by R1 and R2) and semi automated method was 28% (p < 0.01) whereas between the two readers it was 16% (p < 0.01). Response assessments done with volume in comparison to LAD lead to differences in response categories (progression, stability, regression) of 14.7, 11.8 and 8.8% in follow-up of patients; evaluated by R1, R2, and the software solution, respectively.

Conclusion: The software solution with automatic liver segmentation showed performances comparable to the manual delineation of lesions. In the near future, treatment response could be assessed according to volume instead of LAD.

B-255 14:45
The prognostic significance of CT volume measurement in the patients with unresectable hepatocellular carcinoma treated by transcatheter arterial chemoembolization
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Purpose: To analyzes the value of volumetric CT measurement on evaluating the survival rate of unresectable hepatocellular carcinoma patients treated by trans-catheter arterial chemoembolization.

Methods and Materials: 166 advanced HCC patients treated with TACE were involved in this retrospective study. The hepatic CT of all patients were performed before TACE and 4 weeks to 2 months after TACE, to define the morphologic features of HCC including tumor largest diameter, tumor product of diameters, tumor volume, tumor to liver volume ratio (TTLVR), tumor shrinkage ratio post-treatment. Combing morphologic features with corresponding clinical and general data as input, correlation between survival time and variables of patients or lesions have been analyzed with SPSS 11.5 statistical software. A Cox proportional hazard model was used to analyze prognostic factors.

Results: The overall cumulative survival rates for 6, 12, 24, 36 and 60 months were 78.92, 49.85, 23.82, 15.60 and 8.92%, respectively. The median survival time was 12 months. Univariate analysis and multivariate analysis showed 4 parameters were significant prognostic factors. They were TTLVR, portal vein cancerous thrombus, times of repeated TACE and serum AFP level of post-treatment. When the TTLVR value is less than 70%, the survival time is reversely correlated with TTLVR value.

Conclusion: Volumetric CT technique was a reasonable method to predict the prognosis of patients with unresectable HCC who undergo TACE. TTLVR was a significant prognosis factor that influences the survival of HCC patients treated by TACE.

B-256 14:54

also
EPOS

Ablation margins in open and percutaneous RFA for colorectal liver metastases: Does it matter?
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Purpose: To assess the role of ablation margins (AM), influence of open (o-RFA) versus computer tomography-guided RFA (CT-RFA) and pre/post-RFA-image comparability on local recurrence (LR) in colorectal liver metastases (CRLM).

Methods and Materials: Patients with synchronous and metachronous CRLM without extrahepatic disease were included. Tumour-morphology was obtained before/after treatment: size, location, number, AM and comparability of pre/post-RFA-imaging (projection of abdominal organs, similarity positioning score, SPS). Identical projections were scored as SPS1 (good comparability), and different projections as SPS2 (not good comparable). LR was identified prospectively on follow-up imaging (CT-MRI-ultrasound).

Results: 49 patients with 110 tumours underwent 69 RFAs (45 patients/78 tumours o-RFA, 24 patients/32 tumours CT-RFA, 12 patients ≥ 1 RFA). 16/49 patients and 42/110 tumours had LR. AM < 10 mm and LR were not significantly related. Greater AMs were seen with o-RFA in both patients and tumours, (p-value 0.000/0.098, respectively), and less LR in tumours (p-value 0.052). LR tumours were larger (25.1 versus 15.7 mm, p-value 0.000). O-RFA-treated tumours were smaller than CT-RFA-treated ones (15.8 mm versus 28.3 mm, p-value 0.001). No significance was found between scoring and concomitant liver surgery or RFA-approach. Group 1 had 15 LR, group 2 27 (p-value 0.003). Mean time to LR was 8 months in patients/8.5 month in tumours. RFA-approach and time to LR were not related.

Conclusion: Risk factors for LR are tumour size, RFA-approach and scoring of pre-/postoperative-imaging. Comparability of the pre-/postoperative imaging is extremely important for determining the success of RFA, thus less LR. AM seems to have less influence on LR.

B-257 15:03
Dual energy CT in evaluating tumor response to hepatic radiofrequency ablation
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Purpose: To determine the value of dual energy (DE) scanning with virtual-non-enhanced-images (VNE) and iodine-maps for evaluation of therapeutic response to radiofrequency-ablation (RFA) for hepatic tumors.

Methods and Materials: 75 patients with hepatic tumors who underwent DE-CT after RFA were enrolled. Our DE-CT protocol included unenhanced, arterial, and portal phase scans. VNE and iodine-maps were created from 80- and 140 kVp images during the arterial and portal phases, and then were compared with true-nonenhanced-images (TNE) and fusion images, both quantitatively and qualitatively. CT numbers of the hepatic parenchyma, ablation zone and image noise were measured on all six images. Contrast-to-noise ratio (CNR) of the ablation zone and aorta-to-liver were calculated. Image quality was rated on a 5-point scale by the reviewers.

Results: Mean CT numbers of the hepatic parenchyma and ablation zone were not significantly different between TNE and VNE (p> 0.05). Heterogeneity in attenuation values between the center and periphery of the ablation zone was significantly larger on fusion images (39.2 HU) than on iodine-maps (2.7 HU) (p <.001). CNR of the aorta was significantly higher on iodine-maps (20.4) than on fusion images (18.0) (p <.001). The reviewers scored the quality of VNE as good or fair (mean 2.1) except for patients with lipiodol-uptaken lesions, and preferred iodine-maps to fusion images in terms of conspicuity of ablation zones.

Conclusion: With DE-CT scanning, VNE can be an alternative to TNE in the evaluation of tumor response after RFA without previous TACE history. Iodine-maps provide excellent internal homogeneity of the ablation zone and higher lesion-to-liver CNR than standard images which can be helpful in the detection of residual tumors.

B-258 15:12
Evaluation of the european association for the study of liver disease (EASL) necrosis criteria on MDCT: Comparison of two-dimensional and volumetric quantification to assess treatment response
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Purpose: The EASL necrosis criteria are routinely used as a surrogate marker for hepatocellular carcinoma (HCC) response to therapy. The performance of routinely used two-dimensional (2D) measurement of necrosis was compared to volumetric

quantification of necrosis after 90-Yttrium (^{90}Y) radioembolization.

Methods and Materials: IRB approval was obtained for this HIPAA compliant study. Twenty-four HCCs were evaluated in 24 patients by triphasic MDCT scans performed before and after ^{90}Y radioembolization. The percent change in viable tumor tissue was quantified using WHO guidelines on the axial, coronal and sagittal planes. Enhancing and non-enhanced areas represented necrotic and viable tissue, respectively. Volumetric necrosis was obtained using prototype semi-automated segmentation software. The 2D percent changes were transformed into volumetric equivalents and results were compared using Bland-Altman plots. The response rates to ^{90}Y treatment, assessed by EASL necrosis criteria, were calculated. The agreement between the methods was examined by kappa (κ) statistics.

Results: Bias and 95% limits of agreement were -50.6% (-329.7 to 228.6%), -61.9% (-344.5 to 220.7%), and -57.5% (-335.5 to 220.4%) for the axial, coronal, and sagittal planes, respectively. Poor agreement was demonstrated between the two techniques when assessing response by necrosis criteria (axial: κ = 0.12, 95% CI: -0.03 to 0.22; coronal: κ = 0.22, 95% CI: 0.14 to 0.30; sagittal: κ = 0.09, 95% CI: 0.003 to 0.18).

Conclusion: There is poor agreement between two-dimensional and volumetric analysis of HCC necrosis after treatment. Two-dimensional analysis of necrosis based on WHO guidelines may have limited value in the assessment of tumor response.

B-259 15:21

Intraoperative liver CT: A feasibility study

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Purpose: Cross-sectional imaging based on navigation and virtual reality planning tools are established in neurosurgery and orthopedic surgery. Transferring these methods to liver surgery is challenging due to intraoperative organ shifting. The purpose was to demonstrate that intraoperative liver CT is feasible in diagnostic quality and liver lesions are detectable.

Methods and Materials: 11 consecutive patients (f=4, m=7, median age 67 y (range 54-80 y)) with liver metastasis of colorectal cancer (n=9) and hepatocellular carcinoma (n=2) were included. Multiphase liver MSCT was performed prior to inclusion and partial liver resection was planned. After complete mobilization and exposure of the liver in a "multifunctional image-guided therapy suite", a liver MSCT in the portal-venous phase was acquired under aseptic conditions. For avoidance of artifacts from metallic devices, a carbon retractor was placed for retraction of wound margins. Diagnostic image quality of intraoperative liver scans were analyzed with a grading scale, 1-4 (1= no diagnostic quality to 4= no artifacts) and number of liver lesions in pre- and intraoperative scans were assessed by two experienced readers.

Results: In all patients, intraoperative CT scans were of diagnostic value with no diagnosis hindering artifacts. Pre-operatively 32 liver lesions and intra-operatively 26 lesions were detected. All missed lesions were cysts smaller < 8 mm in size.

Conclusion: Intraoperative liver CT is feasible with diagnostic quality and depicts all relevant liver lesions. Intra-operative CT might help the surgeon to adjust the preoperative virtual three-dimensional model of the liver on the intra-operative setting. In future liver-segmentation might take place intra-operatively.

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

Musculoskeletal

SS 510

Tumors

Moderators:
A. Kassarjian; Majadahonda/ES
D. Vanel; Bologna/IT

B-260 14:00

Angiosarcoma or carcinoma metastases

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Purpose: To identify radiological features of osseous angiosarcoma, which can be used to avoid erroneously diagnosing metastases based on radiological multifocality, and histological epitheloid phenotype.

Methods and Materials: From the databases of two Bone Tumor Committees, 66 patients with a histological diagnosis of osseous angiosarcoma were retrieved. Epidemiological and imaging characteristics were recorded and histopathology was reviewed.

Results: In 66 patients, 190 lesions were detected by radiographs and CT (28

patients) and/or MRI (19 patients). Multifocality was observed in 27 patients (41%), and most lesions were located in the femur. Typical lesions were lytic, had a geographically pattern of destruction and were well marginated. Most lesions showed cortical destruction (72%). No periostal reaction was seen in most cases (72%). In 11 of 39 patients (28%), increased tumor extension and or (additional) lesions (29 lesions; 17%) were visible on MRI and CT. In 13 cases (33%), cortex destruction was better shown on CT or MRI. In 6 patients (15%), periostal reaction was only seen on MRI or CT and not on radiographs. The signal intensity of all lesions was low on T1 and high on T2. Extensive reactive changes on T2 weighted images were seen in 11 patients (58%). This was never reported in literature before.

Conclusion: When regional multifocal lytic, well marginated lesions with cortical destruction are seen, especially in the femur, with marked reactive soft tissue changes on MRI, a diagnosis of angiosarcoma should trigger the use of additional immune-histochemical tests to confirm the vascular nature of the tumor.

B-261 14:09

Peripheral nerve tractography in soft tissue tumors

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Purpose: This study aims to evaluate the feasibility of 3 Tesla DTI to characterize the regional 3D morphology of potentially affected peripheral nerves in soft tissue tumor (STT) patients.

Methods and Materials: 17 patients with suspected STT (9 female, 8 male) underwent 3 T MR imaging using an axial DTI sequence (b-value of 700 ms, 16 gradient encoding directions, voxel size 2.6 mmx2.6 mmx4 mm and 1.5 mmx1.5 mmx3.7 mm) in addition to the standard diagnostic protocol. After the anatomical definition of multiple regions of interest along the peripheral nerves on axial T2-weighted sequences, the trajectories were calculated using the Philips Achieva (release 2.1.1.0) software and a FACT algorithm (FA threshold: 0.15, maximum angle change: 27°).

Results: In 16/17 cases, major peripheral nerves were sufficiently visualized adjacent to the STT. Tractography successfully depicted the 3D course of the sciatic and/or femoral nerve (n=11), tibial nerve (n=3), median (n=1) and radial nerve (n=1). In 9 cases, tractography showed the nerves in a well defined distance to the STT. 6 nerves showed an immediate anatomical relationship to the STT and were found to be intact and partly displaced. In one case, the tibial nerve showed a disrupted morphology within a leiomyosarcoma of the calf. Infiltration of the nerve was histologically confirmed.

Conclusion: The 3D topographic relationship between major peripheral nerves and soft tissue tumors may be readily visualized by 3 T MR DTI and nerve tractography and may aid in surgical planning. Ongoing histological correlation will clarify if nerve infiltration by STT can be reliably identified using advanced MR imaging techniques.

B-262 14:18

Imaging features of angiomyoma

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Purpose: To describe the imaging features of the angiomyoma (gray scale and Doppler ultrasonography, and magnetic resonance findings) in a series of nine angiomyomas and to correlate them with the clinical and pathologic findings.

Methods and Materials: We retrospectively reviewed the clinical histories and imaging of nine patients with histological diagnosis of angiomyoma that were attended in our institution over the last 7 years.

Results: The sonographic findings were characteristic and very similar in all of the tumours. Their appearance was that of an oval-shaped subcutaneous solid homogeneous tumour with a smooth margin. The size ranged from 8 to 38 mm in its maximum diameter (average 20.9 mm). Typically, small vessels with arterial flow were seen in an echogenic background. The resistive index (RI) was variable. Magnetic resonance imaging showed a solid well-defined tumour, isointense to the muscle on SE T1-weighted images, and with a heterogeneous hyperintense signal intensity on STIR and on FSE T2- weighted sequences (with or without fat suppression). The images showed strong enhancement of the tumours after administration of gadolinium chelates. None of the cases showed infiltration of the superficial fascia.

Conclusion: A very characteristic ultrasonographic and Doppler pattern was found. When these features appear in an extremity on a mobile, elastic and slow growing tumour, the diagnosis of angiomyoma should be considered as the most probable. MRI and percutaneous biopsy may only be required in exceptional circumstances.

Friday

B-263 14:27

Osteoid osteoma-like lesions: MDCT features and treatment by radiofrequency ablation

F. Becce[1], A. Feydy[2], A. Rochette[2], F. Larousserie[2], L. Guillou[1], E. Mouhsine[1], P. Anract[2], J.-L. Drapé[2], N. Theumann[1]; [1]*Lausanne/CH*, [2]*Paris/FR* (fabio.becce@chuv.ch)

Purpose: Clinical and imaging features of osteoid osteoma (OO) may be misleading at times. Furthermore, various lucent bone lesions may mimic OO. Our purpose was to assess the multidetector computed tomography (MDCT) features of the lesions mimicking OO (OO-like lesions) and to evaluate their treatment by radiofrequency (RF) ablation.

Methods and Materials: All RF ablation procedures performed for a presumed diagnosis of OO were retrospectively reviewed. Per-procedural needle biopsies were performed whenever possible for histopathological confirmation of the diagnosis. The following MDCT features were assessed for every lesion: skeletal distribution, location, size and calcification of the "nidus", surrounding osteosclerosis, and periosteal reaction. Clinical success of RF ablation was evaluated.

Results: Eighty patients (54 males, 26 females, mean age 24.1 years, age range 5-48) were treated by RF ablation. Biopsy specimen was obtained in 57 cases (71.3%). Histopathological diagnoses were: 31 (54.4%) non-contributory biopsies, 16 (28.1%) OO, and 10 (17.5%) OO-like lesions. OO-like lesions were 5 chronic osteomyelitis, 3 chondroblastoma, 1 eosinophilic granuloma, 1 fibrous dysplasia. OO-like lesions were of greater size than OO (p = 0.004). Furthermore, OO-like lesions exhibited a trend for moderate surrounding osteosclerosis, less periosteal reaction and medullary-located "nidus" in comparison with OO. Primary clinical success for OO-like lesions was 100% (10/10) at 1 month, 85.7% (6/7) at 6 months, and 85.7% (6/7) at 1 year.

Conclusion: Greater size, differences in amount of surrounding osteosclerosis and periosteal reaction, and "nidus" location may help distinguish OO-like lesions from OO. OO-like lesions are though successfully treated by RF ablation.

B-264 14:36

Imaging anti-angiogenic effects of zoledronic acid for early assessment of therapy response in experimental bone metastases by DCE-MRI

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Purpose: The purpose of this study was to evaluate anti-angiogenic effects of the bisphosphonate zoledronic acid (ZA) using dynamic contrast enhanced MRI (DCE-MRI) in experimental bone metastases as compared to the standard methods for assessment of treatment response by MRI and CT.

Methods and Materials: Rats bearing breast cancer bone metastases were imaged at days 30, 35, 45 and 55 after tumor implantation by a volume CT and a clinical 1.5 T MRI scanner to determine osteolytic lesion size (OLS) and the extent of the soft tissue component (STC) of skeletal lesions. Treated animals (n=7) received ZA and were compared to untreated controls (n=10). DCE-MRI data were acquired in bone metastases and analyzed according to the two-compartment model of Brix (1991) to calculate the exchange rate constant k_{ep} and amplitude A. For statistics, the Wilcoxon test was applied; p-values < 0.05 were considered significant.

Results: Compared to control group, significantly decreased values for the OLS were found on day 55 for rats treated with ZA (42.5 T/C%), but no significant changes for the STC were observed from days 30 to 55. Using DCE-MRI, treated animals showed significant changes in A as early as from day 35 on (84.2 T/C%) until day 55 (82.2 T/C%) and for k_{ep} on day 55 (62.0 T/C%) in bone metastases as compared to controls.

Conclusion: The assessment of anti-angiogenic properties of ZA by the DCE-MRI parameter amplitude A can be used as an early indicator of therapy response prior to morphological changes in experimental breast cancer bone metastases.

B-265 14:45

Evaluation of treatment response of experimental bone metastases to an (alpha)v (beta)3 integrin antagonist using DCE-MRI

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Purpose: Our aim was to study the effects of the inhibition of $\alpha v \beta 3$ integrins in experimental bone metastases and the possibility of an early assessment of treatment response using dynamic contrast-enhanced-MRI (DCE-MRI).

Methods and Materials: We compared breast cancer bone metastases in nude rats of untreated controls (n=7) to treated animals (n=10; application of an $\alpha v \beta 3$ antagonist beginning at day 30) at days 30, 35, 45 and 55 after tumor cell inoculation using 1.5 T MRI scanner and flat panel-equipped volume CT (VCT). DCE-MRI-

acquired parameters amplitude A and exchange rate constant k_{ep} were determined in bone metastases according to the two-compartment model of Brix (1991). All examined values were expressed as relative values compared to the initial values at day 30. Results were statistically analyzed using T-test.

Results: As assessed with VCT and MRI, mean relative values of the osteolytic lesion size (OLS) and the soft tissue component (STC) of bone metastases increased constantly in untreated controls until the end of the observation time. Significant differences between the treatment and the control groups were found at days 45 and 55 for the OLS and at day 55 for the STC. However, relative mean values of amplitude A were significantly decreased in treated animals at days 35, 45 and 55 whereas for k_{ep} the significant increase was assessed at day 55 as compared to controls.

Conclusion: Treatment response in experimental bone metastases could be assessed by the DCE-MRI parameter amplitude A before a change in morphology was observed in these lesions.

B-266 14:54

Prognostic value of wholebody-MRI in asymptomatic monoclonal plasma cell disease

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Purpose: The present study investigates the prognostic significance of focal lesions or a diffuse bone marrow infiltration detected with wholebody-MRI (wb-MRI) in patients with asymptomatic monoclonal plasma cell disease.

Methods and Materials: 250 patients with monoclonal gammopathy of undetermined significance (MGUS, n=84), plasmacytoma (n=17) or asymptomatic multiple myeloma (aMM, n=149) were examined with wb-MRI on a 1.5 T-system using T1 and T2-weighted sequences yielding composed scans between the skull vertex and the feet. Two radiologists assessed in consensus the bone marrow infiltration pattern and focal lesions. The prognostic significance of the presence and absence, as well as the number of focal lesions for progression into a higher stage or symptomatic myeloma were analyzed.

Results: Focal lesions were present in 9% of MGUS-patients and 28% of aMM-patients. In patients with solitary plasmacytoma, additional lesions were detected in 35% of patients. In 185 patients without any focal lesions, a diffuse bone marrow infiltration was detected in 65 (35%) patients. The presence of focal lesions per se and an increasing number of lesions were an adverse prognostic factor for progression into a higher stage or symptomatic myeloma (p < 0.001). Furthermore, a diffuse infiltration pattern was an adverse prognostic factor for progression free survival in patients with aMM.

Conclusion: Focal lesions detected in wb-MRI are significant adverse prognostic factors for patients with plasma cell disease who would not require systemic therapy according to current standards. We recommend wb-MRI in all patients with monoclonal plasma cell disease in order to assess individual risk profiles.

B-267 15:03

Comparison of a new whole body continuous table movement protocol versus a standard step-by-step whole body MR protocol for the assessment of patients with multiple myeloma

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Purpose: To evaluate a new whole-body (WB) continuous table movement (C™) MR-protocol for the assessment of multiple myeloma (MM) in comparison to a step-by-step WB MR-protocol as reference.

Methods and Materials: 18 patients with MM were examined at 1.5 T (Magnetom Avanto) using a C™ MR protocol (axial T2-w BLADE STIR and T1-w FLASH sequence). As a standard of reference, step-by-step WB coronal and sagittal T1-w TSE and STIR sequences were acquired. Protocol time was assessed. Two radiologists assessed image quality, ability to depict bone marrow lesions (< / > 1 cm/diffuse infiltration) and soft tissue lesions and liver assessability. Changes in the Durie-and-Salmon Plus-stages were assessed. Chi-Square and Wilcoxon tests were performed.

Results: Mean protocol time was 24 min for the standard versus 10 min for the C™ protocol. There was no significant difference in image quality (p = 0.063). Lesion depiction for lesions < / > 1 cm / diffuse infiltration and detectability of soft tissue lesions were identical. Liver assessability was significantly better using the C™ STIR compared to the standard STIR sequence (p < 0.001). In none of the patients, a shift in the Durie-and-Salmon-Plus-stage occurred.

Conclusion: The WB C™ protocol allows the staging of patients with MM with almost equal image quality and identical ability to detect bone marrow/soft tissue lesions compared to the standard protocol with better organ assessability in 50% of the scan time. It might allow a higher patient throughput in clinical routine and might facilitate the depiction of extramedullary lesions.

B-268 15:12

Signal behavior of focal bone marrow lesions in patients with multiple myeloma (MM) using T1w-TSE, T2w-STIR and diffusion weighted imaging with background suppression (DWIBS)

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Purpose: This study analyses the potential of DWIBS in MM-diagnostics by evaluating the apparent diffusion coefficient (ADC), contrast-to-noise-ratio (CNR) and lesion-to-bone-marrow-contrast (C_{lbm}) of focal bone marrow lesions provided by T1w-, T2w-STIR and DWIBS in correlation with the serum concentration of M-component (sMC).
Methods and Materials: Data from 72 consecutive patients with MM who underwent whole body staging MRI were analysed retrospectively. Coronal T1w-TSE, T2w-STIR and DWIBS-sequences (b=0/800 s/mm²) were applied. Signal and ADC of focal lesions in the lumbar spine and pelvis were determined respecting a maximum number of 3 lesions per patient. C_{lbm} and CNR were calculated separately for patients with low sMC (< 10 g/l, group 1) and high sMC (> 10 g/dl, group 2) and were compared using a double sided unpaired t-test.
Results: 67 lesions in 36 patients were evaluated. The mean ADC in group 1 ($1.41\pm0.60\times10^{-3}$ mm²/s) was significantly higher (p < 0.05) than in group 2 (0.91 ± 0.35). The mean CNR and C_{lbm} for T2w-STIR and T1w-SE were significantly higher (p < 0.05) in group 1 (T2: CNR=90±65/C_{lbm}=2.0±1.2; T1: 9.0±7.0/0.3±0.2) than in group 2 (39±38/1.1±0.9; 4.7±3.8/0.2±0.1). CNR and C_{lbm} for DWIBS (b=800) showed no significant variation (34±25/1.4±1.1 and 30±28/1.7±1.2).
Conclusion: Focal MM-lesions show a variation of the ADC and of the CNR and C_{lbm} generated by T2w-STIR and T1w-TSE depending on the sMC. The signal provided by high b-value DWIBS does not vary with the sMC. Additional DWIBS imaging may therefore improve the conspicuity of focal MM-lesions in patients with high sMC and provide additional information on the lesions' biology.

B-269 15:21

Whole body MRI for staging of multiple myeloma after stem cell transplantation

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Purpose: Diagnostic value of whole body MRI (WBMRI) in staging patients with multiple myeloma (MM) after stem cell transplantation (SCTX) in comparison to established imaging modalities.
Methods and Materials: 42 patients (14f/28 m, age 54 y, 36-70 y) with MM were examined on a 1.5 (37/42), respectively, 3 T (5/42) MRI with a WBMRI protocol using fat-suppressed STIR, T1-FEE, and contrast-enhanced fat-suppressed T1 sequences in addition to established post SCTX imaging modalities for posttherapeutic monitoring in a 6 (±2) month interval post SCTX. The analysis of the WBMRIs was performed by two radiologists in consensus. The established imaging modalities (conventional X-ray, sonography, multisclice CT, MRI, PET, PET/CT, scintigraphy) were correlated to WBMRI.
Results: WBMRI revealed in 31 of 42 (73%) patients bone involvement in the skeletal system, which were interpreted as residuals of basic disease in 12 of 42 (29%) patients and due to significant contrast enhancement as persistent bone involvement of the basic disease in 19 of 42 (49%) patients. Changes in the Durie and Salmon PLUS staging system after SCTX in comparison to established diagnostic imaging modalities resulted in 4/42 (10%) patients. Extraosseous relapse lymphoma was diagnosed by WBMRI in 4/42 (10%). In 4/42 (10%) patients other therapy relevant findings (meningioma, osteonecrosis of the femoral bone, spine fractures, etc). were diagnosed.
Conclusion: WBMRI offers in the majority of cases additional diagnostic information in comparison to established diagnostic modalities. Therefore, WBMRI shows potential for indication as imaging modality of choice in the staging after SCTX.

Chest

SS 504

Lung cancer imaging

Moderators:
M. Mereu; Chieti/IT
E.J. Stern; Seattle, WA/US

B-270 14:00

Respiratory gating for FDG-PET/CT imaging of pulmonary nodules: Effect on gross tumor volume and SUV measurements

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Purpose: PET/CT is an established method for lung cancer diagnosis and staging. However, imaging of moving tissues such as the lungs suffers from motion artifacts: an overestimation of tracer-avid volumes of interest while underestimating their intensities. Respiratory gating can improve image quality in phantom models, and here we prove its use for PET/CT in a clinical setting.
Methods and Materials: 18 patients with known pulmonary nodules received ungated and gated FDG-PET/CT scans along with their regular staging. Lesion volumes were determined in CT and also in PET. In addition, SUV values were determined. Statistical significance was tested using the two-tailed paired Student's t-test and the Wilcoxon test. Lesion size and measured SUVs were correlated.
Results: With activated respiratory gating, the average lesion area per slice as well as the lesions' Z dimension were significantly lowered (by 15.5 and 10.3%, p = 0.014 and 0.007), resulting in a decrease of measured tumor volume by 44.5% (p = 0.025). The difference between lesion volumes in gated PET and CT was significantly lower than the difference in ungated PET and CT (-126.6%, p = 0.025). SUV_{max} increased by 22.4% (p < 0.001) and $SUV_{average}$ by 13.3% (p = 0.002), while SUV_{min} showed no significant change (p = 0.48) and together with constant SNRs revealed no increase in background noise.
Conclusion: Respiratory gating has the ability to enhance image quality in PET/CT of pulmonary lesions and leads to a better estimation of lesion volumes and SUVs.

B-271 14:09

Whole-body integrated FDG-PET/CT in non-small cell lung cancer patients: How to improve diagnostic capability for postsurgical recurrence as compared with standard radiologic examination?

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Purpose: To prospectively compare the diagnostic capability of postsurgical recurrence among qualitatively assessed FDG-PET/CT without and with SUV assessment and standard radiologic method in non-small cell lung cancer (NSCLC) patients.
Methods and Materials: 121 consecutive postoperative NSCLC patients (80 males, 41 females; mean age, 71 years) were prospectively underwent PET/CT and standard radiologic method. On comparison of capability for qualitative assessment between two methods, the probability of recurrence on each method was assessed by using 5-point visual scoring system. Then, diagnostic capabilities of intra-and extra-thoracic recurrences on both methods were compared by using ROC analyses. To improve diagnostic capability of PET/CT, SUVs of qualitatively assessed positive lesions were assessed by ROI measurements, and feasible threshold value of SUVmax was determined by ROC-based positive test. Finally, sensitivity, specificity and accuracy about each recurrence were compared among PET/CT without and with SUV assessment and standard method by means of McNemar's test.
Results: Although area under the curve (Az) of qualitatively assessed PET/CT had no significant difference with that of standard method about extra-thoracic recurrence, Az of PET/CT (Az=0.91) was significantly higher than that of standard method (Az=0.75, p < 0.05). When adapted 2.6 as feasible threshold value of SUV and evaluated intra-thoracic recurrence, accuracy of qualitatively assessed FDG-PET/CT with SUV assessment was significantly higher than that of quantitatively assessed PET/CT without SUV assessment and standard method (p < 0.05).
Conclusion: Qualitatively assessed PET/CT with SUV assessment is a more accurate method than qualitatively assessed PET/CT and a standard radiologic method for postsurgical recurrence assessment in NSCLC patients.

B-272 14:18

Familial risk of lung cancer: Preliminary baseline result of multicenter low dose computed tomography in Taiwan

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Purpose: Family history of lung cancer is supposed to be a risk factor for family members. We initiated the multicenter low dose computed tomographic (LDCT) project to screen the family members of lung cancers.
Methods and Materials: Seven medical centers covering northern and southern Taiwan adjoined this program, using LDCT to examine the asymptomatic volunteers who were the members of lung cancer from "Genetic epidemiological study of lung cancer in Taiwan and clinical application - Focusing on female lung adenocarcinoma (GEFLAC)". The ages of participants should be older than 55 y/o, or should be older than the cancer families in those ages less than 55 y/o. Simplex (first degree relatives) and multiplex families (2 or more relatives with lung cancer in a family) were compared.
Results: 971 participants (673 from simplex and 298 from multiplex families) were collected from August/2007 to September/2009. The mean age was 59.65. Totally, 371 participants were documented having noncalcified nodules (247 from simplex and 124 from multiplex). Twenty-five nodules received biopsy and 15 of them were proved to be cancers including 10 adenocarcinoma, 4 bronchoalveolar cancers and 1 atypical carcinoid. The prevalence rates of lung cancer were 0.6% (4 cancers) for simplex family and 3.7% (11 cancers) for multiplex family (p value = 0.001).
Conclusion: The multiplex families have a higher risk of lung cancer than simplex. LDCT of lung is valuable for detection lung cancers in such populations with lung cancer history.

B-273 14:27

Incidentalomas found at PET/CT in patients investigated for lung malignancy: Sheffield region experience

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Purpose: Unexpected findings at PET/CT in patients investigated for lung disease, as per the NICE guidelines, are common. The final diagnoses and significance of these findings were assessed.
Methods and Materials: All patients having PET/CT for the investigation of lung disease between January 2006 and March 2008 referred to the Sheffield Regional PET/CT service were reviewed. The final diagnoses for these incidental findings were sought from the referring clinicians.
Results: 818 patients were investigated for lung disease in the study period. 176 (21%) patients had incidental findings (99 males; 77 female: mean age 70.1 years, range 43 - 89 years). In 82 patients, the incidentaloma was not further investigated; in 44 due to advanced lung cancer. 62% incidental findings investigated were due to pathology, most commonly related to the gastro-intestinal tract: 4 colorectal carcinomas, 21 tubulovillous adenomas, 1 gastric carcinoma, 4 diverticular disease and 4 miscellaneous. Further tumours were detected in the breast (2), pituitary (2), parotid (2), ovary, tongue and spinal cord. Other detected abnormalities included multinodular goitre (9), atrophic thyroid, follicular thyroid lesion (unclassified), thyroiditis, adrenal mass (resolved spontaneously), tonsillitis, complex ovarian cyst and laryngeal nerve palsy. Overcalling of incidental findings was most common within the pharynx and larynx.
Conclusion: Overall, 7% patients with lung disease having a PET/CT scan had an incidental finding. This was significant in 4.5%. Most significant findings were in the gastrointestinal tract. The presence of lymphoid tissue within the pharynx resulted in a high false positive reporting rate in this region.

B-274 14:36

Diffusion-weighted whole body imaging with background body signal suppression vs FDG-PET: Comparison of accuracy of detection for lung cancer patients

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Purpose: To evaluate the compatibility of diffusion weighted whole body imaging with background body signal suppression (DWIBS) for assessment of non-small cell lung cancer (NSCLC) patients with comparison with FDG-PET/CT
Methods and Materials: A group of 56 patients with NSCLC proved by pathologic examination or follow-up imaging findings was set as reference standards, and all patients underwent both DWIBS and PET/CT. The results of NSCLC lesions detecting of DWIBS and PET/CT were compared.
Results: DWIBS had a sensitivity of 91%, a specificity of 90%, and an accuracy of 90%, with a positive predictive value (PPV) of 96% and a negative predictive value

(NPV) of 80% for lymph nodes metastases. PET/CT had a sensitivity of 98%, a specificity of 97% and a diagnostic accuracy of 97%, with a PPV of 99% and a NPV of 93% for lymph nodes metastases. Differences in the accuracy of lymph nodes detection between PET/CT and DWIBS (P = 0.031) were significant, DWIBS had a sensitivity of 90%, a specificity of 95%, and an accuracy of 92%, with a positive predictive value (PPV) of 97% and a negative predictive value (NPV) of 83% for metastases. PET/CT had a sensitivity of 98%, a specificity of 100% and a diagnostic accuracy of 98%, with a PPV of 100% and a NPV of 95% for metastases. The differences were not statistically significant (p = 1.0).
Conclusion: DWIBS is a reliable clinical technique for the assessment of lung cancer, lymph nodes and metastatic spread with high sensitivity and accuracy.

B-275 14:45

Diffusion weighted MRI with background signal suppression (DWIBS) for the detection of pulmonary nodules at 1.5 Tesla: Initial results

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Purpose: To investigate the feasibility of diffusion weighted MRI with background signal suppression (DWIBS) for detecting pulmonary nodules at 1.5 Tesla.
Methods and Materials: 18 patients with disseminated cancer disease (bronchial carcinoma, n=8; pulmonary metastasis, n=10), in which MDCT had assured the presence of at least one pulmonary nodule, were examined using a respiratory gated DWIBS-sequence (TR/TE, 2700/65 ms; TI, 180 ms; FOV, 425x278 mm; b-factor; 0 and 500 s/mm²; scan-time, 119 s) at 1.5 Tesla. Coronal Maximum-Intensity-Projection (MIP) images were reconstructed in a 5° interval. Two experienced radiologists consensually analyzed the MR data sets in a random order and assessed size and location of the detected nodules. The MDCT images served as the reference. For statistical analysis sensitivity, specificity, positive-predictive-value (PPV) and negative-predictive-value (NPV) for all lesions were calculated.
Results: Reading the CT data sets a total of 62 pulmonary nodules was found, ranging from 3 mm to 9.2 cm (diameter 3-5 mm, n=16; 6-10 mm, n=19; > 10 mm, n=27). For the DWIBS-sequence, a sensitivity of 84.2% was calculated for nodules ranging 6 to 10 mm and 96.3% for nodules > 10 mm. In contrast, only 62.5% of lesions < 5 mm were detected using DWIBS imaging. The overall specificity of DWIBS MRI was 92.3%. PPV and NPV were 96 and 80%, respectively.
Conclusion: This study confirms the feasibility of DWIBS-MRI for the detection of small lung lesions at 1.5 Tesla. The sequence used has a high diagnostic accuracy in the detection of solid pulmonary nodules and allows for the detection of nodules > 6 mm with a sensitivity comparable to MDCT (> 90%).

B-276 14:54

also EPOS

Correlation between tumor volume and tumor perfusion changes following neo-adjuvant chemotherapy in patients with lung cancer:
Preliminary experience

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Purpose: To correlate changes in CT Perfusion (CTp) parameters following neo-adjuvant chemotherapy (antiangiogenic therapy, NAC) with changes of tumor perfusion. To evaluate whether baseline CTp may predict tumor volume (TV) changes following therapy.
Methods and Materials: 96 patients with lung cancer were evaluated with CTp, of which 9 patients undergoing NAC (bevacizumab and ipilimumab) ± radiotherapy were prospectively enrolled in the study. All had baseline CTp, all had follow-up CTp after therapy completion. Perfusion parameters (BF, BV, MTT, TTP, PEI) of tumor were calculated by dedicated software (CT perfusion 3.1, 64 slice MDCT), and statistically correlated with tumor volume.
Results: 7 out of 9 followed-up patients who had NAC had TV reduction. BF, BV, and MTT changes following therapy significantly correlated with tumor volume changes. Trend to correlation was found between baseline tumor BF, BV, MTT, and TV changes. Of the remaining 87 patients, 23 patients had palliative radiotherapy; however, follow-up CTp was not performed, correlation between the CTp parameters and treatment response was assessed clinically and showed: according to the RECIST criteria, responders: 17 and non-responders: 6. Responders had significantly higher pre-CRT (chemo±radiotherapy) BF and BV (P < 0.05) and had significantly shorter pre-CRT MTT (P < 0.05) than non-responders. TV contraction rate had a significant correlation with BF, BV (P < 0.05) and MTT (P < 0.05). Values of TTP and PEI did not show any significant difference.
Conclusion: Consensual change of TV and CTp following NAC has been statistically demonstrated, showing the potential of CTp for monitoring such therapy. Criterions such as high BF and BV and low MTT may predict high TV reduction following therapy.

B-277 15:03

Imaging findings of pericardial metastasis on chest CT

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Purpose: To assess imaging features of pathology proven pericardial metastasis on CT imaging.

Methods and Materials: This IRB approved retrospective study included 60 patients (M=24, F=36; mean age 62 ± 13 years) with pathology proven pericardial metastases. Patients with contiguous primary or secondary lesions were excluded. All had contrast enhanced chest CT and studies were reviewed independently by two thoracic radiologists on a PACS workstation for presence and location of pericardial effusion, irregularity, enhancement, nodules and masses; presence of co-existent cardiac metastasis was noted.

Results: The primary was lung cancer (30), breast cancer (9), lymphoma (7), thymoma (2), colorectal (2) and 1 each had melanoma, ovarian, parathyroid, rectal, transitional cell and endometrial cancers and unknown in 2. 54/60 (90%) had pericardial effusion (small in 23/60, moderate in 21/60 and large in 10/60 patients); 14/60 (23%) patients had nodules or masses in the pericardium; 21/60 (35%) had pericardial enhancement and 27/60 (45%) had pericardial thickening. The most common location of pericardial nodules and irregularity was along the free wall of the right ventricle (6/14) and right atrio-ventricular groove (5/14). The remaining 3/14 patients had pericardial mass in the oblique recess of the pericardium, over the left ventricle and over the interventricular groove each.

Conclusion: CT feature of pericardial metastases are pericardial effusion, pericardial lymph nodes, pericardial thickening, enhancement and nodules in decreasing frequency. Pericardial nodules, nodular thickening and enhancement tend to predominantly affect pericardium overlying the anterior free wall of the right ventricle and right ventricle outflow tract.

B-278 15:12

Comparison of CT features between completely resolving nodules and non-resolving nodules in the NELSON study

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Purpose: To retrospectively analyze the characteristics of pulmonary nodules detected in low-dose CT which completely resolved during follow-up.

Methods and Materials: Three hundred and seven CT scans were selected from the NELSON lung cancer screening trial between 2004 and 2006. All scans showed at least one nodule which was presented at an earlier scans and was resolved at later scans. The solid nodules $\geq$ 15 mm^3 and all the non- and partial-solid nodules were included. The nodules classifications were based on location, attachment, consistency, edge, shape and distance to costal pleural.

Results: In total, 822 nodules were found in 307 participants. The mean age of participants was 61±6 years (range 51-77 years), 85% were male. 436 (53%) nodules were completely resolved during follow-up. The means of maximum diameter and volume for resolving nodules at baseline were 9.1 mm (range 4.0-25.1 mm) and 219.2 mm^3 (range 16.1-4312.9 mm^3), respectively, and were 6.2 mm (range 3.4-16.7 mm) and 68.3 mm^3 (range 15-880.3 mm^3), respectively, for non-resolving nodules. 98.5% non-solid and partial solid nodules, 98.1% nodules with unsharp margins and 94.4% irregular nodules were completely resolved. Resolving nodules were 59.7% in intraparenchymal nodules and 35.9% in attached nodules. More than half of the subjects with resolving nodules had also non-resolving nodules.

Conclusion: Compared to intraparenchymal nodules, nodules with attachments had lower probability for disappearance. Nodules with non-solid components and ill-defined edges were more likely to resolve. There was no reference in location and shape for predicting nodule resolving.

B-279 15:21

Evaluation of treatment response and radiation-induced pulmonary injury after stereotactic body radiotherapy with real-time tumor tracking

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Purpose: To evaluate the treatment responses and radiation-induced pulmonary injuries in patients who have undergone stereotactic body radiotherapy with real-time tumor tracking (cyberknife radiosurgery) for malignant lung tumors.

Methods and Materials: Fifty-four patients were treated with cyberknife radiosurgery for malignant lung tumors. Before the cyberknife radiosurgery, 3-5 fiducial markers were implanted in or near tumors under CT guidance. A total dose of 24-60 Gy was delivered to the planning treatment volume. We retrospectively reviewed CT scans for treatment responses and the findings of radiation-induced pulmonary

injuries. Radiation fibrosis was classified as modified conventional, mass-like, and scar-like. The tumor size and pattern of radiation-induced pulmonary injuries were evaluated by two radiologists.

Results: Patients underwent follow-up CT examinations for 2-25 months (median, 9.4 months). The maximal responses on CT images were complete responses in 14 patients (26%), partial responses in 39 patients (72%), and stable disease in 1 patient (2%). The overall response rate (combined complete and partial responses) was 98%. Local recurrences occurred in 7 patients (12%). Radiation pneumonitis occurred in 37 patients (68%) and radiation-induced fibrosis was present in 25 patients (46%). Of the 25 patients with radiation fibrosis, modified conventional fibrosis was noted in 17 patients (68%), mass-like fibrosis existed in 6 patients (24%), and scar-like fibrosis was demonstrated in 2 patients (8%).

Conclusion: An excellent response rate was achieved using cyberknife radiosurgery for lung tumors. The pattern of cyberknife radiosurgery-induced pulmonary injuries was different from conventional radiation-induced pulmonary injuries.

14:00 - 15:30   **Room E1**

Neuro

SS 511a

Stroke: Diagnosis and management

Moderators:
V. Dousset; Bordeaux/FR
V. Pereira; Geneva/CH

B-280 14:00

Susceptibility-vessel sign in thin-section gradient echo T2*-weighted imaging: Correlation with radiologic outcome in acute ischemic stroke

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Purpose: To evaluate value of thin section gradient echo T2*-weighted images (T2*-WI) compared to conventional thick T2*-WI in detection of susceptibility-vessel (SV) sign and in correlation with recanalization rate in acute ischemic stroke.

Methods and Materials: Thirty-four acute stroke patients included in this study underwent stroke protocol brain MR including thick (5 mm, 1 mm gap) and thin-section (2 mm, no gap) GRE T2*-WI and intraarterial thrombolysis (IAT) within 6 hr after clinical onset. Two experienced neuroradiologists determined the existence of SV sign and measured the length of SV sign on both conventional and thin-section T2*-WI with consensus. The existence of SV sign and success of recanalization was confirmed by conventional angiography. We compared SV sign detection rate, rate of cardioembolism, mean length of SV sign of thin-section images to conventional images. We evaluated association between length of SV sign on thin section image and successful recanalization (TIMI 2 or 3) on conventional angiography after IAT.

Results: The SV sign was more frequently seen on thin-section image (67.6%) than on conventional image (50%) (p < 0.05). The rate of cardioembolism showed no significant difference on both thin-section images (60.8%) and conventional (64.7%) (p=0.94). The mean length of SV sign was longer on thin-section image (14.8±8.7 mm) than conventional image (13.0±8.8 mm) (p < 0.01). An ROC analysis demonstrated that the length of SV sign on thin-section image could well predict successful recanalization after IA thrombolysis (AUC=0.810, p < 0.01).

Conclusion: SV sign on T2*-WI is well correlated with cardioembolism rate or successful recanalization rate after IAT. Thin-section T2*-WI is clinically useful by showing SV sign more sensitively and prominently than conventional gradient-echo image.

B-281 14:09

Is radiation therapy for nasopharyngeal carcinoma a risk factor for intracranial and extracranial arterial stenosis?

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Purpose: To determine the relationship between intracranial arterial stenosis, extracranial carotid stenosis and radiation therapy for nasopharyngeal carcinoma (NPC), in patients with history of symptomatic cerebral ischemia.

Methods and Materials: Consecutive patients with TIA or ischaemic stroke referred for CT angiography between Jan 2008 and Jun 2009 were recruited. Binary logistic regression forward step likelihood ratio analysis was performed to determine the relationship among different sites of arterial stenosis, history of radiation therapy for NPC, age, sex, history of smoking, diabetes mellitus, hypertension, hyperlipidaemia and ischaemic heart disease.

Results: 88 patients, 70 male and 18 female, were included. Mean age was 64.8. 13 patients had history of radiation therapy for NPC. The mean duration between radiation therapy and CT angiography was 15.2 years. 52 (59.1%) patients were found to have intracranial arterial stenosis, 40 (45.5%) have extracranial internal carotid artery stenosis (ICA), and 15 (17%) have common carotid artery (CCA) stenosis. History of radiation therapy was significantly associated with CCA stenosis (adjusted OR 25.9, 95%CI=6.1, 109.6). Age (adjusted OR 1.07, 95%CI=1.02, 1.12) and smoking (adjusted OR 3.5, 95%CI=1.3, 9.3), but not radiation therapy, were associated with stenosis at extracranial ICA. Age was the single significant factor (adjusted OR 1.10, 95%CI=1.04, 1.15) associated with intracranial arterial stenosis, even when intracranial ICA and intracranial vertebral artery were analyzed individually.

Conclusion: Radiation therapy for NPC is a significant risk factor for CCA but not intracranial stenosis. The odds of CCA stenosis in patients received radiation therapy for NPC is 26 times that of non-irradiated patients.

B-282 14:18
Comparison of cerebral perfusion parameters in symptomatic and asymptomatic patients with carotid artery stenosis

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Purpose: To compare CT brain perfusion parameters before and after carotid artery stenting between patients treated for symptomatic and asymptomatic carotid artery stenosis.

Methods and Materials: Twenty patients with asymptomatic stenosis who were treated in the work-up before coronary artery bypass grafting (CABG) and 38 patients with symptomatic stenosis underwent CT perfusion (CTP) on a multidetector-row CT scanner before and after stenting. In both groups, severity of treated stenosis was > 70%. We calculated mean transit time (MTT), cerebral blood volume (CBV) and cerebral blood flow (CBF), and derived relative numbers that compared treated to untreated hemispheres: ratios of CBV (rCBV) and CBF (rCBF) and difference in MTT (dMTT). These relative perfusion parameters were assessed and compared between symptomatic and asymptomatic patients using the Mann-Whitney U-test.

Results: Before treatment rCBF showed a significant difference between symptomatic and asymptomatic patients (0.86 versus 0.94, p < 0.05). rCBV was equal in both symptomatic and asymptomatic patients (1.04 versus 1.04, p=0.857). After stenting, both rCBV and rCBF were significantly lower in symptomatic patients ((0.96 versus 1.01, p < 0.05) and (0.92 versus 0.99, p < 0.05)). dMTT was higher in symptomatic patients before and after treatment, although not significantly ((1.03 versus 0.63, p=0.095) and (0.14 versus 0.04, p=0.215)).

Conclusion: While asymptomatic patients only show slightly reduced rCBF before treatment, symptomatic patients have significantly lower rCBF that does not normalize after treatment as consequence of persistent prolonged MTT and impaired rCBV. This suggests that symptomatic patients have limited mechanisms to compensate for reduced cerebral perfusion pressure.

B-283 14:27
The volume of the carotid plaque is a predictor of ipsilateral hemispheric ischemic lesions: A 3 Tesla MRI study

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Purpose: Histological composition of the carotid atherosclerotic plaque (CAP) can predict the risk of ipsilateral ischemic stroke. We used 3-Tesla MRI to assess the association between the CAP volume and the amount and total volume of ipsilateral hemispheric ischemic lesions (IHIL).

Methods and Materials: MRI protocol included T1-, T2- and TOF- images of the carotid bifurcation, and FLAIR images of the brain. Semi-automated volumetric analysis was used to determine CAP volume and the amount and total volume of IHIL on the axial FLAIR images. The presence of intra-plaque hemorrhage, disrupted fibrous cap, large lipid core, and calcification of the CAP was correlated with the amount and the total volume of IHIL.

Results: 21 patients with 34 CAPs were prospectively included. There were 9 high-grade (> 70%, NASCET), 12 moderate-grade (50 - 69%), and 13 lower-grade (< 50%) stenoses of the internal carotid artery (ICA). 6 patients had a recently symptomatic ICA stenosis. The CAP volume was significantly correlated with both the total volume and the amount of IHIL (r=0.38; p=0.02 and r=0.33; p=0.05, respectively). There was a significant correlation between the presence of calcification in CAP and the total volume of IHIL (r= 0.36; p=0.02). Neither the degree of stenosis, nor other plaque morphology features were correlated to the amount or the volume of IHIL. The amount and the volume of IHIL did not differ between symptomatic and asymptomatic patients.

Conclusion: The volume of the carotid plaque and the presence of calcifications were significant predictors of ipsilateral hemispheric ischemic lesions in this study.

B-284 14:36
Preoperative evaluation of interventional therapy for patients with symptomatic middle cerebral artery stenosis: In vivo high-resolution plaque imaging using 3 Tesla MRI

M. Wang[1], D. Shi[1], T. Li[1], J. Lian[1], Y. Li[1], M. Wang[1], Y. Han[1], Y. Dai[2]; [1]Zhengzhou/CN, [2]Shanghai/CN (meiyun9999@gmail.com)

Purpose: Diagnosis of middle cerebral artery (MCA) atherosclerosis is important as patients with symptomatic MCA stenosis have a higher stroke risk per year. In this study, we aim to evaluate the value of high-resolution MRI (HR-MRI) in detecting MCA plaques at 3.0 T.

Methods and Materials: We studied twelve patients (mean age 52 years; range 26 to 60 years) with symptomatic MCA stenosis confirmed by DSA. MRI was performed on a 3.0 T MRI system (TrioTim, Siemens Medical Solutions). MRA three-dimensional TOF images were obtained in an axial plane and used as a localizer. High-resolution T1-, T2- and PD-weighted images were acquired along MCA short axis, and T1- and PD-weighted postcontrast images were also obtained. A quantification of wall thickness area, lumen area, and degree of stenosis was performed on T2-weighted images at the level of maximal MCA stenosis. The characteristic of the plaques were also analyzed.

Results: At the level of MCA stenosis, a focal arterial wall thickening consistent with a plaque was clearly seen in all cases. Eight cases showed vulnerable plaque with ruptured fibrous cap, plaque neovasculature, or increased inflammation and were treated with interventional therapy; the stenosis in the other 4 patients caused by stable plaque were treated with medicine. No ischemic events occurred in the following 6 months after therapy in all patients.

Conclusion: HR-MRI can provide in vivo images of plaque on MCA walls and identify patients at risk for stroke occurrence, which is a useful tool for determining the indication of interventional therapy.

B-285 14:45
The effect of collateralization, procedure time, mismatch and recanalization grade on tissue outcome after immediate mechanical recanalization

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Purpose: To estimate the efficacy of revascularization cerebral arteries with mechanical techniques and to evaluate the impact of missmatch, revascularization grade, and collateralization on tissue outcome.

Methods and Materials: Brain tissue outcome in 31 acute stroke patients who received mechanical revascularization was evaluated. Phenox clot retriever was used in 7 cases, penumbra system in 21 cases, and in 3 cases stent angioplasty was applied. Ischemic stroke was diagnosed by stroke CT on admission including native CT, CT-angiography (CTA), and volume perfusion CT (CTP). Collateralization and mismatch was visually graded on a 3 point scale on CTA and CTP. Brain tissue outcome was calculated from change in volume of segmented infarcted brain lesions in prae- and postinterventional CT (Analyze 9.0 software).

Results: 21 (61.1%) of included patients presented with ACM occlusion and 9 with carotid artery occlusion. A complete recanalization was achieved in 17 (54.8%) patients, a partial recanalization was achieved in 8 (25.8%), poor recanalization in 3 (9.7%), and no recanalization in 3 (9.7%). One patient died due to massive intracanial bleeding. A significant reduction of final infarct size could be achieved with recanalization. There was a significantly reduced infarct size for better collateralization and proven missmatch but no significant impact of procedure time.

Conclusion: Favourable tissue outcome depends on recanalization grade, collateral score, and mismatch on CCT. Procedural time shows no significant influence. It might also be helpful to visualize collateralization by volume CT-scan or DSA as an additional prognostic parameter.

B-286 14:54
Cerebral perfusion in patients with chronic brain ischemia and its link to carotid stenosis degree

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Purpose: To evaluate changes of brain perfusion parameters in patients, having different degree of internal carotid arterystenosis.

Methods and Materials: 63 patients (47 male, 16 female) with stenosis of internal carotid artery (ICA) of 72% (54 to 93%) (ECST criteria) at the age of 45 to 67 years (mean 54) and 30 patients of control group (22 male 8 female, age 39 to 61) underwent brain perfusion CT and CT-angiography of carotid artery with 64-slice scanner (Aquilion 64, Toshiba) using next protocol: scan level of basal ganglia, collimation 4x8 mm, 1 rotation per second, 80 kV, 200 mAs, delay before scan 5

sec, 50 ml of contrast media with iodine concentration 350 mg/ml, flow speed 5 ml/sec. Next helical CT-angiography of carotid and intracranial arteries was performed. **Results:** In case of ICA stenosis degree, more than 60% mean transit time was raised with increasing of ICA stenosis degree with significant difference from control group (p> 0.05) in white matter of ACA and MCA territories of ipsilateral hemisphere. Cerebral blood volume was raised in patients having stenosis of ICA within 60-80% (p> 0.05), if stenosis degree was more than 80% CBV decreased comparing to control group. If ICA stenosis was more than 60%, cerebral blood flow decreased with growth of stenosis degree with significant difference from control group (p < 0.05). **Conclusion:** In patients with degree of ICA stenosis within 60-80%, CBV and MTT increase and CBF decreases with growth of degree stenosis. In patients with ICA stenosis more than 80%, MTT increases, CBV and CBF decrease.

B-287 15:03

Displacement mapping for stroke patients using high b-value q-space diffusion-weighted MRI

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Purpose: Q-space analysis using high b-value diffusion-weighted MR data is able to provide information of micro structure, compared with conventional MR imaging including low b-value diffusion-weighted imaging (DWI). The purpose of this study was to evaluate the use of mean displacement map in patients with stroke using high b-value q-space diffusion-weighted MRI (QSI).
Methods and Materials: A total of twenty-one patients (9 women and 12 men, mean age 65.5 y.o). presenting acute or subacute cerebral infarctions were participated in this study. MR imaging protocol consisted of conventional MR sequences, DWI (b-value; 1000 s/mm²) and QSI (b-value; maximum 12,000 s/mm², 12 steps). ADC maps of conventional DWI and mean displacement (MD) maps of QSI data were obtained and region of analysis for the total 22 ischemic lesions and corresponding normal tissues was performed.
Results: Decreased ADC values in all lesions were shown on ADC maps. There was no correlation between ADC and MD values in the ischemic lesions (R=0.21). MD values of the lesions were 8.60 ± 1.26 µm (mean ± SD). Most of the lesions (16/22), MD values were higher in the ischemic lesions, compared with normal brain tissue. Three showed the lower and the rests showed mixed (higher and lower) MD values.
Conclusion: The use of MD maps using QSI data provides more and different information in addition to conventional sequences. An even more larger study is needed; it may be a potential biomarker for stroke patients.

B-288 15:12

Acute basilar artery occlusion treated with intra-arterial thrombolysis: MRI predictors of clinical outcome

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Purpose: Intra-arterial thrombolysis (IAT) for acute basilar artery occlusion (BAO) improves the prognosis. The extent of early ischemic damage on pre-treatment diffusion-weighted MR-imaging (DWI) can predict the outcome in BAO and influence the response to IAT. The predictive value of previously published DWI-scoring systems has not been compared yet. We studied the MRI and clinical predictors of outcome, e.g. NIH-Stroke-Scale (NIHSS), Glasgow-Coma-Scale (GCS).
Methods and Materials: Patients with acute BAO treated with IAT at our Stroke Unit within 12 h after symptom onset were studied. Pre-treatment and 24h post-interventional MRI-scans as well as a clinical follow-ups were performed. Three recently published DWI-scoring systems were compared and a modified scoring system was proposed.
Results: Thirty-six patients (13 women, 23 men; mean age 60, SD15) were included. The median NIHSS-score on admission was 17. The mean time-to-treat was 5.6 h after onset of symptoms. Recanalisation after IAT was achieved in 26 patients (72%). The outcome at three months was good (mRS 0-3) in 19 (52.8%) and poor (mRS 4-6) in 17 (47.2%) patients. There was no significant correlation between the time-to-treat, recanalisation rate and the clinical outcome. Significant baseline predictors were the NIHSS on admission and GCS. All DWI-scoring systems significantly correlated with the clinical outcome. The multivariate analysis revealed that the herein proposed DWI-score was a more reliable predictor of functional outcome. (P=0.004).
Conclusion: The proposed DWI-scoring for the early ischemic damage in BAO is a strong predictor of clinical outcome. Still, the therapeutic decision must be also guided by the clinical status.

B-289 15:21

Final cerebral infarct volume is predictable by MR imaging at one week

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Purpose: Cerebral Infarct volume, an increasingly used endpoint in phase II trials, is considered stationary at least 30 days after the ictus. We investigated whether information conveyed by MRI measurements of "final" infarct volume could be assessed as early as the subacute stage (days 3-6) rather than waiting for the chronic stage (days 30-45).
Methods and Materials: Ninety-five patients with middle cerebral artery stroke, prospectively included in a multicenter study, underwent MRI during the first 12 hours after onset (MRI.1), between days 3 and 6 (MRI.2) and between days 30 and 45 (MRI.3). We first addressed the relationship between subacute (FLAIR.2) and chronic volumes (FLAIR.3) using a linear regression model. Then, we tested the relationship between FLAIR volumes (either FLAIR.2 or FLAIR.3) and functional disability measured by modified Rankin scale (mRS), using logistic regression. The models' performances were assessed using the area under the curve (AUC) in receiver operating characteristic analysis.
Results: A linear association between log FLAIR.2 and log FLAIR.3 volumes was observed. The proportion of FLAIR.3 variation explained by FLAIR.2 was high (R²=81%) without covariate that improved this percentage. Both FLAIR.2 or FLAIR.3 were independent predictors of mRS (odds ratio, 0.89 and 0.86; 95% confidence interval, 0.80-0.99 and 0.75-0.98; p=0.026 and 0.023). The association between either FLAIR volumes and mRS did not differ (AUC= 0.897 for FLAIR.2 and 0.888 for FLAIR.3).
Conclusion: Stroke damages could be assessed by a subacute volume because it allows for predicting the fixed volume and conveys the same clinical prognosis.

14:00 - 15:30   **Room F1**

Interventional Radiology

SS 509a

Interventional oncology

Moderators:
L. Crocetti; Pisa/IT
P. Reimer; Karlsruhe/DE

B-290 14:00

also EPOS

Clinical outcome of CT-guided iodine-125 implantation therapy for retroperitoneal lymph node metastases

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Purpose: This study aimed to explore the clinical efficacy of CT-guided radioactive iodine-125 seed implantation in treating patients with metastatic retroperitoneal lymph nodes.
Methods and Materials: A total of 25 patients with retroperitoneal lymph node metastases were involved in I-125 seed implantation therapy. Treatment Planning System (TPS) was used to reconstruct the 3 dimensional image of the tumor, and thus to calculate the correlated quantity and distribution of I-125 seed.
Results: Follow-up period for this group of patients was 2 to 30 months, and median survival time was 19 months. Symptoms of refractory pain were significantly resolved post-interventionally (P < 0.05), and Karnofsky score went up dramatically (P < 0.05). Most often, patients reported pain relief 2 to 5 days after treatment. Follow-up imaging studies were performed 2 months later which revealed complete response (CR) in 7 cases, partial response (PR) in 13 cases, no change (NC) in 4 cases, and progression (PD) in 1 case. Overall effective rate (CR+PR) ended up 80%. Median survival time was 25.5 months, with 1 year, 2 year survival rates 92, 36% respectively. 5 patients died of multi-organ failure or other metastases, with no relationship to the treated lymph node metastasis. There is no shift of radioactive seeds found on follow-up studies.
Conclusion: CT-guided radioactive I-125 seed implantation which showed good palliative pain relief with acceptable short term effects has proved in our study to be a new, safe, effective and less complicated treatment option for metastatic peritoneal lymph nodes.

B-291 14:09

Real-time magnetic resonance temperature monitoring in moving organs: A clinical routine setting for laser ablation of tumor in the human liver

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Purpose: Clinical evaluation of a newly developed temperature-sensitive MR sequence using the proton resonance frequency (PRF) shift method in a clinical setting of laser ablation of liver tumors.

Methods and Materials: Thirty patients with different primary and secondary liver tumors were treated using a miniature laser applicator (Monocath; Anakat, Berlin) under MR-guidance. Real-time temperature monitoring was performed using a color-coded PRF-based echo planar imaging (EPI) sequence (TR/TE 500/12 ms, flip angle 65°, resolution 128x97, FOV 320 mm, fat saturation, bandwidth 260 Hz/Px, 2.5 mm slices, distance factor 200%, GRAPPA acceleration factor 2; MAGNETOM Avanto, 1.5 T, Siemens, Erlangen). Findings were correlated with the contrast-enhanced MR perfusion imaging after ablation.

Results: The new PRF-based monitoring sequence allows exact and reliable temperature measurements within 4 eligible color-coded temperature ranges in the breathing patient. The standard deviation was less than 4 °C. The extent of induced coagulation necrosis on perfusion imaging showed a good correlation with areas of temperature greater 55 °C on the PRF-sequence. The duration of the procedure was not influenced using this new sequence.

Conclusion: The new PRF-based temperature monitoring sequence provides exact qualitative and quantitative data and appears very robust to pulsation and breathing artifacts. The use of laser light as compared with other thermal ablative procedures allows for permanent interference-free sequence acquisition during therapy.

B-292 14:18

MR thermometry methods evaluation using an MR-compatible liver-equivalent gel phantom and a fiber-optic thermometer: Application to tumor thermal ablation

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Purpose: To evaluate T1 and PRF thermometry methods for LITT, utilizing fast MR sequences and fiber-optic thermometer.

Methods and Materials: Using MR imaging and spectrometry methods, a liver-equivalent polyacrylamide gel phantom was developed, consisting of contrast agents for MR relaxation times adjustment and substances, i.e. hemoglobin and polyvinyl-acetate microsphere, for, respectively, the absorption and scattering of laser radiation. The MR-guided LITT was applied to pig liver and the gel phantom; temperature was measured using a fiber-optic thermometer and MR imaging performed applying a 1.5-Tesla tomograph with a segmented EPI sequence for the PRF method and the following sequences for T1 method: FLASH, IRTF, SRTF and TRUFI. Plotting MR signal intensity against measured temperature determines the temperature constant for the T1 method.

Results: Below 60ºC, measured temperatures and those determined with PRF method agreed. The calibration experiments to determine the temperature constant for T1 method are analyzed and processed, with initial analysis showing that the IRTF and FLASH sequences have the highest temperature sensitivity and the most linear relationship between MR signal intensity and measured temperature. SRTF sequence presents relatively good linearity but inferior temperature sensitivity compared to IRTF and FLASH. Conversely, TRUFI sequence exhibited a non-linear relationship.

Conclusion: The accuracy of MR thermometry is sufficient to control the temperature for the LITT. PRF is preferred for temperatures below 60 °C due to its excellent linear correlation with fiber-optic temperature. Among the T1 sequences, FLASH is preferable as the most robust, though not the most accurate, T1 sequence.

B-293 14:27

US-guided high-intensity focused ultrasound treatment for advanced pancreatic cancer: Imaging evaluation of local tumor response and symptoms relief

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Purpose: To prospectively assess the safety and feasibility of Ultrasound-guided High Intensity Focused Ultrasound (US-HIFU) ablation and to evaluate local efficacy and pain relief in patients with late-stage pancreatic cancer.

Methods and Materials: The procedure was performed by the JC HIFU system [Chongqing Haifu (HIFU), Chongqing-China], under general anaesthesia. All patients were evaluated clinically and by PET/CT, MRI, MDCT.

Results: From January 2008 to September 2009, nine patients with 9 pancreatic lesions underwent US-HIFU treatment. Patients had histologically confirmed pancreatic adenocarcinoma in 7 and neuroendocrine tumors in two cases. All were pretreated with chemotherapy, biological therapy and/or radiotherapy, with no response. Patients were judged to be unsuitable for surgical resection and referred to HIFU. Seven patients presented a cephalo-pancreatic lesion; in 2 cases tumor was located respectively to the istmus and pancreatic tail. Mean age was 63.1 years (range 43-77). Tumours average diameter was 5.3 cm (range 2.5 - 7.5). MDCT and PET/CT showed a tissue volume control in 8/9 patients; 1 stable disease was observed. Nine out of 8 patients were rapidly palliated in symptoms with long lasting pain control after a mean follow-up of 8 months. Four patients are still on treatment. One complication occurred after HIFU, with complete occlusion of the involved portal vein. Average treatment and sonication time were 136±38.6 minutes and 1775±725 seconds, respectively. All the patients but one returned home 3 day after treatment.

Conclusion: US-HIFU ablation is safe and feasible with palliative efficacy in pain control of patients with solid pancreatic tumors.

B-294 14:36

Hepatic radiofrequency ablation: Ex-vivo quantification of vessels' heat sink effects

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Purpose: To quantitatively evaluate the cooling effects of vessels at varying flow rates in a standardized experimental model of radiofrequency-(RF) ablation in the liver.

Methods and Materials: 169 RF-ablations were performed in 31 porcine livers at 25 or 37ºC using a bipolar RF-system at standardized ablation parameters. Vessels were simulated by saline perfused 5 mm glass tubes 5 mm from the applicator with flow rates of 0 to 1800 ml/min. Based on digital planimetry, ablation zones were analyzed regarding: a) their opening angle towards the glass tube and b) the percentage of ablated tissue compared to the expectedly ablated tissue not influenced by heat sink effects. Quantifications were performed for eight distinct sectors from the centre of the applicator to the vessel.

Results: At 25ºC, a cooling effect was observed at a flow of 1 ml/min (opening angle 49 vs. 0º, P < 0.05; differences in all sectors, P < 0.05). At a flow of 5 ml/min, the cooling effect increased (opening angle 164 vs. 46º; P < 0.01; differences in sectors IV and V, P < 0.01) and did not change with increasing flows. At 37ºC, a cooling effect was observed at a flow of 2 ml/min (opening angle 58 vs. 0º, P < 0.01; differences in sectors VI and VII, P < 0.01) which further increased at flows of 5 ml/min (P < 0.05), 10 ml/min (P < 0.05) and 50 ml/min (P < 0.05). The maximum opening angle at 37ºC was 140º.

Conclusion: In this experimental setting, tubes with flow rates of 1 ml/min at 25ºC and of 2 ml/min at 37ºC induce local cooling effects.

B-295 14:45

Intra-operative microwave ablation (MWA) of liver metastasis: Preliminary report of reproducibility of ablation zone with high frequency and high energy antennae system in humans

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Purpose: Microwave ablation (MWA) is a promising new ablation technique, but the relation of time and power to ablation zone size is uncertain. We report our experience with in vivo ablative zone reproducibility using a novel, high power (100 Watts), intra-operative 2.4 GHz microwave ablation system.

Methods and Materials: The time of ablation was recorded prospectively in 22 individual treatments in consecutive patients, with metastatic liver disease. The mean tumour diameter was 22.5 mm (range 9-45 mm). Sixty seconds of ablation was performed per 10 mm of tumour diameter plus a 5 mm treatment margin (range 60-300 s). Maximal diameter and volume of ablation zones were measured on an imaging workstation (GE Advantage Windows) on studies performed 24 hours post treatment. Correlation between diameter and volume against duration of ablation was performed using Spearman's test. 95% confidence intervals (CI) were calculated for mean diameter and volume at each ablation time.

Results: The mean diameter of ablation zone was 45 mm (10-88 mm) and mean volume was 164 ml (22-579 ml). There was good correlation between ablation time with both diameter (rho 0.421, p=0.05) and volume (rho 0.680, p < 0.001). Overall, the 95% CI for the mean diameter was ±5.3 mm but for longer ablation times (≥4 minutes) this was 9 mm, compared to 5.1 mm for short ablation times (< 4 minutes). Similarly for tumour volume, the 95% CI was ±57 ml but ±96 ml for longer ablations, compared to ±56 ml for short ablation.

Conclusion: Although the maximal diameter and volume of ablation zone correlate with the duration of ablation, there is a significant range in ablation zone size.

B-296 14:54

Microwave ablation therapy of pulmonary neoplasms: Safety and efficacy
T.J. Vogl, N.-E.A. Nour-Eldin, N.N.N. Naguib, S. Zangos; *Frankfurt a. Main/DE*
(t.vogl@em.uni-frankfurt.de)

Purpose: To prospectively evaluate effectiveness, follow-up imaging features, and safety of microwave ablation in patients with pulmonary malignancies.
Methods and Materials: This prospective study was approved by the institutional ethical committee board; informed consent was waived. The study included 130 ablation sessions for lung tumors in 85 patients (35 males, 50 females; mean age: 58.9 years, SD: 12.1). Tumor pathology was: 6 primary (non small cell lung carcinoma) and 124 pulmonary metastases (from colorectal ca, breast ca, hepatocellular ca, prostatic ca and renal cell ca). The exclusion criteria of the ablation therapy were patients with lesions of maximal diameter more than 5 cm, or more than 5 in number and coagulopathy. Percutaneous microwave ablation was performed under CT fluoroscopy guidance. Tumor criteria, response and post ablation complications were assessed. Mixed linear modeling and logistic regression were performed.
Results: The preablation tumors volume ranges 0.26-5.29 cm³ (mean 1.75 cm³, SD 1.59) and mean of largest axial diameter 2.1 cm (0.5-5 cm, SD: 1.2). At follow-up (3-12 months, mean: 6.2), 26.9% (35 of 50) of patients had residual disease at the ablation site, predicted by using index size of larger than 3 cm (P = 0.01). Kaplan-Meier analysis yielded an actuarial survival of 76.5% at 1 year. Tumor control response was more favorable for lesions < 3 cm in diameter (P=0.01) in contrast to tumors > 3 cm. Procedure specific mortality was 1.2% (1 out of 85 patients) due to massive bleeding. Immediate complications per sessions included: pneumothorax: mild in 5 sessions (5.9%) and moderate requiring manual drainage in 6 sessions (7%), haemoptysis (4 out of 85 sessions), pulmonary haemorrhage: 6 out of 85 sessions (7.1%).
Conclusion: Microwave ablation is a minimally invasive procedure and may be safely applied to lung tumors. The tumor control response is favorable for lesions up to 3 cm in diameter with increased incidence of recurrence for larger tumors.

B-297 15:03

also EPOS

Microwave ablation (MWA) for the treatment of lung tumors: Preliminary experience
G. Carrafiello, M. Mangini, I. De Bernardi, F. Fontana, D. Laganà, E. Cotta, D. Agnello, C. Fugazzola; *Varese/IT (gcarraf@tin.it)*

Purpose: The purpose of our study was to retrospectively evaluate feasibility, safety, clinical efficacy, and survival of microwave ablation (MWA) in 10 patients with unresectable lung tumor.
Methods and Materials: 11 lesions were treated in 11 ablative sessions in 10 patients. The treaments were performed with a MW generator with 45 W and 915 Mhz connected to an antenna 14.5G for 10 minutes. Antenna's positioning was performed with CT fluoroscopic guidance or XperGuide. All patients were undergone to a follow-up with CT at 1, 3, 6 months from procedure.
Results: Feasibility was 100%, mortality at 30 days was 0%, clinical efficacy of 89% and survival at 3 months of 90%.
Conclusion: This study shows that, in selected patients, MWA represents a valid alternative to other ablative techniques. Furthermore, studies are necessary to demonstrate short and long effects of this methodology and allow a comparison to other ablative systems, in particular to radiofrequency.

B-298 15:12

Comparison of two port-systems with different catheter size regarding catheter-related complications and intrainterventional pain perception
C. Plumhans, F. Schoth, F. Behrendt, S. Keil, R.W. Günther, A. Mahnken; *Aachen/DE (plumhans@rad.rwth-aachen.de)*

Purpose: The aim of our study was to compare the implantation of two different totally implantable access ports (TIAP) devises. We focused our attention on intrainterventional painperception, tip-migration and complications.
Methods and Materials: From April to October 2008 a TIAP was implanted in 94 oncological patients via the internal jugular vein and under ultrasound-guidance. Indication for placement was systemic intravenous chemotherapy. Patients in which follow-up contrast-enhanced CT scans were planed within tumour aftercare; a high pressure port-system (PowerPort, Bard Access System, USA) with an 8-F catheter was implanted (n=49). Other patients received a conventional port-system (Bardport, Bard Access System, USA) with a 6-F catheter (n=45). Intrainterventional painperception, postinterventional tip-migration and radiation dose were documented for each port-system and implantation-side. Differences were compared with Wilcoxon t-test. For ordinal variables, comparison of two groups was performed with the Fisher's exact test. P < 0.05 was considered as statistically significant.

Results: No major periinterventional complication occurred. Intainterventional painperception was similar in both groups. Significantly lower tip migration was observed in the PowerPort-group (p=0.03) and when the port-system was implanted on the right side (p=0.03). Catheter occlusion occurred in 3 patients and a catheter loop in 1 patient of the BardPort-group versus none in the PowerPort-group. The corresponding value for vein thrombosis was 1 case in the Powerport-group, while none in the BardPort-group.
Conclusion: The implantation of both TIAPs via the internal jugular vein and under ultrasound-guidance is safe and reliable. Regarding the postinterventional tip position and port dysfunction the PowerPort-system seems to be advantageous.

B-299 15:21

Implanted port-catheter system in patients with liver malignancy: Incidence of complications and duration of patency related to the primary tumor type
W. Alhajji, N.-E.A. Nour-Eldin, N.N.N. Naguib, T.J. Vogl; *Frankfurt a. Main/DE (dralhajji@yahoo.com)*

Purpose: To assess the impact of the primary tumor type on the overall incidence of complications, and duration of patency of the port- catheter system.
Methods and Materials: In the current study, 135 patients (mean age: 60.4 year, range: 33-81, SD: 10.5) were prospectively evaluated. 160 port-catheter systems were implanted via transfemoral approach under angiography guidance. 11 patients had primary liver tumor, 124 had metastatic liver tumor of the following origin: colorectal carcinoma (Ca) (n=55), pancreatic Ca (n=18), Breast Ca (n=20), gastric Ca (n=6), ovarian Ca (n=4), prostatic Ca (n=3), renal cell Ca (n=4), melanoma (n=4), and others (n=10). The duration of patency was tested using Kaplan-Meier and long-Rank-Test, and the incidence of complication using the Chi square test.
Results: Patients with primary diagnosis of liver malignancy had no complications; the duration of patency of the port-catheter system used in this patient group showed a mean value 270 days (range: 60-750, SD: 207.4). Colorectal carcinoma the incidence of complications was 21.8%, the mean duration of patency was 272 days (range: 1-1426, SD 255.6). Pancreas Ca. 11.1%, 395.8 (7-2139, 482). Breast Ca. 20%, 295 (60-720, 178). Gastric Ca. 0%, 66 (8-240, 97.8). Ovarian Ca. 0%, 260 (101-560, 135.8). Prostatic Ca. 0%, 150 (60-240, 127). Renal cell Ca. 0%, 230 (90-480, 217). Melanoma 50%, 120 (30-240, 108). Patients with other types of tumors showed 30%, 144.7 (30-330, 118.5). A statistically significant difference between the primary tumors was detected regarding the incidence of complications (p value=0.0495) and the duration of patency (p value=0.01361).
Conclusion: The current study showed the incidence of complication and duration of patency of the port-catheter system to be significantly related to the primary tumor type.

14:00 - 15:30   **Room F2**

Breast

SS 502

The role of US in breast imaging

Moderators:
T. Fischer; Berlin/DE
W. Jakubowski; Warsaw/PL

B-300 14:00

Sub-categorization of ultrasonographic (US) BI-RADS category 4: Positive predictive values and affecting factors
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Purpose: To evaluate the positive predictive value (PPV) in sonographically-detected breast lesions of BI-RADS category 4a, 4b, and 4c and to find how variable clinical factors influence the PPV of sub-categorization of category 4.
Methods and Materials: A total of 2440 patients (age range: 12-85 years, mean: 44.18 years) who had focal breast lesions diagnosed on ultrasonography (US) as BI-RADS category 4a, 4b, or 4c were included in this study. All patients underwent subsequent US-guided percutaneous or excisional biopsy for pathologic confirmation. Seven breast radiologists with different clinical experiences (range: 1~11years) were randomly distributed for US examination of each patient, prospectively. Patient's age, presence of clinical symptoms, lesion size (measuring more or less than 10 mm), multiplicity and the radiologist's experience (attending breast radiologists vs fellows) was compared to the surgically-proven pathologic results of each BI-RADS subcategory. Positive predictive values (PPV) of each subcategory were calculated.

Results: Among the 2440 suspicious breast lesions, 448 (18.4%) were pathologically confirmed as malignancy. Overall PPV of each US BI-RADS subcategory was 7.5% for category 4a, 36.7% for category 4b, and 81.5% for category 4c. The radiologist's experience did not significantly influence the PPV in each US BI-RADS subcategory of suspicious breast lesions. Also, patient's age, presence of symptoms, lesion size, and multiplicity did not influence the PPV of US BI-RADS sub-category.

Conclusion: PPV of category 4 lesions fulfilled the US ACR BI-RADS recommendation and showed irrelevance to the radiologists' experience and additional information of the patient's clinical features.

B-301 14:09

Significant differentiation of focal breast lesions: Use of strain ratio in breast ultrasound

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Purpose: Does calculation of strain ratios (SRs) improve differentiation of sonographically detected focal breast lesions compared with B-mode scanning and elastography?

Methods and Materials: A total of 227 women with histologically proven focal breast lesions (113 benign, 114 malignant) were included in a study at two German Breast Centers and underwent standardized imaging using a high-end ultrasound system (HITACHI HV 900). The B-mode ultrasound scans and elastograms were interpreted by two experienced examiners in consensus using BI-RADS criteria. A tumor-adjusted ROI (mean color pixel density) was related to a comparable ROI placed in lateral fatty tissue to calculate SRs. Sensitivity, specificity, and cut-off value of SRs (ROC analysis) were calculated.

Results: The women had a mean age of 54 years (range, 19-87 years). Tumor diameter was 16±8.5 mm. Sensitivity and specificity were 96/55% for B-mode imaging, 81/89% for elastography, and 90/89% for SR. An SR cut-off value of 2.45 (AUC 0.949) significantly separated (p < 0.05) malignant (mean 5.1±4.2) from benign (mean 1.6±1.0) focal breast lesions. SR had a positive predictive value of 89%, which was superior to B-mode scanning (68%) and elastography (84%).

Conclusion: Calculation of strain ratios can contribute to further standardization of elastography and significantly differentiates benign and malignant breast lesions with high specificity.

B-302 14:18

Utility of second look ultrasound in the management of incidental enhancing lesions detected by breast MR imaging

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Purpose: To assess utility of second-look ultrasound for the identification of incidental enhancing lesions detected by breast MRI.

Methods and Materials: Among 655 consecutive breast MRI, 62 lesions (evident on MR images, non-palpable, first look ultrasound and mammographically occult) were recommended for second look ultrasound. The MRI enhancement of the lesions was mass-like in 59 cases (95%), non mass-like in 3 cases (5%). Forty-two lesions (68%) were ≤10 mm; only 3 lesions (5%) were > 20 mm. Of all lesions, the BI-RADS RM category was highly suspicious for malignancy in 6 cases (10%), suspicious in 33 cases (53%), probably benign in 23 cases (37%). The association among MRI lesions characteristic, lesion size, pathologic results and detection rate with second look ultrasound was analyzed. The gold standard was pathological results and/or follow-up (range: 18-24 months). Statistical analysis was performed with the Fisher exact test.

Results: Second look ultrasound identified 44 of 62 (71%) of lesions depicted at MRI. The detection rate with second look ultrasound was higher with mass-like MRI lesions (75%) than non-mass MRI lesions (0%), with lesion size > 10 mm (90%) and with lesion BI-RADS 4 (88%).
Second look ultrasound guided biopsy detected 12 of 17 (71%) malignant lesions. There was no correlation between likelihood of carcinoma and presence of ultrasound correlate lesions.

Conclusion: Second look ultrasound is reliably problem solving tool in the identification and characterization of the majority of incidental MRI findings. It contributes to accurately select the cases in which MRI-guided biopsy are required.

B-303 14:27

Evaluation of the accuracy of a computer aided diagnosis (CAD) system in breast ultrasound according to the radiologist's experience

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Purpose: To evaluate the performances of a Computer Aided Detection (CAD) system in breast ultrasound to improve the characterization of breast lesions detected in ultrasonography, for junior and senior radiologists.

Methods and Materials: 160 breast lesions detected in ultrasonography were randomly and blindly reviewed by four radiologists with different levels of expertise [4 months (A), 12 months (B), 5 years (C), 20 years (D)], without and with the help of an ultrasound CAD system (B-CAD, Medipattern®, Canada). Evaluation criteria were: lesion type, BI-RADS category, final assessment benign/malignant. Sensitivity (Se) and specificity (Sp) with and without CAD were calculated for each radiologist. Intrinsic Se and Sp of CAD alone were also calculated.

Results: 83 benign and 77 malignant lesions were included. For the expert radiologist (D), Se was unchanged with CAD (98.7%) but Sp was reduced (69.9 vs 45.8%). For less experienced radiologists (A, B and C), Se increased with CAD (A: 88.3 to 90.9%), (B: 88.3 to 94.8%), (C: 87 to 96.1%) (NS). 3, 5 and 7 additional malignant lesions were, respectively, diagnosed. For radiologists B and C, Sp decreased with CAD (B: 68.7 to 56.6%), (C: 79.5 to 57.8%). The CAD system alone detected all cancer cases (Se =100%), as Sp was 48.2%.

Conclusion: CAD in breast ultrasonography might improve the diagnosis of malignant lesions for junior radiologists. Nevertheless, CAD ultrasonography systems reduce Sp and increase the rate of biopsies for benign lesions.

B-304 14:36

Negative axillary ultrasound in primary breast cancer: How reassured should we really be?

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Purpose: Axillary ultrasound has become an important adjunct in the staging of breast cancer in recent years. We retrospectively studied a sample of 155 women with invasive breast cancer and normal axillary ultrasound to investigate whether the characteristics of the primary tumour could predict the likelihood of false negative axillary ultrasound.

Methods and Materials: Screening and symptomatic patients were identified from pathology records and information collated from pathology and imaging records.

Results: Of the 155 normal ultrasounds, 45 (29%) were positive at axillary surgery. True and false negative groups were compared in terms of the following: tumour size, pathological type and grade, lymphovascular invasion and oestrogen receptor (ER) status. Breast tumour size was significantly different with the average size in the true negative group 21 mm and in the false negative group 30 mm (p < 0.002). There was no significant difference in tumour grade or ER status. However, the histological type varied significantly between the groups, with excess lobular carcinomas in the false negative group (6/110 vs 6/45, p < 0.001). The false negative group was more likely to show lymphovascular invasion in the breast (31 vs 5%, p < 0.001).

Conclusion: There are significant differences in tumour characteristics between women with true negative and those with false negative axillary ultrasound in terms of size, primary tumour histological type and presence of lymphovascular invasion. In particular, axillary assessment in primary lobular carcinoma may be more difficult and a negative result should be interpreted with caution.

B-305 14:45

Inter- and intraobserver agreement in BI-RADS US: Are they good enough?

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Purpose: To retrospectively evaluate inter- and intraobserver agreement between radiologists by using terminology of the Breast Imaging Reporting and Data System (BI-RADS) to characterize and categorize lesions on sonograms.

Methods and Materials: One hundred lesions in 95 patients who underwent ultrasound-guided biopsy constituted the study group. Three radiologists, blind to patient information and final pathological diagnosis, independently evaluated static sonographic images of each lesion and described them according to BI-RADS-US. One of the radiologists reassessed all the lesions two months after the initial evaluation. Interobserver agreement was calculated using Fleiss kappa coefficient. Negative predictive value (NPV) of category 3 and positive predictive value (PPV) of category 4 A, 4B, 4C and 5 lesions were calculated.

Results: The greatest interobserver agreement was found for orientation (k=0.72) and shape (k=0.76). Moderate levels of agreement was found for posterior feature

(k=0.47) and echo pattern (k=0.41). Fair levels of agreement was observed for margin (k=0.24) and final category (k=0.35). The lowest levels of concordance occurred in boundary (k=0.12). Perfect intraobserver agreement was found for shape (k=0.83), echo pattern (k=0.81) and boundary (k=0.84), whereas substantial agreement was observed for orientation (k=0.77), margin (k=0.71), posterior features (k=0.68) and final category (k=0.79). NPV of category 3 lesions was 95%. PPVs of category 4 and 5 lesions were as follows: category 4 A 14.6%, category 4B 40.8%, category 4C 78.5% and category 5 87%.

Conclusion: Compared to BI-RADS mammography, the use of BI-RADS-US is still new for the radiologists. With specialized education and self-auditing, we believe better agreement can be achieved.

B-306 14:54

also EPOS

Ultrasound breast findings in diabetic mastopathy

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Purpose: To describe ultrasound (US) breast findings in diabetic mastopathy (DM) patients.
Methods and Materials: We retrospectively analyzed medical records (clinical, US, and histopathological findings) of diabetic insulin-dependent women who attended the Breast Department of our institution with DM and who were diagnosed by US-guided breast core biopsy from January 2002 to September 2008 and followed for at least one year.
Results: Seven patients (mean age 41, range 32 to 69 years) were identified. Six had Type I and 1 Type II diabetes, all with a history of insulin dependence for more than 5 years. All of them presented palpable nodules, 6 unilateral and 1 bilateral (mean size 27.6 mm, range 14-40 mm). The main US characteristics of nodules (n=8) were: solid (8), irregular (7), hypoechoic mass (8), ill-defined margins (8), heterogeneous echogenicity (8) and posterior acoustic shadowing (6). All lesions were categorized as BIRADS 4. None of the patients developed breast cancer during follow-up.
Conclusion: Breast US findings of DM in insulin-dependent diabetic women were similar to those of breast carcinoma. These images in insulin dependent diabetic patients may be confirmed as DM ruling out carcinoma by US-guided breast core biopsy making surgical interventions unnecessary. Prospective and multicenter studies with more subjects evaluated will confirm this preliminary observation.

B-307 15:03

also EPOS

The role of ultrasound (US) and US-guided core needle biopsy of axillary lymph nodes in preoperative staging of breast cancer

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Purpose: To evaluate the role of US and US-guided (CNB) of axillary lymph nodes in preoperative staging of breast cancer.
Methods and Materials: From August 2008 to August 2009, we performed 138 US axillary preoperative studies in patients who had indication of Sentinel Lymph Node Biopsy (SLNB). We divided the patients into three groups, according to US findings: a) normal, if the axillary nodes had a thin cortex and a relatively large fatty hilium; b) asymetric cortical thickening (between 2, 5 and 5 mm); c) suspicious axillary lymph nodes with a cortical thickening > 5 mm or without fatty hilium. All lesions were histologically proven.
Results: A total of 83 patients had the axillary US Normal. After SLNB, 71 were diagnosed accurately, and the other 12 had metastases; 7 of 12 micrometastases (< 2 mm), 3 metastases (3 mm) and 2 metastases (> 3 mm). Of the 31 asymmetric cortical thickening, 21 had metastases proven by axillary or US-guided biopsy and 1 case micrometastases. All of the 24 suspicious axillary lymph nodes were proven by US-guided CNB.
Conclusion: Axillary US has a high sensibility and specificity, and It is the study of choice for initial lymph node evaluation. US-guided CNB of axillary lymph nodes is a safe and easy procedure and have less false negatives than FNA. If nodal positivity is confirmed, SLNB can be avoided. Asymmetric cortical thickening and dismissed or absent hilium are related with axillary metastases and US-guided CNB can be made for the accurate preoperative staging.

B-308 15:12

Interobserver variability of US elastography: How it affects the diagnosis of breast lesions

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Purpose: To evaluate the interobserver variability of elastography in the diagnosis of breast lesions on real time US, and how elastography improves the agreement of final assessment on conventional ultrasound (US).
Methods and Materials: From April to May 2008, 65 breast lesions of 54 patients (mean age: 42.6 years, range: 18-72 years) with US-guided core biopsy were included in this study. Conventional US and elastography images were obtained prior to biopsy. US elastography images were obtained and prospectively analyzed by three radiologists with individual real-time image scanning. Each radiologist recorded final US BI-RADS assessments of conventional US and final assessment combined US elastography following the lesion to fat elasticity ratio and elasticity score. The histopathologic results obtained from US-guided core biopsy were used as reference standard. Interobserver variabilities of US elastography, and the final assessment of conventional and combined US elastography were evaluated.
Results: Of the 65 lesions with US-guided core biopsy, 43 (66.2%) were diagnosed as benign, and 22 (33.8%) as malignant. For interobserver agreement of elastography on real time performance, fair agreement were obtained for both lesion to fat elasticity ratio (intraclass correlation coefficient (ICC) score: 0.26) and elasticity score ($\kappa = 0.28$). The interobserver agreement of final assessment with combination of conventional US and US elastography ($\kappa = 0.27$) was not improved when compared with that with conventional US only ($\kappa = 0.37$).
Conclusion: Significant variability exists with elastography and this does not significantly reduce the interobserver variability of final assessment of breast lesions on US.

B-309 15:21

Strain ratio measurement method: A more objective breast lesion diagnosis method with UE

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Purpose: To evaluate the difference of stiffness of benign and malignant breast lesions for finding a more objective diagnostic method with ultrasonic elastography (UE).
Methods and Materials: From January 2008 to April 2009, 559 solid lesions (415 benign, 144 malignant) from 428 consecutive patients (age range 12-77 years) were diagnosed by UE. By using the strain ratio measurement method together with the ultrasound machine, the strain ratio of the lesion was calculated. Final diagnosis was confirmed by histopathology. The study was approved by the ethics committee of the hospital. The area under the curve (AUC) and cutoff point, both of which were obtained by using a receiver operating characteristic curve analysis, were used to assess diagnostic performance. And the diagnostic performances were further compared with that of 5-point scoring system by Z test. Sensitivity, specificity, and accuracy were compared by using MecNemar test.
Results: The strain ratios of benign lesions (mean 1.83, SD 1.22) and malignant lesions (mean 8.38, SD 7.65) were different (P = 0.000). When a cutoff point of 3.05 was used, UE had 92.4% sensitivity, 91.1% specificity, and 91.4% accuracy. With this method, UE had higher sensitivity than 5-point scoring system (P < 0.05). The AUC of the strain ratio measurement method was 0.944; the AUC of the 5-point scoring system was 0.885. The diagnostic performance of the strain ratio measurement method was better than the 5-point scoring system with UE (P < 0.05).
Conclusion: Strain ratio measurement method would provide a new, more objectively diagnostic method besides 5-point scoring system for UE.

Friday

GI Tract

SS 501b

Crohn's disease

Moderators:
J.S. Laméris; Amsterdam/NL

B-310 14:00

Correlation between the Harvey-Bradshaw activity index and multidetector-CT enterography findings in Crohn's disease

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Purpose: To prove the association between the Harvey-Bradshaw activity index and multidetector-CT enterography findings suggestive of activity in Crohn's disease.
Methods and Materials: Forty consecutive cases were reviewed in a descriptive retrospective study. MDCT enterography findings: wall thickness, mucosal and submucosal enhancement, mural attenuation pattern, engorgement of vasa recta, fibrofatty proliferation and the presence and enhancement of mesenteric adenopathy were compared with the HBI value using Chi-square test, Pearson's correlation and stepwise linear regression analysis.
Results: Of the 40 cases (75% male; mean age 41.3 ± 15.6 years) 85% were in relapse according the Harvey-Bradshaw index. 100% of the cases in relapse showed positive MDCT findings. 83% of patients in remission also showed abnormalities. 97.5% had wall thickness > 3 mm (mean 7.75 ± 2.12 mm), while 95 showed engorgement of vasa recta. The mean mucosal enhancement was 97.05 ± 19.97 U/H (49-128 U/H) predominating the "target" mural attenuation pattern (55%). Mean submucosal enhancement was 52.18 ± 29.33 U/H. Mesenteric adenopathy was observed in 87.5% with a mean attenuation of 87.93 ± 18.95 U/H. 80% had fibrofatty proliferation. Different levels of relapse according the HBI showed a clear linear variation in mucosal and submucosal enhancement values. There is statistically significant low grade association ($R^2 = 0.364$; $p < 0.05$) among the Harvey-Bradshaw index, mural enhancement and wall thickness.
Conclusion: There is a statistically significant low grade association among the Harvey-Bradshaw index, mural enhancement and wall thickness assessed by MDCT enterography in patients with Crohn's disease.

B-311 14:09

Grading of luminal Crohn's disease activity at magnetic resonance imaging

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Purpose: To determine how Crohn's disease (CD) activity at MR enterography/enteroclysis is graded by international experts.
Methods and Materials: Radiologists whom had published on grading luminal CD at MRI between 2006 and 2009 or presented at RSNA and ECR were invited. Participants completed a questionnaire concerning MRI methods and features for grading luminal CD. All items were scored and importance was assessed by means of a visual analogue score (VAS) between 0 (unimportant) and 100 (important).
Results: 8 out of 22 abdominal radiologists (experience 6-16 years) responded, including all 5 radiologists with 3 and/or more recent publications/presentations. All radiologists indicated that bowel wall thickness (VAS mean 69; SD 21), T1-enhancement and the comb sign were used in grading. Bowel wall enhancement was considered as mild-severe disease activity, but the importance was indicated variably (VAS mean 69; SD 28). The comb sign was considered severe disease by 6 radiologists (VAS mean 60; SD 18). Seven radiologists found that an abscess indicated severe disease activity (VAS mean 73; SD 18). T1-stratification (6/8, VAS mean 53; SD 10) and enlarged lymph nodes (6/8, VAS mean 40; SD 15) indicated disease activity. T2-signal intensity (5/8), creeping fat (5/8), stenosis (5/8), the outer contour of bowel wall (4/8), ulcerations (4/8), T2-stratification (2/8) and enhancing lymph nodes (2/8) were less often used.
Conclusion: Bowel wall thickness, T1-enhancement and the comb sign were the features most often used by experienced abdominal radiologists for grading luminal CD. There was no consensus on the relevance of the other imaging features.

B-312 14:18

also EPOS

Development and validation of a MR index of activity for evaluation of Crohn's disease

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Purpose: The objective of the study was to determine the value of Magnetic Resonance (MR) for assessment of Crohn's disease (CD) activity and validate the data in an independent cohort.
Methods and Materials: 50 patients with clinically active or inactive CD were included in the derivation cohort and 48 in the validation cohort. All patients underwent colonoscopy and MR within 48 hours. Endoscopic activity was evaluated by CDEIS and endoscopic lesions were classified as inactive, mild-moderate and severe. The MR parameters evaluated in each colonic segment were: wall thickness, pre- and post-contrast wall signal intensity, relative contrast enhancement (RCE), edema, ulcers, pseudopolyps, and lymph nodes.
Results: A progressive increase in the values of the parameters measured in correlation with disease severity was observed. Significant differences ($p < 0.001$) were found between inactive and mild/moderate and severe disease for wall thickness, signal post-contrast, RCE, edema and ulcers in both derivation and validation cohort. Variables with independent predictive value for determining disease activity and severity in the derivation cohort were wall thickness, RCE, edema and ulcers, with a sensitivity and specificity for detecting disease activity of 0.84 and 0.82 in the derivation cohort and 0.90 and 0.89 in the validation cohort. A significant correlation (r=0.78, $p < 0.001$) was observed between CDEIS and a MR index based on these variables in the derivation cohort and in the validation cohort (r=0.80, $p < 0.001$).
Conclusion: The high accuracy of MR for detection activity and severe lesions brings the possibility of using MR as an alternative to endoscopy in assessment of colonic CD.

B-313 14:27

Quantitative analysis of contrast kinetics for differentiation between active and inactive Crohn's disease on dynamic contrast-enhanced MRI of the small bowel

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Purpose: To assess the possibility to differentiate between active and inactive Crohn's disease (CD) through quantitative analysis of contrast kinetics parameters such as Peak Enhancement (PE) and rate of early enhancement (REE), as obtained from dynamic contrast-enhanced MRI of the small bowel.
Methods and Materials: Seventy patients with biopsy-proven clinically active or inactive CD underwent dynamic contrast-enhanced MRI of the small bowel after oral administration of iso-osmotic solution. PE and REE were calculated by tracing regions of interest on the most thickened and enhancing small bowel loops, and compared between patients with active and inactive CD. In active CD patients, correlation between PE, REE and Crohn's disease activity index (CDAI) was calculated. Finally, sensitivity, specificity, and cut-off for each parameter were calculated by means of receiver operating characteristic curve (ROC) analysis.
Results: PE and REE were significantly higher in active than in inactive CD (216.0±31.7 vs 101.3±25.7 and 3.76±1.31 vs 0.51±0.48, respectively; two-tailed Mann-Whitney test, $p < 0.0001$). CDAI showed a statistically significant positive correlation with PE (Spearman rank test, r_s=0.4585, p=0.0006) and REE (r_s=0.4785, p=0.0003). PE and REE had sensitivity and specificity of 100% with cut-offs of 135.5 and 2, respectively.
Conclusion: Quantitative analysis of contrast kinetics parameters such as PE and REE obtained through dynamic contrast-enhanced MRI of the small bowel allows accurate noninvasive differentiation between active and inactive CD.

B-314 14:36

also EPOS

MR activity assessment in Crohn's disease of the terminal ileum: Free-breathing diffusion-weighted imaging (DWI) and dynamic motility evaluation

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Purpose: To investigate the value of a MRI scoring system including dynamic motility evaluation and free-breathing diffusion-weighted MR imaging (DWI) in the assessment of small bowel Crohn's disease activity.
Methods and Materials: 52 patients with terminal ileum Crohn's disease underwent MR examination after bowel oral distension with polyethyleneglycol solution. MR-assessment of disease activity was based on a scoring system including evaluation of morphology and motility of small bowel and perivisceral structures (true-FISP,

cine-true-FISP, HASTE T2W sequences), parietal signal intensity in DWI and dynamic assessment of parietal contrast enhancement (FLASH T1W-sequence). Patients were included in three categories, using endoscopic biopsy as the standard reference: inactive, mildly-active and moderate-to-severe active disease.

Results: On diffusion-weighted images, bowel segments with inflammation revealed higher signal compared to normal segments, and in particular the sensitivity, specificity, and accuracy for the assessment of disease activity were 84.0, 80.6, and 81.3%, respectively. In the quantitative assessment, the ADC value in the active disease was lower than that in inactive disease. Comprehensive MR examination allowed a detailed and panoramic evaluation of the small bowel in all subjects. MR activity score led to obtain the following sensitivity, specificity, and overall accuracy: 92.5, 86.3, and 90.8%, respectively.

Conclusion: Free-breathing DWI is useful in the visual assessment of Crohn's disease activity; ADC values are decreased in inflamed bowel segments, because of restricted diffusion, and may facilitate quantitative analysis of disease activity. Accurate assessment of Crohn's disease activity is achieved by using a MR activity score providing an overall interpretation of MRI findings.

B-315   14:45

also EPOS

Crohn's disease: CT enterography findings before and after treatment
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Purpose: To study the CT enterography (CTE) findings in Crohn's disease (CD) before and after treatment.
Methods and Materials: Within a period of 3 years, we followed by CTE 50 patients with CD who were undergoing treatment in our hospital. CD was diagnosed by clinical manifestation, enteroscopy and pathology. All have remission of clinical symptoms or alleviation of inflammation can be seen in enteroscopy after medical or surgical treatment. All the CTE were diagnosed by two experienced radiologists with double-blind mean. Each was analysed including position of every focus, thickness of intestinal wall, types of intestinal wall thickening, stenosis of enteric cavity, complications such as abscess or phlegmon and adjacent organs involvement. CT attenuations and thickness of intestinal wall were measured twice every time and got the average.
Results: After treatment, bowel wall thickening attenuated in 88% CD patients, thickness of bowel wall decreased (8.8±2.8 vs 6.4±1.9 mm) (p < 0.001), CT value of bowel wall in portal stage was also declined (p < 0.001), patients with type A or B bowel wall thickening decreased (78.7 to 35.4%), type C or D increased (21.2 to 64.6%) (p < 0.001), patients with Comb like change decreased (88 to 60%) (p=0.001). Patients with moderate and severe enteric cavity stenosis were reduced (74 to 32%) (p < 0.001). The lowest diameter of enteric cavity was increased after therapy (4.8±1.6 vs 7.5±2.1 mm) (p < 0.01).
Conclusion: CTE signs of active bowel inflammation due to CD attenuated after effective therapy. Treatment effect of Crohn's disease can be efficiently evaluated with CTE.

B-316   14:54

Diagnostic and therapeutic impact of MR enterography in Crohn's disease: A prospective non-randomised study
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Purpose: To assess the impact of MR enterography (MRE) on diagnostic confidence and therapeutic strategy in small bowel Crohn's disease.
Methods and Materials: Gastroenterologists unaware of concurrent investigative results, completed a proforma prior to and following MRE for Crohn's disease patients (17 suspected and 7 known). Clinicians indicated a percentage confidence for presence/absence of small bowel involvement, diagnostic confidence on a 6 point scale (1-no, 2-unlikely, 3-possible, 4-probable, 5-almost certain, 6-yes) for disease extent > 30 cm (DE), limited terminal ileum disease (ITI), jejunal disease (JD), strictures (ST), disease activity (AD), colonic disease (CoD), extraluminal complications (EL), need for surgery (NS); and recorded therapeutic strategy. For analysis, patients were divided into 4 categories - (Gp1) suspected small bowel disease with MRE normal and (Gp2) abnormal, and suspected normal small bowel with MRE normal (Gp3) and (Gp4) abnormal.
Results: Groups 1, 2, 3 and 4 contained 5, 16, 3 and 0 patients, respectively. Following MRE, a 60% confidence for presence of disease in group 1 changed to 96% confidence of disease absence; an 83% confidence for the presence of small bowel disease in group 2 increased to 94% (p < 0.001), an 82% confidence for absence of small bowel involvement in group 3 increased to 97%. Diagnostic confidence for DE, ITI, JD, AD, ST, CoD and NS changed in 71, 75, 50, 65, 50 and 33% of patients, respectively. Therapeutic strategy changed in 50% subsequent to MRE.
Conclusion: MRE significantly influences clinician confidence of small bowel CD involvement/extent, and changes therapeutic strategy in 50%.

B-317   15:03

Evaluation of infliximab therapy in active Crohn's disease by dynamic contrast material-enhanced magnetic resonance (D-CE-MR)
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Purpose: To prospectively evaluate MR of the bowel wall in detecting the clinical outcome in active CD after therapy with Infliximab (IFX).
Methods and Materials: 10 patients with active ileal CD were treated with 3 IFX infusions at weeks 0, 2, 6. All patients underwent, pre and post-IFX therapy, serial bowel D-CE-MR, ileocolonoscopy. Clinical activity was measured by CDAI and C-reactive protein (CRP). Region-of-interest-based quantitative analysis of enhancement kinetics was performed. Enhancement curves were obtained at mucosa-submucosa (M-SM) and at muscularis-sierosa (Ms-S) layers. Endoscopy findings were graded according to modified Rutgeerts score and D' Haens score was used for histological assessment. To quantify mural attenuation, the enhancement at M-SM and at Ms-S layers was added and the area under the curve (AUC) pre and post-therapy was calculated (inter-group analysis).
Results: At enrolment, all patients were considered as having active disease: mean CDAI was 220 (95% CI, 146-237). All CD patients showed a clinical response to induction treatment. At baseline, all 10 CD patients showed a layered pattern of enhancement pre-therapy, while all patients following therapy and all controls showed a homogeneous pattern at MRI. The AUC value was significantly greater in patients pre vs post-therapy (p < 0.01); post-therapy AUC value was similar to that in controls.
Conclusion: D-CE-MR seems to be a promising, non-invasive tool to monitor the disease course and helpful to define the correct treatment strategy in active CD patients. Moreover, dynamic enhanced-MRI shows to be useful for the evaluation of clinical response in CD patients following IFX therapy.

B-318   15:12

also EPOS

Effectiveness of contrast-enhanced ultrasonography for characterization of bowel strictures in Crohn's disease
B. Pellicer, E. Romá, M. Muñoz, T. Ripollés, M.J. Martínez, J. Vilar; *Valencia/ES (blancapellicer@comv.es)*

Purpose: To evaluate the effectiveness of contrast enhanced ultrasonography for detection and characterization of bowel strictures in Crohn's disease.
Methods and Materials: 11 patients who underwent surgical intervention due to obstructing bowel strictures detected by US were included. Strictures were classified as fibrotic or inflammatory depending on histological findings on surgical pieces. All patients underwent a US examination (Aplio 80; Toshiba, Tokyo, Japan. Pulse inversion programme at low mechanical index) including morphological description based on B mode findings, vascularisation assessment by semiquantitative scale by using colour Doppler mode, and inflammation grade according to increase percentage in contrast enhanced examination of bowel wall. Contrast agent (1.2 mL bolus of SonoVue; Bracco, Milan, Italy) uptake was measured by using quantitative analysis of the brightness in ROI. Measurement of contrast enhancement was assessed as the increase in wall brightness with respect to the baseline brightness.
Results: Our results show that quantitative measurements of enhancement at contrast-enhanced US correlate with the inflammatory activity shown at histology. Percentage increase in contrast enhancement of the bowel wall in patients with inflammatory strictures was significantly greater in comparison with patients with fibrotic strictures (p=0.017). Wall thickness, grade of colour Doppler and qualitative evaluation of enhancement does not correlate with the histological classification of strictures (p=0.329, 0.122, 0.087).
Conclusion: Quantitative measurement of bowel enhancement obtained by using contrast-enhanced US could be useful to evaluate stricturing Crohn's disease given its capacity to distinguish between inflammatory and fibrotic strictures with an accuracy of 82%.

B-319   15:21

also EPOS

Computed tomographic measurement of abdominal visceral adipose tissue in Crohn's disease: Not a useful marker of disease characteristics
A.M. Ni Laoire, O.M. Delaney, S.R. McWilliams, A.N. Desmond, O.J. O'Connor, M.M. Maher, F. Shanahan; *Cork/IE (ainenilaoire@gmail.com)*

Purpose: Abdominal visceral adipose tissue (VAT) is known to be metabolically active and is a suggested therapeutic target. Increased VAT calculated with CT has been associated with more aggressive disease although study populations have been small (< 40 patients). The aim of this study was to investigate the association between abdominal adiposity and clinical features of Crohn's disease (CD) using abdominal computed tomography (CT).

Friday

Methods and Materials: 152 (82 males) patients with CD were identified and all abdominal CT studies performed (n=276) from June 1999 to June 2009 were included. Demographic and clinical data were obtained by chart review. VAT area (cm²) and subcutaneous adipose tissue (SAT, cm²) were segmented in OsiriX (OsiriX Foundation, Geneva, Switzerland). The impact on VAT/SAT ratio of patient and disease characteristics including disease location, behaviour, number of surgeries, and time to initiation of 6-mercaptopurine (6-MP) and infliximab was assessed.

Results: No significant differences in VAT/SAT ratio were found between disease behaviour or location groups. Significant differences in mean VAT/SAT ratio were found between males and females (p < 0.001). There was a significant positive correlation between age at diagnosis (p < 0.001), duration of disease (p < 0.001), and delay from diagnosis to commencement of 6MP (p=0.029) with VAT/SAT ratio.

Conclusion: The current study based on a larger well-characterised CD population, suggests that although there are some positive correlations between VAT/SAT and patient and disease characteristics, there is little clinical utility of opportunistic calculation of VAT in Crohn's disease.

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

Physics in Radiology

SS 513

MR and CT technologies

Moderators:
L. Knutsson; Lund/SE
M. Tosetti; Pisa/IT

B-320   14:00

Robust pharmacokinetic prostate MRI using an automated per-patient reference tissue artery input function estimator

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Purpose: Pharmacokinetic (PK) MR is important for diagnosing prostate cancer, though depends heavily on the estimation of the arterial input function. In a previous study, it was shown that the per-patient reference tissue (RT) method provides a significant better discriminative performance of PK-parameters, but required manual annotation of RT. In this study, a more clinically applicable fully automated RT segmentation method is proposed, tackling this limitation. The method was tested with our CADx system when discriminating malignant from benign areas in the peripheral zone (PZ).

Methods and Materials: The method auto-segments PZ tissue from DCE derived data by: 1) Bladder segmentation in the start-to-enhance map using Otsu histogram thresholding. 2) Prostate detection with a Hessian based multiscale blob detector in the relative-enhancement map. 3) Normal PZ segmention by morphological operators. The auto-segmented PZ was used to estimate the PK-parameters. In 39 consecutive patients, malignant, benign and normal tissue were annotated, guided by whole mount step-section histopathology. PK-parameters were computed for each ROI and used to train a support vector machine.

Results: In total, 42 malignant, 29 benign and 37 PZ regions were annotated. For all patients, PZ was successfully segmented. The diagnostic accuracy (Az) obtained for differentiating PCa from benign lesions using a conventional general patient plasma profile showed an Az of 0.64 (0.53-0.74). Using the auto-method the diagnostic value improved significantly to 0.76 (0.67-0.86, p=0.017), whereas the manual-method showed Az=0.79 (0.70-0.89, p=0.01).

Conclusion: Automated per-patient RT PK-modeling is feasible. A significantly better Az compared to the conventional fixed calibration was obtained and is similar to using manual per-patient calibration.

B-321   14:09

Small animal imaging with micro-, flat-panel and clinical multi-detector row CT-scanners: An applicability analysis

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Purpose: Decisive parameters of small animal CT imaging have been studied for three CT scanner designs commonly employed. The goal has been to determine which technical CT concept is best suited for addressing the problems of in-vivo small CT animal imaging.

Methods and Materials: Technical scanner concepts comprised clinical MDCT, flat-panel detector Volume-CT (fpVCT) and micro-CT (µCT). Homogeneity, noise, temporal stability, CT number scaling, spatial and low-contrast resolution and radiation exposure have been studied with custom-designed small animal phantoms and

tested in vivo with DCE-CT. Data acquisition and ROI analysis were conducted in a uniform manner for all scanners.

Results: In phantom studies, MDCT and µCT showed good homogeneity (±2.5 HU) and temporal stability (±(2-4) HU). Homogeneity depended on phantom and scan parameters for µCT and fpVCT and was hampered by cupping (40-70 HU) for fpVCT. Noise solely depended on gantry rotation time and was lowest for MDCT (15 HU max). CT number scaling was non-linear for all scanners. Highest spatial resolution was 360 µm (MDCT), 200 µm (fpVCT) and 100 µm (µCT). Low-contrast lesions of ~1 mm could be detected with all systems. Radiation exposure per small-animal whole-body scan ranged 40-440 mGy·cm (µCT), 70-230 mGy·cm (MDCT) and 100-980 mGy·cm (fpVCT). DCE-CT using MDCT and fpVCT allowed determination of rat liver perfusion ((0.0576-0.0980) min^{-1}).

Conclusion: Small animal CT imaging requires careful scanner selection depending on clinical problem: High temporal resolution and overall stability make MDCT best suited for quantitative studies; fpVCT's increased spatial resolution and volume coverage permit motion-gated scanning; highest spatial resolution for studying subject morphology is offered by µCT.

B-322   14:18

Scatter and beam hardening precorrection in case of tube-voltage modulation and shaped prefiltration

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Purpose: To reduce scatter and beam hardening artifacts in X-ray CT scanners with tube voltage modulation and shaped prefiltration.

Methods and Materials: Scatter and beam hardening are prominent artifacts in X-ray CT. Currently, there is no precorrection method that inherently accounts for both tube voltage modulation and shaped-prefiltration. Our method uses detector pixel specific and tube voltage dependent precorrections to account for beam hardening and scatter correction. The parameters of the precorrection functions are determined from a single calibration scan. Thereby, the only assumption on the calibration phantom is that it is homogeneous and made of one single material. In order to calibrate the parameters of the physical model, we use the information of the forward projection of the segmented phantom. A smoothness constraint is applied to the parameter space to regularize the underdetermined system of non-linear equations. The physical model is then used to precorrect CT-scans. Our algorithm was evaluated using simulated and measured data.

Results: In simulation studies, our correction model proved to be nearly perfect and the algorithm showed its abilities by correcting the beam hardening and scatter effects with a relative error below 2.5%. Artifacts in reconstructed images of measured data are significantly reduced compared to the standard reconstruction.

Conclusion: The proposed approach significantly reduces scatter and beam hardening artifacts and can correctly address scans with tube voltage modulation.

B-323   14:27

Dual energy CT material decomposition from inconsistent rays (MDIR)

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Purpose: To correctly address beam-hardening during material decomposition in Dual Energy CT (DECT) with geometrically inconsistent rays.

Methods and Materials: DECT generally allows to correctly deal with beam hardening. However, currently there exists no method to do so in cases where geometrically non-identical (inconsistent) rays are acquired for the high-energy spectrum and the low-energy spectrum. This is frequently the case e.g. when using dual source spiral mode, tube voltage switching, or subsequent scans with different tube voltages. We propose an iterative method that allows correcting beam-hardening induced artifacts in material decomposition results (e.g. water density and bone density images). The method is evaluated using simulated data in various trajectories and measured data running the Siemens Somatom Definition Flash scanner in dual energy dual source spiral mode.

Results: In simulations and measurements, both kinds of beam hardening induced artifacts (density errors and streak artifacts) get completely corrected. Consequently, monoenergetic images at diagnostic energy (e.g. 70 keV images) do not show any beam hardening artifacts after using the proposed method. As two iterations are found to be sufficient, the computational load is moderate. Thereby, the method allows maintaining constant image noise and spatial resolution.

Conclusion: MDIR is the first method that is able to eliminate beam hardening induced artifacts in the frequent case of geometrically inconsistent raw data sets. The computational load is moderate, and spatial resolution and image noise are preserved.

B-324 14:36

Evaluation of an image-based method to calculate monoenergetic images from dual energy images

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Purpose: Raw data based methods for the calculation of mono-energetic images are well known. However, commercially available Dual Source CT systems with DE capabilities cannot utilize them due to non-matching X-ray trajectories. Image based methods allow to overcome this limitation and allow the calculation of mono-energetic images.

Methods and Materials: DE images were acquired on a Definition Flash (Siemens, Germany) using three different acquisition settings: 80/140 kV, 80/140 kV+SN and 100/140 kV+SN ('+SN': additional beam pre-filtration). Cylindrical (20 to 30 cm diameter), elliptical and anthropomorphic phantoms simulating different patient sizes were investigated. To assess the accuracy of the calculated mono-energetic images, iodine inserts of different size and concentration (7.5 to 30 mg/ml) were scanned. DE images were post-processed using "mono-energetic" (syngo DualEnergy, Siemens), which first calculates material density images using calibration tables and then based on the physical attenuation coefficients mono-energetic images (40 and 190 keV).

Results: There was very good agreement between simulation, real and measured iodine densities over the whole range of keV levels in the case of cylindrical and elliptical water phantoms (difference < 10%). For the anthropomorphic phantoms - in particular for energy levels below about 50 keV and above 100 keV - slightly larger errors occurred. The use of the 80/14 0 kV+SN setting led to significantly improved statistical errors.

Conclusion: Image-based methods for the calculation for mono-energetic images from DE CT images are feasible. The tin filter improves image quality for low and high keV settings. In the absence of pronounced beam hardening artifacts, calculated CT values are accurate.

B-325 14:45

Development of a software package for left ventricular volumetric and functional analysis on cine MR images

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Purpose: To develop and validate a software package for the semiautomatic segmentation of left ventricle on short-axis cine MR images and subsequent estimation of cardiac parameters.

Methods and Materials: Cardiac MRI was performed in 22 consecutive patients with coronary artery disease. A software running under Windows was developed for the automatic detection of left ventricular (LV) endocardial and epicardial contours on each MR image using a Bayesian flooding segmentation algorithm and weighted least squares B-splines minimization. The obtained contours could be manually corrected with a spline drawing tool integrated into the software. The software automatically calculated LV volumes, ejection fraction and mass. Three independent observers evaluated the reproducibility of the semiautomatic image analysis. Software calculations were compared with those derived by manually tracing LV contours.

Results: The mean number of automatically obtained outlines not requiring any manual correction was 82.1±17.3% of the total number of contours per study. The mean time for semiautomatic segmentation was 2.2±0.7 min per patient. The LV parameters obtained by semiautomatic segmentation and manual tracing were not significantly different (p> 0.05), and they were highly correlated (r> 0.82). The mean difference between manual and semiautomatic image analysis for estimating end-diastolic volume, end-systolic volume, ejection fraction and mass was 6.4±8.0 ml, 3.0±5.6 ml, -0.5±4.1% and -6.7±12.8 g, respectively. The intraobserver and interobserver variability for the semiautomatic determination of LV indices was 0.7-1.3 and 0.8-3.7%, respectively.

Conclusion: The developed software package provides accurate, reproducible and quick estimations of LV volumetric and functional parameters from MRI data.

B-326 14:54

Technical feasibility and potential artifacts of whole-body MRI at 1.5 Tesla and 3 Tesla: A comparative study

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Purpose: To analyze the impact of altered magnetic field properties on image quality and artifacts when a whole-body MRI (WB-MRI) protocol at 1.5 Tesla is migrated to 3 Tesla.

Methods and Materials: 15 volunteers underwent non-contrasted WB-MRI at 1.5 and 3 Tesla. Coronal T1w-TSE- and STIR-imaging of the whole-body and spine was performed. Also, axial HASTE-imaging of the lung and abdomen, T1-/T2w-TSE-, GRE- and EPI-sequences of the brain were performed, including respiratory-triggered T2w-TSE-sequences of the liver. Both data sets were compared by two independent readers assessing image quality/artifacts on a five-point scale. Quantitative grading for image quality/artifacts was defined as means and standard deviation.

Results: Overall image impression was both rated as "good" at 1.5 and 3 T for T1-w-TSE- and STIR-imaging of the whole body and spine. Yet, quantitative image grading values were significantly better for T2-w-TSE of the liver and brain at 1.5 T (p < 0.05). Better image homogeneity and less dielectric effects were observed at 1.5 T for T1-w-TSE- and STIR-WB-MRI (P < 0.05), yet without significant impact on diagnostic value. Susceptibility artifacts were higher for T1w-GRE-imaging of the brain at 3 T, compared to the TSE-sequence at 1.5 T (ns) without impact on diagnostic value. Overall scan time was reduced at 3 T (40:28 min) compared to 1.5 T (45:44 min).

Conclusion: WB-MRI is feasible at 3 T with diagnostic image quality. Compared with 1.5 T-WB-MRI, 3 T-WB-MRI shows significantly more artifacts with a mild to moderate influence on image assessment. Overall scan time is further reduced at 3 T at constant image resolution.

B-327 15:03

also EPOS

In vivo characterization of thermal properties of kidney tissue by MRI thermometry coupled with high intensity focused ultrasound and modulated perfusion

F. Cornelis, B. Quesson, R. Hubrecht, Y. Le Bras, C. Moonen, N. Grenier; *Bordeaux/FR (francoiscornelis@hotmail.com)*

Purpose: This study suggests to evaluate in vivo and quantitatively the effects of perfusion and absorption rate and the thermal diffusivity implied in the deposit and the transfer of the thermal energy during the application of the HIFU according to the bio heat transfer model (BHT) to biological tissues.

Methods and Materials: In order to validate the theory, non-destructives heating by HIFU monitored by rapid volumetric MRI thermometry were performed on pig kidney, associated with a perfusion modulation using angioplasty balloons. Absorption and perfusion rates were determined by fitting the integrated thermal load curves in time (spatial integration of the thermal maps) and with an analytical solution of the BHT equation proposed for single point HIFU heating. Thermal diffusivity was determined independently by analyzing the spatial spread of the temperature in time during the cooling period. Moreover, destructives heating followed by several non-destructives heating were realized in order to evaluate in vivo the effect of the HIFU on the perfusion rate, the absorption and the diffusion coefficient and their variations in time.

Results: The BHT model is adapted to describe the spatio-temporal evolution of tissue temperature in the renal cortex. The results show an excellent agreement with the theory and modifications of the perfusion rate after destructive heating. Absorption coefficient and thermal diffusivity were found to be independent of flow.

Conclusion: These results will make possible a better control of the thermal ablation by HIFU at the time of clinical procedures and could limit adverse effects.

B-328 15:12

Reproducibility of multi echo susceptibility weighted imaging (SWI)

C. Denk, A. Rauscher; *Vancouver, BC/CA (ch.denk@gmail.com)*

Purpose: Brain iron content is often regarded as a potential biomarker for many neurological diseases. Susceptibility weighted imaging (SWI) is sensitive to iron content and is therefore gaining popularity in the imaging of multiple sclerosis, Parkinson disease and other neurological disorders. However, the reproducibility of its metrics (magnitude, phase, combined, T2* decay) has not been investigated yet. Therefore, we assessed reproducibility of these metrics.

Methods and Materials: SWI (TE=13-41 ms, deltaTE=7 ms, voxel size = 0.4x0.4x0.75 mm³) was performed twice in 12 healthy subjects (average age 34) on a 3 T Philips magnet. Time between scans was 1-3 days. Coefficient of variation (COV), linear regression (LR), Pearson correlation (PC) and Spearman correlation (SC) were calculated in 28 different brain regions (ROI) in phase, magnitude, combined and R2* maps.

Results: The [mean±SD, median] of COV in all ROIs and all subjects were [0.7±2.4%, 0.27%] in phase, [2±2.5%, 1.1%] in magnitude, [2.4±3.9%, 1%] in combined and [3.9±4.7%, 2.6%] in R2*, with an overall [1.8±2.7%, 3%] COV value. Correlation and regression were consistently good for each individual region. Averaged over all images, all regions and all subjects PC was 0.7 (mean)±0.25 (SD), SC was 0.61±0.21, LR slope was 0.74±0.3 and LR intercept of 0.30±0.35.

Conclusion: The low COV values in all metrics indicate high reproducibility. The reproducibility of phase is better than SWI and in particular R2*. Phase may therefore be better suitable than R2* for the assessment of abnormal cerebral iron content.

B-329   15:21

Presurgical visualization of cerebral superficial veins with susceptibility weighted imaging (SWI)

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Purpose: Image guided brain surgery may use veins on the brain's surface as landmarks since the spatial relationship between sulci and blood vessels is not altered by brain edema-shrinkage, or brain shift during surgery. Conventional methods use contrast enhanced (CE) MR angiography. We propose SWI and novel post processing techniques to visualize the brain's superficial veins at high spatial resolution without a contrast agent.
Methods and Materials: SWI whole brain scans were acquired in 6 healthy volunteers and presurgically in 7 epilepsy patients on a 3 T Philips system. SWI combines magnitude and phase of a high resolution fully flow compensated 3D gradient echo scan. The phase images were unwrapped using the unwrapping tool PhUN and then converted into a phase mask and multiplied with the corresponding magnitude to create SWI venograms. These venograms were median filtered to suppress the background tissue. Vesselness filter and Vessel Enhancing Diffusion filters were used iteratively to enhance tubular structures. The 3D rendered superficial vein images were overlaid on a structural scan and were compared with CE angiograms.
Results: A close spatial relationship between sulci and veins was seen in all subjects, and displayed the superficial venous architecture on the whole brain. More details, such as smaller veins, were resolved with SWI compared to CE angiography.
Conclusion: This non-invasive visualization method of superficial veins at high spatial resolution without the need of a contrast agent may lead to a more precise presurgical and surgical neuronavigation. The postprocessing steps could be easily translated into clinical routine.

14:00 - 15:30   **Room L/M**

Vascular

SS 515

Non-invasive imaging of the aorta and pulmonary arteries

Moderators:
T. Frauenfelder; Zurich/CH
T. Sabharwal; London/UK

B-330   14:00

also EPOS

Influence of iodine delivery rate on pulmonary artery attenuation in CT angiography in the evaluation for pulmonary embolism

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Purpose: MDCT angiography of the pulmonary arteries is regarded the gold-standard in the detection of pulmonary embolism (PE). The contrast injection regimen is crucial in the examination procedure. In patients with poor venous access, contrast material is sometimes administered through smaller lines and at lower flow rates to prevent extravasation. The purpose of this study was to evaluate the influence of the iodinedeliveryrate (IDR) on the attenuation values in the pulmonary trunk (PA).
Methods and Materials: 208 consecutive patients with suspicion of PE were included. Imaging was performed on a 64-slice CT (Brilliance64, Philips), with an acquisition duration of 3.5-4.0 s. Pre-warmed (37°C) contrast (70 ml Iobitriodol; Xenetix, Guerbet) followed by a saline chaser (35 ml) was delivered with flow rates of 2-5 ml/s (IDR: 0.7-1.75 gI/s). Scandelay was adapted according to a testbolus procedure (20 cc, same IDR). HU values were measured in the PA and compared in a group analysis (Student t-test, Spearman's rho, level of significance < 0.05).
Results: In 138 patients, an IDR of 1.75 gI/s was applied (44:1.4 gI/s, 5:1.23 gI/s, 12:1.05 gI/s, 6:0.875 gI/s and 3:0.7 gI/s). A positive relationship (r = 0.29; p < 0.0001) was observed for the IDR and the corresponding attenuation values in the PA. The average HU (mean ± SD) for the patients receiving > 1.4 g I/s (329 ± 91 HU) was significantly higher than for the patients with lower flow rates < 1.23 gI/s (251 ± 72 HU), P < 0.0001.
Conclusion: Usage of a test-bolus for the work-up of PE leads to a robust examination protocol in CT angiography. With the examination protocol given, an IDR of > 1.4 gI/s with an injection duration of approx. 17 s should lead to an average attenuation level of > 300 HU in the pulmonary vasculature.

B-331   14:09

Prospective electrocardiography-triggered CT angiography of the thoracic aorta in patients with atrial fibrillation or accelerated heart rates: Feasibility and image quality

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Purpose: To prospectively investigate feasibility and image quality and to calculate radiation dose estimates for computed tomography angiography (CTA) of the thoracic aorta in patients with atrial fibrillation or accelerated heart rates using prospective electrocardiography-triggered sequential dual-source data acquisition in end-systole.
Methods and Materials: This study was institutional review board-approved; written informed consent was obtained. Of 233 consecutive patients referred for ECG-assisted CTA of the thoracic aorta, 15 with accelerated heart rates (> 80 bpm) and 25 with atrial fibrillation were prospectively and consecutively enrolled (mean age 70±16.5 years). All patients underwent prospective ECG-triggered sequential dual-source CTA (Somatom Defintion, Siemens) with tube current (250 mAs/rot) centered at 250 ms past the R-peak in the cardiac cycle (end-systole). Tube voltage was adjusted to body mass index (BMI < 25.0 kg/m², 100 kV; ≥25.0 kg/m², 120 kV). Presence of motion or stair-step artifacts of the thoracic aorta was independently assessed by two readers. Radiation dose estimates were calculated from the dose-length-product.
Results: All CT images showed diagnostic image quality with no examination rated non-diagnostic. Minor step artifacts were present in one patient (7%) with an accelerated heart rate and in 9 patients (36%) with atrial fibrillation. Overall interobserver agreement on image quality was excellent (κ=0.94). Mean CTDI$_{VOL}$ was 4.8±1.2 and 12.9±1.9 mGy, mean estimated effective dose was 2.0±0.6 and 5.3±1.0 mSv for 100 and 120 kV, respectively.
Conclusion: Prospective ECG-gated sequential dual-source CTA of the thoracic aorta is feasible despite heart rates > 80 bpm or atrial fibrillation, making motion-free imaging of the thoracic aorta possible at a considerable low radiation dose.

B-332   14:18

Saving dose in chestpain CT examination using a high-pitch dual spiral technique

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Purpose: To evaluate ECG-triggered chestpain CT-scans using high-pitch dual-spiral protocols, and to measure radiation dose and image quality both in an Alderson phantom and in a group of patients.
Methods and Materials: An anthropomorphic Alderson phantom was assembled with thermoluminiscent detectors (TLD) and its chest was scanned on a Dual Source CT (Siemens Somatom Definition Flash), which can simultaneously integrate data from both sources (120 kVp, collimation: 128x0.6 mm, pitch: 3.2, scan range: 276 mm, scan speed: 430 mm/s). Reference scans were obtained with a conventional gating technique (120 kVp, ECG-pulsing-interval: 30-70% of the R-R cycle, pitch 0.3). Equivalent dose was calculated from the TLD measurements and the dose report of the CT scanner. 31 patients were scanned with the high pitch protocol, using an ECG-timing, such that the heart is scanned entirely during diastole. Image quality of the coronary arteries was assessed on a per-segment-basis (15 segments per patient; 2 point-scale; 1: diagnostic, 2: non diagnostic).
Results: In the Alderson phantom, measured dose was 2.65 mSv with the high pitch protocol and 19.27 mSv with the standard chestpain protocol. In patients with heart rates below 65 bpm, 95.4% of coronary segments were diagnostic. In patients with heart rates above 65 bpm, 72.8% were diagnostic.
Conclusion: High-pitch chestpain protocols only require a fraction of the dose of conventional ECG gated chestpain protocols. With less than one second, the scan time is very short. This protocol can be recommended for patients with unclear chest pain with rhythmic heart rates below 65 bpm.

B-333   14:27

Dynamic cine CT angiography of the proximal aneurysm neck: Conformational changes during the cardiac cycle with possible consequences for endograft selection and sizing

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Purpose: To assess the clinical value and potential impact in the endograft treatment of the dynamic-cine-CT-Angiography of the proximal neck.
Methods and Materials: Electrocardiographically-gated CTA datasets were acquired utilizing a 64-slice CT scanner on 30 consecutive pre-operative AAA patients. Pulsatility measurements were taken at 3 clinically relevant levels within the aneurysm neck: 2-cm above the highest renal artery; at the level of renal arteries;

1-cm below the lowest renal artery. Manual CTA measurements were randomly performed on axial images twice by three independent readers. Aortic area and diameter changes were determined. On the basis of standard static axial images, one vascular surgeon and one interventional radiologist selected the size of the potential infrarenal stent-graft main body to implant (diameter available: 23, 26, 28.5, and 32 mm). The size of the stent-graft main body diameter selected was compared to the dynamic measurements obtained.
Results: Significant aortic pulsatility exists within the aneurysm neck during the cardiac cycle. Proximal neck diameter significantly increased during the cardiac cycle with a maximum increase of up to 11.2%; in detail, when compared with dynamic measurements, the oversizing performed in the selection of stent-graft main body was inadequate in about 25% of patients.
Conclusion: Static CT imaging may not adequately size the stent-graft main body diameter due to aortic pulsatility, resulting in potential endograft undersizing, migration, type I endoleaks, and consequently poor patient outcomes. Dynamic CT imaging may also allow a correct selection of stent-graft in terms of fixation based on the aortic pulsatility pattern.

B-334 14:36

Dual energy CT angiography for the detection of endoleaks after endovascular aneurysm repair

H. Seifarth, A. Braegelmann, M. Puesken, B. Buerke, J. Wessling, D. Maintz, W. Heindel; *Münster/DE (seifarth@uni-muenster.de)*

Purpose: To determine whether a single delayed phase examination is suitable for the detection of endoleaks after endovascular aneurysm repair (EVAR) using dual energy CT Angiography (DE-CTA).
Methods and Materials: 50 consecutive patients underwent DE-CTA in the follow-up after EVAR. For all patients, true non-enhanced images (TNI) were acquired. Contrast enhanced images were acquired in the arterial and delayed phase using the dual energy scan mode. Virtual non-enhanced images (VNI) were calculated from the delayed phase images. Depiction of calcifications in TNI and VNI was rated either as identical or different. Presence of endoleaks was evaluated in the arterial phase and in the three datasets from the delayed phase (140 kV, mixed, 80 kV). Depiction of endoleaks in all phases was rated using a three point Lickert scale.
Results: Calcifications in TNI and VNI were rated identical in all patients. Arterial phase images revealed 26 endoleaks (2 type I, 24 type II). Delayed phase images revealed 24 (140 kV), 27 (mixed) and 27 endoleaks (80 kV). Depiction of endoleaks was rated excellent in arterial and 80 kV delayed phase images (1.1±0.3 and 1.2±0.4) and good in mixed and 140 kV delayed phase images (1.5±0.6 and 1.8±0.8). No significant difference was found between ratings in the arterial and 80 kV delayed phase images (p=0.3). A significant difference was found between ratings in the arterial phase and mixed and 140 kV delayed phase images (p < 0.05).
Conclusion: Delayed phase imaging using DE-CTA with virtual non-enhanced images allows a reliable detection of endoleaks after EVAR compared to the standard triphasic approach.

B-335 14:45

Measuring the change in vessel movement induced by aortic arch repair

E. Schwartz, G. Langs, R. Gottardi, M. Czerny, J. Holfeld, P. Peloschek, C. Loewe; *Vienna/AT (Ernst.Schwartz@meduniwien.ac.at)*

Purpose: Details about the change in vessel motion induced by procedures such as total supra-aortic rerouting or double vessel transposition followed by stent-graft placement are highly valuable for post-operative risk assessment for the individual patient. We propose an automated method to quantitatively assess such changes in the motion pattern of the aortic arch.
Methods and Materials: The vessel lumen is first segmented in each frame of a CTA sequence using level set methods. A dynamic model of the aorta is computed by establishing correspondences between approximately 2000 virtual measurement points on the surface of the aorta using a minimum description length criterion. Based on the model local stretching, bending and pulsatility were measured. The method was evaluated on a set of 6 gated CTAs at 10 frames per cardiac cycle and a resolution of 0.67 mm.
Results: We validated the performance of the method using the reproducibility of its results. 5 distinct models were learnt from every sequence using different sets of measurement points. The resulting mean inter-model variability for the same sequence lay between 0.414 and 0.555 voxels.
Conclusion: The method obtains precise measurements of the local deformation patterns of the aortic arch. It allows for the comparison of the measurements on models acquired pre-treatment, post-transposition, and post-stent-graft-placement. They enable the physician to quantify the change in motion of the aortic arch caused by the intervention. It is an essential tool in understanding the effect of the procedure, and in assessing patient specific treatment risks and outcome prediction.

B-336 14:54

Combined MRI: Imaging of deep venous thrombosis and lung arteries after a single injection of blood pool MR contrast agent gadofosveset

A. Hansch, G. Poehlmann, H.-J. Mentzel; *Jena/DE (andreas.hansch@med.uni-jena.de)*

Purpose: The aim of this study was to evaluate the diagnostic suitability of the new intravascular contrast agent Gadofosveset (Vasovist®, Bayer Schering Pharma AG, Berlin/Germany) for the magnetic resonance imaging (MRI) of the venous system of the lower leg and of the lung arteries.
Methods and Materials: Thirty six consecutive inpatients with DVT (mean age 57.5 ± 16.2 [SD] years) were prospectively enrolled in the study between June 2008 and July 2009. All patients presenting with venous thrombosis confirmed by ultrasound (US) but without clinical signs of PE were enrolled in the study. MRI was performed with a 1.5-T scanner (Magnetom Avanto, Siemens Healthcare/Medical Solutions, Erlangen, Germany). The pulmonary arteries were imaged using a 3D Fast Low Angle Shot (FLASH) gradient recalled echo sequence. The imaging as whole-body venography was performed by fat-suppressed 3D gradient echo Volume Interpolated Breath-hold Examination (VIBE FS). The diagnostic quality of Gadofosveset-enhanced MRI was scored on a 5-point scale.
Results: The diagnostic quality of Gadofosveset-enhanced MRI was very good. Compared to US, this method detected significantly (p < 0.05) more DVT in the pelvic region, as well as in the upper and lower leg. Additionally, Gadofosveset-enhanced MRI was able to reveal the presence of PE in 9 of the 36 asymptomatic patients.
Conclusion: The study shows the suitability of a combined protocol for the diagnosis of PE and DVT in MRI using Gadofosveset. This method is more sensitive in the detection of DVT compared to US. MRI detected PE in 25% of the pulmonary asymptomatic patients.

B-337 15:03

Imaging the thoracic aorta: Contrast-enhanced 3D-MRA versus 3D-TrueFISP with multiple image reconstruction using CLAWS

N. Kawel, L. Winter, P. Jhooti, M. Zellweger, K. Scheffler, J. Bremerich; *Basle/CH*

Purpose: Magnetic resonance angiography (MRA) is widely used for imaging of the thoracic aortic, but contrast enhanced 3-dimensional angiography CE-3D-MRA is hampered by motion artefacts, particularly at the aortic root. This limitation has been overcome by ECG- and respiratory-gated MRA. This technique, however, can be very time consuming. Recently, a new ECG- and respiratory gated 3D-TrueFISP sequence with multiple image reconstruction using CLAWS (3D-TrueFISP-CLAWS) compensating for changes of respiratory pattern has become available. The purpose of this study was to compare standard CE-3D-MRA with 3D-TrueFISP-CLAWS with respect to image quality and acquisition times.
Methods and Materials: 13 patients (32-64 years) were imaged on a 1.5 Tesla scanner. For analysis, acquisition times and image quality for the 3D-TrueFISP-CLAWS and the CE-3D-MRA were compared. Image quality of different parts of the thoracic aorta and its branches was scored on a scale from 1 (structure not visible) to 5 (excellent visibility).
Results: The acquisition times for 3D-TrueFISP-CLAWS and CE-3D-MRA were 9 min 37 s and 5 min, respectively. Visibility of the aortic anulus, sinus, sinutubular junction, proximal coronaries, ascending, and descending aorta was better on 3D-TrueFISP-CLAWS as compared to CE-3D-MRA (3.5/2.3; 4.1/2.8; 4.1/2.9; 3.8/1.5; 4.6/3.7; 4.8/4.3). Visibility of aortic arch and supraaortic vessels, on the other hand, were similar with both techniques (4.1/4.3; 4.3/4.3).
Conclusion: Compared to standard CE-3D-MRA, 3D-TrueFISP-CLAWS requires no contrast material and provides superior image quality of the aorta and its branches in structures adjacent to the heart and enables an acceptable acquisition time of less than 10 min.

B-338 15:12

Aortic pulse wave velocity estimation using flow sensitive 4D MRI at 3 T

A. Frydrychowicz[1], A. Harloff[2], W. Wallis[2], S. Brendecke[2], J. Simon[2], M. Markl[2]; [1]*Madison, WI/US*, [2]*Freiburg/DE (afrydrychowicz@uwhealth.org)*

Purpose: To determine the value of flow-sensitive 4D MRI for the assessment of pulse wave velocity (PWV) as a measure of vessel compliance in the thoracic aorta.
Methods and Materials: Examinations on a clinical 3 T scanner (TRIO, Siemens) were performed after IRB approval and informed consent. Data from 12 healthy volunteers (24.5±3.2 years) were compared with 25 stroke patients (66.1±7.8 years) with known aortic atherosclerosis and 9 age-matched normals (64.2±7.8 years) not compromised by aortic atherosclerosis. Pulse wave velocity calculations were based on velocity data incorporating the entire thoracic aorta and were compared to data relying on two specific anatomical landmarks only. For calculation of PWV,

Friday

time-to-peak (TTP) and time-to-foot (TTF) were automatically derived from the waveform and compared to recently proposed cross-correlation (XCor).

Results: TTF and XCor provided more stable estimations of waveform changes along the path of the aorta (i.e., less scattered data) if compared to TTP. TTF showed best correlation to previously published data and was used for further analysis. As expected, global aortic PWV was higher in atherosclerotic patients (7.03±1.19 m/s) as compared to age-matched controls (6.40±0.97 m/s). Both groups revealed significantly increased velocities in comparison to young volunteers (4.39±0.32 m/s, p < 0.05). Estimation of measurement inaccuracies and error propagation analysis demonstrated minor uncertainties in measured flow waveforms and moderate relative errors below 16% for aortic compliance in all 46 subjects.

Conclusion: PWV calculation based on 4D MRI is feasible exploiting the full volumetric coverage of the sequence. This may be specifically advantageous in tortously wound aortae of some atherosclerotic patients.

B-339 15:21

Analysis of aortic hemodynamics after treatment for coarctation using flow-sensitive 4D-MRT at 3 T

A. Frydrychowicz, D. Hirtler, R. Arnold, J. Geiger, M. Langer, J. Hennig, M. Markl; *Freiburg/DE (afrydrychowicz@uwhealth.org)*

Purpose: To evaluate alterations of aortic hemodynamics and derived vessel wall parameters after treatment of coarctation by flow-sensitive cine-3D-MRI and to compare findings to healthy volunteers.

Methods and Materials: 28 patients (16.5±8.0 years, range 4-36) after coarctation repair (end-to-end anastomosis, Waldhausen and Vossschulte repair, graft interposition, endovascular dilatation) and 19 volunteers (35.3±18.1 years, range 20-75) were included after IRB approval and informed consent. Flow-sensitive cine 3D phase contrast MRI at 3 T (TRIO, Siemens) was applied. Visualization was achieved with EnSight (CEI, USA) applying streamlines and particle traces. Quantification of vessel wall parameters was performed with MatLab. Analysis criteria were blood flow velocity, helicity, additional helices, development of vortices, wall shear stress (WSS), and oscillatory shear index (OSI).

Results: Visual analysis revealed preserved helicity in the patients, an increased number of additional helices (25/28 patients) and vortices in the aorta, and notably vortices in the orifices of the supraaortic arteries in 18/28 patients. The operative site showed a relative re-stenosis with a diameter of 13.3±4.0 mm (range 6-24) and a post-stenotic dilatation of 18.8±6.5 mm (range 7-43), MR velocity measurements corresponded well with Doppler ultrasound. Quantitative analyses revealed significantly increased circumferential and magnitude WSS (0.44±0.17 N/m^2 in patients vs. 0.27±0.08 N/m^2 in volunteers, p < 0.005) and decreased OSI. No significant differences between operative strategies were found.

Conclusion: Flow-sensitive MRI revealed marked changes in the hemodynamics after coarctation repair. Follow-up examinations have to clarify whether a predictive value can be attributed to hemodynamics or derived vessel wall parameters. However, quantitative analyses point towards an influence concerning arterial remodeling.

14:00 - 15:30   **Room N/O**

Neuro

SS 511b

Advances in CT

Moderators:
A. Drevelegas; Thessaloniki/GR
P. Vilela; Almada/PT

B-340 14:00

Stroke-CT: CTA or perfusion-CT? Which should be done first?

D. Morhard, C.D. Wirth, M.F. Reiser, H.-C. Becker, B. Ertl-Wagner; *Munich/DE*

Purpose: Standard stroke CT protocols start with non-enhanced CT followed by perfusion-CT (PCT) and end with CTA. To ensure good image quality of CTA without substantial venous contamination (superimposition) an interval of several minutes between PCT and CTA is standard practice. The purpose of our study was to evaluate the influence of changing the order of PCT and CTA on quantitative perfusion parameters and venous contrast enhancement.

Methods and Materials: Stroke CT data sets of 86 patients, 47 patients with CTA before PCT and 39 with CTA after PCT were analyzed in this study. In all cases, parameter maps of cerebral blood flow, cerebral blood volume, time to peak and mean transit time as well as contrast enhancement of parenchyma (unaffected hemisphere) and of the superior sagittal sinus (SSS) were obtained.

Results: Neither perfusion parameters nor the attenuation of brain parenchyma demonstrated significant differences (all p> 0.18) between the two groups. The mean attenuation values within the SSS at the time of the baseline scan of the PCT differed significantly between the two groups (PCT first: 48.8 HU; CTA first 124.4 HU; p < 0.001).

Conclusion: Previous contrast agent administration for CTA had no significant influence on PCT. Performing PCT first induced a contrast agent preloading in the venous vessels which could result in lower CTA image quality. A reversal of the "classic" order of CTA and PCT in stroke-CT avoids venous preloading in CTA so that the complete examination might be performed within a shorter period of time.

B-341 14:09

Arterial input function characteristics for CT-perfusion in normal patients and patients with carotid stenosis or occlusion

E.J. Smit, J.W. Dankbaar, H.W.A.M. de Jong, A.M. Mendrik, B. van Ginneken, M. Prokop; *Utrecht/NL (ewoudsmit@gmail.com)*

Purpose: In quantitative brain CT-perfusion (CTP), commonly only one arterial input function (AIF) is chosen for the entire brain. Due to dispersion and delay caused by pathology or distance between the AIF and the measured region, one AIF may result in incorrect regional perfusion measurements. We compared timing and dispersion characteristics of AIFs selected in various major cerebral arteries.

Methods and Materials: We retrospectively identified 10 normal patients and 15 patients with unilateral internal carotid artery (ICA) occlusion or stenosis who underwent CTP and CT-angiography. We used time-to-peak (TTP) and mean-transit-time (MTT) to characterize delay and dispersion of AIFs in both ICAs, the basilar artery, an anterior cerebral artery, both middle cerebral arteries, and both posterior cerebral arteries. AIFs were calculated with Philips perfusion software. Mean differences in TTP and MTT between the various arteries were calculated with a 95% confidence interval.

Results: In normal patients, no right-to-left differences were found in TTP and MTT. Significant differences were found between the cerebral arteries in TTP (0.7-0.9 s) and MTT (0.6-1.4 s). In patients with ICA pathology, TTP and MTT were significantly higher (1.5 s) in the pathologic ICA compared to contralateral. Compared to normal patients, differences in TTP were similar (0.8-1.0 s), but larger for MTT (1.3-1.9 s).

Conclusion: TTP and MTT vary between different cerebral arteries, with MTT differences being more prominent in patients with unilateral ICA pathology compared to normal patients. This suggests that TTP and MTT are separately influenced by pathology and traveled distance. Therefore, a single AIF may not be suited for regional brain perfusion measurements.

B-342 14:18

Carotid artery wall thickness and leukoaraiosis: Evaluation using multi-detector row CT angiography

L. Saba, R. Sanfilippo, M. Atzeni, G. Caddeo, R. Montisci, G. Mallarini; *Cagliari/IT (lucasaba@tiscali.it)*

Purpose: To determine whether carotid artery wall thickness (CAWT) studied by using multi-detector-row CT angiography (MDCTA) is correlated to leukoaraiosis and its severity.

Methods and Materials: 98 patients (56 male, mean age 73 years) were retrospectively studied by using multi-detector row CT. Supra-aortic vessels analysis and CT brain were acquired in the same procedure. In each patient, CAWT was measured with an internal digital caliper and presence and severity of leukoaraiosis was assessed. Continuous data were described as the mean value ± standard deviation (SD) and they were compared with Student t test. Correlation coefficient by using Pearson statistics and ROC curves were calculated. A p value < 0.05 was considered as mean statistical significance.

Results: Measurements of the distal common CAWT ranged from 0.5 to 1.6 mm. A correlation between leukoaraiosis and increase of CAWT was observed (Pearson correlation 0.373; p < 0.001). By using as threshold 0.9 mm, it was found an important statistical association between thick CAWT and leukoaraiosis: (p < 0.001). By using 0.9 mm as threshold ROC curve analysis indicated a sensitivity of 58% and a specificity 75% for leukoaraiosis.

Conclusion: The results of this study showed a statistically significant correlation between increase of CAWT and leukoaraiosis (and its severity).

B-343 14:27

Evaluation of collateral flow in cerebral vessel occlusion using 4D CT-angiography: Impact on the outcome after multimodal recanalization therapy

V. Hesselmann, T. Niederstadt, H. Seifarth, R. Dziewas, W. Schwindt, D. Maintz, W. Heindel; *Münster/DE (maintz@uni-muenster.de)*

Purpose: To visualize the collateral flow by calculating 4D CT-angiography from stroke CT and estimate its impact on the tissue outcome after recanalization therapy.
Methods and Materials: We included 62 patients with ischemic stroke in whom either an intravenous or intraarterial thrombolysis or a mechanical recanalization was performed. A perfusion dataset was reconstructed with a slice thickness of 1.5 mm and visualized using a volume rendering display, resulting DSA-like data-sets. 2 independent readers evaluated the quality of the collateralization using a 3 point Lickert scale. These data were compared to the results for the CT volume perfusion. The size of the infarction was estimated on the basis of time to peak maps using the ASPECT score as well as in follow-up CT.
Results: Of the 62 patients 48 patients suffered from occlusion of the middle cerebral artery or its branches. In 28 patients (58.3%), a missmatch between was found. Collateral flow was weak in 35.3% of patients, moderate in 29.2% and good in 33.3% of patients. In all patients with mismatch, recanalization was successful as shown in follow-up CT. In all patients without mismatch, infarct demarcation was seen in follow-up CT. Good collateral flow was associated with a significantly better ASPECT score (p < 0.05) in follow-up CT.
Conclusion: Collateral flow can be estimated form 4D-CTA calculated from CT volume perfusion datasets. Good collateralization is associated with significantly better outcome compared to weak collateralization.

B-344 14:36

also EPOS

Lower radiation dose adaptive statistical iterative reconstruction head CT examinations match quality of prior conventional dose studies

E.G. Stein, P.S. Pawha, B.N. Delman, L.N. Tanenbaum; *New York, NY/US (nuromri@gmail.com)*

Purpose: Adaptive statistical iterative reconstruction is a recently available re-construction technique that, compared to filtered back projection (FBP) methods typically used in CT, provides a reduction in image noise and improvement in low contrast detectability (LCD). A retrospective review of dose-reduced images obtained with ASIR was compared to prior studies obtained on the same patients using FBP reconstruction and a variety of conventional techniques. Quantitative assessment of the noise in all image sets was performed.
Methods and Materials: Twenty-six patients referred for head CT were scanned on a Discovery CT750 HD clinical CT scanner and reconstructed using ASIR. Medical records of these patients were reviewed to identify prior head CT studies performed on up to 5 other CT scanners with conventional radiation doses and FBP reconstruction. Radiation doses from prior examinations were determined either from the dose length product recorded at the time of the study or by estimation using ImPACT 0.99x.
Results: Average radiation dose was reduced by 29% from 1.5 mSv (FBP) to 1.1 mSv (ASIR) (p < 0.0001). Noise levels were not significantly different using the low radiation dose techniques with ASIR as compared with conventional radiation doses and FBP reconstruction.
Conclusion: ASIR allows reduction in radiation dose while maintaining diagnostic image quality for routine clinical head CT imaging.

B-345 14:45

**Digital-subtraction volume-4D-CT angiography of the brain:
Reducing radiation dose using a mathematical model for bolus timing**

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Purpose: To determine the time window for contrast injection in cerebral arteriog-raphy by volume-4D-CTA and to limit radiation dose in compliance with diagnostic reference levels (head CT: 544 mGy • cm).
Methods and Materials: 320 rows Volume CT technology (Aquilion-One, Toshiba) was used. Bolus timing was performed to determine arrival times in the basilar artery and the sinus confluence. To predict individually the shape and the maximum of the measurement bolus the normalized time-density curves of the test bolus were numerically convolved with the injection protocol by using home written software. The time window of the dynamic scan was reduced to three acquisitions centred on the calculated maximum contrast on the time density curve. 46 patients (mean 55.7 years) were included. Test-bolus: 10 ml/370 mg/ml iodine (6 ml/s), diagnostic: 50 ml.
Results: Peak enhancement: test-bolus in the basilar artery 11.4 ± 2.60 s, sinus confluence 17.1 ± 2.46 s. Computer calculation (diagnostic bolus) for basilar artery was 16.0 ± 2.35 s, sinus confluence 21.6 ± 2.42 s. Dose length product calculation for test-bolus (single slice) was 29.4, for subtraction mask (1 rotation) 196.1 and for dynamic volume scans (3 rotations) 235.3 mGy • cm. Radiation dose accumulated to a total of 460.8 mGy • cm.
Conclusion: The cross-over point of the arterial and venous time-density-curves derived from test bolus measurements proofed to be a reliable point in time to start contrast injection in Volume-CTA of the brain. Contrast bolus optimization protocols are a precondition to keep total radiation dose within established limits.

B-346 14:54

Brain perfusion CT using a 256-slice CT: Improvement of diagnostic information by large volume coverage

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Purpose: To evaluate the feasibility and potential diagnostic value of CT-perfusion computed tomography (CT) using an 8 cm wide detector of a commercially available 256-slice CT for imaging brain perfusion.
Methods and Materials: CT-perfusion data sets were obtained in 29 subjects (15 men, 14 women, mean age 69.5 years) with clinical signs of cerebral ischemia. Studies were performed with a 256-slice CT scanner (128 detector rows, flying z-focus, 8 cm detector width in z-direction). Protocol consisted of 80 kV, 125 mAs, 20 measurements and 10 mm reconstructed slice thickness. 40 ml iopromid at a flow of 7 ml/s was followed by 50 ml saline solution. Two independent readers evaluated 2 reconstructed 10 mm slices for simulation of a standard detector CT perfusion scan (SDCT) at the level of the basal ganglia and a complete data set including 8x10 mm slices (CVCT: complete volume CT). Number of pathological findings and partially or completely missed findings in the SDCT evaluation was determined.
Results: Adequate image quality, which allowed for postprocessing software and calculation of TTP, MTT, CBF and CBV maps was achieved in all patients. 19 lesions were identified after evaluation of the entire data sets. SDCT evaluation missed 6 lesions completely. Ten hypoperfused areas were completely covered with the CVCT, but incompletely with the SDCT evaluation. Both SDCT and CVCT evaluation visualized 3 lesions completely.
Conclusion: Initial experience with a 256 slice CT compared to standard CT perfusion evaluation of the brain demonstrates potential clinical advantages with complete instead of incomplete coverage of hypoperfused areas or detection of additional small lesions.

B-347 15:03

Experimental studies on functional response in normal rat brain to hypercarbia using perfusion CT

Z. Jiawen, F. Xiaoyuan, L. Hanqiu, Y. Zhenwei, Y. Yanmei; *Shanghai/CN (zhangjw2000@hotmail.com)*

Purpose: To investigate CT perfusion value changes in normal rat brain tissue at hypercarbia and analyze correlations between perfusion CT and the results of α-SMA immunohistochemical staining.
Methods and Materials: Total 10 male SD rats, weighting 250-300 g. Perfusion CT was performed pre- and post- (15 minutes delay) inhalation of a mixture of 10% CO_2 and 90% air. Perfusion CT values were measured at the right nucleus caudatus in rat brain. After perfusion CT, the samples in rat brain were examined histologically using HE and immunohistochemical staining for α-SMA. These data were analyzed with SPSS 11.5 statistical software.
Results: After inhalation of a mixture of 10% CO_2 and 90% air, rat right caudate nucleus area CBV, CBF values were significantly higher than those before hy-percarbia (t=4.92, P=0.001 and t=6.75, P < 0.001). The increasing rates of CBV, CBF were (87.14±46.45)%, (65.75±22.05)%, respectively. However, no significant differences were detected for changes of PS and MTT after hypercarbia (P> 0.05 for both). Significant correlations were observed between the number for SMA positively stained vessels and changing rates of CBV and CBF after hypercarbia in rat normal brain (r=0.652 and r=0.89, respectively; P < 0.05 for both).
Conclusion: Perfusion CT in the change in blood $PaCO_2$ can reflect the hemody-namic changes in normal rat brain tissues. These results demonstrate that changing rates of CBV and CBF correlate well with the number of mature vessels by means of changing blood $PaCO_2$ in normal rat brain tissues.

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B-348 15:12

Experimental studies on functional response of tumoral vascular to hypercarbia in rat brain C6 glioma model using perfusion CT

Z. Jiawen, F. Xiaoyuan, Y. Zhenwei, L. Hanqiu, Y. Yanmei; *Shanghai/CN* (zhangjw2000@hotmail.com)

Purpose: To investigate CT perfusion paremeter changes in a C6 rat glioma model at hypercarbia, and evaluate the tumoral vascular maturity using perfusion CT.
Methods and Materials: Total 20 male SD rats were divided into glioma and control groups at random. Rats in glioma group were implanted C6 glioma cells at right caudate nucleus of rat brain. After three weeks, perfusion CT was performed pre- and post- (15 minutes delay) inhalation of a mixture of 10% CO_2 and 90% air. The samples in rat brain tissue were examined histologically using HE and immunohistochemical staining for α-SMA and FVIII. SMA (+)/FVIII-MVD (%) of each rat glioma was caculated as tumoral vascular maturity index (VMI). The data were analyzed using SPSS11.5 statistical software.
Results: The CBV, CBF and PS values in glioma group were significant higher than those in control group. After inhalation of a mixture of 10% CO_2 and 90% air, CBV, CBF values within tumors were higher than those before hypercarbia. The increasing rates of CBV and CBF within tumors were lower than that of CBV and CBF in normal rat brain tissues. Significant correlations were observed between the number for FVIII-MVD and CBV, PS in glioma group. The changing rates of CBV and CBF after hypercarbia in glioma group were not significant correlation with immunohistochemical parameters and VMI.
Conclusion: Perfusion CT can reflect tumoral angiogenesis within C6 rat brain gliomas. However, the changing rates of CBV and CBF in hypercarbia do not correlate well with the number of mature vessels and VMI.

B-349 15:21

Using 64-slice CT perfusion imaging to evaluate the histopathologic grade of intracranial gliomas

Z. Jiawen[1], F. Xiaoyuan[1], L. Bin[2], Y. Yongqiang[2]; [1]*Shanghai/CN*, [2]*Hefei/CN* (zhangjw2000@hotmail.com)

Purpose: To detect the role and value of 64-slice CT perfusion imaging in preoperative grading gliomas.
Methods and Materials: Thirty-one glioma patients (11 low grade gliomas and 20 high grade gliomas) underwent 64-slice CT cerebral perfusion examination before operation. The absolute value of CBF, CBV and PS was obtained from regions of maximal abnormality in tumor parenchyma on CBV, CBF and PS color perfusion maps. Perfusion parameters were processed using SPSS 11.5 software. The receiver operating characteristic (ROC) curve was used to assess their values on distinguishing the low grade and high grade gliomas.
Results: The CBF, CBV and PS value of low grade gliomas were (2.40±1.42) ml.100 g^{-1}, (55.91±56.98) ml.100 g^{-1}.min^{-1}, (4.16±0.76) ml.100 g^{-1}.min^{-1}, respectively. The CBF, CBV and PS value of high grade gliomas were (4.46±1.24) ml.100 g^{-1}.min^{-1}, (105.18±34.13) ml.100 g^{-1}.min^{-1}, (11.68±6.09) ml.100 g^{-1}.min^{-1}, respectively. The significant differences of P value were noted as follows: CBV (P=0.002), CBF (P=0.015) and PS (P < 0.001). The CBV, CBF and PS value of gliomas had strong association with the grade of glioma, and the r value was 0.573 (P=0.001), 0.445 (P=0.012) and 0.701 (P < 0.001), respectively. The area under Receiver Operating Characteristic (ROC) curve was 0.845 for CBV, 0.768 for CBF and 0.923 for PS. ROC curves revealed better specificity and sensitivity in PS and CBV than in CBF for glioma grade.
Conclusion: 64-slice CT perfusion imaging provides useful information for the grade of glioma and might have the potential to significantly impact clinical management of gliomas.

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

Cardiac

SS 503

New insights from acute myocardial infarction by MRI

Moderators:
J. Barkhausen; Lübeck/DE
R. Vliegenthart Proença; Groningen/NL

B-350 14:00

Relation between myocardial oedema and mass during the acute and convalescent phase of apical ballooning syndrome: A prospective cardiac magnetic resonance study

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Purpose: Apical ballooning syndrome (ABS) (Takotsubo cardiomyopathy) is a new diagnostic entity. The relation between myocardial oedema and mass in healing ABS has not been systematically investigated. We hypothesised that the resolution of myocardial oedema was associated with a decrease of myocardial mass.
Methods and Materials: 13 (0.92%) of 1400 patients admitted for acute myocardial infarction had ABS. CMR was performed within 20 ± 13 hours and after 125 ± 27 days. A T2-weighted triple inversion technique was applied, and the signal intensity (SI) ratio of skeletal muscle to myocardium was assessed. Left ventricular (LV) mass, volumes and function were quantified from steady state free precession (SSFP) images. Additional late gadolineum enhancement (LGE) images were obtained.
Results: Mean age of the cohort was 58.5 ± 6.7 years. A significant decrease in LV mass was observed during follow-up compared to the acute phase (107.6 ± 13.2 g vs 81.9 ± 13.7 g, p < 0.001). The reduction of LV mass paralleled the normalization of initially increased myocardial SI on T2 images in the LV apical region (2.5 ± 0.4 vs 1.9 ± 0.2), and the normalization of ejection fraction (EF) (40.8 ± 8.5% vs 63.5 ± 3.1). No patients showed LGE, but mitral valve insufficiency was observed in 2 patients.
Conclusion: Reversible abnormalities in T2-weighted CMR are paralleled by a transient increase in LV mass and decrease in EF during the course of ABS. Myocardial oedema may explain these findings, and prove insight into the pathophysiology of this entity.

B-351 14:09

Single-slice multiecho T2* cardiovascular magnetic resonance (CMR) for detection of susceptibility artefacts related to microvascular obstruction (MVO) and hemorrhage in patients with reperfused acute myocardial infarction (MI): Preliminary results

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Purpose: MVO in MI is characterized by disruption of capillary integrity followed by leakage of red blood cells into the interstitium during the reflow period. Our hypothesis was that presence of haemoglobin degradation products within the necrotic area may cause susceptibility effects leading to regional T2* shortening.
Methods and Materials: Twenty-seven patients with MI underwent CMR in the sub-acute phase after coronary reperfusion (mean 7.4 days) using a 1.5 T scanner. In all cases, a standard protocol was used including T2w-STIR and delayed enhancement (DE) imaging post-Gd-BOPTA; an additional multi-echo T2* sequence was acquired with the following echo times: TE = 2.6, 4.8, 7.1, 9.3, 11.5, 13.7, 16.0, 18.2 ms. For T2* measurements, a region-of-interest was placed within the infarcted region, in the adjacent and remote segments using DE images as reference; signal intensity was measured and data were plotted against TEs to form a decay curve and obtain T2* measurements. Based on DE findings, patients were divided in MVO vs non-MVO infarcts and data about T2* were compared.
Results: T2* was significantly lower in MVO (n=12) vs non-MVO (n=15) infarcts within the necrotic segments (respectively 12.5±2.4 vs 35.6±8.5 ms; p < 0.01) whereas no significant differences were observed in remote (40.6±4.0 vs 42.7±7.6 ms, p=0.58) and adjacent (27.2±5.3 vs 39.7±8.4 ms; p=0.05) segments. Among MVO-group, T2* shortening was observed in both hemorrhagic (hypointense central core on T2w-STIR; n=8) and non-hemorrhagic infarctions (n=4).
Conclusion: Although limited by a small number of observations, our preliminary data suggest that MVO-infarcts are characterized by regional T2* shortening (T2*< 20 ms) within necrotic segments likely reflecting presence of hemoglobin degradation products.

B-352 14:18

Influence of primary percutaneous intervention (pPCI) delay on left ventricular remodeling, infarct size reduction and functional recovery at follow-up after ST-elevation acute myocardial infarction (STEMI): Insight from cardiac MR (CMR)

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Purpose: Previous studies with CMR have shown that delaying pPCI in STEMI patients produces negative effects on myocardial salvage already after 90 minutes of coronary occlusion, also reflected by larger extent of infarct size (IS) and microvascular damage (MVO). The aim of this study was to assess with CMR the influence of treatment delay in STEMI on functional behavior, changes in IS and LV volumes at 4 months' follow-up.
Methods and Materials: Seventy patients with STEMI treated with pPCI, underwent CMR in the acute phase and after 4 months. Patients were subcategorized into 4 time-to-reperfusion quartiles: < 90 min (group I, n=19), 90-150 min (group II, n=17),> 150-360 min (group III, n=17), and > 360 min (group IV, n=17). A standard CMR protocol including T2w-STIR and LE imaging (Gd-BOPTA) was acquired. IS, MVO, LV end-diastolic (EDV) and end-systolic (ESV) volumes and ejection fraction (EF) were calculated.
Results: In the acute phase, shorter time-to-reperfusion was associated with smaller IS and MVO. IS progressively increased overtime from 8% (group I) to 17.9% (group IV) (p=0.005); similarly MVO was larger in later reperfused patients (0.5, 1.5, 3.7, 6.6%, p=0.039, respectively). Shrinkage of IS was higher in later reperfused STEMI (IS variation respectively-34.2 and-33.5% in groups IV and III vs.-6.9 and-15.8% in groups I and II). At follow-up, a progressive increase in LVEDV and LVESV was observed among groups whereas LV functional recovery did not significantly vary.
Conclusion: A treatment delay over 6 hours negatively affects infarct remodeling at 4 months' with less impact on functional recovery. The higher IS shrinkage observed in later reperfused STEMI likely reflects the larger extent of necrotic tissue in these pts with thinner fibrous scar and increased negative remodeling.

B-353 14:27

Right ventricular involvement in acute myocardial infarction: Evaluation of edema, delayed enhancement and RV function by cardiac MRI

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Purpose: To evaluate right ventricular (RV) function, edema and scar tissue in a large patient group after acute myocardial infarction (MI) and acute revascularisation.
Methods and Materials: 440 pts. (64.5 ± 12.8 y) were studied 48 to 120 h after acute MI and acute PTCA using a 1.5 T scanner (Philips). SSFP sequences in short axis (SA) orientation were used for volumetry, T2-weighted images in SA for visualisation of edema and 3D DE sequences for the detection of scar tissue after the application of 0.15 mmol/kg gadolinium-DTPA. RV ejection fraction (RV-EF) of patients with RV-involvement (group 1) was compared to RV-EF of age matched MI patients without RV-involvement (group 2).
Results: 60 of 440 patients (13.6%) showed a RV-involvement (group 1) with localized RV wall motion abnormalities. All patients in group 1 demonstrated with a localized RV edema. The anterior RV wall (6 patients) was less often affected than the posterior RV wall (54 patients); p < 0.01. In DE imaging 49/60 patients showed an RV-involvement, no microvascular obstruction could be detected. RV-EF was significantly lower in group 1 compared to group 2 (42.1±10.5 vs. 51.5±5.5; p < 0.01).
Conclusion: RV damage is present in more than 10% of patients after acute MI. It is related to a significant impairment of RV function. An edema is always present and could be easily assessed by T2-weighted sequence, whereas DE was not present in all patients. Therefore, MRI can also be used to calculate the myocardial salvage in the RV. The phenomenon of microvascular obstruction probably does not exist at the RV.

B-354 14:36

Investigation of T2-weighted signal intensity of infracted myocardium and its correlation with delayed enhancement magnetic resonance imaging after acute myocardal infarction: Part II - patients study

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Purpose: To evaluate the signal pattern on T2-weighted images (T2WI) after ST-elevation MI (STEMI) and determine its relation to persistent microvascular obstruction (PMO) for the assessment of prognostic significance.
Methods and Materials: We prospectively, consecutively enrolled 51 patients with STEMI treated with primary percutaneous intervention. All patients underwent cardiac MRI 4-7 days after STEMI. After 6 months, follow-up MRI was performed

to assess degree of LV remodeling. We classified the lesions into two groups according to their signal intensity on T2WI of initial MRI (group A: homogeneous high signal intensity, group B: iso-, low-signal intensity). To determine the relationship between T2 signal pattern and the DE-MRI findings, we analyzed the presence of PMO, size of infarction, and transmural extent of infarction on DE-MRI. We also compared the parameters of global systolic function on both initial and follow-up MRI between the two groups.
Results: Group B was detected in 25 (49.0%) of 51 patients. PMVO was more frequently observed in group B than group A (88 vs 7.7%, p < 0.05). Group B showed larger infraction area (25.4 vs 11.3%, p < 0.05). 17 patients (34%) only in Group B with nonviable myocardium (transmural extent of infarction > 75%) showed an increased LV end-systolic volume > 15% compared with baseline.
Conclusion: Low signal intensity on T2WI is significantly correlated with the presence of PMO in DE-MRI, large infarction area, and high transmural extent. In addition, it relates directly to prognosis in patient with STEMI as an important determinant of LV remodeling.

B-355 14:45

Assessment of microvascular obstruction and prediction of long-term remodeling after acute myocardial infarction: Cardiac MR (CMR) imaging study

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Purpose: To determine the best time point for detection of microvascular obstruction (MVO) and late enhancement areas (LE) in patients with acute myocardial infarction (AMI) and to evaluate which CMR imaging technique best predicts left ventricular remodeling after one year.
Methods and Materials: 41 patients with first acute MI and successful recanalization underwent 4 cine CMR examinations within one year. For assessment of LE and MVO, we used an inversion prepared 2D and 3D segmented TurboFlash sequence in short-axis orientation of the heart. LE and MO were measured 2 (early enhancement) and 10 minutes (late enhancement) after application of 0.2 mmol Gd-DTPA /kg body weight. The left ventricle (LV) was assessed planimetrically.
Results: Areas of MVO were detected in 32/41 early and in 31/41 late after contrast application at exam 1. The number decreased at exam 2 to 23/41 and 15/41 patients, respectively. Areas of LE decreased within 10 days between exam 1 and 2 from 19.5 ± 12.1 to 14.1 ± 9.1% (p < 0.001). Areas of LE at exam 1 was the strongest predictor of change in LV ejection fraction and end-systolic volumes (r = -0.742 and 0.628, P < 0.001, respectively).
Conclusion: The real extent of MVO is best assessed on images obtained 2 minutes after contrast application and within 24-48 hours after acute MI. The best prognostic marker of LV remodeling proved to be the area of LE determined within the first 48 hours after AMI.

B-356 14:54

also EPOS

Comparison of two cardiovascular magnetic resonance imaging parameters for identifying reversible myocardial dysfunction

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Purpose: Cardiovascular magnetic resonance based viability studies have shown that dysfunctional myocardial segments with 25-75% infarct transmurality (IT) have an intermediate likelihood of functional recovery after revascularization. The purpose of this study is to prospectively test either the inotropic reserve (IR) during low-dose dobutamine (5-10 µg/kg/min) (LDD) or thickness of the residual non-contrast-enhanced myocardial rim (RIM) > 3 mm has better predictive value for functional recovery after revascularization in segments with 25-75% IT.
Methods and Materials: Contrast-enhanced (CE) and LDD magnetic resonance imaging (MRI) were performed in 18 patients (age 62 ± 10 years) with chronic coronary artery disease and left ventricular systolic dysfunction (ejection fraction 36 ± 10%) before they underwent surgical (n=13) or percutaneous (n=5) revascularization. The extent of regional contractility and contrast enhancement at the same locations were determined by MRI before and 27 ± 3 weeks after revascularization.
Results: Before revascularization, 45 (14.7%) of the 306 myocardial segments analyzed had abnormal contractility and 25-75% IT. IR during LDD had 71% sensitivity, 79% specificity, 88% positive predictive value (PPV) and 55% negative predictive value (NPV) for predicting functional recovery after revascularization. The RIM value > 3 mm had 87% sensitivity, 29% specificity, 73% PPV, and 50% NPV.
Conclusion: Inotropic reserve during low-dose dobutamine MRI is superior to non-contrast-enhanced myocardial RIM cutoff value > 3 mm for prediction of myocardial viability in dysfunctional segments with 25-75% infarct transmurality.

B-357 15:03

Left bundle branch block: Usefulness of MRI in the evaluation of regional left ventricular dyssynchrony and in the detection of previous myocardial infarction with late enhancement

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Purpose: Left bundle branch block is a common cardiac conduction abnormality diagnosed on ECG. LBBB can be a primary abnormality of the cardiac electrical conduction system or it can be secondary to other cardiogical pathologies. The aim of this study was to evaluate the mechanical left ventricular dyssynchrony with high temporal resolution cine MRI and to evaluate the presence of late-enhancement (LE) in order to diagnose previous myocardial infarction.
Methods and Materials: 38 patients with LBBB underwent cardiac MRI using a 1.5 T magnet. The MRI protocol consisted of a left ventricular trueFISP functional study followed by Late Enhancement data sets acquired 10-15 minutes after IV administration of 0.2 mmol/kg BW of extracellular Gd contrast agent. Different patterns of LE were related to the underlying pathology as stated by clinical and other diagnostic imaging features.
Results: We detected the characteristic septal flattening during early ventricular systole in all the patients, tenting of mitral valve apparatus in 5 pts and functional mitral regurgitation in 2 pts. In 1 pt, we found the characteristic functional features of dilated cardiomyopathy with no myocardial area of LE. In 8 pts, we found areas of LE (transmural in 3 pts and subendocardial in 5 pts) with typical patterns of myocardial infarction (MI). In 30 patients, we found a reduction of the ejection fraction.
Conclusion: MRI is a useful diagnostic tool in the evaluation of LBBB in patients where the assessment of ventricular dyssynerygy on echocardiography is not technically possible and when the area of previous myocardial infarction cannot be determined.

B-358 15:12

Double inversion recovery "black-blood" gradient echo for detection of myocardial infarction

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Purpose: To investigate, if myocardial infarction with a double IR gradient echo (GRE) sequence can improve suppression of blood signal in the left ventricular cavity in delayed enhancement imaging.
Methods and Materials: 16 patients with myocardial infarction were examined at 1.5 T (Philips, Achieva). Ten minutes after contrast media application (0.2 mmol/kg gadopentetate dimeglumine), a segmented 2D IR GRE sequence (TR/TE/bandwidth: 1.2 msec, 3.6 msec, 384 Hz/Px) was used for DCE imaging as reference method. A segmented double IR GRE sequence (TR/TE/bandwidth: 1.2 msec, 3.6 msec, 384 Hz/Px) was used to achieve improved suppression of signal in the left ventricular cavity. The optimal inversion time for the standard IR GRE sequence was determined with a look locker sequence. The two inversion times for the double IR GRE sequence were calculated with in-house-written software according to results of a phantom study. Contrast-to-noise ratios of myocardial infarction in relation to normal myocardium ($CNR_{inf-myo}$) and to the left ventricular cavity ($CNR_{inf-LVC}$) were calculated.
Results: The mean values for $CNR_{inf-myo}$ and $CNR_{inf-LVC}$ for the reference technique, IR GE were 14.2 and 5.8 and for the double IR GRE 13.2 and 8.8. No significant difference was found for the $CNR_{inf-myo}$ (n.s., p > 0.05). The ratio of $CNR_{inf-LVC}$ and CNR_{inf_myo} was 0.66 for the double IR GRE and 0.41 for the reference technique.
Conclusion: A double IR GRE sequence improves the ratio of CNR of infarction and left ventricular cavity compared to a reference technique.

B-359 15:21

Predictors of right ventricular dysfunction in patients with successfully treated acute anterior ST-elevation myocardial infarction

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Purpose: To determine predictors of right ventricle (RV) dysfunction in patients with acute anterior ST-elevation myocardial infarction (STEMI) successfully treated with primary angioplasty.
Methods and Materials: 71 patients (57 males, mean age 58.0±11.7 years) underwent cardiac magnetic resonance (CMR) 3-5 days after anterior STEMI sucessfully treated (TIMI3) with primary angioplasty. Cine CMR and late-gadolinum enhancement (LGE) images of RV and left ventricle (LV) were assessed offline.

Results: Comparing patients with and without RV dysfunction (RV ejection fraction (EF) < 40%), the former have lower LVEF (27±7% vs. 39±11%, p=0.0001) and higher LV endsystolic volume (ESV) (112±27 vs. 91±33 ml, p=0.03), LGE volume (54±23 vs. 37±27 ml, p=0.02), CPKmax (7495±4351 vs. 4447±4067IU/l, p=0.01), CPKMBmax (862± 464 vs. 484± 375IU/l, p=0.01) and TnImax level (129± 65 vs. 64±52 μg/l, p=0.0001). Univariate predictors of RV dysfunction were LVEF (odds ratio (OR) 3.79 per 10% EF decrease; 95% confidence interval (CI): 1.68-8.55; p=0.001), ESV (OR 1.23 per 10 ml increase; 95%CI: 1.02-1.49; p=0.03), LGE volume (OR 1.29 per 10 ml; 95%CI: 1.04-1.61), CPKmax (OR 1.02 per 100IU/l increase; 95%CI: 1.00-1.03; p=0.02), CPKMBmax (OR 1.02 per 10IU/l increase; 95%CI: 1.01-1.03; p=0.004) and TnI (OR 1.2 per 10IU/L increase; 95%CI: 1.08-1.34; p=0.001). In multivariate analysis, the independent predictors of RV dysfunction were LV function (OR 2.87 per 10% EF decrease; 95%CI: 1.21-6.8; p=0.02) and TnI (OR 1.14 per 10 μg/l increase; 95%CI: 1.01-1.29; p=0.03)
Conclusion: Despite successful primary angioplasty in patients with anterior STEMI, the prevalence of both RV dysfunction and RV infarction is high. In these patients, RV dysfunction is predominately determined by LV dysfunction and TnI level.

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

Interventional Radiology

SS 509b

Genitourinary interventions

Moderators:
P. Avramov; Novi Sad/RS
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B-360 14:00

Effects on renal function of renal artery stenting: Long-term results in a single centre experience

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Purpose: To retrospectively evaluate the mid- and long-term effect of renal artery stenting in renal function in hypertensive patients with renovascular disease.
Methods and Materials: The study included a series of 102 hypertensive consecutive patients (M/F=64/38, mean age 63.8 years), with clinical, imaging and functional findings of renovascular disease and significant (> 60%) atherosclerotic ostial renal artery stenosis, treated by stenting. Thirty-three (32.3%) patients had impaired renal function (single functioning kidney in 15 patients). Strict imaging and clinical follow-up were performed in all cases. Renal function was monitored by serum creatinine levels.
Results: Immediate technical success rate was 99.2% (119/120 stents). The mean follow-up was 31 months (range 1-96 months), with 25/119 (21%) in-stent restenosis, significantly related to the stent diameter (P=0.0003). At 12 months, hypertension was cured/improved in 58.6% of patients. No patients had acute postprocedural renal function deterioration. Among patients with renal failure (n=33), renal function was improved/stabilized in 79.3 and 88% of cases, at 6 and 24 months follow-up, respectively. In the remaining patients (n=69), a moderate (maximum creatinine level, 2.2 mg/dL) and transient increase of serum creatinine level were observed in 4 cases (5.8%), after at least 6 months follow-up.
Conclusion: Renal artery stenting in selected patients represents a safe procedure. It does not impair renal function in patients without renal impairment, whereas it is able to improve or stabilize the renal function in patients with renal insufficiency.

B-361 14:09

PTRA is more effective than previously shown! Outcome of PTRA improves when evaluated by "Break point analysis"

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Purpose: Atherosclerosis is a generalized and progressive disease known to obstruct renal arteries causing progressive azotemia. Restoring unobstructed blood flow to the kidney in azotemic patients often improves the renal function. To evaluate the outcome guidelines recommend "Break point analysis" or "Binary outcome" (Rundback, Circulation 2002). Complications to PTRA includes impaired renal function due to contrast media induced nephropathy or atheroembolization. The present retrospective study has compared the clinical outcome when based on "Break point analysis" vs "Binary outcome".
Methods and Materials: The effect on renal function for each patient was defined based on "Break point analysis" where serial s-creatinine values before and after PTRA generates a slope-value. An increase in slope-value after PTRA indicates

an improvement in renal function. This was compared to "Binary outcome" using only single s-creatinine value the week before and 3-6 months after PTRA. After informed consent 11 azotemic patients treated for ARAS by PTRA were included for a retrospective evaluation of the clinical outcome regarding renal function. Changes in renal function were based on both serial measurement and single values of renal function before and after PTRA.

Results: Five of eleven patients showed improved renal function after PTRA when based on "Break point analysis", only two when based on "Binary outcome".

Conclusion: "Break point analysis" shows improved renal function in more patient than when evaluated by single measurements. Impaired renal function after revascularisation may be due to the progressive disease and not a complication to the treatment.

B-362 14:18

also EPOS

Embolisation of polycystic kidneys: An alternative to nephrectomy before renal transplantation

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Purpose: In autosomal polycystic disease, surgical nephrectomy is necessary before transplantation when kidney volume is excessive. We evaluated prospectively the effectiveness of unilateral embolisation as an alternative to surgery to obtain a volume reduction allowing graft implantation.

Methods and Materials: Twenty patients, with an autosomal dominant polycystic kidney disease and enlarged kidneys descending below iliac crest, had unilateral renal embolisation. In all cases, distal infusion of microspheres and proximal coiling were associated until circulatory arrest. To prevent post-embolisation syndrome, a protocol with analgesic, anti-inflammatory and antibiotic drugs was prescribed. Volume reduction was evaluated by CT before and at 3 and 6 months after embolisation. The treatment was considered as a success when the lower pole of embolized kidney was located above the iliac crest at 6 months, making transplantation possible.

Results: Embolisation was technically successful in all patients. The treatment was well tolerated clinically in all cases, without immediate or delayed complications. In 18 patients (90%), this treatment was effective in one session, with an average volume reduction of 45% at 3 months and 59% at 6 months. The last patient had a supplemental cyst sclerosis to reach the objective. Till now, 20 patients reached the 6 months end-point and 15 were listed for kidney transplantation; 8 of these were successfully grafted.

Conclusion: Embolisation of polycystic kidneys facilitates renal transplantation and seems to be an excellent alternative to nephrectomy due to its lower morbidity.

B-363 14:27

Radiofrequency ablation of renal tumors in patients with solitary kidney

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Purpose: To evaluate the efficacy and safety of percutaneous radiofrequency ablation (RFA) of renal tumors in patients with a solitary kidney.

Methods and Materials: A retrospective review of 10 patients with a solitary kidney treated with RFA for renal mass. The ten patients had 17 tumors (one patient had 4 masses, one patient had 3 masses, two patients had 2 masses and six patients had one mass). All patients had solitary kidney after contralateral radical nephrectomy because of cancer. All procedures were CT-guided and performed under general anesthesia. Renal function was tested after each procedure and patients were followed by CT (we considered the absence of enhancement a sign of complete necrosis).

Results: Average mass size was 2.7 cm (range 1.2-5.5 cm). Four patients had metastases. Technical success was noted in 15 masses (88%), three of them required a 2nd RFA session. Their diameter ranged from 1.2 to 4 cm: 11 masses were exophytic location, 2 were parenchymal location and 2 were exophytic and parenchymal. Residual disease was noted in 2 masses (of 5.5 and 3.2 cm), both exophytic and parenchymal location. Serum creatinine values were normal in 9 patients. Only one patient with a 2 cm parenchymal tumor increased serum creatinine secondarily to a hydronephrosis caused by a iatrogenic urinary tract stricture. No others complications were observed. The average follow-up was 23 months.

Conclusion: RFA is a safe and effective alternative for patients with renal mass in a solitary kidney as their renal function can be preserved.

B-364 14:36

Evaluation of a pneumatically actuated MR-compatible robot for MR-guided prostate biopsy

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Purpose: Evaluation of a pneumatically actuated MR-compatible robotic device to perform biopsy in the prostate with real-time 3 T MR imaging guidance.

Methods and Materials: The robotic system is fitted with five computer-controlled degrees of freedom for delivering an interventional procedure. The entire device is constructed of MR compatible materials, i.e. nonmagnetic and non-conductive, to eliminate artifacts and distortion of the MR images. The robotic device is remotely controlled by means of pneumatic motors and a graphical user interface, providing real-time MR-guided monitoring of the intervention. The device is mounted to the table of a 3 T whole body MR scanner. Trials were conducted on an abdominal phantom, with real-time MR guidance. Biopsy needles were placed by expert and novice users towards internal 1 mm targets. The needle was visualized with a three-dimensional T1-weighted sequence (TR/TE 6.52/2.54 ms; flipangle 10 degrees). Accuracy was determined by computing the needle tip to target distance.

Results: The robotic system successfully assisted with guiding biopsy needle placement. No artifacts caused by the robotic system were observed in the MR images. Position and orientation of all biopsy insertions were appropriately visualized on the 3-dimensional T1-weighted MR images. Precision of needle placement was 2.5 mm (range 0-4.1 mm). The average time to reach the target was 4.58 minutes (range 3.50-6.40).

Conclusion: MR imaging guided prostate biopsy using a pneumatically actuated MR-compatible robot provides adequate precision of insertion and orientation of the biopsy needle and shows great promise for MR-guided biopsy procedures.

B-365 14:45

Balloon-occluded retrograde transvenous foam sclerotherapy (B-ORTFS) of symptomatic high-flow female varicocele with sodium-tetradecyl-sulphate foam

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Purpose: To assess the efficacy of Balloon-Occluded Retrograde Transvenous Foam Sclerotherapy (B-ORTFS) in high-flow pelvic varicocele using 3% sodium-tetradecyl-sulphate (STS) foam.

Methods and Materials: A retrospective study was conducted in 12 patients (mean age: 35.2 years; range: 23-46) with pelvic congestion syndrome (PCS) with atypical high-flow venous collaterals treated by B-ORTFS between June 2005 and May 2008. High-flow venous collaterals were tributary of the ipsilateral hypogastric vein in 4 (33.3%) patients, to the contralateral hypogastric vein 3 (25.0%), to both hypogastric veins in 3 (25.0%), to the contralateral ovarian vein in 1 (8.3%) and to both hypogastric veins and the contralateral ovarian vein in 2 (16.7%). Continuous pain and dyspareunia was present in 10 (83.3%), urinary urgency in 2 (16.7%) patient and worsening of pain during menstruation in 5 (41.7%) patients. B-ORTFD was performed by injection of 3% STS foam into the pelvic varices after balloon-occlusion of the major venous vessels (hypogastric or ovarian veins) to which the high-flow venous collaterals were tributary.

Results: The procedure was technical successful in all patients (100%). After the injection of 3% STS foam, three (25.0%) patients presented a colic-like pain with spontaneous resolution after 5 minutes. During follow-up, no recurrences of PCS were detected. A significant improvement of symptoms (Student's t test $P < 0.01$) was observed at 1, 3, 6 and 12 months.

Conclusion: B-ORTFS of high-flow female varicocele using 3% STS foam is a safe and effective procedure which should be taken in consideration as an alternative to other endovascular and surgical options.

B-366 14:54

Uterine artery embolization: Immediate postprocedural Doppler ultrasonography changes

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Purpose: To calculate the early Doppler changes (peak systolic velocity (PSV), end diastolic velocity (EDV) and resistive index (RI)) in the uterine artery (UA) following uterine artery embolization (UAE).

Methods and Materials: The prospective study was approved by the institutional review board. An informed consent was obtained from all patients. Included were 25 females (Mean age: 46.24 years). For each patient, the PSV, EDV and RI were measured in both uterine arteries before and within 6 hours after UAE. Measurements

Friday

were trans-abdominally taken using a 3.5 MHz curvilinear abdominal transducer. All embolization procedures were technically successful.

Results: Following UAE on both sides, the PSV (Left p=0.0022, Right p=0.0076) and EDV (Left p < 0.0001, Right p < 0.0001) were significantly reduced while the RI (Left p < 0.0001, Right p < 0.0001) was significantly elevated. The left PSV and EDV were reduced from a mean of 64.98 cm/sec (Range: 34.1-128.5, SD: 26.02) and 18.98 cm/sec (Range: 8.2-42.7, SD: 8.58) before UAE to a mean of 43.35 cm/sec (Range: 15.8-98, SD: 18.17) and 5.91 cm/sec (Range: 0.6-18, SD: 3.71) while the RI was elevated from a mean of 0.71 (Range: 0.63-0.89, SD: 0.06) to 0.86 (Range: 0.76-0.98, SD: 0.06) after UAE, respectively. Similarly, on the right side the PSV, EDV and RI before UAE were: 62.61 cm/sec (36-111, 20.54), 20.3 cm/sec (7.4-49.5, 9.15) and 0.69 (0.54-0.83, 0.06) and after UAE were 47.15 cm/sec (10.7-91.8, 21.84), 7.53 cm/sec (0.3-26.5, 6.17) and 0.85 (0.65-0.99, 0.07).

Conclusion: Following UAE, the peak systolic and end diastolic velocities are significantly elevated while the resistive index is significantly reduced relative to the pre-embolization values.

B-367 15:03

Does size really matter? An analysis of effect of the size of uterine fibroids and volume of embolic material on the complication rate of uterine artery embolisation

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Purpose: To determine whether there is a correlation between large uterine fibroid size, uterine volume, number of vials of embolic agent and risk of complication from uterine artery embolization.

Methods and Materials: Retrospective analysis of prospectively collected data on 121 patients undergoing uterine fibroid embolization for symptomatic uterine fibroids at single institution.

Results: 29 patients had maximum dominant fibroid size $\geq$ 10 cm. Of the 121 patients, 7 patients had complications. 1. No statistical difference was demonstrated between fibroid size and complication rate using the Fisher's Exact test with p value = 0.19. 2. No statistical difference was demonstrated between uterine volume and complication rate using the Fisher's Exact test with p value = 0.69. 84 of the 121 patients had documentation of the number vials used during the procedure. 3. There was a statistical correlation between large number of embolic vials and complication rate. This demonstrated that large number of vials was associated with decreased risk of complications.

Conclusion: In the population, we treated we found no direct correlation between fibroid size or uterine volume and incidence of complications. Hence, therefore in our institution, the size of the fibroids and uterine volume are not an exclusion criterion when considering patients for UFE. In addition, there was no statistical correlation between fibroid size and number of embolic vials required for embolisation. However, there was a slight negative correlation between volume of embolic agent and complication rate. Our data demonstrated that large number of embolic vials reduced the risk of developing complications.

B-368 15:12

Magnetic resonance imaging-guided focused ultrasound treatment of uterine fibroids in patients with abdominal scars, using an energy-blocking patch

S.-W. Yoon; *Gyunggi-Do/KR (jansonsrad@gmail.com)*

Purpose: Previously, abdominal scars were considered a contraindication to magnetic resonance imaging-guided focused ultrasound (MRgFUS) treatment of uterine fibroids, if they were in the energy beam path. The purpose of this study was to evaluate the safety and effectiveness of an energy-blocking patch for MRgFUS of uterine fibroids in patients with abdominal scars in order to access the plausibility of such intervention in this subgroup of patients.

Methods and Materials: Patients underwent MRgFUS using an isolating patch covering the scar. Prior to treatments, patches composed of ultrasound blocking material were placed on patients' skin on top of the scar. Adverse events were recorded during the procedure, and during a follow-up period of 3 months. Immediately after each treatment, contrast enhanced T1-weighted MR images were acquired, and the non-perfused volume (NPV) ratio was measured to determine the technical success of the treatment.

Results: Twenty patients (19 Korean and 1 Caucasian) with mean age of 44 years and BMI of 22.1 were treated for their symptomatic uterine fibroids. The average size of scar was 3.2 X 104.6 mm. All treatments were completed with no technical problems. No serious adverse events were reported. Two patients presented with small red spots around the scars that disappeared within a week without intervention. The average NPV ratio was 53.5±21%.

Conclusion: The energy-blocking patch can provide an effective treatment option for patients with uterine fibroids and scars in the beam path, who were previously excluded from MRgFUS treatment due to an increased risk of skin burn.

B-369 15:21

Comparison of patient dose in flat-panel and conventional angiography systems during uterine artery embolization (UAE)

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Purpose: To compare the exposure doses to patients during uterine artery embolization (UAE) in conventional DSA angiographic unit and digital flat-panel system.

Methods and Materials: Thirty women (mean age: 36.6±6.6; Range: 24-50) who underwent UAE due to symptomatic uterine fibroids were enrolled in study. We randomized them for two angiographic equipments (digital flat-panel system and conventional unit). Doses to patients' skin were measured with thermoluminescent dosimeters. Ovarian doses were calculated using data of entrance and exit dose to each patient. The skin and ovarian doses to the patients were compared between two groups.

Results: The mean pelvic thickness was not significantly different between flat panel and conventional group (25.7±4.8 cm versus 21.4±3.2 cm; P=0.7). The mean right side entrance dose was 1586±1221 in conventional group and 522.3±400.1 mGy in flat panel group (P=0.005). These figures were 1470±1170 and 456±396 mGy for left side, respectively (P=0.006). The mean right side exit dose was 18.8±12.3 for conventional group and 9.4±6.4 mGy for flat panel group (P=0.013). These figures were 16.7±11.3 and 10.2±7.2 mGy for left side, respectively (P=0.06). The mean right ovarian dose was 139.9±92 in conventional group and 23.6±16.2 mGy for flat panel group (P < 0.0001). These figures were 101.7±77.6 and 24.6±16.9 mGy for left side, respectively (P=0.002).

Conclusion: Considering that preserving fertility is a key point in patients who underwent UAE, reducing the ovarian dose is essential and our results showed that using flat panel angiography system is very effective for this purpose.

Saturday, March 6

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

Musculoskeletal

SS 810

Knee

Moderators:
A.R. Mester; Budapest/HU
P. Van Dyck; Edegem/BE

B-370 10:30

High resolution isotropic knee-MRI at 3 T with a 15-channel-knee-coil and a 3D-TSE-sequence with optimized acquisition strategies

M. Notohamiprodjo[1], A. Horng[1], B. Kuschel[1], P. Bär[2], M.F. Reiser[1], C. Glaser[1]; [1]Munich/DE, [2]Erlangen/DE (mike.notohamiprodjo@med.uni-muenchen.de)

Purpose: We evaluated high-resolution (HR) Knee-MRI at 3 T with a 15-channel-knee-coil and an isotropic PDfs-weighted 3D-TSE-sequence with advanced acquisition strategies for optimized contrast.
Methods and Materials: 15 volunteers and 50 patients were examined with a 15-channel-knee-coil at 3 T (Magnetom VERIO, Siemens) using a sagittal PDfs-weighted 3D-TSE-sequence (TR1200 ms/TE31 ms/Voxel-size: 0.6x0.5x0.5 mm/acquisition-time 10:48 min) with optimized flip-angles, radial k-space-sampling and elliptical scanning and a 2D-TSE-sequence in 3 planes (TR4050 ms/TE30 ms/Voxel-size: 0.3x0.3x3.0 mm/total acquisition-time 12:20 min). Signal- and Contrast-to-Noise-Ratios (SNR; CNR) were calculated with the subtraction-method. Using 1 mm-reformats in 3 planes, two radiologists independently assessed depiction of cartilage, menisci and ligaments and detection and diagnostic confidence of internal knee disorders in volunteers and patients, respectively (5-point-Likert-scale). Statistical analysis was performed with paired t-tests, interreader-correlation with weighted-κ-coefficients.
Results: SNR_{fluid} (3D/2D: 201/130) and $SNR_{cartilage}$ (97/62) of the isotropic 3D-sequence were significantly higher (p < 0.001), whereas SNR of low intensity structures (i.e. subchondral bone, menisci) were significantly lower (p < 0.001). $CNR_{fluid/cartilage}$ (3D/2D: 188/115) and $CNR_{cartilage/bone}$ (93/47) were significantly higher for 3D-TSE (p < 0.001). Anatomical detail depiction was significantly better for the femoral trochlea (4.9±0.3/3.3±1.0) and small structures like meniscal roots. Detection and diagnostic confidence of internal knee derangements were not significantly different; however, delineation of subtle cartilage lesions in regions usually suffering from partial volume, that is, femoral trochlea or dorsal femur condyles was clearer with 3D-TSE. Interreader-correlation was slightly better for 3D-TSE (κ=0.87/0.82).
Conclusion: 3 T and a 15-channel-coil allow HR isotropic knee-MRI with an optimized 3D-TSE-sequence, providing excellent image quality and clinical performance at least equivalent to current 2D-protocols. It may be particularly useful for regions usually suffering from partial volume.

B-371 10:39

Macrophage imaging in knee infectious synovitis: Magnetic resonance imaging findings

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Purpose: The purpose of this study was to prospectively evaluate macrophage imaging using ultrasmall superparamagnetic iron oxyde (USPIO) enhanced MR imaging to depict bacterial knee infection in an experimental rabbit model.
Methods and Materials: Unilateral knee infection was induced by intra-articular injection of Staphylococcus Aureus in 8 rabbits. The controlateral knees were left native to serve as internal control. After a mean delay of 3 days, two magnetic resonance imaging sessions (3 T MR unit) were performed before and 24 hours intravenous administration of the USPIO. Protocol included T1w SE, T2w SE and T2*w gradient echo images. MR data were qualitatively and quantitatively analyzed and compared with histopathologic analysis (HE stain, Perls Blue stain). Signal-noise ratio changes after USPIO administration were compared using Wilcoxon signed rank test.
Results: All inoculated knees presented an infectious synovitis with intense infiltration of iron-loaded macrophages. In those infected knees, signal loss was visually and quantitatively observed on T1w (P = 0.01), T2w (P = 0.01), and T2*w images (P = 0.01), 24 hours USPIO administration, reflecting the presence of USPIO-loaded macrophages within the synovium. At the opposite, no significant MR signal changes were observed in control knees (P = 0.07-0.48), where a normal synovium without infiltration of iron-loaded macrophages was found.

Conclusion: The ability of USPIO enhanced MR macrophage imaging to identity infectious synovitis at clinically used magnetic field strength has been demonstrated. Applications in musculoskeletal disease may allow more precise identification of infection and permit cellular imaging -based therapy monitoring.

B-372 10:48

Loading of the knee during 3.0 Tesla MRI is associated with significantly increased medial meniscus extrusion in mild and moderate osteoarthritis

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Purpose: The aim of the current investigation is to study the influence of loading on the MRI presentation of different knee structures such as the meniscus and ligaments at 3 Tesla (T) in subjects with osteoarthritis (OA) and normal controls.
Methods and Materials: 30 subjects, 10 healthy and 20 with radiographic evidence of OA (10 mild and 10 moderate) underwent 3 T MRI under ULC and LC at 50% body weight. All images were analyzed by two musculoskeletal radiologists identifying and grading cartilage, meniscal, ligamentous abnormalities. The changes between unloading conditions (ULC) and loading conditions (LC) were assessed. For meniscus, cartilage and ligaments the changes of lesions, signal and shape were evaluated. In addition, for the meniscus, changes in extrusion were examined. A multivariate regression model was used for correlations to correct the data for the impact of age, gender, BMI. A paired T-Test was performed to calculate the differences in meniscus extrusion.
Results: Subjects with degenerative knee abnormalities demonstrated significantly increased meniscus extrusion under LC when compared to normal subjects (p=0.0008-0.0027). Subjects with knee abnormalities and higher KL scores showed significantly more changes in lesion, signal and shape of the meniscus (80% (16/20) vs. 20% (2/10); p=0.0025), ligaments and cartilage during LC.
Conclusion: The study demonstrates for the first time that axial loading has an effect on articular cartilage, ligament, and meniscus morphology, which is more significant in subjects with degenerative disease and may serve as an additional diagnostic tool to better assess early OA.

B-373 10:57

Systematic appraisal on cut-offs for the presence of knee osteo-arthritis on MRI

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Purpose: The aim of this study was to discuss MR scoring systems and methods for describing severity and presence of osteo-arthritis.
Methods and Materials: We performed a systematic review study including the following keywords: MR and Kellgren/Lawrence, Ahlback, KOSS, clinical ACR, Mankin, knee pain and osteoarthritis. We used the year 2000 as a starting point. Inclusion criteria were: isolated single or multicentre OA studies presenting own study populations, and at least a semi-quantitative scoring of cartilage or osteophyte on MR. We excluded studies with (post)traumatic knees.
Results: We detected 26 publications out of 407 in Pubmed which included all mentioned criteria. Scoring methods can be divided in three groups: WORMS (multi-feature Whole Organ MR Scoring system), KOSS (Knee Osteoarthritis Scoring System) and miscellaneous methods. Out of 26 articles, WORMS was described 10 times and KOSS 3 times. A relation with conventional radiograph was reported in 10 studies. The articles in which a correlation with Kellgren and Lawrence score was done reported in all studies a significant relation. We did not find studies in which two different MR scoring methods were used. Reproducibility of all scores was good to excellent. Features of OA were scored separately, but none of the MR scores, circumscribed an overall cut-off for presence of severity of OA.
Conclusion: There are still no unambiguous criteria for grading OA using MR to be used in clinical practice or epidemiological research.

B-374 11:06

MR imaging of anterior cruciate ligament reconstruction poor outcomes

S.A. Khedr, A. Gaballa; Jiddah/SA

Purpose: To study the diagnostic value of MR imaging in assessment of poor outcomes of ACL reconstruction graft using second look arthroscopy of the knee as a gold standard.
Methods and Materials: 37 patients were included in this study. MRI examination was done for all patients followed by knee arthroscopy study. MR images were assessed for: (1) ACL graft failure assessing the primary and secondary signs, (2)

Tibial and femoral tunnel location and (3) Complication of ACL graft reconstruction. MR imaging results were then compared with the arthroscopic results to determine sensitivity, specificity, and accuracy of MR imaging.

Results: Second look arthroscopy revealed 14 full-thickness ACL graft tears, 11 partial-thickness ACL graft tears and 12 intact ACL grafts. The sensitivity, specificity and accuracy for diagnosis of complete thickness tear of ACL grafts were 71.4, 91.3 and 83.7%, respectively, for partial thickness tear of ACL grafts were 63.6, 85.1 and 81%, respectively, and for intact ACL grafts were 63.3, 88.4 and 81%, respectively. Abnormal anterior placement of the tibial tunnel was found in 8 patients and was associated with ACL graft impingement. Arthrofibrosis was found in 3 patients, cyclops lesions in 4 patients, patellar tendinosis in 5 patients and impingement in 11 patients.

Conclusion: MR imaging is a reliable tool for evaluation of ACL graft poor outcomes including graft failure, insufficiency and complications. It was able to discriminate complete ACL graft tear from partial-thickness tear and intact graft.

B-375   11:15

Diagnostic value of quantitative contrast-enhanced MRI in evaluating the revascularization of the anterior cruciate ligament autograft: An early predictor of ligamentization course

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Purpose: To evaluate the revascularization rate and pattern of Bone-Patellar Tendon-Bone autograft used in ACL reconstruction.

Methods and Materials: Eighteen patients were assessed at third day and at time intervals of 1, 6, 9 and 12 months post-operatively. T1-weighted-images in an oblique-axial-plane were obtained before and after the administration of gadolinium. Signal-to-noise quotient (SNQ) was calculated for two cross-sectional-graft areas: the graft itself and the surrounding hypervascular tissue, at three specific graft sites (intra-articular, tibial-tunnel and juxta-screw site). Comparisons of the enhancement index ($EI:SNQ_{after}/SNQ_{before}$ Gd) were performed with three-way fully repeated measures ANOVA and correlated with clinical examination results.

Results: There was a significant time interval*graft site*cross-sectional-graft area interaction (F=3.28, p=0.008). Post-hoc analysis revealed that the EI of the surrounding tissue was significantly higher than the EI of the graft itself in all three sites and time intervals (p < 0.001) and correlated well with clinical examination results. Furthermore, the hypervascular tissue seems to extend with the same pattern in all sites, occupying the 19.7, 21.3 and 17.5% of graft's cross-sectional area at 6, 9 and 12 months, respectively.

Conclusion: Early onset of revascularization occurs progressively from the surrounding tissue towards the avascular central core of the graft and spreads along its whole length. The rapid development of the hypervascular tissue reduces both the time and the cross-sectional-graft area that remains avascular, leading to its early ligamentization. By the time the patient resumes sports activities, the maximum of vascularity is achieved at the graft and is maintained throughout the first post-operative year.

B-376   11:24

Assessment of the rotational alignment of the lower extremity with MR imaging: Technical feasibility

P. Schmidt[1], G. Scheurecker[2], G. Seitlinger[1], F. Fuerntrath[1], S. Hofmann[1], J. Kramer[2]; [1]*Stolzalpe/AT*, [2]*Linz/AT (peter.schmidt@lkh-stolzalpe.at)*

Purpose: To assess an MRI protocol for the analysis of Maltorsion syndrome of the lower extremities (LE).

Methods and Materials: We examined 100 patients with clinical suspicion of maltorsion of the LE with the use of a T1w FFE sequence. The patients were placed supine, hips and knees fully extended and strapped down, the feet in 15° of external rotation fastened to a plate. The hips, knees and ankles were each simultaneously examined. Torsion of femur and tibia, knee joint rotation and TTTG distance were measured by two authors repeatedly analog to published methods with CT and MRI. Column statistics, correlation and linear regression were performed.

Results: The acquisition of 24 slices at the hips takes 4:58 min., of 25 slices at the knees 3:41 min. and of 10 slices at the ankles 1:56 min. No motion artefacts were observed. Volumetric analysis of the joints proved to be more consistent than a single slice technique as used with CT. Inter- and intra-observer correlations with r2 > 0.8 proved consistency of the measurements. Mean and (range) are: femur torsion 11.69° (-13 - 35), tibia torsion 25.86° (0 - 48), knee joint rotation 4.288° (0 - 23), TTTG 17.83 mm (10 - 33). The values of femur and tibia torsion are normally distributed; those of knee joint rotation and TTTG are not. Due to radiation concerns, we have no CT correlation.

Conclusion: Rotational alignment of both LE can feasibly be examined with one MR imaging study, thereby avoiding radiation as with CT.

B-377   11:33

Anterior knee pain and objective patella instability: Differences in the rotational alignment of the lower extremity versus healthy volunteers as assessed by MRI

G. Scheurecker[1], G. Seitlinger[2], F. Fuerntrath[2], P. Schmidt[2], S. Hofmann[2], J. Kramer[1]; [1]*Linz/AT*, [2]*Stolzalpe/AT (georg.scheurecker@inode.at)*

Purpose: To show how patients with anterior knee pain (AKP) or patella instability (PI) differ in their rotational alignment of the lower extremity (LE) compared to healthy volunteers (HV).

Methods and Materials: We examined 30 patients with PI, 75 patients with AKP and 30 HV. We examined each pair of the large joints of both LE simultaneously with an axial MRI sequence. The patients were placed supine with legs straight throughout a single study. We measured the torsion of femur (FT) and tibia (TT), knee joint rotation (KJ) and the tibial tuberosity-trochlear groove distance (TTTG). We performed each measurement according to published orthopedic standards. Mann-Whitney tests were performed with a p < 0.05 considered to be significant.

Results: FT and TT show no statistically significant difference between HV, OPI and AKP. TTTG of HV is significant lower than that of AKP, with TTTG of AKP again significant lower than that of OPI. External rotation in the knee joint is significantly higher in OPI than in HV. There is no significant difference between KJ in AKP and OPI, although the angles tend to be higher in OPI.

Conclusion: Torsion of the femur and the tibia seem to show too many normal variants without resulting pain or instability. TTTG aids in separating HV from OPI or some cases of AKP. The common external rotation of the knee in OPI may lead to higher, possible false positive measurements of the TTTG.

B-378   11:42

dGEMRIC of the meniscus: Preliminary results

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Purpose: To evaluate the imaging characteristics of the medial meniscus in a standard dGEMRIC protocol of the knee.

Methods and Materials: Ten healthy subjects (mean age 27.8 y, range 20 - 35 y) without any history or signs and symptoms of knee osteoarthritis were enrolled. Our dGEMRIC protocol consisted of a pre-and postcontrast variable flip angle 3D GRE sequence for T1 mapping on a 3 T MRI unit. The medial meniscus was evaluated with ROIs for each the anterior and posterior horn with each ROI further divided into pairs for red and white zone, and central and surface zone, respectively. From the ROIs of the native and postcontrast T1 maps the delta relaxation rate ($\partial R1$) was calculated. ANOVA analysis was performed with a p <.05 considered to be significant.

Results: Statistically significant differences with p <.001 existed for the anterior vs. posterior horn, the white zones, the surface and central zones, as well as for the white vs. red and the surface vs. central zone of the posterior horn. Generally, mean $\partial R1$ was lower in the posterior horn vs. the anterior horn in all pairs, the white vs. red and the central vs. surface zone. All other pairs of evaluation did not differ significantly, especially the red zones of each horn.

Conclusion: dGEMRIC performed for cartilage evaluation depicts differences between the anterior and posterior horn of the meniscus and within the posterior horn itself. Whether these results are due to differences in architecture, proteoglycan content, blood supply or synovial diffusion needs further study.

B-379   11:51

Patellar instability: Patellofemoral joint alignment assessed with MRI at 0°, 15°, 30°, 45°, 60°, 75° and 90° of knee flexion

G. Scheurecker[1], G. Seitlinger[2], P. Schmidt[2], S. Hofmann[2], J. Kramer[1]; [1]*Linz/AT*, [2]*Stolzalpe/AT (georg.scheurecker@inode.at)*

Purpose: What distinguishes patients with objective patellar instability from healthy volunteers - evaluation of parameters of patellofemoral joint alignment at various angles of knee flexion.

Methods and Materials: Thirty patients with objective patella instability (OPI) and thirty healthy volunteers (HV) underwent MR imaging at 0° - 90° of knee flexion with 15° increments. Analysis was performed on secondary MPRs. We measured patella tilt angle as described by Dejour (PT Dejour), lateral patella tilt angle (LPTA), lateral patellofemoral angle according to Laurin (LA), lateral trochlea inclination (LTI), sulcus angle (SA), lateral shift (LS) and tibial tuberosity - trochlear groove distance with reference to the surgical epicondylar axis (TTTG). We performed Mann-Whitney U-tests as well as ROC analysis and ANOVA, each with a p < 0.05 considered as significant.

Results: All measurements at all flexion angles show statistically significant differences between OPI and HV except LPTA at flexion angles of 0°, 75° and 90°, LS

at 0° and 60°, and TTTG at 90°. ROC analysis shows the best area-under-curve for LTI at 0° knee flexion (0.8939). Combining TTTG with a cutoff ≥20 mm and PT with a cutoff < 12°, each measured at 30° knee flexion, gives a sensitivity/specificity/accuracy of 90/100/95%. Combining cutoffs for TTTG ≥20 mm and SA > 145°, each measured at 0° of knee flexion, gives a sensitivity/specificity/accuracy of 83.33/100/91.67%.

Conclusion: Combining TTTG and PT at 30° of knee flexion distinguishes accurately between OPI and HV, but combining TTTG and SA at more feasible 0° of knee flexion comes close to the former.

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

Abdominal Viscera (Solid Organs)

SS 801a

Liver carcinogenesis: Detection, characterisation and grading

Moderators:
L. Annet; Brussels/BE
C. Ayuso; Barcelona/ES

B-380   10:30

Clinical outcomes of follow-up CT for small (5-10 mm) arterially-enhancing nodules in the liver and risk factors for developing hepatocellular carcinoma
M. Park, Y.-S. Kim, W. Lee, H.K. Lim, H. Rhim; *Seoul/KR*

Purpose: To evaluate the outcomes of small (5-10 mm) arterially-enhancing nodules (SAENs) defined exclusively at the hepatic arterial phase of CT in a HCC-screening population and to determine clinical or imaging features helpful in differentiating HCC precursors from benign conditions.
Methods and Materials: This investigation was designed and initiated prospectively, and data were analyzed retrospectively. The study population included 112 patients (M:F=100:12, age 36-92 years) with 175 SAENs who had risk factors for HCC and were recommended to follow-up at three-month intervals. Follow-up was performed for > 24 months if the lesions were persistent. We evaluated serial changes during follow-up (1.4-41.8 months, mean 35.7 months) and analyzed the initial CT findings with multivariate analyses to evaluate the risk factors.
Results: Of 175 SAENs, 101 (57.7%) disappeared, 34 (19.4%) persisted, and 40 (22.9%) became HCCs. The mean interval of HCC development was 6.4months (range 1.4-41.3 months). The positive and negative predictive values of interval growth for becoming HCC were 81.3 and 92.9%, respectively. Presence of HCC treatment history (p=0.005, risk ratio [RR]=7.429), larger size of SAEN (p=0.003, RR=1.630), presence of coexistent HCC (p=0.021, RR=3.777), and absence of coexistent typical arterioportal shunt (p=0.003, RR=4.459) turned out to be independently significant risk factors for future HCC development.
Conclusion: SAENs were frequently seen in HCC-screening population, and these nodules have a 23% probability of becoming HCC. Risk increased particularly when the lesion was associated with a previous or concurrent HCC, showed an interval growth or a large size close to 10 mm, or was found without a coexistent typical arterioportal shunt.

B-381   10:39

Detection and characterization of focal liver lesions by MDCT in cirrhotic patients undergoing liver transplantation (LT)
V. Battaglia, I. Bargellini, E. Bozzi, F. Bianchi, D. Campani, C. Bartolozzi; *Pisa/IT (novetrequarti@yahoo.it)*

Purpose: To evaluate the diagnostic performance of three-phasic MDCT in detection and characterization of focal liver lesions in cirrhotic patients and in assessing patients within/outside Milan criteria (MC).
Methods and Materials: Two-hundred consecutive patients (M/F: 153/47, mean age 54.8 years) undergone LT between November 2004 and June 2009. All patients were imaged by MDCT before LT. Diagnosis of focal liver lesions, at imaging, was based on the latest International guidelines. CT results were correlated to pathologic findings on explanted livers on a patient-by-patient and lesion-by-lesion basis.
Results: Histology revealed 111 hepatocellular carcinomas (HCC) in 71 patients (mean size 22.8 ±12.6 mm, range 3-67 mm); 41 high grade dysplastic nodules (HGDN) in 24 patients (mean size 14.2±7.5 mm, range 7-45 mm). MDCT detected 132/152 (86.8%) nodules and correctly diagnosed 91/111 (82%) HCCs and 18/41 (44%) DNs. Diagnosis of HCC was significantly influenced by nodule size (P=.0003). MDCT described 37 nodules, not confirmed at pathology, classified as HCCs (n=11,

29.7%), DNs (n=12, 32.4%) or indeterminate (n=14, 38.7%). On a patient-by-patient basis, sensitivity and specificity of MDCT for the diagnosis of HCC were 93% (66/71) and 93% (120/129), respectively. Out of 66 patients considered to have HCC either at MDCT or pathology (54 within/12 outside MC, respectively), MDCT wrongly classified 2 patients as outside MC and 1 patient as within MC.
Conclusion: MDCT can overestimate the extension of HCC but is a reliable method for screening cirrhotic patients before LT. Diagnostic accuracy in identifying HCC is high. Diagnostic accuracy in identifying patients either within/outside MC has been 95.4%.

B-382   10:48

Dual energy-CT of hypervascular liver lesions in patients with HCC: Investigation of image quality, iodine uptake, and virtual non-contrast images
J.-C. Altenbernd, T. Heusner, S.C. Ladd, A. Ringelstein, M. Forsting, G. Antoch; *Essen/DE (jens.altenbernd@uk-essen.de)*

Purpose: To investigate dual energy-CT (DECT) of hypervascular liver lesions (HLL) in patients with HCC.
Methods and Materials: 40 patients (29 men, 11 women; mean age 64y ± 10y) with HLL were examined with abdominal DECT. In each patient, a non-enhanced and a contrast-enhanced scan with arterial and portalvenous delay were performed. Attenuation was measured in Hounsfield units (HU) separately on: (1) the non-enhanced scan, (2) a virtual non-enhanced scan reconstructed from the two different tube currents, (3) the 80 kV-scan, (4) the 140 kV-scan, and (5) on the averaged images (mixing ratio 0.3). Measurements were performed in the following regions: normal liver, muscle, air, fat, and aorta. The differences in the contrast to noise ratio (CNR) and the signal to noise ratio (SNR) were compared between the different data sets using the Wilcoxon-test.
Results: The mean difference in Hounsfield units of hypervascular liver lesions between 80 kV images and averaged-images was 28.31±15.44 (p < 0.05). The HU-differences of muscle, fat, air, aorta, and normal liver between non-enhanced and virtual non-enhanced scans were 1.23±8.16 (p=0.52), 11.31±11.12 (p < 0.05), 0.87±18.37 (p=0.55), 0.31±9.06 (p=0.88), and 3.41±5.18 (p < 0.05). The SNR of averaged images (12.37±4.64) and 80 kV images (10.98±5.06) differed significantly (p=0.017) while the CNR was similar (p=0.536).
Conclusion: An increased signal to noise ratio in 80 kV images as compared with averaged dual-energy-images may improve the sensitivity when detecting hypervascular lesions on 80 kV data sets. Further studies will have to address this question. The attenuation on virtual non-enhanced images differs significantly from conventional contrast-enhanced images in some body regions.

B-383   10:57

Hepatocellular carcinoma in liver transplant candidates: Prospective comparison of ultrasound, multislice CT, MR imaging with gadobenate dimeglumine
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Purpose: To intraindividually evaluate the performance of US, Multislice CT and MR Imaging with gadobenate dimeglumine for identification of HCC in patients scheduled for liver transplantation.
Methods and Materials: 120 consecutive patients with 125 HCC nodules underwent US, MRI at 1.5 and 64-slice CT at a mean interval of 20 days. Imaging results were correlated with histopathologic findings and imaging follow-up. MR acquisitions comprised unenhanced breath-hold T2W images and volumetric 3D Gd-BOPTA-enhanced (0.1 mmol/kg; MultiHance, Bracco®) T1W GRE images acquired at 25, 60, 180 s (dynamic phase) and 90 min (hepatobiliary phase). 64-slice CT was performed with 3-mm section thickness, 250 mAs, 120 kVp. A triple-phase protocol was started 18, 60 and 180 s after reaching a trigger threshold of 150 HU above baseline CT number of the aorta. Image analysis was performed by three observers in consensus. Diagnostic accuracy was evaluated using the alternative-free response receiver operating characteristic (AFROC) method. Sensitivity, Specificity, with corresponding 95% confidence intervals were determined.
Results: MR Imaging with Gd-BOPTA (0.88) reported the significantly higher diagnostic accuracy; MSCT (0.80) was also significantly better than and US (0.699). On a lesion-by-lesion basis, the mean sensitivity (85.5%) of Gd-BOPTA MRI was significantly higher than that of CT (75%) and US (75.6%) The mean specificity (92.1%) of Gd-BOPTA MRI was significantly higher than that of CT (89.9%) and US (64.2%).
Conclusion: Gd-BOPTA-enhanced MRI is significantly more accurate, sensitive and specific than 64-slice CT and US for the diagnosis of HCC in patients with cirrhosis prior to liver transplantation.

B-384 11:06

Noninvasive diagnostic vascular criteria (wash-in and washout) for hepatocellular carcinoma in cirrhotic patients: Qualitative comparison evaluation of gadoxetic acid-DTPA-enhanced MR imaging and multidetector CT

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Purpose: To evaluate efficacy of Gd-EOB-DTPA enhanced MRI for diagnosis of hepatocellular carcinoma (HCC) in cirrhotic patients based on noninvasive diagnostic vascular criteria (wash-in and washout) comparing with that of dynamic MDCT.
Methods and Materials: We retrospectively reviewed 67 patients with pathologically proven 80 HCC nodules performed with both EOB-enhanced MRI and MDCT. All Images were qualitatively and independently evaluated by three readers in random reading sessions with 4-point grading score. Separate and combined mean grading scores for wash-in and washout criteria were calculated. Based on the results, all nodules were also classified as "positive or negative nodule" to evaluate the overall diagnostic ability.
Results: The mean grading score for wash-in alone of Gd-EOB-DTPA enhanced MR images was significantly higher than that of MDCT (P < 0.001). The mean grading score for washout alone in portal phase and in equilibrium phase was not significantly different between MDCT and Gd-EOB-DTPA enhanced MRI, though the results in equilibrium phase of Gd-EOB-DTPA enhanced MRI was better than those of MDCT. The mean confidence score for combined of wash-in and washout in equilibrium phase of Gd-EOB-DTPA enhanced MRI was significantly higher than that of MDCT (P < 0.05). The sensitivity of "positive nodule" on Gd-EOB-DTPA enhanced MRI (77.5%) was higher than that on MDCT (69.6%) but the significant differences were not observed.
Conclusion: Gd-EOB-DTPA enhanced MRI more prominently presents the noninvasive diagnostic vascular criteria than MDCT and provides certain noninvasive diagnosis for HCC in cirrhotic patients.

B-385 11:15

Hepatocellular carcinoma (HCC) with indeterminate findings at initial CT or MRI: Does imaging follow-up allow detection of conclusive imaging findings before significant tumor growth?

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Purpose: To evaluate whether imaging follow-up of HCC presenting as indeterminate lesion at baseline CT or MRI allows detection of conclusive imaging findings.
Methods and Materials: This IRB-approved retrospective study included 25 cirrhotic patients (17 M, 8 F; mean age, 63 y) who underwent baseline and follow-up CT or MRI of the liver between August 2005 and August 2009 (mean interval, 270±180 days), with 28 small (≤ 2 cm) HCCs with indeterminate findings at baseline study: hypervascularity without washout during hepatic venous or delayed phase (n=16), or hypovascularity on all phases (n=12). Proof of HCCs was obtained with histopathological analysis (n=13) or imaging follow-up (n=15). Two independent radiologists evaluated the images for onset of signs of conclusive imaging findings according to AASLD guidelines. Lesion maximal diameter at baseline and follow-up examination were recorded. Tumor growth and mean interval follow-up were compared among lesions with and without conclusive imaging findings of HCC at follow-up (Student's t-test).
Results: At follow-up, 17/28 (61%) indeterminate lesions on baseline examination (mean size, 1.2±0.4 cm) showed conclusive imaging findings of HCC: washout sign appeared in 11/16 (69%) hypervascular lesions, and 6/12 (50%) hypovascular lesions became hypervascular. There was no significant difference in mean tumor growth between HCCs with conclusive imaging findings and those unchanged during follow-up (1.2±0.4 to 1.6±0.4 cm vs. 1.1±0.3 to 1.4±0.3 cm, p=0.58). The mean interval follow-up was 255±181 days for lesions showing conclusive imaging findings, and 285±150 days for lesions unchanged (p=0.73).
Conclusion: Interval changes in enhancement pattern may precede significant tumor growth during imaging follow-up of small indeterminate HCCs.

B-386 11:24

Growth rate of small (≤ 2 cm) HCC in cirrhotic patients: Determining optimal screening interval with serial CT and MRI

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Purpose: To retrospectively determine the growth rate and the optimal follow-up interval for the surveillance of small HCC in cirrhotic patients.

Methods and Materials: The study population included 50 cirrhotic patients (38 M, 12 F; mean age, 64 years) with 74 HCCs ≤ 2 cm who underwent serial contrast-enhanced CT or MRI between August 2005 and August 2009. Tumors were confirmed histologically (n=19) or after long-term imaging follow-up (n=55). Patients were divided in 3 subgroups based on the time interval (TI) between examinations: Group A (n=22 patients; TI ≤ 180 days; mean, 109 days), Group B (n=17; 180 < TI ≤ 365 days; mean, 262 days), Group C (n=11; TI > 365 days; mean, 543 days). Two independent radiologists measured the three perpendicular maximum diameters of each tumor at index and follow-up examinations and calculated tumor volume. Tumor growth rate was assessed with tumor percentual diameter increase (TPDI), tumor diameter doubling time (TDDT), and tumor volume doubling time (TVDT). TPDI among groups was compared using Student t-test.
Results: Between the index and follow-up examination, mean tumor diameter increased from 1.3±0.5 to 1.7±0.7 cm for Group A (n=30 HCCs), from 1.1±0.3 to 1.4±0.4 cm for Group B (n=19), and from 1.2±0.4 to 1.7±0.6 cm for Group C (n=25). There was significant difference in mean TPDI between group B (36±30%) and C (50±41%) (p=0.03) but no difference between Group A (27±22%) and B (p=0.27). The mean TDDT and TVDT were, respectively, 761 days (range, 61-2,832 days) and 360 days (range, 25-2,697 days).
Conclusion: Small HCCs demonstrate slow growth at imaging follow-up. A 6-12 months imaging follow-up may be recommended for the surveillance of small HCCs in cirrhotic patients.

B-387 11:33

Hepatobiliary-phase signal intensity of hepatic nodules in Gd-EOB-DTPA-enhanced MRI does not correlate with histological findings in cirrhotic patients

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Purpose: To correlate the signal intensity of hepatic nodules with respect to the liver in the hepatobiliary phase after Gd-EOB-DTPA (Primovist®) administration with the histological findings in cirrhotic patients.
Methods and Materials: We studied 49 hepatic nodules in 43 cirrhotic patients examined with 2D and 3D Gd-EOB-DTPA-enhanced T1-weighted echo-gradient MRI at 1.0 T (n=2) or 1.5 T (n=41). Images were read in the cellular phase (15-20 minutes after the injection of the contrast agent). Nodules were classified at visual inspection as isointense, hypointense, or hyperintense respect to the adjacent liver parenchyma and the signal intensity of the lesions was correlated to the histological findings.
Results: Histologically, the 49 nodules (mean size, 25 mm; range, 10-80 mm) were hepatocellular carcinoma (n=26), dysplastic nodules (n=17), macronodular regenerative nodules (n=2), and adenocarcinoma (n=4). At Gd-EOB-DTPA-enhanced MRI, 36 lesions (73%) were hypointense, 9 (18%) were isointense, and 4 were hyperintense (8%). Of the 26 hepatocellular carcinomas, 19 (73%) were hypointense, 4 (15%) were isointense, and 3 (11%) were hyperintense. Of the 17 dysplastic nodules, 11 (64%) were hypointense, 5 (29%) were isointense, and 1 (6%) was hyperintense. The two lesions classified as macronodular regenerative nodule (100%) were hypointense. The four adenocarcinomas (100%) were hypointense.
Conclusion: In this study, the signal intensity of hepatic nodules in the cellular phase after the administration of Gd-EOB-DTPA cannot differentiate between benign and malignant lesions.

B-388 11:42

Enhancement patterns of hepatocellular carcinomas on multiphasic, multi-detector row CT: Comparison with pathologic differentiation

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Purpose: To correlate the enhancement patterns of hepatocellular carcinoma (HCC) on multiphasic MDCT with the degree of tumor differentiation.
Methods and Materials: 220 patients with 246 surgically proven HCCs including 31 well-differentiated (WD), 147 moderately-differentiated (MD), 65 poorly-differentiated (PD), and 3 undifferentiated tumors were included. CT protocol included precontrast, arterial, portal, and delayed phases. Images were evaluated for enhancement pattern, degree of attenuation at each phase, relative timing of washout, and presence of intratumoral vessels, through consensus reading by two radiologists. Imaging features were correlated with tumor differentiation using Fisher's exact test or x^2-test.
Results: In arterial phase, 193 of 246 (78.5%) HCCs showed hypervascularity, with a higher proportion in MD-HCCs (83.7%). Arterial iso- or hypoattenuation was more commonly observed in PD- and WD-HCCs (30.8 and 29%, respectively). Of 193 hypervascular HCCs, approximately 3/4 of MD- and PD-HCCs showed

typical washout on portal or delayed phase, whereas it was only 50% in WD-HCCs (P <.048). PD- and MD-HCCs showed early washout on portal phase while WD-HCCs tended to have no washout until delayed phase (P <.033). Intratumoral vessels were mainly detected in MD-HCCs (63.9%) and PD-HCCs (64.6%), than in WD-HCCs (29%; P < 0.001). There was a tendency of HCCs 2 cm or larger more likely to be MD- or PD-HCCs.

Conclusion: MD-HCCs generally show classic enhancement patterns of HCC, while WD- and PD-HCCs account for most of atypical enhancement patterns. Presence of intratumoral vessels, timing of washout, and tumor size were correlated with the pathologic differentiation of HCCs.

B-389   11:51

Gadoxetate disodium-enhanced MRI for evaluation of histologic grading of hepatocelllualr carcinomas: Special emphasis on hepatobiliary phase imaging

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Purpose: To determine enhancement characteristics of hepatocellular carcinomas (HCCs) on gadoxetic acid-enhanced MRI and to assess the usefulness of hepatobiliary phase (HBP) MR imaging for evaluation of histologic grades of HCC.
Methods and Materials: Eighty-nine patients with 123 pathologically confirmed HCCs who underwent gadoxetic acid-enhanced MRI at 3.0 T unit were included in this study. There were 19 grade I tumors, 69 grade II tumors, 26 grade III tumors and 5 grade IV tumors. Unenhanced images, dynamic images and HBP images were obtained using a FS-3D GRE sequence before and after administration of gadoxetic acid (0.025 mmole/kg). Two abdominal radiologists evaluated relative signal intensity (SI) of the lesions compared to adjacent liver, and determined which phase showed the best lesion conspicuity. In addition, SNRs of the tumor and liver, the lesion- to- liver CNRs, and enhancement ratio (ER) of tumors were measured.
Results: Among 123 HCCs, 110 lesions (89.4%) showed low SI, 2 lesions (1.6%) had iso-SI, and 11 lesions (8.9%) showed high SI on HBP images. The lesion conspicuity is the best on HBP imaging. Only four grade I tumors and seven grade II tumors showed hyperenhancement on HBP imaging. Grade I tumors showed significantly higher ER than other tumors: 63.4 vs. 25.4%. However, there was no significant difference in SNRs of the tumors, and the lesion-to-liver CNRs based on histologic grade of HCCs.
Conclusion: Although gadoxetic acid-enhanced MRI seems to have a limitation in evaluating tumor grade of HCCs, HBP imaging provided high contrast between the tumors and the liver.

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

Chest

SS 804

Pulmonary angiography: Beyond angio CT

Moderators:
G. Staskiewicz; Lublin/PL
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B-390   10:30

Lung perfusion analysis with dual energy CT: Influence of window-settings on the diagnosis of underlying pathologies of perfusion deficits

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Purpose: On lung perfusion analysis with Dual Energy CT (DECT) commonly three patterns of perfusion deficits (PD) are observed: Wedge-shaped, circumscribed but not wedge-shaped, and patchy. We investigated the influence of different window-settings on the identification of the underlying pathologies for these types of PD.
Methods and Materials: 3534 segments in 186 consecutive patients who underwent pulmonary DECT angiography for clinically suspected pulmonary embolism were analyzed. Iodine distribution in the lung parenchyma was calculated and assessed for PD. Afterwards, lung and angio-window were applied and assessed for vascular and parenchymal pathologies.
Results: 1313/3534 segments showed PD, of which 193 were wedge-shaped, 458 circumscribed and 662 patchy. Circumscribed and patchy PD were almost only associated with parenchymal pathologies (infiltration, emphysema, tumor, ground glass) and only in 0.1% with PE. The underlying pathologies for wedge-shaped PD were in 86% PE, in 2% tumors compressing pulmonary arteries, in another 2% located bullae and in further 3% infiltrations. 7% (n = 15) of the segments in this group did not show any detectable pathologies, but in 80% (n = 10) of these

cases patients had PE in another segment. In total, 3% (n = 5) of wedge-shaped PD in 2 patients remained with unclear direct cause.
Conclusion: Whereas patchy and circumscribed PD are almost exclusively associated with parenchymal pathologies, wedge-shaped PD are mostly associated with PE. For a small number of wedge-shaped PD, the underlying cause remained unclear. Peripherally situated micro-emboli may be discussed for that finding.

B-391   10:39

Evaluation of acute pulmonary embolism (PE) with dual energy CT: Respective usefulness of morphologic and functional information

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Purpose: To investigate the respective usefulness of "diagnostic" and perfusion scans in acute pulmonary embolism.
Methods and Materials: The study group included 30 consecutive patients with no underlying cardio-respiratory disease in whom acute pulmonary embolism was diagnosed on dual energy MDCT angiograms. Two radiologists evaluated by consensus the presence of: (a) endoluminal clots on transverse "diagnostic" scans (contiguous 1-mm thick averaged images from both tubes), and (b) triangular perfusion defects of embolic type on perfusion scans.
Results: Considering 20 segments per patient (total: 600 segments), the "diagnostic" scans identified 153 segments with endoluminal clots (153/600; 25.5% of segments) (isolated segmental clots: 47 segments; isolated subsegmental clots: 30 segments; segmental and subsegmental clots: 76 segments) and 447 segments without endoluminal abnormalities (74.5%). Perfusion scans: (a) identified perfusion defects in 87 of the 153 embolic segments (87/153; 56.9%), beyond obstructive (32/87) and nonobstructive (55/87) clots; (b) were normal in the remaining 66 embolic segments (66/153; 43.1%); (c) identified perfusion defects of embolic type in 19 of the 447 segments without endovascular abnormalities (19/447; 4.2%). A good correlation was found between the percentage of obstruction of the pulmonary arterial bed (mean Mastora score: 9.5%) and the mean percentage of the pulmonary microcirculation devoid of perfusion (mean percentage: 11.2%) (p < 0.0001; r=0.72).
Conclusion: These results demonstrate a complementarity between the two series of images when evaluating acute pulmonary embolism.

B-392   10:48

also EPOS

Role of dual energy CT in pulmonary embolism

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Purpose: To evaluate the utility of dual energy CT in evaluation of patients with pulmonary thromboembolism at segmental and sub segmental levels.
Methods and Materials: Patients suspected to have pulmonary embolism underwent CT pulmonary angiography on a dual source CT scanner (Siemens-Somatom Definition). Dual energy scans were obtained in all patients, images were reconstructed to obtain: 1) MIP images of pulmonary arteries, 2) Perfusion images from dual energy data sets, 3) Pulmonary parenchyma on HRCT and 4) 0.6 mm contigous source images. The scans were evaluated by two independent radiologists to determine the sensitivity of MIP images of the pulmonary arteries to detect pulmonary emboli. In cases which were negative for pulmonary emboli on MIP, images of pulmonary arteries the perfusion images were evaluated. If any perfusion defects were seen, corresponding lung window images were evaluated as well as corresponding segmental/subsegmental pulmonary arteries were evaluated for occlusive/non-occlusive thrombi.
Results: 117 patients underwent CT pulmonary angiography to detect pulmonary emboli. Evaluation of the MIP of pulmonary arteries revealed 71 negative studies for pulmonary emboli, 46 were positive for pulmonary emboli. Of the 71 negative studies for pulmonary emboli, 23 revealed perfusion defects. Of these, 7 demonstrated segmental/subsegmental emboli on close evaluation of 0.6 mm source images. The 16 cases which demonstrated perfusion defects and no segmental/subsegmental emboli on the 0.6 mm source images revealed corresponding parenchymal/interstial abnormalities on the HRCT sections.
Conclusion: Dual energy CT is very useful in the detection of segmental/subsegmental emboli, especially in the setting of a negative pulmonary angiogram.

B-393   10:57

Parametric mapping of MRI perfusion sequences for the diagnosis of pulmonary embolism

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Purpose: To evaluate the contribution of post-processing by parametric maps and enhancement curves obtained from MRI perfusion sequences for the diagnosis of acute pulmonary embolism.

Methods and Materials: This study was an ancillary study of a clinical trial comparing MRI to CT for diagnosis of pulmonary embolism. In 120 patients, perfusion sequences were studied to determine their specific contribution to the diagnosis. Two methods were compared: 1) native and subtracted perfusion images were analysed visually and 2) image post-processing was performed using Functool software (GEMS), yielding parametric maps of the Integral of Positive Enhancement Integral (IPE) and Mean Enhancement Time (MET), and enhancement curves in lung parenchyma. The results of these two analyses were compared to the standard of reference (CT).

Results: In 19 cases (16%), images could not be analysed according to the two methods, due to inadequate contrast injection or artefacts limiting interpretation. Thirty-nine of the 101 patients analysed (40%) had pulmonary embolism on CT. Visual analysis of perfusion images yielded a sensitivity and specificity of, respectively, 79 and 74%. Post-processing with parametric maps and analysis of enhancement curves yielded a similar sensitivity (79%) but a slightly higher specificity (82%). False positives were in majority due to perfusion defects related to focal or diffuse airway disease.

Conclusion: Post-processing by parametric maps and enhancement curves may improve specificity of diagnosis of PE on perfusion MRI sequences.

B-394 11:06

Dual energy CT angiography of chronic thromboembolic disease: Can it help recognize links between pulmonary vascular features and perfusion defects?

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Purpose: To evaluate whether dual energy CT angiography (DE-CTA) could identify links between morphologic and functional abnormalities in chronic pulmonary thromboembolism (CPTE).

Methods and Materials: Seventeen consecutive patients with CPTE without underlying cardiorespiratory disease were investigated with DE-CTA with reconstruction of 2 series of images: (a) transverse diagnostic scans; and (b) perfusion scans. Two radiologists evaluated by consensus the presence of: (a) pulmonary vascular features of CPTE and abnormally dilated systemic arteries on diagnostic CT scans, and (b) perfusion defects of embolic type on perfusion scans.

Results: Diagnostic scans showed a total of 166 PAs (166/833; 26.4%) with features of CPTE (mean ±SD number of abnormal arteries/patient: 9.8 ± 5.3), more frequently seen at the level of peripheral than central arteries (8.94 vs 0.82; $p < 0.0001$), including severe stenosis with partial (97/166; 58%) or complete (20/166; 12%) obstruction, webs and bands (37/166; 22%), partial filling defects (7/166; 4%), focal stenosis (4/166; 2%) and abrupt vessel narrowing (1/166; 0.6%). Perfusion scans showed 39 perfusion defects in 8 patients (median number: 4; range: 1-11). The most severe pulmonary vascular features of CPTE (i.e., severe stenosis with partial or complete obstruction) were seen with a significantly higher frequency in segments with perfusion defects than in segments with normal perfusion ($p < 0.0001$). Enlarged systemic arteries were observed with a significantly higher frequency ipsilateral to lungs with perfusion defects (9/12; 75%) compared with lungs without perfusion defects (5/22; 22.7%) (p=0.004).

Conclusion: Dual energy CTA demonstrates links between the severity of pulmonary vascular obstruction and perfusion impairment.

B-395 11:15

Dual-layer dual energy MDCT: Initial experience with iodine distribution maps of the entire chest in imaging of pulmonary embolism

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Purpose: To prospectively evaluate the use of iodine distribution maps acquired with a dual-layer dual energy MDCT to detect pulmonary embolism in the entire chest including the lung periphery.

Methods and Materials: In this prospective study, pulmonary CT angiography was performed in 30 patients referred for exclusion of pulmonary embolism on a dual-layer dual energy MDCT (Orion N, Philips Healthcare, Cleveland, OH) allowing simultaneous acquisition of two energy windows. Three sets of images (low, high energy and conventional CT) were automatically generated. Conventional CT images were assessed by an experienced thorax radiologist (> 15 years of experience) for pulmonary pathologies. Iodine distribution maps were generated from the low and high energy images giving a quantitative estimation of iodine concentration in the lungs including the entire chest as well as lung periphery. Image quality of pulmonary CTA/iodine distribution maps were subjectively graded (1: excellent - 5: poor). Iodine distribution maps were then assessed for perfusion defects and compared to findings in conventional CT images.

Results: Iodine distribution maps could be obtained for all patients including the entire chest with visualization of peripheral lung parenchyma. Subjective image quality of pulmonary CTA/iodine distribution maps was rated as 2 and 2.5, respectively. Pulmonary embolism was present in one patient. The perfusion defect in the iodine distribution map was consistent with the peripheral lung area affected by pulmonary embolism.

Conclusion: Iodine distribution maps obtained from simultaneously acquired high and low energy images using dual-layer dual energy MDCT allow detection of perfusion defects in the entire chest including lung periphery caused by pulmonary embolism.

B-396 11:24

also EPOS

Evaluation of the quality of CT pulmonary angiogram in pregancy and comparison with age matched controls

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Purpose: To evaluate the incidence of pulmonary embolism (PE) in pregnancy and the immediate postpartum period. To evaluate the quality of CT pulmonary angiograms (CTPA) in pregnancy and postpartum period and compare with age and sex matched non-pregnant controls.

Methods and Materials: The study group comprised 124 consecutive pregnant and postpartum women who presented with suspected PE and 124 age and sex matched non-pregnant controls. The individual studies were evaluated for diagnostic quality and presence of PE. Diagnostic quality was measured by means of regions of interest in the main pulmonary, right pulmonary, left pulmonary, segmental and subsegmental pulmonary arteries and the hounsfield unit was recorded. Subsequent maternal and paediatric outcomes were determined by patient follow-up.

Results: The incidence of PE in pregnancy and postpartum period on CTPA was 4.8%. There was an incidence of 3.1% in pregnancy and 8.5% in the immediate postpartum period. There was no significant difference in diagnostic quality of CTPA between pregnant and non-pregnant patients. The incidence of PE in pregnancy and immediate postpartum period was less than that for non-pregnant women of the same age (6.5% vs. 16.9%).

Conclusion: PE is the leading cause of maternal death however, the incidence of PE in pregnancy remains low. The diagnostic quality of CTPA scans in pregnancy is equal to those in non-pregnant controls. The optimum imaging strategy for PE in pregnancy remains controversial. Multidetector 64 slice CT allows evaluation of subsegmental pulmonary arteries and possibly decreases the amount of non diagnostic scans in pregnant women.

B-397 11:33

also EPOS

Reproducibility of CT signs of right heart strain in acute pulmonary embolism

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Purpose: Several CT signs have been described to determine right ventricular (RV) strain in patients with acute pulmonary embolism (PE). We aimed to determine the interobserver reproducibility of these signs for identifying the least observer dependent method.

Methods and Materials: Two experienced observers independently evaluated CT pulmonary angiography (CTPA) studies of 50 patients with acute PE for CT signs of RV strain: bowing of the inter-ventricular septum, inferior vena cava (IVC) reflux, RV diameter (RVD)/left ventricular (LV) diameter (LVD) ratio on axial and four chamber views, and RV volume (RVV)/LV volume (LVV) ratio. Interobserver reproducibility was assessed using Kappa statistics for qualitative variables and Spearman's rank correlation and Bland Altman analysis for continuous variables.

Results: The two observers had fair to moderate agreement (k=0.32-0.44) for septal bowing and moderate to good agreement (k=0.57-0.68) for diagnosing IVC reflux. The Spearman's rank correlation coefficients for RVD_{axial}/LVD_{axial} ratio and RVD_{4-CH}/LVD_{4-CH} ratio between the two observers were 0.88 ($P < 0.001$) and 0.85 ($P < 0.001$), respectively. On Bland Altman analysis, the mean differences (±standard deviation) for RVD_{axial}/LVD_{axial} ratio and RVD_{4-CH}/LVD_{4-CH} ratio were 0.014 (±0.195) and 0.001 (±0.242), respectively. The Spearman correlation coefficient for RVV/LVV ratio was 0.93 ($P < 0.001$). On Bland Altman analysis, the mean difference for RVV/LVV ratio was 0.033 (±0.229).

Conclusion: If CT signs of RV dysfunction are used to make patient management decisions, practitioners should be aware of the variable degree of subjectivity and reproducibility associated with these observations. Volumetric analyses with determination of the RVV/LVV ratio are the least user dependent and most reproducible.

B-398 11:42

Assessment of pulmonary hemodynamics in patients with chronic thromboembolic pulmonary hypertension (CTEPH) by high temporal resolution phase contrast MR imaging and correlation with simultaneous invasive pressure recordings

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Purpose: To validate the assessment of mean pulmonary artery pressure (mPAP) and pulmonary vascular resistancy (PVR) by high temporal resolution phase-contrast magnetic resonance imaging (PC-MRI) and to correlate the results with invasive catheter-based measurements.
Methods and Materials: Nineteen patients with suspected CTEPH underwent simultaneously acquired catheter-based mPAP and PVR measurement and high temporal resolution PC-MRI at 1.5 T. Using a non-segmented phase-contrast FLASH pulse sequence with high temporal resolution (TR/TE 10/2.5 msec), the measurements were performed with prospective triggering to the ECG and during free breathing of the patients. Based on velocity- and flow-time-curves, the absolute acceleration time (Ata), the maximum of mean velocities (MV), the volume of acceleration (AV), and the maximum flow acceleration (dQ/dt) were calculated.
Results: In all nineteen patients, flow and simultaneous invasive hemodynamic measurements could be carried out successfully. Using multiple correlation analysis of the parameters, a linear combination resulted in the following equation to calculate the mPAP: mPAP = 5,310-(0.462*Ata)-(0.436*MV)+(0.704*AV)+(0.00581 *dQ/dt). The derived values from PC-MRI correlated very well with simultaneously measured invasive mPAP values (R=0.955, p < 0.001). There was also a significant correlation with invasive PVR measurements (R = 0.601, p < 0.002).
Conclusion: High temporal resolution PC-MRI allows for reliable determination of mPAP in patients with suspected CTEPH. Furthermore, estimation of PVR seems to be possible. These results strengthen the role of MR imaging in the diagnostic work-up of the disease.

B-399 11:51

also EPOS

The comparative study of dual energy CT lung perfusion and pulmonary angiography with pulmonary perfusion scintigraphy in the diagnosis of pulmonary embolism

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Purpose: To investigate the accuracy of dual energy computed tomography in the depiction of lung perfusion defects and intravascular clots of the pulmonary arteries in patients with suspected pulmonary embolism (PE), and determine the diagnostic value of Dual Energy CT Pulmonary Angiography and Lung Perfusion (DE-CTPA and LP) in the assessment of pulmonary embolism with reference to pulmonary ventilation/perfusion scintigraphy.
Methods and Materials: Fifty patients with clinical suspected PE (male 26, female 24) underwent both DE-CTPA and LP and pulmonary ventilation/perfusion scintigraphy. The results were compared by segment, and the correlation between the intravascular clots in CTPA and the perfusion defects in CTLP was analyzed, and diagnostic accuracy of DE-CTLP was calculated regarding scintigraphy as standard of reference.
Results: (1) A total of 46 cases, 920 segments can be analyzed and diagnosed, while the other 4 cases had to be given up because of the poor image quality. For the CTPA, intravascular clots were found in 262 segments. For the perfusion imaging, 266 segments were identified the perfusion defects, while 268 segments were positive in the scintigraphy. (2) The perfusion defects in CTLP correlated well with the clots in CTPA (r=0.883, P < 0;0.01). The Dual energy Lung perfusion imaging shows good agreement with scintigraphic findings (Kappa = 0.940, P < 0.001). Compared with scintigraphy, the diagnostic accuracy per segment amounted to 97.5%, with 96.2% sensitivity and 98.0% specificity. The positive predictive value was 95.5%, and negative predictive value was 98.3%. (3) The radiation dose of DE-CTPA &LP scan was 4.37±0.47 mSv by using the CareDose4D technique.
Conclusion: DE-CTPA and LP, which can show the intravascular clots and lung perfusion defects simultaneously, can qualitative diagnose PE accurately, and correlated well between DE-CTPA and DE-CTLP shows good agreement to scintigraphy. The diagnostic accuracy of PE, even subsegmental PE, was remarkably elevated by using DE-CTPA and LP. Thus, DE-CTPA and LP can provide a pulmonary CT angiogram, high-resolution morphology of the lung parenchyma and perfusion information in one single exam, which is useful and valuable for the clinic.

Cardiac

SS 803

Assessment of atherosclerosis by cardiac MDCT

Moderators:
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B-400 10:30

Detection of subclinical atherosclerosis in a study population of HIV-infected patients receiving highly active antiretroviral therapy (HAART): Preliminary data from coronary multidetector computed tomography (MDCT)

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Purpose: Acute coronary syndromes and coronary artery disease (CAD) represent an emerging complication in HIV-infected patients under HAART likely related to metabolic changes (dyslipidemia, insulin-resistance and hypertension) induced by therapy leading to accelerated atherosclerosis. Present study sought to non-invasively assess incidence of CAD in an asymptomatic HIV-positive population receiving HAART, using MDCT as reference tool.
Methods and Materials: From an initial database of approximately 500 subjects, thirty-four HIV-infected patients (age range 25-73 yrs; mean 50.3 yrs) were enrolled; all subjects were asymptomatic and stratified as low cardiovascular risk patients according to the CUORE-project risk score. A standard MDCT acquisition protocol was acquired in all cases using a Dual-Source scanner with standard acquisition parameters and using an ECG-pulsing technique to minimize individual radiation exposure. MDCT data sets were evaluated for presence of coronary calcifications, non-calcified plaques, and significant stenoses (i.e. > 50%). Patients with significant CAD were addressed to selective coronary angiography (SCA) and results were correlated with clinical data (i.e. CD4+ and HIV-RNA).
Results: Significant coronary lesions (> 50%) were observed in 44% of our population (n=15) and confirmed at SCA. According to patient's clinical characteristics, responder showed a 50% prevalence of significant CAD (12/24) whereas non-responders and naive patients had respectively a 25% (1/4) and 33% prevalence (2/6).
Conclusion: Our preliminary data suggest that HIV-infected population is prone to accelerated, asymptomatic atherosclerosis; MDCT allows direct quantification of atherosclerotic burden and may be used as a non-invasive diagnostic tool for cardiovascular risk stratification and monitoring in patients under HAART. Relevant clinical implications entails prevention of major cardiovascular events.

B-401 10:39

Prevalence of treatable severe coronary artery disease in cardiac asymptomatic peripheral arterial disease patients

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Purpose: To evaluate the prevalence of significant coronary artery disease in patients with peripheral arterial disease (PAD) by non-invasive cardiac imaging using multidetector computed tomography (MDCT) and dobutamine stress magnetic resonance imaging (DSMR).
Methods and Materials: Patients from four vascular surgery departments with symptomatic PAD but without objectified coronary disease were randomised to undergo extensive imaging or usual care. Two hundred and thirty-one patients were randomised to extensive imaging (n=115) or standard care (n=116). In the imaging arm, unenhanced and contrast-enhanced MDCT was performed, using a 16- or 64-MDCT scanner. In case of a stenosis > 50% in the left main coronary artery, patients were referred to a cardiologist for further diagnostic work-up and subsequent treatment. All other patients in the imaging arm underwent DSMR. In case of inducible ischemia on DSMR, patients were also referred to a cardiologist.
Results: One hundred and fifteen patients were randomised to the imaging arm (80% male, mean age 62±7.3 years). MDCT was performed in 108 patients. Fifty-three (46%) had at least one significant stenosis. A stenosis of the left main coronary artery or its equivalent was found in 22 patients (19%). Of the 76 patients in whom DSMR was performed, 2 had inducible ischemia. In total 24 patients (21%, 95% confidence interval 14-29%) had evidence of severe coronary artery disease that would require additional treatment on top of usual risk factor management.
Conclusion: Non-invasive cardiac imaging in cardiac asymptomatic PAD patients identifies a class I coronary revascularisation indication in one-fifth of patients.

B-402 10:48

also EPOS

Presence and extent of calcified and non-calcified coronary atherosclerotic plaque burden as measured by cardiac CT between black and white patients with acute chest pain

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Purpose: Population-based studies consistently demonstrate lower burdens of coronary calcification among blacks despite an increased risk for cardiovascular events compared with whites. In a large cohort of consecutive black and white subjects, we compared the presence and extent of coronary atherosclerotic plaque as measured by coronary CT angiography (CCTA).
Methods and Materials: Subjects underwent CCTA (Definition, Siemens) for acute chest pain. Each coronary artery segment was evaluated for the presence of ≥ 50% stenosis and type (calcified, non-calcified, mixed) of atherosclerotic plaque. In addition, non-calcified plaque volume was quantified using a threshold-based automated algorithm. Presence and extent of atherosclerotic plaque between the groups was compared in univariate and multivariate regression analysis.
Results: Among 301 subjects (33% male, mean age: 55 ± 11 yrs), 150 subjects (50%) had black ethnicity. Black subjects were more likely diabetic (p < 0.01) and had a significantly higher number of segments with non-calcified plaque (1.4 ± 1.4 vs. 0.7 ± 1.1, p < 0.0001) as well as non-calcified plaque volume (2.233 ± 0.88 ml vs. 1.523 ± 0.64 ml, p < 0.0001). In contrast, subjects with black ethnicity had a lower number of segments with calcified plaque (0.5 ± 1.1 vs. 1.2 ± 1.8, p = 0.0002) as well as lower Agatston Scores (99 ± 275 vs. 138 ± 343, p = 0.008). Moreover, this significantly higher non-calcified plaque burden persisted after adjustment for diabetes and other risk factors (ß: 1.4, 95%-CI: 0.4 - 1.1).
Conclusion: We demonstrate that blacks, despite having a lower burden of calcified plaque, have a significantly higher burden of non-calcified plaque as detected by CCTA. Further studies are warranted to determine whether non-calcified plaque detection improves current risk prediction schemes in the black population.

B-403 10:57

Biomarkers of atherosclerotic disease activity and myocardial remodeling: Correlation with findings at cardiac CT

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Purpose: We aimed at correlating the plasma levels of biomarkers of atherosclerotic disease activity and myocardial remodeling with findings at cardiac CT.
Methods and Materials: 120 patients (54 women, 60±11 yrs) with suspected coronary artery disease underwent catheter angiography and dual-source CT coronary angiography. Patients were evaluated for coronary artery stenosis and vessel involvement with atherosclerosis. Cardiac function parameters were obtained using cine CT reconstructions. Plasma samples were analyzed with a cytokine and protease profiling panel. Seven biomarkers with a reported relationship with atherosclerosis and myocardial remodeling were measured: TNFα, IL-6, IL-8, matrix metalloproteinase (MMP)-2, MMP-3, MMP-7, MMP-8, and MMP-9. Data were analyzed using regression analysis.
Results: 89/120 patients showed atherosclerosis in at least one vessel. 58/120 had significant (> 50%) stenosis in at least one vessel. We found a significant (p < 0.05) positive correlation between the concentrations of IL-8 and MMP-3 and the degree of atherosclerosis. MMP-7 levels were significantly (p < 0.05) higher in patients with 3 vessel disease (55.5±20.7 vs. 41.3±23.2 ng). MMP2 and TNFα were significantly higher (p < 0.05) in patients with significant stenosis (48.1±21.6 vs 60.2±22.2 ng and 25.2±10.7 vs. 37.6±13.4 ng). There was a significant (p < 0.05) positive correlation between MMP7 and TNFα and cardiac function with better cardiac output in the presence of high plasma levels of those markers. MMP-8 and MMP-9 did not show any significant correlations.
Conclusion: Elevated levels of IL-8, MMP-2, MMP-3, MMP-7 and TNFα are associated with CT evidence of greater atherosclerotic disease activity and obstructive disease. MMP7 and TNFα may indicate more active myocardial remodeling with higher functional indices.

B-404 11:06

Major adverse cardiac events and the severity of coronary atherosclerosis assessed by CT coronary angiography in an outpatient population with suspected or known coronary artery disease

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Purpose: To investigate the predictive value of 64-slice Computed Tomography Coronary Angiography (CTCA) for major adverse cardiac events (MACE) in patients with suspected or known coronary artery disease (CAD).

Methods and Materials: 767 consecutive patients (496 men, age 62±11 years) with suspected or known heart disease referred for non-invasive coronary evaluation underwent 64-slice CTCA (Sensation 64, Siemens; Iomeprol 400 mgl/ml). Patients were followed-up for the occurrence of MACE (i.e. cardiac death, nonfatal myocardial infarction, unstable angina).
Results: 11564 coronary segments were assessed. Of these, 178 (1.5%) were not assessable because of insufficient image quality. Overall, CTCA revealed absence of CAD in 219 (28.5%) patients, non-obstructive CAD (coronary plaque ≤ 50%) in 282 (36.8%) patients, and obstructive CAD in 266 (34.7%) patients. A total of 21 major cardiac events (4 cardiac deaths, 12 myocardial infarctions, 5 unstable anginas) occurred during a mean follow-up of 20 months. One non-cardiac death occurred. Seventeen events occurred in the group of patients with obstructive CAD and 4 events occurred in the group of non obstructive CAD. The event rate was 0% among patients with normal coronary arteries at CTCA. At multivariate analysis, presence of obstructive CAD and diabetes were the only independent predictors of MACE.
Conclusion: Atherosclerotic burden evaluation by CTCA provides an independent prognostic value for prediction of MACE. Patients with normal CTCA findings have an excellent prognosis at follow-up.

B-405 11:15

Increased levels of oxidized LDL and hs-CRP among patients with exclusively non-calcified plaque as measured by coronary computed tomography angiography

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Purpose: Non-calcified atherosclerotic plaque may indicate increased cardiovascular risk. In a cross-sectional analysis, we determined the association between composition of atherosclerotic plaque and blood biomarkers, which have shown to predict cardiovascular events.
Methods and Materials: Patients with acute chest pain but no evidence of ischemia underwent contrast-enhanced coronary CT angiography to determine presence, extent and composition of coronary atherosclerotic plaque. Levels of blood biomarkers were independently measured at the time of the CT scan.
Results: Among 313 patients (mean age: 51.6±11 years, 62% male), few biomarkers were associated with the extent of calcified plaque (high sensitive C-reactive protein (hsCRP), matrix metalloproteinase 2 (MMP-2), and Cystatin C, p < 0.02) or non-calcified plaque (hsCRP, and ApoA1; p < 0.03) but these associations were attenuated after adjustment for age and gender. Subjects with exclusively non-calcified plaque (n=15 [5%]) had significantly higher levels of hs-CRP and oxidized low-density lipoprotein (ox-LDL) (p=0.01 and 0.03, respectively) but lower levels of adiponectin (p=0.03) when compared subjects with calcified plaque (n=130, 42%), despite that those were significantly older and had more cardiovascular risk factors.
Conclusion: Younger patients with non-calcified plaque have higher levels of hs-CRP and ox-LDL and decreased levels of adiponectin, which may support the hypothesis that inflammation contributes significantly to early coronary atherosclerosis. Further research is warranted to confirm that non-calcified plaque is an early marker of cardiovascular risk in younger patients.

B-406 11:24

Coronary calcium improves assessment of coronary heart disease risk

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Purpose: The purpose of this study was to evaluate whether the addition of the coronary calcium score to cardiovascular risk factors improves risk classification for coronary heart disease in a prospective, population-based study.
Methods and Materials: The study comprised 2038 asymptomatic participants (69.6±6.2 years) from the Rotterdam study. All participants underwent electron-beam tomography to assess the amount of coronary calcium. During a median follow-up of 6.8 years, 129 coronary events occurred. Subjects were classified in 10-year coronary risk categories based on the Framingham risk model before and after adding coronary calcium. Reclassification due to adding coronary calcium was evaluated.
Results: Reclassification after adding coronary calcium was most substantial in subjects initially classified as intermediate risk (10-20% risk). In men, 64% were reclassified, 38% moved to the low-risk (< 10% risk) and 26% to the high-risk category (> 20% risk). In women at intermediate risk, 58% were reclassified of which 38% moved downward and 20% upward in risk. All subjects were reclassified into more accurate risk categories. When coronary calcium was added to the Framingham risk model, discrimination improved significantly (C-index from 0.72 to 0.78, p < 0.001).

Saturday

Conclusion: Coronary calcium measurement, especially in individuals initially judged to be at intermediate Framingham risk, improves accuracy of risk classification for coronary heart disease, compared to risk factors alone. Based on coronary calcium testing, nearly two-thirds of an asymptomatic population at intermediate risk was reclassified as having either low or high risk of coronary heart disease.

B-407 11:33

Noncalcified coronary plaque in asymptomatic subjects with low coronary artery calcium score: Prevalence, plaque characteristics, and predictors with coronary CT angiography

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Purpose: We aimed to investigate the prevalence and severity of noncalcified coronary plaque (NCP) using coronary CT angiography (CCTA) in asymptomatic subjects with low coronary artery calcium score (CACS) as compared to those with 0 CACS.
Methods and Materials: We enrolled 7515 asymptomatic subjects (4751 men, 2764 women; mean age 51.4 years) who had undergone both CACS and CCTA for health screening purpose. Patients were categorized as having 0 CACS (n=6040) or low CACS (n=707; men from 1 to 50 and women from 1 to 10). The presence of plaque, severity of stenosis, plaques characteristics were assessed by CCTA. We also evaluated conventional risk factors to assess predictors for the presence of NCP in asymptomatic subjects with low CACS using multiple logistic regression method.
Results: NCP was detected in 418 out of 6040 patients (6.9%) with 0 CACS and 223 out of 707 patients (31.5%) with low CACS (p < 0.05). Compared to subjects with 0 CACS, those with low CACS had increased rates of significant stenosis caused by NCP (0.8 vs 7.5%, p < 0.05). In the low CACS group, independent predictors for presence of NCP were male gender, lower HDL cholesterol, diabetes and hypertension compared to subjects without NCP (all p < 0.05). Diabetes and hypertension were independent risk factors for NCP with significant stenosis (p < 0.05).
Conclusion: Compared to subjects with 0 CACS, the prevalence or severity of NCP is significantly higher in asymptomatic subjects with low CACS.

B-408 11:42

also EPOS

How to detect the atherosclerosis early? Conclusions of international twin study 2009

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Purpose: To estimate heritability and environmental effects on arterial stiffness using a twin sample.
Methods and Materials: 128 Italian (70 MZ, 58 DZ), 50 American (47 MZ, 3 DZ) and 50 Hungarian (42 MZ, 8 DZ) twin pairs were included in the study as part of International twin study 2009. TensioMed Arteriograph was used to measure the arterial stiffness parameters, carotid IMT (CCA proximal and distal, ACI proximal on both sides) by ultrasound at the same time.
Results: Based on 96 Italian pairs (52 MZ, 44 DZ; mean age 60.67±7.02), the preliminary results on AIxbra were: intraclass correlation 0.45 (95% CI, 0.21 to 0.62) in MZ and 0.19 (95% CI, -0.13 to 0.45) in DZ pairs; heritability 0.45 (95% CI, 0.22 to 0.62) and unshared environmental effect 0.55 (95% CI, 0.38 to 0.78) adjusted by age. Regarding PWVao, intraclass correlation was found to be 0.32 (95% CI, 0.07 to 0.52) in MZ, 0.25 (95% CI -0.08 to 0.51) in DZ pairs; heritability was 0.14 (95% CI, 0.0 to 0.52), shared environmental effect was 0.18 (95% CI, 0.0 to 0.46) and unshared environmental effect was 0.68 (95% CI, 0.48 to 0.90). Carotid IMT and AIxbra, PWVao correlations will be also calculated. Final results based on 230 pairs will be presented.
Conclusion: Arterial stiffness parameters are heritable; this can be detected in early stage either by carotid ultrasound or pulsewave analysis in order to be treated by appropriate therapy to prevent consequences of atherosclerosis like stroke, heart attack or peripherial vascular disease.

B-409 11:51

Detection of coronary atherosclerotic plaque progression by CT coronary angiography: A 3 year follow-up study

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Purpose: Non-invasive evaluation of coronary plaque progression by CT coronary angiography (CTCA) may improve insights in natural history, and in intervention response. To show whether this is feasible, we evaluated coronary plaque progression during 3 year follow-up by CTCA in survivors of an acute coronary syndrome (ACS).
Methods and Materials: Fifty-two patients had a CTCA at baseline of which 36 (30 men; mean age 54.2±9.8) underwent a follow-up scan after 3 years (mean follow-up period 38 months±3.1). Two observers qualitatively evaluated the scans on a per segment basis, and graded segments into 6 categories (0%; > 0-20%; > 20-50%; > 50-70%; > 70-< 100% and 100% lumen diameter reduction). Progression was defined as change in stenosis category between baseline and follow-up scan.
Results: A total of 491 segments without stent implantation were included in the analysis. Prevalence of coronary plaque on a per segment level was 35% (171/491) and on a per patient level 86% (31/36). Significant stenoses (> 50% lumen reduction) were found in 27% of the patients (10/36). Plaque progression was observed in 2% (11/491) of the segments and in 25% (9/36) of the patients. Five calcified plaques and 2 mixed plaques showed minimal plaque progression while 4 calcified plaques developed during the FU. Only in 1 patient a lesion progressed to a significant stenosis.
Conclusion: CTCA detected (minimal) plaque progression in 25% of the patients during a 3 year follow-up period after an ACS.

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

Genitourinary

SS 807

Prostate cancer

Moderators:
E. Sala; Cambridge/UK
J. Venâncio; Lisbon/PT

B-410 10:30

Comparison of whole body MRI including DWI and 11C-choline PET/CT in recurrent prostate cancer patients

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Purpose: To assess the potential of whole-body MRI including DWI in recurrent prostate cancer in relation to ^{11}C-Choline-PET/CT.
Methods and Materials: 22 patients underwent whole-body MRI using axial DWI (b-values 50 and 600 s/mm²) and ^{11}C-Choline-PET/CT. To compare diagnostic performance for MRI and ^{11}C-Choline PET/CT, ROC curves were calculated. ADC-values and SUV were determined in all lymph nodes, bone metastases and representative non-involved bone. ADC-values and SUVs were compared by using linear-regression analysis. All clinical findings/consensus of ^{11}C-Choline-PET/CT and MRI served as standard of reference.
Results: 83 lesions were considered as malignant: 10 local recurrences, 45 lymph nodes, 35 bone and 5 lung metastases. Overall sensitivity, specificity and accuracy for ^{11}C-Choline-PET/CT were 94.3, 76.3 and 93.1%, for whole body MRI 77.9, 94.1 and 81.0%, respectively. AUC was significantly higher for ^{11}C-Choline-PET/CT than for MRI (0.865 and 0.802, respectively). While 8/10 local recurrences were only detected in 11C-Choline-PET/CT, 6 bone metastases were only found by MRI. A highly significant difference (p < 0.01) could be found for the mean ADCs and SUVs for benign and malignant retroperitoneal and pelvic lymph nodes with a moderate and highly significant inverse correlation (r=-0.54, p < 0.0001). SUVs of bone metastases were significantly higher than in normal bone (p < 0.01), whereas ADCs showed only a trend to higher values in metastases compared to normal bone.
Conclusion: Whole-body MRI including DWI is a promising tool for assessment of lesions in recurrent prostate cancer patients. Our preliminary data suggest that MRI is inferior to ^{11}C-Choline-PET/CT concerning local recurrence, but seems to have complementary value in lymph node and bone metastases.

B-411 10:39

1HMRSI-DCEMR versus [(11)C]choline PET/CT in the detection of local prostate cancer recurrence after retropubic radical prostatectomy

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Purpose: The aim of this study was to compare proton MR spectroscopic imaging (1H-MRSI) and dynamic contrast-enhanced MRI (DCE-MRI) combined techniques analysis versus PET/CT in the detection of local prostate cancer recurrence after Radical Retropubic Prostatectomy (RRP).
Methods and Materials: Eighty-two patients with PSA values major than 0.8 ng/ml and TRUS suspected for local recurrence of prostate cancer after RRP underwent to MR examination on 1.5 T scanner (Avanto, Siemens, Erlangen, Germany) equipped with surface phased array and endorectal coil. Scan protocol included morphologic imaging with TSE T2-weighted sequences on the axial, sagittal and coronal planes,

spectroscopic imaging with 3D CSI sequences and dynamic contrast enhanced using 3D FLASH T1-weigthed sequence. The same patients underwent PET/CT. As gold standard, TRUS biopsy results and PSA value reduction after radiation therapy. ROC curve analysis was performed in order to compare each technique diagnostic accuracy level.
Results: By 1HMRSI-DCEMR we obtained a sensitivity of 93% and specificity of 88% and by PET/CT 85 and 40%, respectively, in small lesions (mean volume local recurrence < 10 mm). 1HMRSI-DCEMR showed 91% sensitivity with 93% specificity in lesions with local recurrence mean volume > 10 mm. In this case PET/CT showed a 92% sensitivity and 89% specificity.
Conclusion: The diagnostic accuracy of combined 1HMRSI-DCEMR was higher than PET/CT (mean volume local recurrence < 10 mm). We obtained similar accuracy level between techniques for lesions major than 10 mm.

B-412   10:48
Prediction of biochemical failure following radical prostatectomy in prostate cancer: Prognostic value of apparent diffusion coefficient at 3 Tesla
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Purpose: To determine if apparent diffusion coefficient (ADC) value before surgery is predictive of biochemical failure in patients who underwent radical prostatectomy for prostate cancer.
Methods and Materials: Between August 2005 and July 2007, 158 men (age range, 46 - 77 years) who received radical prostatectomy underwent diffusion-weighted MR imaging (DWI) at 3 T before surgery and were included in this study. ADC measurement of prostate cancer at DWI was retrospectively and independently performed by two radiologists on the basis of histopathological findings. ADC values for cancer and individual clinical variables (serum prostate-specific antigen [PSA] level, Gleason score, clinical stage, greatest percentage of cancer in all biopsy cores, percentage of positive cores in all biopsy cores, perineural invasion, extracapsular extension, seminal vesicle invasion, tumor volume, tumor maximum diameter) were evaluated with respect to biochemical failure prediction. Biochemical failure following radical prostatectomy was defined as two consecutive values ≥ 0.2 ng/ml.
Results: During a mean follow-up of 24.5 months, 30 (19%) patients who received radical prostatectomy had biochemical failure. Univariate Cox analysis revealed that ADC value, Gleason score, serum PSA level and percentage of positive cores in all biopsy cores were all significantly ($P < 0.05$) related to the development of biochemical failure. Multivariate Cox analysis revealed that the sole independent predictive variable was ADC value (relative hazard ratio, 0.052; 95% confidence interval: 0.005, 0.542; $P = 0.006$).
Conclusion: Our results suggest that pretreatment ADC value may be a useful clinical prognostic biomarker for the prediction of biochemical failure following radical prostatectomy.

B-413   10:57
Correlation of apparent diffusion coefficient values at 3 T MRI with prostate cancer Gleason grade in the peripheral zone
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Purpose: To determine the correlation of the apparent diffusion coefficient (ADC) from 3 Tesla Diffusion weighted MRI (DW-MRI) with cancer Gleason grades determined in the peripheral zone of the prostate.
Methods and Materials: 51 Patients with biopsy proven prostate cancer underwent MR imaging including DWI-MRI using b-values 0, 50, 500 and 800 s/mm^2. In radical prostatectomy specimens, separate slice-by-slice determinations of Gleason grades groups (GGG) and qualitative grade (QG) groups in step-sections containing tumor were made. ADC maps generated from DWI-MRI were aligned to step-sections and regions-of-interest annotated for each tumor slices. Median ADC (mADC) of tumors was correlated to GGG and QG groups. The performance of mADC to differentiate low-, intermediate- and high-grade tumors was determined using the area (Az) under the receiver operating characteristics curve (ROC).
Results: In 51 prostatectomy specimens, 62 different tumors and 251 step-section tumor lesions were identified. Tumor mADC values showed a significant correlation with GGG (r=-0.63; p < 0.001) and QG groups (r=-0.69; p < 0.001). Low-grade tumors had a mADC of 1.35×10^{-3} s/mm^2 (SD±0.24), intermediate-grade, 0.97×10^{-3} s/mm^2 (SD±0.21) and high-grade tumors a mADC of 0.86×10^{-3} s/mm^2 (SD±0.16). Using mADC values, ROC analysis provided a discriminatory performance of Az=0.90, in discerning low-grade from combined intermediate- and high-grade lesions and an Az=0.85 for discerning high-grade from combined low- and intermediate-grades.
Conclusion: 3 T ADC values correlate well with prostate cancer Gleason grades. For tumor mADC values, a high discriminatory performance is achieved in separating lesions with low-, intermediate- and high-grade cancer. 3 T DW-MRI appears a very useful biomarker for prostate cancer aggressiveness.

B-414   11:06
Detection of prostate adenocarcinoma foci in men with prior negative prostate biopsy and elevated prostate specific antigen (PSA) levels: Role of magnetic resonance spectroscopy imaging (MRSI) and magnetic resonance perfusion (MRP)
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Purpose: To prospectively evaluate the role of MRSI and MRP in the detection of prostate tumor foci in patients with persistently elevated PSA levels and prior negative random TRUS-guided biopsy.
Methods and Materials: We recruited 180 consecutive patients with a first negative random TRUS-guided prostate biopsy, elevated PSA levels (range ≥ 4 ng/ml and < 10 ng/ml) ratio (free PSA / total PSA) < 20% and negative digital rectal examination. Patients were randomly assigned to two groups. Group A: patients underwent a second random TRUS-guided biopsy. Group B: patients underwent a second direct TRUS-guided biopsy in suspicious areas described at MR exam, samples targeted on these areas were associated to two additional random samples.
Results: On a core by core basis, MRSI had a 83.3% sensitivity, 72.7% specificity, 71.4% PPV, 84.2% NPV and 77.5% accuracy, MRP had a 75.6% sensitivity, 76.7% specificity, 73.6% PPV, 78.5% NPV and 76.2% accuracy and the combination MRSI + MRP a 89.7% sensitivity, 80.4% specificity, 81.3% PPV, 89.1% NPV and 85% accuracy. On a patient by patient basis, MRSI had a 92.3% sensitivity, 88.2% specificity, 85.7% PPV, 93.7% NPV and 90% accuracy, MRP had a 84.6% sensitivity, 82.3% specificity, 78.5% PPV, 87.5% NPV and 83.3% accuracy and the association MRSI + MRP a 92.6% sensitivity, 88.8% specificity, 88.7% PPV, 92.7% NPV and 90.7% accuracy for predicting prostate cancer detection.
Conclusion: The combination of MRSI + MRP showed the potential to guide biopsy to histologically confirmed cancer foci in patients with previously negative biopsy.

B-415   11:15
Added value of dynamic contrast-enhanced subtraction MR imaging in predicting seminal vesicle invasion in prostate cancer: Preliminary results
C.-I. Shin, J. Cho, S. Kim; *Seoul/KR (behappy@radiol.snu.ac.kr)*

Purpose: To assess the added value of dynamic contrast-enhanced subtraction (DCES) magnetic resonance images combined with T2 weighted images (T2WI) in predicting seminal vesicle invasion (SVI) in prostate cancer.
Methods and Materials: The institutional review board approved this retrospective study and waived informed consent. One hundred and thirty-three consecutive men (age range, 47-83 years; mean age, 67.0 years) who underwent 3 T MR imaging and then radical prostatectomy, with SVI (n=17) and without SVI (n=118), were included. MR images were retrospectively reviewed by one radiologist for SVI on T2WI and T2WI with DCES image using a 5-point scale. Receiver operating characteristic (ROC) analyses and McNemar test were obtained to evaluate reader performance.
Results: With addition of DCES image, the area under the ROC curve (AUC) led to a significant increase in the prediction of SVI (0.760 vs 0.907 [p =.008]). The specificity also significantly increased (65 vs 71% [p = 0.011]), but increment of sensitivity shows no statistical difference (71 vs 94% [p = 0.125]).
Conclusion: Adding DCES images to T2WI improves diagnostic performance for predicting SVI.

B-416   11:24
also EPOS
Quantitative analysis in assessing perfusion characteristics of malignant and benign tissues of prostate with contrast-enhanced ultrasonography: A prospective study
F. Li, S. Xie, J. Xia, J. Du, H. Fang; *Shanghai/CN (fenghuali61@yahoo.cn)*

Purpose: To evaluate perfusion characteristics of malignant and benign tissues of prostate with contrast-enhanced ultrasonography (CEUS) and investigate the efficacy of CEUS in differentiating malignant lesions from benign tissues.
Methods and Materials: 52 patients with serum prostate-specific antigen levels higher than 4.00 ng/ml were enrolled. CEUS was performed using a continuous real-time gray scale contrast-tuned imaging (CnTI) technique. After CEUS examinations, all patients underwent ultrasound guided biopsy. The regions of interest were drawn in the sites of biopsy in the outer gland symmetrically, and the time-intensity curves were analyzed for the following indices: baseline intensity (BI), peak intensity (PI); increased signal intensity (SI), arrival time (AT); time to peak (TTP), accelerate time (ACT), wash-out slope of the curve (a2), rise slope of the curve (a3) and area under the time intensity curve (AUC).
Results: Prostate cancers were detected in 22 of 52 patients. For all patients, malignant lesions and benign tissues differ significantly in BI and SI (P = 0.036, 0.017); for the same patient of prostate cancer, the parameters of BI, SI , AT and

Saturday

a3 in malignant lesions were significantly different from those in benign tissues (P = 0.031, 0.028, 0.007, 0.009); and for the same patient of benign, right and left outer gland tissues differ significantly in BI and PI (P = 0.009, 0.008).

Conclusion: Quantitative analysis with CEUS reveals prostate cancer has the blood perfusion characteristics of faster arrival, quicker wash in and higher enhancement, and it also reflects the symmetric blood perfusion characteristics in both sides of benign outer gland tissue objectively.

B-417 11:33

Concordance between MR imaging guided prostate biopsy Gleason grade and prostatectomy Gleason grade vs 10-core systematic transrectal ultrasound guided biopsies

T. Hambrock, C. Hoeks, H. Huisman, I. Van Oort, A. Witjes, C. Hulsbergen-vandeKaa, J.O. Barentsz; *Nijmegen/NL (t.hambrock@rad.umcn.nl)*

Purpose: Transrectal ultrasound guided prostate biopsies (TRUS-GB) are known to significantly underpredict the true Gleason grades determined in prostatectomy specimens. An accurate determination of the true Gleason grades prior to treatment is of paramount important in decision making. We determined the concordance between prostate biopsy determined highest Gleason grade (HGG) obtained with MR imaging guided biopsies (MR-GB) vs. HGG of systematic 10-core TRUS-GB and the corresponding prostatectomy determined HGG.

Methods and Materials: 64 consecutive patients with prostate cancer diagnosed using 10-core TRUS-GBs and 30 patients using an MR-GB device, were included. All patients had subsequent prostatectomies. One pathologist determined the HGG in all biopsy and prostatectomy specimens. Patients were subdivided based on the HGG determined in the prostatectomy specimen: a) HGG of 3 b) HGG of 4 and c) HGG of 5. The concordance of biopsy determined HGG with these groups was assessed.

Results: Overall, MR-GB determined HGG, accurately predicted the HGG in prostatectomy in 90% (27/30 patients) while for 10-core TRUS-GBs this was 55% (35/64 patients) (p=< 0.01). The concordance with prostatectomy determined HGG of 4 was 100% (10 of 10) for MR-GB and 56% (12 of 26) for TRUS-GB (p=< 0.01). For a HGG of 5, this was 63% (5 of 8) for MR-GB and 30% (6 of 20) for TRUS-GB.

Conclusion: MR-GBs are superior to conventional 10-core TRUS-GB in predicting the HGG in prostatectomy. MR imaging prior to biopsies and MR-GB offer important advance in improving tumor aggressiveness prediction and can therefore improve patient risk stratification and management.

B-418 11:42

MRI in diagnosis of prostate cancer: Does post biopsy changes affect its accuracy?

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Purpose: To study the effect of hemorrhage after transrectal ultrasound (TRUS) of prostate on the diagnostic accuracy of MRI in cases of prostate cancer.

Methods and Materials: The study included 50 patients with suspicious of prostate cancer, their mean PSA was 30 ng/ml (range 45-75). All of our patients underwent 6 cores guided TRUS of the prostate followed within one week by MRI of the prostate including T2w and diffusion weighted (DW) MRI of the pelvis. We used the final histopathology as reference standard.

Results: We divided the prostate into 6 segments and each one corresponds to the site of biopsy. The sensitivity, specificity and overall accuracy for T2w MRI was 100, 58 and 67%, respectively, and for DW MRI it was 85, 100 and 87%, respectively.

Conclusion: DW MRI is a non-invasive technique; its diagnostic accuracy is not affected by post biopsy hemorrhage and can be done after biopsy without delay.

B-419 11:51

also EPOS

MR spectroscopy of prostate cancer after targeted high frequency focused ultrasound treatment

Z. Tarján, B. Bálint, L. Lukács, P. Bata, A. Keszthelyi, E. Székely; *Budapest/HU (ztarjan@gmail.com)*

Purpose: To compare the diagnostic accuracy of rectal coil MR spectroscopy (MRS), PSA and biopsy in detecting residual tumors in the prostate and therapeutic efficacy after targeted High Frequency Focused Ultrasound (HIFU).

Methods and Materials: Fourteen prostate cancer patients (65-78 years, mean 69 years) underwent transrectal MR/MRS examination of the prostate before and 1 month after HIFU treatment. A 1.5 T system was used equipped with multivoxel MRS technique using combined multiphase and transrectal coils. Viable tumor was considered in those voxels, where the (cholin+creatinin)/citrate ratio was higher than 1.5. MRS data of 28 left and right half prostates were compared separately

with US guided biopsies taken from the left and right half prostates prior and 6 months after HIFU. The PSA values were also detected in 1, 3 and 6 months after treatment, viable tumor was considered in case of elevation. The data were concordance analysed (MedCalc 9.4.2.0).

Results: Good correlation was found between MRS and biopsy results before HIFU treatment (K= 0.76). After HIFU treatment biopsy detected cancer in 11 half prostates in 8 patients, while MRS detected cancer in 9 half prostates in 6 patients (K= 0.54). PSA elevation had weak correlation with biopsy (K= 0.125) significantly lower than with MRS (p < 0.01).

Conclusion: Contrary to some literature data in this cohort, we have found rectal coil MRS superior to PSA in predicting prostate cancer HIFU treatment failure. MRS correlated significantly better with biopsy and gave results earlier than PSA elevation trends.

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

GI Tract

SS 801b

Rectal cancer

Moderators:
C.A. Cuénod; Paris/FR
T.C. Lauenstein; Essen/DE

B-420 10:30

Diffusion weighted imaging additional to T2-weighted MRI for improved selection of complete responders after chemoradiation for locally advanced rectal cancer

D.M.J. Lambregts, M. Maas, F.C.H. Bakers, V.C. Cappendijk, G.L. Beets, J.E. Wildberger, R.G.H. Beets-Tan; *Maastricht/NL (d.lambregts@mumc.nl)*

Purpose: Standard T2-weighted (T2W) MRI is insufficient for selection of complete responders (CR) after chemoradiation for locally advanced rectal cancer. A more accurate selection would enable further tailoring of treatment. Our aim was to evaluate the value of diffusion weighted MRI (DWI) additional to T2W-MRI for identification of CR after therapy.

Methods and Materials: 55 locally advanced rectal cancer patients underwent chemoradiation followed by a restaging MRI after 6-8 weeks. Imaging consisted of standard T2W-MRI and a DWI-sequence (b-values 0, 1000 s/mm^2). Two readers (pelvic MR-expert and junior GI-radiologist) scored the MR images for likelihood of CR using a confidence level score (0=definitely residual tumour to 4=definitely CR): first on T2W-MRI only and immediately thereafter after addition of (b1000) DWI-images. Histology (ypT0 versus ypT1-4) was the standard reference.

Results: 13 patients had a CR, 42 had residual tumour (2 pT1, 15 pT2, 24 pT3, 1 pT4). On T2W-MRI, both readers correctly identified 5 of the 13 complete responders (sens 38%, spec 95% for the expert and 38%, 88% for the junior radiologist). After addition of DWI, the two readers, respectively, correctly identified 9 and 10 of the complete responders (sens 69%, spec 100% (expert) and 78%, 87% (junior radiologist)). After addition of DWI, area under the ROC-curve improved from 0.80 to 0.83 (expert) and from 0.69 to 0.85 (junior reader). This difference was significant for the junior reader (p=0.01).

Conclusion: 1. Addition of DWI improves accuracy for selection of complete responders. 2. This improvement could allow a more safe selection of patients for non-invasive treatment (wait-and-see) after chemoradiation.

B-421 10:39

Dynamic contrast-enhanced magnetic resonance (DCE-MR) for the monitoring of neoadjuvant chemoradiation therapy (NACRT) in rectal adenocarcinoma: Initial experience with 20 patients

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Purpose: To monitor neoadjuvant chemoradiation therapy (NACRT) in rectal adenocarcinoma with dynamic contrast-enhanced magnetic resonance (DCE-MR) and evaluate whether DCE-MR findings correlate with response to therapy.

Methods and Materials: After approval by our institutional ethics committee, written informed consent was obtained from all participants. Twenty patients (11 M, 9 F; mean age 61.4 years) with locally advanced rectal adenocarcinoma underwent DCE-MR before and after NACRT, followed by surgery. Dynamic T1-weighted imaging was performed after injection of gadopentetate dimeglumine (0.2 mL/Kg, 3.5 mL/sec), followed by saline. Tumor transfer constant (Ktrans), leakage space (Ve), rate constant (Kep), area under the curve (IAUC60) were calculated using MRI-Workbench. Patients

were divided into response groups according to pathological stage on the surgical specimen: 1-complete response (ypT0ypN0), 2-local downstaging (T or N), 3-no local downstaging or increase in local tumor stage (non-responsive). Anova was used to test for contrast between the 3 groups, t-tests for differences between complete and non-responsive groups, and paired t-test for overall pre/post-therapy differences.
Results: Overall Ktrans and Kep decreased whilst Ve increased significantly (p < 0.01) after therapy. Five patients had complete response, 11 local downstaging and 4 were non-responsive. Anova revealed no group contrast within the pre- and post-therapy values, or changes in values during therapy. T-tests showed significant differences in post-therapy median Ktrans and IAUC60, and in fractional change of Kep between complete and non-responsive groups (p < 0.05).
Conclusion: DCE-MR showed potential for monitoring NACRT in rectal adenocarcinoma; larger studies may be needed to potentially correlate DCE-MR findings with response to therapy.

B-422   10:48

Apparent diffusion coefficient for predicting tumor response to neoadjuvant chemoradiotherapy for locally advanced rectal cancer
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Purpose: To investigate which one would more accurately predict pathological complete response (CR) to neoadjuvant-chemoradiation therapy (CRT) for locally advanced rectal cancer among the pre-CRT apparent diffusion coefficient (ADC), post-CRT ADC and the percentage of the difference.
Methods and Materials: Fifty-six patients underwent pre- and post-CRT, 1.5-T rectal MRI with DWI (b=0, 600, 1000 s/mm^2). A radiologist measured three times the pre-and post-CRT ADC values of the rectal cancer. The mean ADC values of the pre-and post-CRT ADC were compared between the CR and the non-CR. To identify the optimal cut-off value for discriminating CR from non-CR, receiver operating characteristic analysis was applied to the pre-and post-CRT ADC values as well as to the percentage of the ADC difference. Histopathologic results served as the reference standard.
Results: The post-CRT mean ADC ($1.41 \pm 0.10 \times 10^{-3}$ mm^2/s) of the CR (n=8) was significantly higher than that ($1.13 \pm 0.19 \times 10^{-3}$ mm^2/s) of the non-CR (n=48) (P=0.0002). The pre-CRT mean ADC ($0.84 \pm 0.10 \times 10^{-3}$ mm^2/s) of the CR did not differ significantly from that ($0.90 \pm 0.15 \times 10^{-3}$ mm^2/s) of the non-CR (P=0.2701). The optimal cut-off value (1.29×10^{-3} mm^2/s) of the post-CRT ADC showed a comparable accuracy to that of the specific cut-off value (an increase of 42%) of the percentage of the ADC difference (85.7, 80.4%; P=0.5078).
Conclusion: A post-CRT ADC as well as a percentage of the difference between pre- and post-CRT ADC can reliably predict CR to CRT for locally advanced rectal cancer.

B-423   10:57

also EPOS

Analysis of the diagnostic impact of peritumoral enhancing strands within the perirectal fat in patients with rectal carcinomas after neoadjuvant radiochemotherapy
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Purpose: To assess the diagnostic value of peritumoral enhancing strands within the perirectal fat in patients with rectal carcinoma after neoadjuvant radiochemotherapy.
Methods and Materials: Thirty-one consecutive patients (22 male, 9 female; mean age ± SD, 66.2 ± 8.9 years) with rectal carcinoma underwent preoperative neoadjuvant radiation therapy with concomitant chemotherapy followed by standard resection of the rectum. MR imaging was performed 15-25 days after completion of neoadjuvant therapy, with a 1.5-T unit and a eight-element pelvic phased-array surface coil by using T2-weighted fast spin-echo sequence (TR/TE, 2500/100 msec), and T1-weighted spectral fat saturation inversion recovery sequence (TR/TE, 570/50 msec) before and after Gd-DTPA injection (2 mL/kg) on the transverse and sagittal planes. MR images were analysed by two experienced radiologists (5 and 10 years) in consensus who considered the evidence of peritumoral enhancing strands as presence of tumoral infiltration of perirectal fat. The results of the histopathologic analysis - perirectal fat infiltration and adjacent organ invasion - were compared with MR examination.
Results: In 18 patients, MR imaging and histologic analysis were concordant in tumoral staging (T2, T3, or T4). In 9 patients, MR imaging overstaged the rectal carcinoma due to evidence of peritumoral enhancing strands corresponding to fibrotic reaction within the perirectal fat. In 4 patients, MR imaging downstaged the rectal carcinoma due to microscopic infiltration of the peritumoral fat.
Conclusion: The evidence of peritumoral enhancing strands within the perirectal fat in patients who had neoadjuvant radiochemotherapy is prevalently due to fibrotic scars instead of microscopic tumoral infiltration.

B-424   11:06

MR-based 'wait-and-see' policy in clinical complete responders to chemoradiation in rectal cancer: A promising alternative
M. Maas, D.M.J. Lambregts, R.M. van Dam, P.J. Nelemans, G. Lammering, R. Jansen, G.L. Beets, R.G.H. Beets-Tan; *Maastricht/NL (moniquemaas@live.nl)*

Purpose: Neoadjuvant chemoradiation for locally advanced rectal cancer increasingly results in complete response (ypT0N0). Accurate selection of complete responders could allow for minimal invasive treatment ('wait-and-see' with omission of surgery). The purpose of this study was to determine whether patients with MRI-based clinical complete response (cCR) who undergo 'wait-and-see' (including follow-up with MRI) have a comparable prognosis as compared to patients with pathological complete response (pCR) after surgery.
Methods and Materials: After chemoradiation patients underwent standard T2-weighted-MRI (3 orthogonal directions) at 1.5 T to evaluate response to therapy. When MRI indicated a cCR, patients were offered a 'wait-and-see'-policy, with intensive follow-up, consisting of 6-24 weekly MRI, endoscopy and laboratory examinations. The pCR-control group was identified from a prospective cohort-study concerning rectal cancer.
Results: MRI identified 12 cCR-patients (median age 63), they underwent 'wait-and-see'-policy. Median follow-up for this group is 20 months (range 2-56). 2 'wait-and-see'-patients had liver metastasis at diagnosis, treated with curative intent. 15 patients (median age 67) with pCR after surgery were identified from the control-group, with a median follow-up of 32 months (range 8-53). One 'wait-and-see'-patient developed recurrent liver metastasis and possible local recurrence. In the 'pCR-after-surgery'-group, one patient developed lung metastasis and one patient died of pneumonia. All other patients are disease-free and alive. Overall survival is 100% for the 'wait-and-see'-patients and 92.9% for the pCR-patients.
Conclusion: MR-based 'wait-and-see'-policy for clinical complete responders to neoadjuvant chemoradiation is a promising and potentially feasible alternative to standard surgical treatment. Identification and follow-up of these patients with MRI are feasible.

B-425   11:15

MRI with diffusion weighted imaging and apparent diffusion coefficient (ADC) assessment in the evaluation of rectal cancer regression after radio-chemotherapy
D. Ippolito, L. Monguzzi, F. Invernizzi, L. Guerra, C. Messa, S. Sironi; *Monza/IT (davide.atena@tiscalinet.it)*

Purpose: To assess the value of MR study with diffusion imaging in patients who have undergone preoperative chemoradiotherapy for rectal cancer, being the tumor regression grade the standard of reference.
Methods and Materials: A total of 24 patients who had a biopsy-proven diagnosis of rectal carcinoma and who underwent neoadjuvant chemoradiation therapy were enrolled. All patients underwent MR examination with a dedicated pelvic phased-array multi-coil with acquisition of multiplanar T2 Turbo Spin Echo sequences. In addition, DWI sequences (b factor: 0 and 1000 mm²/sec) was also performed. MR examination was performed prior to therapy (=MR 1) and two months later (=MR2) after chemoradiation therapy. Two radiologists in consensus evaluated the changes of morphologic features related to tumoral staging, and modification of apparent diffusion coefficient (ADC). Pathological TRG value was obtained according to Mandard's classification (TRG 1=complete regression; TRG=5 absence of regression).
Results: All of the patients who subsequently underwent total mesorectal excision and imaging findings were compared with pathological results. Fifteen out of 24 patients showed complete (TRG 1) or subtotal regression (TRG 2) and were classified as responders, while the remaining patients (TRG 3 to 5) were considered non-responders. The mean ADC value in MR 1 examination was 0.86±0.22 x10-3 mm²/sec, whereas mean values after chemoradiation therapy was 1.43 ±0.25x10-3 mm²/sec. A significant correlation between ADC values and TRGs data was found (p < 0.001). Also, the increase of the mean ADC values pre and after treatment between the responders and not responders was found to be significantly different.
Conclusion: The MR study with DW images may represent a complementary diagnostic tool in the follow-up of patients with rectal cancer, having a good prognostic value in the assessment of neoadjuvant therapy response.

B-426 11:24

also EPOS

Diffusion-weighted MRI in the re-staging of rectal cancer after neoadjuvant therapy: Correlation with histopathology

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Purpose: To compare the diagnostic performance of diffusion-weighted MRI in staging locally advanced rectal adenocarcinoma after neoadjuvant treatment.
Methods and Materials: Twenty consecutive patients (mean age 67±14, 8 females) had preoperative MRI (1.5 T, thin-slice T_2WI, DWI with b=50 and b=800, contrast-enhanced (ce) T_1WI, rectal contrast agent) after completion of neoadjuvant therapy. The diagnostic accuracy of DWI+T_2WI was compared with ceT_1WI+T_2WI, endorectal ultrasonography (ERUS) and histopathological findings.
Results: Histopathological classification showed pT0 (n=1), pT1 (n=1), pT2 (n=8), pT3 (n=8) and pT4 (n=1). Mean ADC values (s/mm²) were 990±273 for the primary tumor, 862±167 for suspected lymphnodes in pN+ and 1060±292 for lymphnodes in pN0 patients (ADC N+ vs. N-, p=0.058). T staging was correct in 85% (DWI), 75% (ceT_1WI) and 60% (ERUS). DWI overstaged 3 patients with pT2 as T3. ceT_1WI overstaged 4 patients with pT2 as T3 and understaged 1 patient with pT3 as T2. Of 14 cases pN0, 2 pN1 and 3 pN2, nodal status (± for metastases) was correctly classified in 90% (DWI), 85% (ceT_1WI) and 71% (ERUS). Sensitivity of DWI for positive nodal status was 80% (4/5 patients) and specificity was 93% (14/15 patients). The one false-negative patient on DWI had two nodal micrometastases. All 8 patients without any detectable lymphnodes on DWI (b=800) were pN0.
Conclusion: DWI and ceT_1WI perform equally well in the local preoperative staging. MRI was superior to routine ERUS in both T and N staging. Staging with DWI+T_2WI only may be feasible in patients who cannot receive intravenous contrast agent.

B-427 11:33

A comparative study of histopathologic parameters and apparent diffusion coefficient values on 3 T rectal MRI in locally advanced rectal cancer following neoadjuvant chemoradiation therapy

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Purpose: To compare the apparent diffusion coefficient (ADC) value on 3-T MRI before and after neoadjuvant chemoradiation therapy (CRT) and the histopathologic parameters such as cellular differentiation, tumor regression grade (TRG), and percentage of fibrosis in locally advanced rectal cancer
Methods and Materials: Thirty-nine consecutive patients (32 men, 7 women; mean age, 62.5 years; range, 43-75 years) with locally advanced rectal cancer who underwent neoadjuvant CRT and subsequent surgery were enrolled in this retrospective study. ADC values were measured both on the pre- and post-CRT diffusion-weighted MR images (DWI) by one radiologist. ΔADC value was calculated. Histopathologically, celluar differentiation, TRG, and percentage of fibrosis were evaluated by one pathologist. We compared pre-CRT ADC, post-CRT ADC, and ΔADC values with histopathologic parameters.
Results: Pre-CRT ADC value was not significantly correlated with all of cellular differentiation, TRG, and percentage of fibrosis (P=0.60, 0.09, and 0.13, respectively). Post-CRT ADC value was significantly correlated with TRG and percentage of fibrosis (r=0.49 and 0.46; P=0.001 and 0.003, respectively). ΔADC value was significantly correlated with TRG and percentage of fibrosis (r=0.54 and 0.48; P=0.000 and 0.002, respectively). Post-CRT ADC and ΔADC were not correlated with cellular differentiation (P=0.09 and 0.12, respectively).
Conclusion: In patients with locally advanced rectal cancer treated with neoadjuvant CRT, post-CRT ADC and ΔADC values seem to be a promising tool for helping predict TRG and percentage of fibrosis which are one of the histopathologic parameters assessing tumor response.

B-428 11:42

also EPOS

ADC measurement of rectal cancer: Can ADC differentiate mucious carcinomas from ordinary tubular adenocarcinomas?

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Purpose: Diffusion weighted imaging (DWI) is now widely indicated to image various body malignancies, including rectal cancer and anal cancer. Mucinous carcinoma, which sometimes arises in rectum and anus, needs different treatment strategy from ordinary tubular adenocarcinoma. In this study, we retrospectively reviewed DWI findings and measured apparent diffusion coefficient (ADC) of cancers of rectum or anus including mucinous carcinoma to assess whether the quantitative analysis of ADC could differentiate mucinous carcinomas from ordinary adenocarcinomas.
Methods and Materials: 75 rectal cancers and six anal cancers which were all surgically resected and pathologically proved were evaluated. Each tumor measured 1 to 15 cm in

its long axis (median 6.0 cm). Pathological examination revealed that the patient group included 55 moderately differentiated adenocarcinomas, 15 mucinous carcinomas, eight well-differentiated adenocarcinomas and three poorly-differentiated adenocarcinomas. DWI was obtained within one month before operations of each tumor. B-factors employed in DWI were 0 and 1500 sec/mm². Motions probing gradient pulses were placed on X-, Y- and Z-directions separately. ADC maps were made between two b-factors. ADC of each tumor was measured using region of interest generated in each tumor as large as possible.
Results: Mean ADCs of mucinous carcinoma and other carcinomas were, respectively, $1.49\pm0.34 \times 10^{-3}$ and $0.80\pm0.15\times10^{-3}$ mm²/sec. The Student t test revealed that the difference between these two was statistically significant (p < 0.001).
Conclusion: ADC measurement has the potential to differentiate mucinous carcinomas from ordinary adenocarcinomas that arise in the rectum and anus.

B-429 11:51

Whole-body MRI versus established sequential, multi-modal diagnostic algorithm for staging of patients with rectal carcinoma: Cost analysis

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Purpose: To compare the total direct costs of whole-body MRI versus established sequential, multi-modal diagnostic algorithm.
Methods and Materials: In a study including 33 patients (25 male, 6 female, mean age 62.5 years), the direct fixed and variable costs of the recommended diagnostic algorithm for pretherapeutic TNM staging of rectal cancer (endoscopy, endoscopic and abdominal ultrasound, chest X-ray, and abdominal CT in case of positive findings in the last two examinations) were compared with those of a novel diagnostic algorithm: rectoscopy followed by MRI using a whole-body scanner. The MRI included T2-weighted sequences of the rectum, 3D-T1-weighted sequences of the liver and thorax after bolus injection of Gd-EOB-DTPA and delayed phases of the liver. On the basis of expert interviews of process drivers (2 surgeons, 2 radiologists), the labor of personnel involved in the algorithms was tracked, involvement times were documented to the nearest minute, and all material items used were recorded. Costs of labor and materials were determined from personnel reimbursement data and vendor pricing. Direct fixed costs were determined from hospital accounting records.
Results: Mean MRI examination time was 55 min. Costs for equipment and material were higher for whole-body-MRI (equipment 116 vs. 30 EUR; material 159 vs. 60 EUR per patient). Personnel costs were lower for MRI (436 vs. 732 EUR). Altogether, the absolute cost advantage of the MR imaging was 13.5% (711 vs. 822 EUR).
Conclusion: Substantial savings are achievable with the use of whole-body MRI in the preoperative TNM staging of patients with rectal carcinoma.

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

Vascular

SS 815

Imaging cerebrovascular disease

Moderators:
C. Malamateniou; Liverpool/UK
J.F.M. Meaney; Dublin/IE

B-430 10:30

Multimodality imaging of carotid artery plaques: ^{18}F-FDG PET, CT, and MRI

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P.A.M. Hofman, J.M.A. van Engelshoven, J.E. Wildberger, M.E. Kooi; *Maastricht/NL*
(rmkwee@gmail.com)

Purpose: The objective was to compare carotid plaque assessment with ^{18}F-fluoro-2-deoxyglucose positron emission tomography (^{18}F-FDG PET), computed tomography (CT), and magnetic resonance imaging (MRI).
Methods and Materials: Fifty patients with symptomatic carotid atherosclerosis underwent ^{18}F-FDG PET/CT and MRI. Correlations and agreement between imaging findings were assessed by Spearman and Pearson rank correlation tests, T-tests, and Bland-Altman plots.
Results: No strong correlations were found between plaque ^{18}F-FDG standard uptake values (SUVs) and CT/MRI findings (Spearman ρ's -0.088-0.385). Maximum SUV was significantly larger in plaques with IPH (1.56 vs. 1.47, P=0.032). SUVs did not significantly differ between plaques with an intact and thick, versus plaques with a thin and/or ruptured fibrous cap at MRI (1.21 vs. 1.23, P=0.323; and 1.45 vs. 1.54, P=0.727). Pearson ρ's between CT and MRI measurements varied from 0.554-0.794 (P < 0.001). For lipid-rich necrotic core (LRNC) volume, the CT-

MRI correlation was stronger in mildly (≤10%) than in severely (> 10%) calcified plaques (Pearson ρ 0.730 vs. 0.475). Mean difference in measurement ±95% limits of agreement between CT and MRI for minimum lumen area, volumes of vessel wall, LRNC, calcifications, and fibrous tissue were 0.4 (P=0.744) ±18.1 mm^2, -41.9 (P=0.450) ±761.7 mm^3, 78.4 (P < 0.001) ±305.0 mm^3, 180.5 (P=0.001) ±625.7 mm^3, and -296.0 (P < 0.001) ±415.8 mm^3, respectively.

Conclusion: Overall, correlations between ^{18}F-FDG PET and CT/MRI findings are weak. Correlations between CT and MRI measurements are moderate-to-strong, but there is considerable variation in absolute differences. Future prospective longitudinal studies should determine which imaging modality is the most effective risk stratifying patients for stroke.

B-431 10:39

Stenosis asymmetry index between symptomatic and symptomatic patients in the analysis of carotid arteries

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Purpose: Extracranial carotid artery stenosis is accepted as a significant risk factor for cerebrovascular events. The purpose of this work was to compare the stenosis asymmetry index (SAI) in symptomatic and asymptomatic patients.
Methods and Materials: 60 consecutive symptomatic (males 36; median age 64) patients and 60 consecutive non symptomatic patients matched for gender and age were analyzed by using a 40-detector-row CT angiography. Each patient was analyzed by injecting 80 ml of contrast material at a 5 ml\sec flow rate. Stenosis degree of 240 carotids was calculated according to NASCET method. For each patient, the ratio between the most severe stenosis and the contralateral was calculated to obtain the SAI. Wilcoxon test was applied to evaluate difference between asymmetry index in symptomatic and asymptomatic group. ROC curve was also calculated.
Results: The results of our study indicate a mean SAI of 1.49 (95% CI 1.39 -1.58) in asymptomatic group and a mean SAI of 1.69 (95% CI 1.54 -1.84) in the symptomatic group with a statistically significant difference (p value = 0.003). The ROC curve analysis indicated that an SAI value of 1.8 has a specificity of 85% presence of cerebral symptoms whereas to have a sensitivity of 85% we should use a 1.2 AI.
Conclusion: The results of our study indicated that the SAI should be used as a further parameter to stratify the stroke risk related to carotid artery.

B-432 10:48

Contrast enhanced ultrasound to quantify carotid intraplaque angiogensis: Reproducibility

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Purpose: Quantifying the degree of intraplaque angiogenesis with contrast enhanced ultrasound (CEUS) may represent a cost effective means of predicting plaque rupture. However, the repeatability of CEUS for the quantification of intraplaque angiogenesis has not been documented. The aim of this study, therefore, was to quantify variability associated with CEUS from different sources: Intra-reader, inter-reader and intra-scan.
Methods and Materials: Dynamic CEUS was performed in 10 asymptomatic patients with > 50% carotid stenosis, immediately following 2 ml bolus of SonoVue at low MI using a Philips US scanner iU22 with an L12-5 probe. The repeat scan was performed 30 minutes later. The peak intensity from the plaque was quantified with Qlab software and normalised to the lumen. The first scan was analysed by two readers to test inter-reader repeatability. It was also re-analysed 2 months later by one reader to test intra-reader repeatability. The second scan was analysed by one reader to test intra-scan repeatability. The intra-class correlation coefficient (ICC) was calculated as (sb2 / (sb2 + s2), where sb is the between-subject standard deviation).
Results: The intra-reader ICC was 0.96, the inter-reader ICC was 0.91 and the inter-scan ICC was 0.93.
Conclusion: The use of dynamic CEUS to assess intraplaque angiogenesis is highly reproducible across both readers and scans.

B-433 10:57

Serial MDCTA imaging of atherosclerotic carotid plaque morphology in patients with ischemic cerebrovascular disease

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Purpose: Atherosclerotic carotid plaque rupture may lead to thrombus formation, embolization and subsequent acute ischemic cerebrovascular events. Plaque ulcerations on imaging are thought to be markers of previous plaque rupture. The aim of this study was to get insight into the natural history of plaque ulceration with serial MDCT angiography.
Methods and Materials: We selected 84 patients with ischemic cerebrovascular disease, who underwent more than one MDCTA of the carotid arteries. Plaque surface morphology at the carotid bifurcation was classified as smooth, irregular or ulcerated and changes over time were evaluated.
Results: The mean time period between the MDCTA scans was 21 ± 13 months. Of 155 arteries available for analysis, 3 (2%) were occluded at the first MDCTA and 28 (18%) showed no atherosclerotic disease. Eighty-six (55%), 23 (15%) and 15 (10%) arteries had smooth, irregular and ulcerated plaque morphology, respectively. On follow-up, MDCTA surface morphology was unchanged in 88% of the arteries, whereas 8% showed progression and 4% regression of plaque morphology. Most importantly, the majority (10 out of 15) of ulcerated plaques showed no changed morphology over a period of 20 ± 15 months. One ulcerated plaque showed progression (in 21 months), 4 showed regression (in 3, 9, 14 and 44 months), whereas in two non-ulcerated plaques an ulceration developed (in 29 and 40 months).
Conclusion: MDCTA allows evaluation of temporal changes in plaque morphology. Atherosclerotic carotid plaque morphology mostly remains unchanged and plaque ulcerations persist for a long time, possibly forming a persistent source of thrombo-emboli.

B-434 11:06

Carotid plaque enhancement after contrast material administration and symptomaticity: An evaluation by using multi-detector-row CT angiography

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Purpose: The purpose of this work was to evaluate carotid plaque enhancement (PE) after contrast material administration and to evaluate whether there is a statistical association with symptoms.
Methods and Materials: 97 consecutive patients (69 males, 28 females; mean age 62 years; age range 39-82 years), studied by using a multi-detector row CT with a NASCET stenosis ≥50%, were retrospectively analyzed. Exams were performed before and after contrast medium administration (CM). Calcified plaques were excluded (Basal Hounsfield Units value > 130) whereas fatty and mixed ones were included (< 60 HU and from 60 to 130 HU, respectively). By using a fixed elliptical Region of Interest (ROI), we measured HU values in the plaque before and after CM. Enhancement analysis was performed and obtained data were compared with patient's symptomaticity.
Results: 39 patients were excluded because they have calcified plaques (40.2%). In the remaining 58 patients, PE was observed in the 74%. A statistically significant difference was observed between symptomatic and asymptomatic patients for the presence of PE (p = 0.0013; OR 7.5). Moreover, we observer that plaque enhancement was higher in fatty plaques (p = 0.023) than in mixed ones and that PE was more frequent in fatty plaque than mixed ones (p = 0.019).
Conclusion: The results of our study suggest that the presence of carotid PE is associated with cerebrovascular symptoms. Fatty plaques are more likely to have PE (and higher) compared to mixed plaques.

B-435 11:15

Soft carotid plaque: Detection with diffusion-weighted imaging (DWI) during contrast enhanced MRA with neurovascular array coil

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Purpose: To prospectively investigate clinical feasibility and value of Diffusion-Weighted (DW)-MRI in evaluating plaques with large Lipid-Necrotic Core (LNC) or heterogeneous plaques with soft content in patients with carotid artery stenosis undergoing CEMRA.
Methods and Materials: Thirty-two consecutive patients with 34 carotid artery stenosis previously detected by Doppler ultrasonography were prospectively enrolled. Mean age was 73.8 years (range, 50-83 years). MRI of the carotid bifurcations was performed on a 1.5 T unit with parallel imaging (SENSE), before and after administration of a blood pool contrast agent. DWI was performed first, followed by a fat-suppressed T1-weighted scan; after the dynamic imaging in First-Pass, all patients were evaluated in Steady-State phase with an axial 3D T1-weighted High Resolution Isotropic sequence. Carotid plaques were classified in: large Lipid-Necrotic Core (LNC) (type I), complex fibrotic-calcified with soft content (type II), fibrotic-calcified plaque without soft content (type III). All patients underwent carotid endarterectomy; MR findings were compared with the surgical specimen.
Results: DWI with SENSE was feasible in all patients. DWI correctly identified carotid plaques with LNC or with a soft component in 19/24 cases; the overall diagnostic performance of DWI for identification of soft plaques was: sensitivity, 79.2%; specificity, 80%; PPV, 90.5%; and NPV, 61.5% (k value 0.54%).

Saturday

Conclusion: DW-MRI is a simple and highly reliable imaging technique for identification of soft carotid plaque, showing good agreement with the surgical specimen. In patients with carotid artery stenosis ongoing CEMRA, the fast detection of vulnerable soft plaques can add significant information to measurement of stenosis.

B-436   11:24

Age of vessel wall hematoma in cervical artery dissection as determined by multi-sequence MRI

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Purpose: It is known that MRI is able to assess the age of a hematoma, e.g. in cerebral hemorrhage. We sought to evaluate the age of vessel wall hematomas (VWH) in patients with spontaneous cervical artery dissection (sCAD), using multi-sequence MRI.

Methods and Materials: 35 consecutive patients (mean age 44±10 years) with sCAD received a high-resolution black-blood MRI at 3 Tesla with fat-saturated pre- and post-contrast T1w-, T2w- and TOF images. VWH were categorized on a 4-point scale into acute, early subacute, late subacute and chronic, based on the relative signal intensities of the hematoma on the T1w- and T2w- images compared to the normal vessel wall.

Results: Mean time (MT) between the occurrence of sCAD and the MRI scan was 30 days (range 1-180 days). When patients were grouped into tertiles according to the age of the sCAD, hematoma types differed significantly between the 3 groups (p < 0.001 for trend). In tertile I (MT=1-11 days), 7 out of 11 patients had signs of acute or early subacute VWH according to the MRI findings, compared to 4 out of 12 patients in tertile II (MT=11-19 days) and 0 out of 12 patients in tertile III (MT=19-180 days). Acute VWH were not found later than day 2 after the occurrence of sCAD, early subacute VWH not later than day 15 and late subacute VWH not later than day 41.

Conclusion: Signal intensities of VWH vary over time and multi-sequence MRI might be useful to determine the age of an arterial dissection.

B-437   11:33

Comparison of contrast enhanced magnetic resonance angiography (CE-MRA) and non-contrast enhanced MRA for imaging of the carotid arteries

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Purpose: To evaluate image quality and diagnostic accuracy of a non-contrast-enhanced magnetic resonance angiography (MRA) technique for imaging of the carotid arteries compared to standard contrast-enhanced (CE) MRA.

Methods and Materials: 32 consecutive patients (62±16 y, 13 m/19 f) with s/o brain ischemia referred for carotid MRA were enrolled in the study. All MR exams were performed on a 3.0 T system and patients underwent both, CE-MRA (3D T1 Flash) and non-CE-MRA (ECG gated TrueFISP). Image quality was rated in terms of delineation of the vessel lumen, signal intensity within the vessel and diagnostic confidence by two readers on a 4 point scale whereas 4 stands for best score. Accuracy of quantitative measurements was evaluated by assessing the cross-sectional vessel area at three predefined levels identical for both techniques in the area of the carotid bifurcation.

Results: All patients finished the exam including both techniques for carotid MRA. Mean score for image quality in terms of vessel lumen delineation was 3.55 for CE-MRA and 3.06 for non-CE-MRA. In terms of signal intensity and diagnostic confidence CE-MRA featured a mean score of 3.39 and 3.68 compared to 2.9 and 3.1 of non-CE-MRA, respectively. Measurement of the vessel lumen showed no significant differences for both techniques (p = 0.16 - 0.41 for three different levels).

Conclusion: Non-CE-MRA can serve as an alternative for CE-MRA without a significantly different image quality or diagnostic accuracy. This is especially interesting in patients with an impaired renal function to reduce the risk of NSF.

B-438   11:42

Steady state MR angiography of the carotid arteries: Feasibility and preliminary clinical experience with gadobenate dimeglumine compared with CT angiography and conventional angiography

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Purpose: To evaluate the potential of Gd-BOPTA for first-pass (FP) and steady state (SS) MR angiography (MRA) of the carotid arteries, compared with computed tomography angiography (CTA) and using digital subtraction angiography (DSA) as reference standard.

Methods and Materials: Forty patients underwent conventional FP MRA with 15 mL gadobenate dimeglumine using a conventional 3D FLASH sequence (Voxel size: 1×1×0.7 mm). Immediately after FP image acquisition, SS vascular images were obtained using a high resolution 3D FLASH sequence (Voxel size: 0.7x0.7x0.7 mm). Two radiologists assessed the quality of the FP and SS acquisitions and calculated sensitivity, specificity, accuracy and predictive valuesfor stenosis grade, length and plaque morphology using DSA as reference. Stenoses were quantified and compared (Spearman rank correlation coefficient, [R (s)]; McNemar test) with DSA and CTA findings in all patients.

Results: The quality of MRA FP and SS images was excellent in 63 (79%) and 47 (56%) vessels, adequate in 11 (14%) and 21 (26%) vessels and suboptimal in 6 (7%) and 12 (15%) vessels. Area under the curve analysis revealed no significant differences between MRA FP, MRA FP+SS and CTA regarding the grading of stenoses (p = 0.838; accuracy values of 97.4, 97.45 and 98.7%, respectively). Greater accuracy (p < 0.001) was noted for FP+SS images over FP images alone for the assessment of plaque morphology (94.5% for FP+SS images vs. 83.3% for FP).

Conclusion: SS MRA of the carotid arteries with Gd-BOPTA feasible and the increased spatial resolution attainable improves evaluation of stenoses and plaque irregularities.

B-439   11:51

High resolution steady state MR angiography of the carotid arteries: Comparison of three different contrast agents for image quality and diagnostic accuracy

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Purpose: To compare image quality and diagnostic accuracy of MS-325, Gd-BOPTA and Gd-DTPA for steady state (SS) MR-angiography (MRA) of the carotid arteries, using conventional angiography (DSA) as reference.

Methods and Materials: 3 groups of 20 subjects underwent first-pass (FP) and SS MRA (voxel size: 0.7 mm³) with MS-325 (group 1), Gd-BOPTA (group 2) or Gd-DTPA (group 3). Signal-to-noise (SNR) and contrast-to-noise (CNR) ratios were calculated. Two readers evaluated vessel stenosis and plaque morphology. Sensitivity, specificity and accuracy of FP and combined reading (FP+SS) and the presence of statistically significant differences (McNemar test: p < 0.001) were determined for each group.

Results: SNR and CNR of FP and SS were higher in group 1 (p < 0.001). The SNR and CNR of group 2 were higher than those of group 3 (p < 0.001). Sensitivity, specificity and accuracy of FP/FP+SS for stenosis assessment were 94/96, 94/98 and 95/97% for group 1, 93/96, 94/97 and 94/97% for group 2, and 90/82, 91/84 and 91/85% for group 3. Sensitivity, specificity and accuracy of FP/FP+SS for plaque morphology were 92/98, 93/98 and 94/99% for group 1, 91/98, 92/97 and 94/98% for group 2, and 89/81, 88/83 and 87/81% for group 3. No differences (p > 0.05) were noted between groups 1 and 2 regarding stenoses assessment and plaque morphology for FP and SS. The findings for groups 1 and 2 were all superior (p < 0.001) to those of group 3.

Conclusion: MS-325 and Gd-BOPTA offer a similar diagnostic performance for SS MRA and are superior to Gd-DTPA for stenosis and plaque characterization.

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

Pediatric

SS 812

Neuro (pre- and post-natal) imaging

Moderators:
F.E. Avni; Brussels/BE
S. Cakirer; Istanbul/TR

B-440   10:30

DTI reveals microstructural brain abnormalities in children with syndromic craniosynostosis

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Purpose: Children with syndromic craniosynostosis often show unexplained neurological impairment. Studies have shown several brain malformations in these patients; however, the underlying cause of developmental delay remains unclear. We hypothesise that Diffusion Tensor Imaging (DTI) used to assess microstructural changes in brain tissue may increase our knowledge on this neurological impairment.

Methods and Materials: A prospective study was performed in children with syndromic craniosynostosis between six and fourteen years old, all treated in our craniofacial center. We enrolled 58 patients; 7 patients with Apert's syndrome, 21 Crouzon/Pfeiffer syndrome, 9 Muencke syndrome, 13 Saethre-Chotzen and 7 patients with a complex form of craniosynostosis. MRI brain scans were performed on a 1.5 Tesla General Eletrics (GE) system, with DTI. Regions of interest (ROIs) were placed in corpus callosum, cingulum, corticospinal tracts, pontine crossing tract, fornix, medial cerebellar peduncle, frontal and occipital white matter, uncinate fasciculus and anterior commissure. For comparison, we used 5 age-matched controls. Eigenvalues and Fractional Anisotropy (FA) were assessed in all above regions, using postprocessing software 'Functool' (GE, medical systems).
Results: Mean White Matter (MWM) is defined by the mean of the right and left frontal and occipital white matter measurements. FA values of the MWM are significantly lower in our patient group (p=0.035). FA values of the corpus callosum, measured in the genu and splenium are also significantly lower in children with a syndromic form of craniosynostosis (p=0.018 and 0.020).
Conclusion: DTI measurements reveal significant microstructural white matter differences between children with craniosynostosis and healthy controls.

B-441   10:39

also EPOS

Quantitative diffusion tensor tractography of the motor and sensory tract in spastic cerebral palsy children: A correlation with their clinical gross motor function

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Purpose: To evaluate the motor and sensory parameters using diffusion tensor imaging (DTI) in children with spastic cerebral palsy (CP).
Methods and Materials: We evaluated 25 children with spastic CP (0-8 years, mean 2.38 years) and 21 normal control children (0-9 years, mean 2.14 years). The clinical severity of CP was evaluated with the gross motor function classification system (GMFCS) by pediatric neurologists, who evaluated 14 children to be severe (GMFCS III-V) and 11 children to be mild (GMFCS I-II). DTI data were obtained with a 1.5 T scanner, and fiber-tracking was performed using the two regions-of-interest (ROI) method. We measured the number of fibers of the corticospinal tract (CST) and posterior thalamic radiation (PTR), tract-based fractional anisotropy (FA), and ROI-based FA. We evaluated the correlation between each value with the GMFCS, and compared each parameter with the severity of CP.
Results: Multiple regression analysis demonstrated that only the motor parameters were significant variables that correlated with the GMFCS (p < 0.001). Additionally, it is shown that only the motor parameters of children with severe CP group are significantly lower than those of mild CP group. In contrast, both motor and sensory parameters of mild CP group were significantly lower than those of control group.
Conclusion: We demonstrated that only the parameters of the motor tract were significantly correlated with GMFCS. It was also found that even if the severity of CP was clinically mild, their motor and sensory parameters in DTI were significantly affected when compared with control group.

B-442   10:48

Transcranial CEUS compared to 3 T MRI in perinatal hypoxia and resuscitation in newborn pigs

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Purpose: To assess whether contrast enhanced ultrasound (CEUS) can detect early brain injury after hypoxia and resuscitation? To evaluate microvascular perfusion changes due to hypoxia, with CEUS compared to MRI with perfusion (PWI) and diffusion weighted (DWI) imaging.
Methods and Materials: Newborn piglets (n=17) were anesthetized and exposed (n=12) to 30 min hypoxemia (FiO_2=8%) followed by resuscitation with 21% or 100% O_2 and reoxygenation. CEUS and MRI with PWI, DWI were performed prior to, during and repeatedly up to seven hours after hypoxia. Time intensity curves of different regions of interest (ROI) in basal ganglia (BG), cortex (C) and whole brain (WB) were calculated. The perfusion parameters were compared between the ROIs and different time points for CEUS/PWI as well as apparent diffusion coefficient (ADC) and histology.
Results: In CEUS, the hyperoxic group changed significantly over time for peak intensity (PI) and area under the curve (AUC) in all ROIs (p < 0.02), compared to the controls. There were no significant changes over time in the 21% group. MRI data showed the same trend. In the histologically injured brains, perfusion changed significantly for TTP, AUC in all ROIs, while ADC in WB decreased towards the end (p=0.03). All pigs exposed to hypoxia showed return to baseline perfusion values in all ROIs at the end.

Conclusion: Our study indicates that CEUS can identify early perfusion changes better than PWI, even though reversible and without correlation to histological findings and decreased diffusion at the endpoint. CEUS/PWI-MRI sole are not useful in the early diagnosis for treatment/prognosis, but opens for new understanding of perinatal hypoxia mechanisms.

B-443   10:57

Investigating spontaneous "fluctuations" of contrast enhancement in childhood pilocytic astrocytomas: Our experience

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Purpose: Childhood pilocytic astrocytoma (PA) accounts for 10% of supratentorial astrocytomas and for 85% of infratentorial astrocytomas. The tumor patterns could be solid and/or cystic and the solid part may enhance in a homogeneous or a heterogeneous fashion; assessment of contrast enhancement (CE) pattern is essential for the diagnosis and follow-up. After partial tumor removal, we observed CE modifications in the absence of residual dimensional changes in pts who have not received neither chemotherapy nor cortisone therapy. We investigated changes of the residual PA with serial MR CE in the absence of dimensional changes of the residual tumor in pts off-therapy.
Methods and Materials: We retrospectively evaluated 912 MR exams of 140 pts with histologically proven diagnosed PA (partial removal or stereotactic brain biopsy), followed for an average of 4.5ys with serial MRI (1.5 T). All MRI studies were performed with 3 orthogonal FSE T1-WI post-gadolinium sequences. We measured 2 orthogonal diameters on the T1-WI post-Gd sections of each enhancing focus and 2 orthogonal diameters on the correspondent T2-WI of the residual tumour.
Results: 65/140 PA were infratentorial, 58/140 supratentorial, 17/140 had multiple locations. Of 140 PA, we selected 39 pts off therapy, without evidence of NF1 and without dimensional changes of the residual tumor. 12/39 showed a CE changes in term of increase/appear and/or decrease/disappear of the CE. 3/12 were infratentorial, 8/12 supratentorial (7 optic-diencephalic,1 hemispheric astrocytoma) and 1/12 endoventricular.
Conclusion: In our experience, residual PA may show a variable CE during the years, in absence of residual tumor dimensions change. Thus, the CE fluctuation alone is not directly correlated with an increase or decrease of residual tumor size.

B-444   11:06

Diffuse periventricular leukomalacia in preterm children: Assessment of grey matter changes by MRI

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Purpose: Preterm children manifest cognitive, educational and behavioral deficits, suggestive of grey matter (GM) injury. A higher prevalence of these deficits is observed in preterm children with diffuse periventricular leukomalacia (PVL). Our purpose was to evaluate changes in the volume of 116 grey matter (GM) areas in preterm children with diffuse PVL.
Methods and Materials: Ten preterm children (gestational age 31.8±2.4 weeks, corrected age 21.78±20.32 months) with diffuse PVL and 36 matched preterm controls subjects with normal structural appearance on brain MRI were included in the study. Using a T1-weighted high resolution 3D spoiled gradient echo sequence, volumes of 116 individual GM areas were calculated after their segmentation using the Voxel Based Morphometry Toolboxes and the Individual Brain Atlas Statistical Parametric Mapping (IBASPM) software packages. Two-tailed Student's t-test was performed to test for differences in regional GM volume between groups.
Results: Decreased regional GM volume was observed in the hippocampus, the amygdala, the olfactory gyrus and the temporal and frontal lobes in preterm children with PVL when compared to controls (P < 0.05). Increased regional GM volume was demonstrated in the basal ganglia, the occipital and parietal lobes (P < 0.05).
Conclusion: White matter injury, hypoxic-ischemic injury or metabolic insults may explain the reduced GM volumes in areas associated with cognition and memory in preterm children with diffuse PVL. Brain plasticity may be at the base of the regional GM volume increase in diffuse PVL.

B-445   11:15

also EPOS

The initial application of MR susceptibility weighted imaging in neonates with punctate white matter lesions

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Purpose: To evaluate punctate white matter lesions in neonatal brain injury with susceptibility weighted imaging (SWI), and to explore the value and limitation of SWI compared with conventional magnetic resonance imaging.

Saturday

A **B** C D E F G S227

Methods and Materials: Fifteen neonates with punctate white matter lesions (punctuate areas with T_1 hyperintensity and T_2 isointensity or hypointensity in the white matter) were investigated (10 male cases, 5 female cases; average age, 8.33 days; range, 2 to 17 days). Conventional magnetic resonance (include T_1WI, T_2WI, Flair and DWI) and SWI were performed in all 15 cases. 15 cases PWML were classified into two groups: 1) T_1 hyperintensity and T_2 isointensity 2) T_1 hyperintensity and T_2 hypointensity. To analyzed the signal intensity changes of two groups in SWI.
Results: There are only 3 cases (20%) of all cases showed evidence of hemorrhage in SWI. Three cases were group 1, and there was only one case showed evidence of hemorrhage in SWI. Twelve cases were group 2, and only 2 cases showed evidence of hemorrhage in SWI.
Conclusion: Most areas of punctate white matter lesions in neonatal brain showed no hemorrhage on SWI. SWI can help identify whether punctate white matter lesions in neonates contains hemorrhage.

B-446 11:24

also EPOS

Proton MR spectroscopy a non-invasive tool to assess different regions of the brain in congenital hypothyroidism

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Purpose: Untreated congenital hypothyroidism produces irreversible brain damage. Proton Magnetic Resonance Spectroscopy (^{1}HMRS) has been used to study metabolic alterations in the various lobes of the cerebral hemisphere including basal ganglia in untreated congenital hypothyroid cases comparing them to patients who have received more than 2 months of treatment.
Methods and Materials: Three groups all below 2 yr of age: a) 4 consecutive cases of congenital hypothyroidism, b) 3 cases of congenital hypothyroidism treated with 8 weeks thyroxine replacement, and c) 6 age matched controls less than 2 yr of age were studied. MRI was done with 1.5 Tesla MR scanner (Magnetom 'Vision', Siemens, Erlangen, Germany). Proton Spectra were obtained using the PRESS technique. Relative concentration of Cho, Cr, NAA were studied.
Results: Conventional MRI was normal in all groups. Cho/Cr was high in frontal lobes of untreated and treated patients, compared to controls but was not statistically significant. Cho/Cr ratio was high in untreated congenital hypothyroid children in the basal ganglia, parietal and temporal white matter (p < 0.005) compared to treated. Rise in NAA/Cho ratio (p < 0.005) noted in basal ganglia and white matter of temporal and occipital lobes in treated cases compared to untreated. Elevation of NAA/Cr (p < 0.005) was noted in white matter of the temporal and occipital lobes in treated patients vis-a-vis untreated.
Conclusion: Spectroscopy demonstrated reduced NAA/Cho in basal ganglia indicating neuronal axonal degeneration and its reversal with treatment apart from showing evidence of impaired myelination in other parts of the brain.

B-447 11:33

also EPOS

Eye movement patterns on fetal MRI

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Purpose: To investigate different fetal eye movement patterns in normal and pathological conditions using dynamic MR-sequences.
Methods and Materials: 70 fetuses with normal brain development and 18 fetuses with Chiari II malformations (18-40 gestational weeks-GW) were examined using dynamic SSFP sequences (1.5 T, sense cardiac coil, slice thickness 15-20 mm, 6 frames/sec). Normally developing fetuses were divided into 3 groups: 18-23 GW: 16 fetuses, 24-32 GW: 33 fetuses, 33-40 GW: 21 fetuses. Eye movements were classified following Birnholz (Science 1981): Type 0 = no eye movements, Type I = single transient deviation, Type II = single prolonged deviation, Type III = complex sequence of deviations without periodicity, Type IV = repetitive/nystagmoid deviations.
Results: Among normally developing fetuses Type 0 and I eye movements decreased while Type II and III movements increased from the youngest to the oldest gestational age group. Differences between the fetal age groups were significant concerning Type IV movements which were only detected in the middle and oldest age group and occurred most frequently in the latter group. 8/18 fetuses with Chiari II malformations showed eye movements. Type IV and II were each found in 2, Type III in 4 fetuses.
Conclusion: The age dependent maturation of different eye movement patterns can be visualized using dynamic fetal MR-sequences. In cases with suspected brainstem abnormalities/dysfunction (such as Chiari II malformations), in the future MR may allow the structural and functional assessment of the fetal brainstem.

B-448 11:42

Fetal ocular measurements by MRI

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Purpose: To present fetal MRI ocular measurement ranges by gestational age.
Methods and Materials: 298 pregnancies from the 18th to the 39th week of gestation were imaged using a 1.5 Tesla MRI. Ocular measurements including inter-ocular distance (IOD), binocular distance (BOD), transverse ocular diameter (OD), anteriorposterior ocular diameter (AP) were measured. The curve estimation analyses for linear and quadratic models were performed to determine the best fit for fetal ocular growth. Comparison data are plotted for the corresponding measurements of the BOD, IOD and OD.
Results: There was no significant difference in the left and right eye measurements for AP (t = 1.654, p = 0.1), and OD (t = -1.428, p = 0.155). However, there was a significant difference in the measurement between AP and OD (t = -22.07, p < 0.001). A quadratic correlation was observed between gestational age and BOD, IOD, OD and AP, the r^2 value of BOD, IOD, AP and OD is 0.915, 0.71, 0.912, 0.91 (P < 0.0001), respectively. Expected measurements at 18 to 40 gestational weeks were predicted. Ocular measurements of fetuses with intrauterine growth retardation (IUGR) lie beneath the growth curve.
Conclusion: The quadratic model was more suitable than a linear model for the evaluation of fetal ocular growth. There was discordant growth of OD and AP, with the AP increasing faster during late pregnancy. Ocular measurements on MRI provided normative data and may be helpful in detecting fetal ocular anomalies and reduced ocular size in IUGR.

B-449 11:51

Potential role of fetal MRI in the diagnosis of cleft-lip palate

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Purpose: To assess the potential role of fetal MRI in the diagnosis of cleft lip-palate.
Methods and Materials: 29 pregnant women with 32 fetuses (from 19 to 37 GW) with a prenatal US determined diagnosis of cleft lip-palate were examined with fetal MRI (1.5-T) using multiplanar T2-w single-shot fast spin-echo sequences and gradient echo with steady-state free precession sequences. We evaluated some parameters of cranial and maxillo facial development:anteroposterior diameter of the mandible and distance between the two rami, interorbital and biorbital diameter, inferior facial angle and fronto-occipital bone diameter. Then we assessed location and extent of the cleft lip, degree of involvement of palate and we defined possible associated anomalies. In all cases, MRI findings were compared with postnatal US or autoptic findings.
Results: In all fetuses orbits, nasal bones, upper lip and palate, chin were well identified with MRI such as the presence of cleft-lip-palate. In 18 fetuses cases, MRI confirmed the US diagnosis. In the remaining 11 fetuses, the comparison between US and MRI findings revealed a greater detail in 8 cases of lip-palate cleft in the evaluation of hard and soft palate and discorfimed/changed the diagnosis or added fetal anomalies missed at US 3 cases (2 cases with midface anomalies, 1 cleft lip).
Conclusion: MRI has a crucial role in the recognition of the finest details of normal fetal anatomy. Fetal MRI evaluation is a valuable tool to investigate cleft-lip-palate and facial anomalies, to corroborate US diagnosis excluding possible associated CNS and non-CNS abnormalities and to plan pregnancy management and pre- or postnatal therapy.

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

Radiographers

SS 814

Dose reduction strategies

Moderators:
H. Harries-Jones; Poole/UK
P.D. Palczewski; Warsaw/PL

B-450 10:30

Frequency distribution of Maltese CT examinations demonstrates potential for dose reduction

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Purpose: The purpose of this survey was to provide frequency data on CT examinations in Malta and using European effective dose levels (E), estimate the collective effective dose (S) for CT examinations.
Methods and Materials: A participation of 57% encompassed CT units from both public and private hospitals comparing well to other surveys (New Jersey-40%; UK-25%; IAEA-10 units, 6 countries; Greece 4 units). Three CT manufacturers were included encompassing 4 different models. The European guideline recommending categorization of CT examinations was adopted to enable international comparison of frequencies. Data was collected by a questionnaire based on NRPB W67 guideline, obtained from the RIS of participating hospitals for the period January to December 2008.
Results: CT comprised 8.85% of ionizing radiation examinations in Malta, being higher than other countries (Norway 7%; Germany, UK, New Zealand 4%; Spain, Sweden 3%; EU survey 4.5-15%). The collective dose (S) was estimated using European average effective dose (E) multiplied by the number of persons exposed within this population. S was estimated for head at 23458man-Sv; abdomen and pelvis 54833 man-Sv and thorax 10616 man-Sv. CT of the head is the most frequent (43%): higher than in Spain (38%), UK (35%) and Ireland (41%) less than in Wales (50%). Abdomen and pelvis: (33%) is more frequently than other countries (12-22%) while thorax similar at 9%.
Conclusion: CT distribution data in Malta has identified differences to other countries. The abdomen and pelvis demonstrate a larger frequency in comparison to other countries with a potential for dose optimization.

B-451 10:39

also EPOS

Variations in doses from CT examinations

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Purpose: Substantial dose variations have been observed between CT laboratories in Norway. Our purpose was to explore the dose differences and to investigate whether these differences could be explained by dose optimization work.
Methods and Materials: Local diagnostic reference level (local DRL) for CT-caput and abdomen was obtained from 22 laboratories. A questionnaire was developed to investigate the dose variation reflecting the organization and performance of the optimization work. Data on optimization parameters was categorised according to a score system, and the correlation between doses and optimization parameters was analyzed One Way ANOVA-tests.
Results: The local DRL dose-length product (DLP) varied by a factor 4 for caput (Range 494 - 1781 mGy cm) and varied by a factor 3 for abdomen (Range 243 - 1000 mGy cm). The mean DLP value was 35% lower in laboratories were the responsible radiographer had postgraduate studies in CT compared with laboratories where the radiographer did not have this education (CT abdomen 402 versus 620 mGy cm). Thorough work with protocols and work in multidisciplinary teams (including medical physicist, radiologist and radiographers) gave an average reduction in local DRL of 20%.
Conclusion: The local DLP for CT procedures varied significantly between the 22 laboratories. Factors reflecting efforts for dose optimization also varied distinctly. This work suggests that the contribution from CT to the collective effective dose can be reduced substantially by multidisciplinary and thorough work with optimization of scan protocols, requiring professional awareness.

B-452 10:48

also EPOS

Low dose abdomen imaging on the HDCT with new gemstone detector and new reconstruction algorithm (ASIR, adaptive statistical iterative reconstruction)

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Purpose: The purpose of this study was to evaluate the effect of ASIR on radiation dose and image quality in CT abdomen imaging using High definition computed tomography (HDCT).
Methods and Materials: Fifty consecutive patients underwent abdomen scan on HDCT scanner with auto-adjusted mA (Noise Index adjusted by Body Mass Index: 22~28). Axial images were reconstructed with and without ASIR algorithm. The radiation dose was recorded and the image quality was evaluated in a double-blind manner by two radiologists using a 5-point scoring system (excellent: 1; bad: 5). The noise level (standard deviation of CT values) in different tissue was also measured. Statistical t test analysis on image quality score and noise of axial images were performed.
Results: The average radiation dose was 4.32±1.92 mSv. The average image quality score (from hepatic vein, portal vein, pancreas, Bifurcation level) in ASIR group (2.17±0.38) was statistical better (p < 0.05) than the non-ASIR group (2.62±0.60). The average noise level of different tissue was also statistical significantly lower in ASIR group than in the non-ASIR group. The percentage decrease in image noise of axial view was 20% in liver, 19% in vein, 9% in bone and 15% in kidney. It was also found that the noise reduction is more effective for thinner slice thickness.
Conclusion: The HDCT can provide more diagnosis information and more consistent image quality with ASIR algorithm. Since the image noise can be effectively reduced by ASIR, it allows a significant reduction of radiation dose in CT abdomen imaging.

B-453 10:57

Correlation of patients' weight and dimensions to CT dose descriptors: CTDI and DLP

F. Zarb[1], L.A. Rainford[2], M.F. McEntee[2]; [1]Msida/MT, [2]Dublin/IE (francis.zarb@um.edu.mt)

Purpose: The establishment of dose reference levels (DRLs) in CT is the first step in the implementation of dose reduction strategies. DRLs are established for 'standard sized' patients. Classification of patients is based on patients' weight which may not be the most appropriate indicator to the required CT scanning parameters. Cross-sectional diameters (transverse and AP diameters of the area under investigation) may be better suited for the implementation of dose reduction strategies and establishment of DRLs in CT. The purpose of this study was to identify relationships between cross-sectional diameters to weight and CT dose descriptors CT Dose Index (CTDI) and Dose Length Product (DLP) to establish whether these dimensions can be used as a measure for the establishment of DRLs.
Methods and Materials: Correlation and stepwise regression analysis were performed on data obtained from 2 CT scanning units using automatic tube current modulation for CT examinations of the abdomen and chest.
Results: The AP diameter is the main contributing factor among the three parameters which influences the dose in CT (CTDI: weight p-value - 0.757; transverse diameter p-value -0.357 AP diameter p-value - 0.022; and DLP: weight p-value - 0.185; transverse diameter p-value - 0.367; AP diameter p-value - 0.036).
Conclusion: Dose reduction strategies and the establishment of DRLs in CT need to consider the thickness of the scanned anatomical area and not merely be based on patients' weight as weight may not always be the correct indicator of the dose necessary for a particular CT examination.

B-454 11:06

Simulated low-dose CT in oncological patients: A feasibility study

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Purpose: Image quality of chest and abdominal CT scan was evaluated at different doses to assess the lowest value of X-ray dose at which the image quality was not being affected.
Methods and Materials: 29 oncological patients submitted to follow-up examinations were examined using a combined MSCT-protocol of the chest and abdomen on a four-raw MSCT (Siemens). Approximately 120 ml of contrast agent (Bracco-Altana) were applied intravenously. Raw data were transferred to an external PC equipped with image reconstruction software to simulate different dose levels (90, 60, 40, 30 and 20 mAs). A mAs-depending noise was added to every image, so that

the changes in current-time-product could be imitated. The images were compared in consensus by two radiologists and graded in four different subcategories on 1 to 5 point scale. For statistical analysis, the Friedman Test was utilized.

Results: For image noise there was a significant change between 40 and 60 mAs. For lesion detection, there was no significant change. The contour of small objects did not differ down to 40 mAs, though further dose reduction had a significant effect. The contrast did not differ even down to 30 mAs. The level of noise was most sensitive to the current. While dose reduction to 60 mAs did not yet have a significant effect, there was a significant increase of noise at 40 mAs.

Conclusion: The MSCT can be applied with lower dose than usually selected in examinations at present to follow-up and to stage the oncological patients adequately.

B-455 11:15

also **EPOS**

Exposure to operators during interventional cardiology

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Purpose: To identify dose levels received by the operator during a Cath Lab intervention and relate them with the approach type, procedure type, and techniques of radiation protection, different locations and operator.

Methods and Materials: The study involved the analysis of 221 common interventions (140 through a femoral approach and 81 by radial approach). For the accountancy of the radiation received by the operator, the Unfors EDD-30 dose rate meter was used. The dose rate meter was used in different locations: left hand, thyroid with and without the lead Necklace, left and right crystalline inside and out of the protection glasses. We analyzed the time of exam (from the puncture to the finalization of procedure), the time of fluoroscopy, accumulated dose, dose rate and the exposure time.

Results: The left hand is the place that presents larger values in all of the parameters, namely 2.49 min of exposition, 33.18 µSv, 5.20 mSv/h. Comparing both approaches, there is significant difference (p < 0.05), between femoral (8.36 µSv) and radial (16.91 µSv) access.

Conclusion: The large use of X-rays in the diagnostic catheterization and coronary angioplasty procedures requires a detailed monitoring to verify the level of absorbed dose. The exposure of personnel, protected by a lead apron, can be in the critical range especially in the area of the eye and neck as the operators do not always wear thyroid shields or lead glasses.

B-456 11:24

Evaluation of dose levels in digital radiology chest X-ray with different additional filters

J.M.R. Santos; *Coimbra/PT (joanamrsantos@netcabo.pt)*

Purpose: In radiology, it is necessary to control, evaluate and optimize patient dose during radiological examinations. Development of radiology should improve the quality of radiological images, decrease the workflow, and must comply with the ALARA principle created by ICRP.

Methods and Materials: The sample was composed of 140 patients who submitted to chest X-ray in a Digital Radiology system that allows additional filter change (0.1 Cu+1 Al; 0.2 Cu+1 Al; 0 Al; 2 Al). For measurement of ESD and DAP, an ionization chamber Diamentor M4-KDK and the software Diasoft 5.2 were used. The study took place in three phases. In the first one, there was no interference from the researcher. In the second phase, another three additional different filters were used, in the third phase, the kilovoltage (kV) has been increased. Images of standard patients with different additional filters were randomly selected and six radiographers evaluate their quality.

Results: The average ESD for standard patients was 0.078 mGy for (0.1 Cu+1 Al), 0.069 mGy for (0.2 Cu+1 Al), 0.127 mGy for 0 Al and 0.101 mGy for 2 Al. The average DAP was 0.083 Gy.cm^2, 0.069 Gy.cm^2, 0.131 Gy.cm^2 and 0.104 Gy.cm^2, for (0.1 Cu+1 Al), (0.2 Cu+1 Al), 0 Al and 2 Al, respectively.

Conclusion: The obtained ESD and DAP values are according to European Diagnostic Reference Level. There was a 11% reduction of ESD and 16% of DAP using the 0.2 Cu+1 Al additional filter, for the standard patient. In third phase using the same filter and increasing Kv, we reduce ESD in 18% and DAP in 17%.

B-457 11:33

also **EPOS**

Evaluation and optimization of dose levels in pediatric chest X-ray: Comparison with international reference levels

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Purpose: In radiology, it is necessary to control, evaluate and optimize patient dose during radiological examinations, especially in pediatrics, because of the higher radiosensitivity of tissues. After measuring DAP and ESD values in chest X-ray, AP and PA,

the results were compared with the "European guidelines on quality criteria for diagnostic radiographic images in pediatrics" in order to optimize the radiological practice.

Methods and Materials: The sample was composed of 272 children, aged between 0 and 15 years, who underwent chest X-ray in a CR system. For DAP and ESD measurement, an ionization chamber Diamentor M4 KDK was used. The study took place in three phases. In the first one, the data were obtained with the exposure conditions in use in the department and therefore with no interference from the researchers. In the second phase, a Kv scale, by weight classes was applied and, finally, in addition to the changes implemented in the previous phase, a lateral ionization chamber was used in patients above 5 kg.

Results: The average DAP was 0.10 Gy.cm^2, 0.07 Gy.cm^2 and 0.04 Gy.cm^2, for phase 1, 2 and 3, respectively. The average ESD was 0.22 mGy in the first phase, 0.16 mGy in the second phase and 0.42 mGy in the third phase.

Conclusion: There was a reduction of ESD by 44% in the second phase and 72% at the end of the study, when compared to the first phase, for the standard patient. Similar reduction was observed in DAP.

B-458 11:42

also **EPOS**

Evaluation and optimization of dose levels in children pelvis X-ray

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Purpose: Considering that the risks associated with ionizing radiations must always be minimized namely in pediatrics due to the children's vulnerability in developing long-term somatic and genetic effects, three factors must be considered: the justification, consistency and optimization of procedures. In this study, the authors registered, evaluated and analyzed DAP and ESD values in pediatric pelvis X-ray. The results were compared with the "European guidelines on quality criteria for diagnostic radiographic images in pediatrics".

Methods and Materials: 157 patients were evaluated with ages between 0 and 18 years. DAP and ESD values were measured with a diamentor M4 KDK of PTW. The study occurred in two different phases. In phase 1, there was absolutely no interference on the way the department worked. During phase 2, a Kv scale was applied regarding the patient's weight.

Results: During phase 1, the DAP value was 0.53 Gy.cm^2. On the phase 2, DAP was 0.36 Gy.cm^2. During phase 1, the ESD value was 1.18 mGy. On the phase 2, ESD value was 0.79 mGy.

Conclusion: The optimization of X-ray procedures is fundamental and necessary to achieve ALARA principals. Procedures protocols should be adequate taking in account patient different anthropomorphic characteristics. A 27% decrease in ESD values and 51% for the exposure time on phase 2 was achieved.

B-459 11:51

Occupational exposure in operation room during dynamic hip screw (DHS) procedure

C. Reis, I. Santos, M. Pinheiro, J. Diogo, N. Machado, L. Lança; *Lisbon/PT*

Purpose: Orthopaedic surgeries often use fluoroscopy for osteosynthesis with Dynamic Hip Screw (DHS). The implementation of optimised practices in a local operation room (OR) concerning occupational exposure of each member of the surgical team is mandatory. The aim of this study was to measure individual dose equivalent (IDE) in OR during DHS procedure and provides recommendations for individual radiological protection.

Methods and Materials: IDE (Hp$_{10}$) was measured by 7 thermoluminescent (TLD) dosimeters/Panasonic-UD-802. TLD were positioned on the surface of protective aprons at the chest of each staff member working at OR (2-orthopaedic surgeons; 1-radiographer; 1-anaesthesiologist and 3-nurses). The mean radiation source distance (RSD) was 0.5 m for the orthopaedic surgeons, 2.3 m for the radiographer, 4 m for the anaesthesiologist, and 1-3 m for nurses. Technical settings (kVp, mAs; RSD; radiological projection-AP/Lateral; fracture classification) were collected from 21 DHS procedures between May and July 2009. Surgeries were performed using a fluoroscopic system (Ziehm).

Results: IDE/(Hp$_{10}$) mean values obtained for DHS procedure were: 11.4 µSv (chief orthopaedic surgeon); 5.71 µSv (assistant orthopaedic surgeon); 0.00 µSv (radiographer); 0.00 µSv (anaesthesiologist); 1.42-2.38 µSv (nurses). Taking in account the number of DHS surgeries performed each year by each staff member, the estimated annual average IDE would be 0.24 mSv (chief orthopaedic surgeon); 0.12 mSv (assistant orthopaedic surgeon); 0.00 mSv (radiographer); 0.00 mSv (anaesthesiologist); 0.03-0.0.05 mSv (nurses).

Conclusion: IDE measurements during DHS procedures could be a good indicator towards the implementation of optimised practices in OR concerning occupational exposure. IDE variations were found between staff members but the results were well below the annual safety limits of the ICRP (20 mSv/year).

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

Neuro

SS 811

Functional MR imaging

Moderators:
M. Caulo; Chieti/IT
T. Stosic-Opincal; Belgrade/RS

B-460   10:30

Functional connectivity-MRI of language network in patients with drug-resistant epilepsy

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Purpose: Subtle linguistic dysfunctions and reorganization of the language network have been described in epileptic patients, suggesting plasticity changes across brain regions. Functional Connectivity (FC) - MRI is a newly-developed technique able to study brain connectivity, by evaluating correlations between spontaneous BOLD signals fluctuations. This study investigates plasticity effects induced by epilepsy on the functional connectivity of the main language-related brain regions.
Methods and Materials: We retrospectively evaluated FC in 22 right-handed patients with drug-resistant, non-tumoral epilepsy (11 with left and 11 with right-lateralized epilepsy) and in 14 healthy volunteers. Patients and controls underwent BOLD fMRI to lateralize language functions in the cerebral hemispheres. Six common seed regions related to the language network (Broadman 45, Superior Temporal Sulcus and Temporo-Parietal Junction of both the hemispheres) were defined from previous studies and verified to fit with individual fMRI activations. BOLD signals fluctuations cross-correlation matrices and corresponding whole-brain connectivity maps were calculated for each subject. Group-level analyses were performed by independent-samples t-tests and ANOVAs.
Results: Both correlation matrices and connectivity maps showed an overall reduced and rearranged connectivity pattern in patients with both L- and R-lateralized epilepsy compared to controls; FC was significantly reduced within the left (dominant) hemisphere (intra-hemispheric FC) and between the two hemispheres (inter-hemispheric FC) (p < 0.05; connectivity maps were FDR-corrected).
Conclusion: In epileptic patients, FC-MRI was able to assess disruption and re-organization of different connectivity links among six cortical regions for language, thus confirming a remote influence of epileptogenic lesions, and possibly accounting for language and cognitive disturbances.

B-461   10:39

Influence of acupuncture on pain modulation during electric stimulation: An fMRI study

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Purpose: The effect of acupuncture on pain relief has been investigated in different studies, with fMRI among others. We evaluated the influence of acupuncture on pain modulation, induced by electrical stimulation, using fMRI, hypothesizing differing brain activation among the acupunctured group.
Methods and Materials: Eighteen volunteers were examined at 1.5 T (Sonata, Siemens Healthcare) after evaluation of the individual pain level. For baseline, fMRI during electrical pain stimulation (left ankle) was performed in a block design fashion with EPI sequences. Afterwards, an additional contralateral acupuncture was performed on acupoints LI10/LV3/ST36 prior to pain stimulation. Statistical analysis was performed with SPM 05.
Results: Group analysis of baseline versus acupuncture showed significant activation of the contralateral SMA, SMC, ipsi- and contralateral dorsal posterior insula and ipsilateral SMC. Respecting acupuncture versus baseline significant activation of the left anterior insula cortex was discovered. Supplementary activation of the right dorsobasal insula was detected using the stimulus intensity as a covariate. Consideration of the subjective pain intensity revealed activation of the right SSC during acupuncture while the right insular cortex decreased.
Conclusion: We revealed activation of brain areas involved in pain modulation as the SMA, SMC and the dorsal posterior insula. During acupuncture, brain activity was significantly reduced and modulated. The majority of detected areas were not influenced by the analyzed covariates. However, right insular cortex activation was modulated by subjective pain intensity, possibly due to its central role in subjective pain processing. Whether being a placebo or a neurobiological effect will be aim of future studies.

B-462   10:48

Supplementary motor area SMA and anterior intraparietal area AIP integrate fine-graded timing and force control during precision grip

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Purpose: We investigated the neuronal processing of the physiologically particularly important precision grip (opposition of index finger and thumb) by the combination of functional magnetic resonance imaging (fMRI) and an MR-compatible haptic interface.
Methods and Materials: Ten healthy subjects performed isometric precision grip force generation with visual task instruction and real-time visual feedback. In a 2 x 2 two-factorial design, both the timing and force could be either constant or varying (identical average timing and force). As we expected only small changes in the fMRI response for the different fine-graded motor control conditions, we maximized the sensitivity of the data analysis and implemented a volumes-of-interest (VOI) restricted general linear model (GLM) analysis including non-explanatory force regressors to eliminate direct force-related low-level activations. The VOIs were defined based on previous studies.
Results: We found significant associations: timing variation (variable vs. constant) and primary motor area M1 and dorsal premotor area PMd; force variation (variable vs. constant) and primary sensory area S1, anterior intraparietal area AIP and PMd; interaction of timing and force and supplementary motor area SMA and AIP.
Conclusion: SMA and AIP integrate fine-graded higher-level timing and force control during precision grip. M1, S1 and PMd process lower-level timing and force control, yet not their integration. These results are the basis for a detailed assessment of manual motor control in a variety of motor diseases. The detailed behavioural assessment by our MR-compatible haptic interface is particularly valuable in patients due to expected larger inter-individual variation in motor performance.

B-463   10:57

Amygdala hyperactivation in women with eating disorder in response to unpleasant stimuli: An fMRI study

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Purpose: Functional magnetic resonance imaging (fMRI) is a neuroimaging technique increasingly used for both patient care and clinical research. In the current study, we employed fMRI to compare patterns of regional brain activation in patients with eating disorders (ED) and healthy volunteers during emotional stimulation.
Methods and Materials: Using fMRI, we examined neural responses to blocks of neutral and fearful images, taken from the IAPS (International Affective Picture System) in a group of 13 young female ED patients and 13 young healthy female controls (no significant differences in age between groups). Data processing and higher level analysis were carried out using FSL (fMRI's Software Library). We used a region of interest (ROI) approach to examine the function of the amygdala in emotional processing.
Results: Patients with ED showed significantly greater right amygdala activation to the fearful images versus neutral images compared with normal control subjects (p = 0.02, Z-max = 3.17, standard coordinates 18, -18, -16).
Conclusion: Our results suggest that female patients with ED exhibit changes in amygdala activity in the processing of fearful stimuli, with higher right amygdala response than healthy volunteers. fMRI could be a useful tool to study the neural substrates underlying eating disorders.

B-464   11:06

Brain modifications after acute alcohol consumption analyzed by fMRI in resting state: First results and explanations

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Purpose: Functional Magnetic Resonance Imaging (fMRI) is able to reveal coactivation of specific brain regions in distributed networks during a resting state condition; therefore, they are called Resting State Networks (RSNs): the most important is the Default-Mode Network (DMN). Acute ethanol consumption is a well-known cause of alteration of the chemical homeostasis and neuronal correlations in the brain. The aim of this study was to verify the presence of modification in the RSNs after acute alcohol consumption.
Methods and Materials: Twelve healthy subjects underwent a first reference 1.5 T MRI examination of the brain with BOLD sequences in resting state. All subjects were invited to drink alcohol in order to reach an air breath concentration higher than

Saturday

0.5 g/L. 40 minutes a second fMRI was performed. The post-processing analysis was based on the Independent Component Analysis (ICA). The count of the total voxels of single RSNs was performed both before and after alcohol consumption and then compared.

Results: In all subjects (20/20) the DMN was seen. Other RSNs, in particular visual (15/20) and attentive network (12/20), were inconstant. In 18/20 subjects, the DMN after the alcohol consumption resulted greater than in the sober condition, in terms of numbers of voxels and of activated areas. Visual and attentive networks decreased in 10/15 and 8/12, respectively.

Conclusion: Acute ethanol consumption is able to modify representation and size of the RSNs, in particular it increases the DMN and it decreases the others, and so hypothetically it may reinforce the resting condition.

B-465   11:15

Spoken versus melodic language processing in healthy volunteers: An fMRI study

S.H.J. Klip, W.M.E. van der Sandt-Koenderman, A.C. van der Meulen, A. van der Lugt, E.G. Visch-Brink, M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

Purpose: Melodic language is thought to be processed differently from spoken language, a feature which is used in melodic intonation therapy (MIT) for severe expressive aphasia. The purpose of this study is to differentially visualise melodic and spoken language processing using functional MRI.

Methods and Materials: Twenty right-handed healthy volunteers were scanned at 3 T using a T2*w GE-EPI sparse sampling sequence (TR/TE 6000/30 ms, acquisition time 3000 ms). The event-related task consisted of auditorily presented spoken or melodically intonated words, as well as neutral utterances which served as the baseline condition. Words and neutral utterances were presented during the silent gap for optimal audibility. Data analysis was performed with SPM2 (Wellcome department, London, UK), consisting of preprocessing of the individual datasets and second level group analyses: we used 1-sample t-tests for main effects of spoken and melodic language and paired t-tests for direct comparisons between spoken and melodic language.

Results: Main effects analyses showed significant activation ($p_{uncorrected} < 0.001$) in the inferior frontal gyrus ("Broca's area") and in the middle and superior temporal gyrus ("Wernicke's area"), which was left-lateralised for spoken language and more or less symmetrical for melodic language. Direct comparison revealed differential activation for melodic versus spoken language in the right hemisphere's homologuous language areas.

Conclusion: Melodic language is processed more bilaterally than spoken language with a greater contribution from the right hemisphere. The presented task may be used in future studies assessing neuronal changes resulting from aphasia therapies that use the melodic components of language, such as MIT.

B-466   11:24

Brain activation during pronounced period of symptoms for idiopathic restless legs syndrome: An fMRI study

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Purpose: To identify brain activation during periodic limb movement (PLM) associated with uncomfortable sensations in idiopathic restless legs syndrome (iRLS) patients.

Methods and Materials: Sixteen drug-naive iRLS patients (12 women, 4 men; 11 early, 5 late disease onset; mean age 56.4±7.7years; mean disease duration 13.9 years) were enrolled in the study. A single-shot multislice gradient echo planar sequence was used for fMRI acquisition and the study was performed at the early night hours, when symptoms aggravate, following a circadian pattern. The motor paradigm consisted of spontaneous PLM evoked by sensory leg uneasiness. Statistical parametric mapping software was used for functional data analysis.

Results: Patients activated primary and supplementary motor areas, cerebellum, dorsal cingulum, insular cortex, putamen, ventral lateral nucleus of the thalamus, midbrain and supramarginal gyrus. The duration of the disease and the movement latency during the fMRI enhanced the activation when included as covariates. Early-onset iRLS patients displayed significantly greater activation of the putamen and the cingulum.

Conclusion: Peak symptoms in iRLS are associated with activation of cortical and subcortical areas. In patients with early disease, greater activation of regions rich in dopamine, suggest the implication of the central dopaminergic pathway in the pathophysiology of the syndrome.

B-467   11:33

also EPOS

Reorganization of functional connectivity MRI in patients with brain tumors

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Purpose: Functional connectivity MRI (FCMRI) measures the spontaneous and synchronous fluctuations of the BOLD signal between spatially remote brain regions. The present study aims at investigate modifications of FCMRI within the language network in patients with a left hemisphere brain glioma.

Methods and Materials: We retrospectively evaluated FCMRI in 40 right-handed patients with a left hemisphere brain glioma and in 14 healthy subjects. Patients and controls underwent fMRI to lateralize language functions in the cerebral hemispheres. For each subject, whole-brain connectivity maps were created positioning a seeding in the left inferior frontal gyrus (left Broadman 45) using the region with maximum BOLD signal as reference and accounting for eventual anatomical derangement secondary to the tumor. 5 seed regions (right Broadman 45, Superior Temporal Sulcus and Temporo-Parietal Junction of both the hemispheres) were derived from connectivity maps. Cross-correlation matrices of BOLD signals fluctuations were calculated for each subject. Group-level analyses were performed by independent-samples t-tests and ANOVAs.

Results: The global FCMRI was significantly reduced in tumor patients compared to controls (p < 0.001). FCMRI was significantly reduced within seed regions of the affected hemisphere (left intra-hemispheric FC) and within the right hemisphere (right intra-hemispheric FC) (p < 0.05); inter-hemispheric FCMRI was also significantly reduced in patients (p < 0.001).

Conclusion: The presence of a brain tumor in the left hemisphere significantly reduces the FC between language-related brain regions. Modification of the FC is not restricted to the area surrounding the tumor, remote and contralateral areas are also influenced.

B-468   11:42

Functional improvement and cortical reorganisation after mirror therapy in chronic stroke patients: A randomised, controlled trial

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Purpose: Mirror therapy has shown to be effective in the recovery of hand function in (sub)acute stroke patients. The purpose of this study was to evaluate the clinical effects of and cortical reorganisation after mirror therapy in chronic stroke patients.

Methods and Materials: Forty chronic stroke patients (mean time post-onset = 3.9 years) were randomly assigned to the mirror (n=20) or control group (n=20). For 6 weeks, patients from both groups performed bimanual exercises once a week under supervision of a physiotherapist and additionally practiced 1 hour/day at home. In the mirror group, a mirror obscured the affected hand such that a visual illusion was created of a normally moving hand. Primary outcome measure of functional improvement was the Fugl-Meyer assessment (FMA). Changes in primary motor cortex activation patterns were assessed with functional MRI using a bimanual hand opening/closing task, performed before and after treatment. Data analysis was performed using SPM2 (Wellcome Department, London, UK), consisting of second level group analyses and quantitative region of interest analyses to calculate weighted laterality indices (WLI).

Results: Improvement on the FMA was greater in the mirror than in the control group (3.6±1.5, P <.05). In the mirror group, but not in the control group, primary motor cortex activation shifted toward the affected hemisphere after treatment (WLI difference = 0.40±0.39, P <.05).

Conclusion: Mirror therapy is effective for recovery of hand function in chronic stroke patients and induced a shift of primary motor cortex activation to the affected hemisphere, suggesting therapy induced cortical reorganisation.

B-469   11:51

also EPOS

Functional connectivity study of broca's mirror region in resting-state in expressive aphasia patients after stroke

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Purpose: To observe the functional connectivity of Broca's mirror region in normal subjects and expressive aphasia patients after stroke with resting-fMRI; to analyze the possible mechanism of expressive aphasia.

Methods and Materials: Resting-fMRI data were obtained in 16 aphasia patients and 15 normal subjects with 1.5 T MR Scanner. The fMRI data were processed with AFNI and Matlab. Based on seed voxels method, the time course correlation between right inferior frontal gyrus (RIFG) (33, 18, 6) with the other areas of the whole brain were output. Group and inter-group analysis was performed with single and two sample t-test.

Results: Eleven subjects were recruited in each group after the affected factors (head motion, behavioral performance and machine noise) were ruled out. Brain regions showed functional connectivity with the RIFG distribute in bilateral hemispheres in normal subjects; however, only exist in right hemisphere in patients group. The left thalamus showed positive correlation with RIFG only in normal subjects. Left insula showed stronger positive correlation with RIFG in normal subjects than that in aphasia patients.

Conclusion: Neural network correlated with RIFG in resting-state might be the neural foundation in retaining the normal language function. RIFG is out of correlation with the left hemisphere in aphasia patients. Left insula is an important area in retaining the normal language function.

10:30 - 12:00	Room Q

Interventional Radiology

SS 809
Aortic interventions

Moderators:
I. Battyány; Pécs/HU
F. Melchiorre; Milan/IT

B-470   10:30
Stent graft placement in aortic arch pathologies treated with or without a debranching procedure: Results from the RESTORE registry

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Purpose: To compare efficacy, safety, and short-term follow-up of thoracic endovascular aortic repair (TEVAR) with a newly designed stentgraft in patient subgroups with and without metachroneous aortic rerouting procedures.
Methods and Materials: Basis of the analysis is a prospective European multicenter monitored clinical registry (RESTORE) of patients treated with acute or elective TEVAR with the Relay stentgraft (Bolton Medical, Sunrise, FL, USA). Patients were assigned to one of two groups without (n=115) or with (n=80) a debranching procedure before stentgraft placement. Debranching procedures included: left subclavian transposition (n=47); subclavian and left carotid transposition (n=21); triple rerouting (n=12). For each group, endpoints were: technical success, complication rate, occurrence of endoleaks and mortality.
Results: For the groups without and with debranching procedures, respectively, technical success was 98.3 and 97.5% (p=1.00). Complication rates were 19.1 and 16.3% (p=0.71). Early endoleaks (within 30 days) occurred in 5.8 and 6.3% (p=1.0). Late endoleaks occurred in 8.2 and 11.1% (p=0.58). Overall mortality was 11.3 and 11.7% (p=0.77).
Conclusion: In the RESTORE dataset, no significant differences and, more importantly, similar outcome can be observed in the patient groups without and with supraaortic debranching procedures before TEVAR with the Relay stentgraft. The data support the hypothesis that debranching procedures are a safe option to extend TEVAR treatment into the aortic arch.

B-471   10:39
Heartbeat-related distension of the thoracic aorta with implications for thoracic endovascular stent graft sizing

F. Rengier[1], V. Henninger[1], T.F. Weber[1], H. Schumacher[2], D. Böckler[1], H.-U. Kauczor[1], H. von Tengg-Kobligk[1]; [1]*Heidelberg/DE*, [2]*Hanau/DE* (f.rengier@dkfz.de)

Purpose: Stent grafts are subject to aortic pulsatility which is a risk factor for complications and material fatigue. The purpose of this study was to investigate the stress induced by heartbeat-related distension of the thoracic aorta in healthy volunteers and to determine its clinical predictors.
Methods and Materials: 61 volunteers (mean±SD/range 49±16/19-82 years; 28 men, 33 women) divided into two age groups (group A, < 50 years, group B ≥50 years) without history of cardiovascular disease were examined with a clinical 1.5-T whole-body MRI. ECG-triggered dynamic data were acquired at five locations in the thoracic aorta using breath-hold TrueFISP imaging: A1, mid ascending aorta; A2/A3, mid/distal aortic arch; A4/A5; mid/distal descending thoracic aorta. The maximum diameter amplitude over the cardiac cycle was determined after semi-automatic segmentation.
Results: Thoracic aortic distension was significant at all five levels (p < 0.001; maximum for age group A/B 27.5/24.8%): Mean±SD at A1-A5 for age group A, 10.9±4.6, 11.0±3.3, 11.6±3.9, 11.0±3.4, 11.6±5.0%, for age group B, 5.4±2.0,

7.1±3.1, 7.3±2.9, 5.3±2.7, 8.5±4.4%. Multiple linear regression analysis (p < 0.001) showed that age group, gender, location, mean arterial blood pressure and heart rate had a significant impact (p < 0.01), while BMI did not (p=n.s). Distension in men was significantly lower than that in women (p < 0.001). Age group A demonstrated a significantly greater distension than age group B (p < 0.001).
Conclusion: In both age groups, heartbeat induces significant distension of up to 27.5% at all levels of the thoracic aorta. Aortic distension implicates caution for stentgraft sizing, especially in younger trauma patients with healthy aortas.

B-472   10:48
Carotid-subclavian bypass and Amplatzer embolization preceding endovascular repair of descending thoracic aorta: A single centre experience

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Purpose: Management of the left subclavian artery (LSA) during proximal aortic stenting is still matter of debate. We report our experience with left carotid-left subclavian bypass (LCSBP) comparing with surgical ligation to embolization of the LSA.
Methods and Materials: From July 1997 to August 2009, 314 patients underwent endovascular stent-graft repair (EVAR) at our Institution. A LCSBP was performed in 45 patients (14.3%) for an inadequate proximal neck (< 5 mm), 3 patients with true aneurysm, 6 with pseudoaneurysm, 32 patients with aortic dissection and 4 penetrating aortic ulcers; in 21 of them, LCSBP was associated to surgical ligation (group I) while in 24 an Amplatzer Vascular Plug occlusion of the LSA was performed (group II).
Results: Operative time for LCSBP was 65 ± 43 minutes in the group 2 and 137.7± 63 minutes in the group 1. Complication occurred in 5/45 patients (11%): transient neurological deficit of the left arm was detected in two patients, stroke in 1 patient of group 2 while thrombosis of LCSBP occurred in 2 patients of group 1, in 1 associated to paraplegia, at fifth postoperative day. Type II endoleak occurred in 5/21 of patients of group 1 and in none of patients of group 2.
Conclusion: LCSBP can be performed with relatively low risk before EVAR; percutaneous embolization of the LSA seems a better method than surgical ligation, avoiding endoleak and major surgical complications.

B-473   10:57
New technique for the preservation of the left common carotid artery in zone 2 endovascular repair of thoracic aortic aneurysm

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Purpose: We describe a technique for the preservation of the left common carotid artery (CCA) in zone 2 endovascular repair of thoracic aortic aneurysm. This technique involves the placement of a guidewire into the left CCA via the right brachial artery before stent-graft deployment to enable precise visualization and protection of the left CCA during the whole procedure.
Methods and Materials: Of the 107 patients with thoracic endovascular aortic repair (TEVAR) in our study, 32 (30%) had the left subclavian artery (LSA) intentionally covered (landing zone 2). Eight of those 32 (25%) had landing zone 2a - the segment distally the origin of the left CCA, halfway between the origin of the left CCA and the LSA. In all patients, a guidewire was positioned into the left CCA via the right brachial artery before stent-graft deployment.
Results: In seven patients, stent-grafts were positioned precisely. In the remaining patient, the positioning was imprecise - the origin of the left CCA was partially covered by the graft. A stent was implanted into the left CCA to restore the flow into the vessel. All procedures were performed successfully.
Conclusion: The technique of placing a guidewire into the left CCA via the right brachial artery before stent-graft deployment is a safe and effective method which enables the precise visualization of the left CCA during the whole procedure. Moreover, in case of inadvertent complete or partial coverage of the origin of the left CCA, it supplies safe and quick access to the artery for stent implantation.

B-474   11:06
Frequency of abdominal aortic expansion after thoracic endovascular repair of aortic dissections during long-term follow-up: Initial results from a single-center study

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Purpose: Surgical treatment of aortic dissection focuses on sealing the primary entry generally located within the thoracic aorta to initiate false lumen thrombosis. The purpose of this study is to characterize the expansion frequency of the

Saturday

abdominal aorta in spite of thoracic endovascular aortic repair (TEVAR) in acute (AAD) and chronic expanding (CEAD) aortic dissections.

Methods and Materials: 60 patients with type-B aortic dissections were treated during 2002 and 2008 with TEVAR: 28 AAD, 32 CEAD. To date, pre- and postoperative computed tomographies were analyzed for 28 patients by two readers in consensus: 18 AAD (median postoperative follow-up 21 months), 10 CEAD (28 months). Parameters assessed included thoracic and abdominal false lumen thrombosis and maximum abdominal diameter. Aortic expansion was defined as total diameter increase > 5 mm or > 15%, respectively.

Results: 30% of CEAD patients showed abdominal expansion before TEVAR and were treated simultaneously with infrarenal aortic repair. In 13% of AAD and in 0% of CEAD patients reduction of abdominal diameters was observed. Abdominal expansion after TEVAR was identified in 27% of AAD patients and in 0% of CEAD patients. Complete false lumen thrombosis occurred in 50% in the thoracic and in 33% in the abdominal segment regarding all patients.

Conclusion: The initial data indicate that expansion of the abdominal aorta after TEVAR represents a frequent complication, especially in AAD. In CEAD abdominal expansion may predominantly coincide with thoracic expansion and may require simultaneous surgical treatment. Long-term follow-up imaging of the complete aorta is necessary to identify abdominal expansion timely.

B-475 11:15

Investigation of healthy aortic geometry and aortic enlargement with age with implications for long-term stent graft sealing

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Purpose: Dilation of the aorta over the years may affect stent graft sealing. The purpose of this study was to investigate the degree of physiological dilation and to characterise thoracic aortic geometry as a function of primary clinical characteristics in healthy volunteers.

Methods and Materials: 61 volunteers (age range/mean 19-82/49±16 years; 28 men, 33 women) without history of cardiovascular disease underwent breath-hold high-resolution contrast-enhanced aortic MRA on a 1.5-T whole-body system. Three geometric parameters (minimum/maximum diameter and area) were assessed at five locations in the thoracic aorta using an automatic centerline segmentation algorithm: A1, mid ascending aorta; A2, A3, mid/distal aortic arch; A4, A5; mid/distal descending thoracic aorta. A multiple linear regression function including gender, location, age, mean arterial blood pressure (MAP) and body surface area (BSA) was tested.

Results: Minimum diameter/maximum diameter/area were mean±SD 27.5±4.6/29.5±4.5/655.6±178.4 at A1 and 18.8±3.2/20.3±3.3/311.2±104.9 at A5. The multiple linear regression function applied was highly significant for all geometric parameters (p < 0.001, r=0.88/0.89/0.90). Location, age, gender, MAP and BSA were significant predictors for thoracic aortic geometry (p < 0.05 for all geometric parameters). Mean±SD difference between A1 and A5 was 8.7±0.4 mm/9.2±0.4 mm/344.5±13.8 mm². With age, the thoracic aorta exhibited a gradual enlargement of 1.2±0.1 mm/1.3±0.1 mm/43.3±3.0 mm² over 10 years.

Conclusion: The normal thoracic aorta dilates significantly throughout its length with age. This may have consequences in terms of the long-term sealing of grafts particularly in younger patients presenting with traumatic aortic rupture without prior history of cardiovascular disease.

B-476 11:24

Aortic neck dilation after endovascular abdominal aortic aneurysm repair: Should it be predicted?

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Purpose: To evaluate whether dynamic computed tomography (CT)-imaging can provide functional vessel information predicting the likely outcomes of aortic neck in patients undergoing EVAR.

Methods and Materials: We prospectively enrolled in our study 20 consecutive patients with AAA (group A) and 20 consecutive patients without AAA. Elettroectrocardiographically-gated CTA datasets were acquired in all patients utilizing a 64-slice CT scanner (Light-Speed Volume CT, General Electric). Axial pulsatility measurements were taken at three clinically relevant levels within the iuxtarenal abdominal aorta: 2-cm above the highest renal artery; at the level of renal arteries; 1-cm below the lowest renal artery. Manual CTA measurements were randomly performed on axial images twice by three independent readers. Cross-sectional area change and wall distensibility obtained in the two groups were determined and statistically compared.

Results: Significant aortic pulsatility exists within the abdominal aorta across the renal arteries during the cardiac cycle in both groups. In particular, in patients with AAA, it was identified a subgroups of patients with an higher infrarenal distensibility.

Conclusion: Dynamic CT imaging could provide insight into the pathophysiology of abdominal aorta with potential consequences for endograft sizing and selection. In particular, the identification of patients with higher infrarenal distensibility, potentially predicting a post-EVAR proximal neck dilation in the long-term follow-up, could change the stent-graft selection looking at an improved fixation. This pilot study suggests that a secure fixation is not only graft and site dependent but also dynamic dependent.

B-477 11:33

10-year experience in the endovascular treatment of AAA: Lesson learned

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Purpose: To report 10-year experience in the endovascular treatment of abdominal aortic aneurysms (AAA).

Methods and Materials: 497 patients with a mean AAA of 52.22±9.75 mm (range 41 - 110 mm) have been treated using different commercially available endoprosthesis. Procedures were performed in election (N=443) cases and in emergency (N=54) with patients under general (N=112), epidural (N=185) or local (N= 200) anaesthesia. A bilateral surgical access was used in 379 cases, monolateral in 104 cases. In 9 patients, a complete percutaneous approach has been used. Before deployment, the hypogastric artery was embolized in 89 cases, IMA in 45 cases, lumbar arteries in 5 patients and accessory renal artery in 17 cases.

Results: Technical success was achieved in 494/497 cases (99.3%). In two cases, the stent graft could not be inserted for the presence of calcified and tortuous iliac and femoral arteries. In one case, the procedure was not completed due to a narrow distal neck. Procedure time decreased from a mean value of 150 min to a mean value of 85 minutes in the last 6 years. A 30-day mortality rate of 7.4% (37/497) was recorded. Ten (2.0%) surgical conversions were performed. Minor complications=5.8% (29/497), major complications=6.4% (31/497). Endoleak occurred in 66/494 cases (13.3%), perioperative N=.24, early N=30, late N=.12. Increase of the aneurysm sac became evident in 61 cases (12.3%), and shrinkage in 177 cases (35.8%). In 254 cases (51.9%), the sac was stable.

Conclusion: In the last 10 years, implantation techniques and endoprosthesis characteristics have greatly improved and excellent results have been achieved.

B-478 11:42

also EPOS

Gene transduction into aortic wall using plasmid-loaded cationized gelatin hydrogel-coated polyester stent graft

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Purpose: To genetically engineer a cationized gelatin (CG) hydrogel-coated polyester stent graft that facilitates controllable gene transduction into aortic wall.

Methods and Materials: Partially-covered polyester stent grafts coated with CG hydrogel containing various amounts (0.1, 1.0 and 10.0 mg/ml) of β-galactosidase (LacZ)-expression plasmid vector (pCAGGS-LacZ) or empty vector (pCAGGS) were implanted in rabbits' balloon injured aortas. The aortas were removed at 1, 3 and 7 days after implantation and analyzed for LacZ expression by RT-PCR and X-gal (5-bromo-4-chloro-3-indolyl-β-D-galactoside) staining. The difference of transgene efficiency among each group was compared using one-way ANOVA and Newman-Keuls' test according to the result of quantitative real time RT-PCR.

Results: LacZ gene transduction into the aortic wall was detected at the implantation site of pCAGGS-LacZ-loaded, but not pCAGGS-loaded, stent grafts. LacZ expression was not detected in the adjacent aortic segments to the pCAGGS-LacZ-loaded stent graft or remote organs including brain, heart, liver and kidney. X-gal staining-positive cells were observed at or near the luminal surface and the ingrowth tissues within graft fibers. Immunohistochemistry suggested that the LacZ-positive cells were mainly neointimal α-smooth muscle actin-positive cells and macrophages. The extent of the transgene expression was dependent upon the quantity of the plasmid DNA loaded onto the stent graft. LacZ mRNA expression was maximal at day 1 and declined at day 7 but was still detectable.

Conclusion: Plasmid-loaded CG hydrogel-coated stent graft is a promising vehicle for local transgene delivery to aortic wall and offers the possibility of transduction of therapeutic genes into vascular wall.

B-479 11:51

Should we trust CTA measurements? A comparative study of CTA and standard angiographic measurements in patients undergoing endovascular treatment of abdominal aortic aneurysms

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Purpose: Invasive angiography is still frequently used for preinterventional planning in patients with abdominal aortic aneurysms (AAAs) who are treated endovasularly. In this study, angiographic measurements were compared with pre- and postinterventional CTA measurements with regard to accuracy.

Methods and Materials: Each patient (n=20) received a CTA before and after intervention. Measurements necessary for sizing of the stentgraft were obtained with a special software tool. In addition to the preinterventional scaled angiography, a postinterventional scaled angiography was performed. From the scaled angiograms, measurements similar to the CTA measurements were obtained. Angiographic and CTA measurements were compared - with the real stentgraft length serving as gold standard. Results were analyzed statistically.

Results: Especially the contralateral arterial length measurements of the preinterventional angiography were more inaccurate than the measurements taken with software assisted CTA (±16 mm). The length of stentgrafts measured by CTA differed with 2.8 ± 2.3 mm from the real stentgraft lengths. Angiographic measurements differed by 8.8 ± 6.5 mm from the real stentgraft size. The mean difference between the pre- and postinterventional distance from the origin of the internal iliac artery to the renal artery was 17 mm on the right side, and 12 mm on the left side.

Conclusion: Angiographic measurements of vessel and stentgraft lenghts are more inaccurate than measurements based on CTA. Usual measuring angiographies are likely no longer needed for planning of endovascular AAA treatment. Pre- and postinterventional differences may be explained by changes in vascular anatomy and different position of centerlines.

Sunday, March 7

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

Abdominal Viscera (Solid Organs)

SS 1201a

Liver metastases: How to evaluate them

Moderators:
E. de Lutio; Pisa/IT
W.R. Jaschke; Innsbruck/AT

B-480 10:30

also EPOS

Imaging of hepatic metastases of colorectal carcinoma: Comparison of sonazoid-enhanced three-dimensional ultrasonography to SPIO-MR imaging and contrast-enhanced CT

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Purpose: To compare the accuracy of dynamic contrast-enhanced multidetector-row CT (CE-CT), Sonazoid-enhanced three-dimensional ultrasonography (CE-US) and superparamagnetic iron oxide-enhanced MRI with diffusion weighted imaging (SPIO-MRI + DWI) in the evaluation of hepatic metastases from colorectal carcinoma.
Methods and Materials: A total of 36 consecutive patients with colorectal cancers were prospectively collected. Eighty-six metastases were identified, of which 16 metastases were confirmed histologically; the remaining 70 metastases were confirmed with follow-up imaging. CE-US images in the arterial and kupffer phases, precontrast and postcontrast SPIO-MRI + DWI, and dynamic-CT images were evaluated. The alternative free-response receiver operating characteristic (AFROC) analysis was performed, and the sensitivities and positive predictive values were analyzed.
Results: Considering all lesions and lesions $\leq$ 1 cm, the A_z values and sensitivities for SPIO-MRI + DWI (0.88/78%, 0.78/56%) were significantly greater than that for CE-CT (0.79/59%, 0.61/22%), and CE-US (0.81/69%, 0.66/37%). For all lesions and lesions $\leq$ 1 cm, the PPV for SPIO-MRI + DWI (97, 100%) was significantly higher than that of CE-CT (84, 56%). For lesions > 1 cm, there were no differences in the mean A_z value, sensitivity, and PPV among all modalities.
Conclusion: For all metastases and for metastases $\leq$ 1 cm, the diagnostic ability for SPIO-MRI + DWI is superior to that of CE-CT and CE-US. SPIO-MRI + DWI have higher PPV than CE-CT for small metastasis and therefore should be recommended for screening of liver metastasis in patients with colorectal carcinoma.

B-482 10:39

Comparison of MRI DWI vs MRI T1 contrast enhancement using (Gd)-DTPA and (Gd-EOB)-DTPA in detection of liver metastasis in patients with advance gastroenteropancreatic-neuroendocrine tumours (GEP-NET)

A.J. Sankowski[1], J.B. Cwikla[1], M.L. Nowicki[1], M. Pech[2], D. Pruchnicka[1], A. Czepukojc[1], J. Walecki[1]; [1] *Warsaw/PL*, [2] *Magdeburg/DE (jaroslaw.cwikla@cskmswia.pl)*

Purpose: To detect number of liver metastasis in patients with advance GEP-NET using MRI diffusion-weighted imaging (DWI) and compare DWI to standard MRI after contrast enhancement, in first group using (Gd)-DTPA (Omniscan) and second (Gd-EOB)-DTPA (Primovist).
Methods and Materials: MRI echo-planar DWI performed prospectively in 51 patients, all with advance GEP-NET, as a part of standard clinical evaluation of disease extent. Standard doses of both (Gd)-DTPA and (Gd-EOB)-DTPA were used. All patients had examination using 1.5 T MRI, in each case DWI and i.v. contrast enhancement T1 images were analysed.
Results: 26 patients had (Gd)-DTPA and 25 had (Gd-EOB)-DTPA, primary tumour located as follows: pancreas 18, small bowel 24, rectum 1 and 7 of unknown origin. The mean number of liver deposits in all patients using DWI was 22.8; after contrast injection in group with (Gd)-DTPA mean number of lesions was 21 and after (Gd-EOB)-DTPA was 23. Significant difference was noted between number of lesions seen in DWI vs. T1 (Gd)-DTPA (P < 0.01, T-test), no difference between DWI and (Gd-EOB)-DTPA (P> 0.05). There was no significant difference between both group of patients after Gd and Gd-EOB including number of lesions detected in DWI mean 23 lesions (P> 0.05).
Conclusion: DWI and (Gd-EOB)-DTPA seems to be superior in detection of liver deposits in patients with GEP-NET over standard MRI after i.v. Gd-DTPA injection. There was no difference between DWI and MR after i.v. (Gd-EOB)-DTPA injection; so further studies are needed to assess value of both approaches in evaluation of liver deposits in patients with advanced GEP-NET.

B-483 10:48

Value of PET/MR retrospective image fusion in detection of hepatic metastases compared to hybrid 18 F-FDGPET/CT and Gd-EOB-DTPA-enhanced MRI

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Purpose: To compare the accuracy of lesion detection and diagnostic confidence between 18 F-FDGPET/CT (PET/CT), Gd-EOB-DTPA MRI (ceMRI) and retrospectively fused PET/MR imaging for depiction of liver lesions.
Methods and Materials: Thirty-seven patients (60.2 ± 12 years) with suspected liver metastases (LM) had PET/CT and ceMRI within 0-30 days (11.9 ± 9 days). PET and ceMRI images were retrospectively fused (PET/MR). Images were reviewed independently by a nuclear medicine physician (R1) and a radiologist (R2) who identified and characterized liver lesions using PET/CT, ceMRI and PET/MR. Malignancy of each lesion was graded on a 5-point confidence scale. Accuracies were determined by receiver operating characteristic (ROC) analysis. Histological analysis served as standard of reference for all malignant lesions.
Results: Eighty-five liver lesions (55 (64.7%) LM and 30 (35.3%) benign lesions) were present in 29/37 (78.4%) patients. 24/37 (64.9%) patients had LM. Detection rate of liver lesions was significantly lower for PET/CT than for ceMRI (63.5 and 84.7%; P = 0.002). Sensitivity/specificity in detection and characterization of LM for PET/CT, ceMRI and PET/MRI (R1; R2) were 76.4/90%, 90.9/100% and 92.7/86.7%; 92.7/96.7%. Difference in sensitivity between PET/CT and PET/MR was significant (P = 0.023). Level of confidence regarding liver lesions > 1 cm was significantly higher in PET/MR than PET/CT (P = 0.047). Accuracies for PET/CT, ceMRI and PET/MR (R1; R2) were 0.85, 0.94 and 0.92, 0.96.
Conclusion: Sensitivity of ceMRI and PET/MR for detecting LM is higher than for PET/CT. PET/MR significantly improved diagnostic confidence as compared to PET/CT regarding lesions > 1 cm in diameter. Compared to ceMRI, PET/MR did not significantly increase sensitivity or diagnostic confidence.

B-484 11:57

Intra-voxel-incoherent-motion-diffusion-weighted-imaging MRI for detection and characterization of liver metastases: Preliminary study

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Purpose: To assess the impact of Intra-voxel-incoherent-motion-diffusion-weighted-imaging (IVIM-DWI) allowing the extraction of true molecular diffusion parameters (D) and intravoxel microperfusion parameters (D*, f) on liver metastases detection and characterization of tumor necrosis.
Methods and Materials: An IVIM-DWI sequence was developed on a 1.5 T MR system, with 10 b factors (0, 10, 20, 30, 50, 80, 100, 200, 400, 800 s/mm^2). 15 patients with colo-rectal carcinoma and liver metastases referred for liver resection were included in this retrospective study. A standard liver MR protocol was performed in addition to IVIM sequence with a mean 12 days delay between liver surgery and MRI. Mean D, D*, f as well as apparent diffusion coefficient (ADC) computed on 4 b factors only were calculated for all liver metastases and adjacent liver. Using liver pathology as the gold standard, sensitivity and PPV of IVIM-DWI for liver metastases detection were compared to that of standard MRI (Mann-Whitney-test). The b-diffusion factor with highest sensitivity for tumor detection was noted. All diffusion parameters were correlated to the degree of liver tumor necrosis (Spearman).
Results: Sensitivity and PPV of IVIM and standard MRI were not significantly different (respective 87 vs. 81%, and 98 vs. 91%, p> 0.05). The b diffusion factor yielding the highest sensitivity was 100 s/mm^2. Both D (r2=0.46, p=0.03) and ADC (r2=0.37, p=0.05) were significantly correlated to the degree of tumor necrosis.
Conclusion: IVIM DWI using low-b factor provides a similar sensitivity with Gd-enhanced liver MRI. Both ADC and molecular diffusion appear correlated to the degree of liver tumor necrosis.

B-485 11:06

Hypovascular metastases detectability on hepatobiliary phase of Gd-EOB-DTPA enhanced MRI: Can we save up 10 min in MR examination time?

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Purpose: To compare the conspicuity of hypovascular metastatic lesion on hepatobiliary phase MR images obtained 10 and 20 min after IV injection of Gd-EOB-DTPA as contrast agent.
Methods and Materials: Sixty-four patients with non-cirrhotic liver and hystologically proved hypovascular metastic lesions were selected among all patients who underwent Gd-EOB-DTPA enhanced MR imaging. MR examinations were carried

out at 1.5 T before and 20 s, 60 s, 180 s, 10 min and 20 min after Gd-EOB-DTPA administration. Two readers of different experience independently evaluated lesion detectability according to a 5-point confidence scale in two different reading sessions, including: A) unenhanced and 10 min hepato-biliary MR images; B) unenhanced and 20 min hepatobiliary MR images. Moreover, signal intensity of liver parenchyma was measured with ROIs and normalized to paravertebral muscle before and during 10 and 20 min hepato-biliary phases, by two observers in conference. Five values of percentage variations per patient were obtained and statistically evaluated.

Results: Although the relative enhancement of liver parenchyma was superior when using a delay of 20 min, no statistically significant differences were observed between 10 and 20 min hepato-biliary phases. Similarly, no significant differences were observed between the two reading sessions for both observers, although the less experienced reader's confidence for the detectability of small lesions (≤1 cm) was significantly higher when assessing 20 min hepato-biliary phase (p=0.001).

Conclusion: When dealing with the detection of hypovascular metastatic lesion in non-cirrhotic liver, we can save up 10 min of examination time for Gd-EOB-DTPA enhanced MR imaging.

B-486   11:15

Does preoperative chemotherapy impact on the ability of the liver to regenerate after hepatectomy for colorectal metastases? Assessment with CT- and MR-based liver volumetry

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Purpose: To evaluate the impact of preoperative chemotherapy on liver regeneration in patients undergoing hepatectomy for colorectal metastases using CT- and MR-based liver volumetry.

Methods and Materials: Records from 184 consecutive patients undergoing liver resection due to colorectal metastases (2003 to 2007) were reviewed from a prospectively collected database. Preoperative chemotherapy was defined as any cytostatic treatment applied within 6 months preoperatively. Liver regeneration was calculated in patients, who underwent pre- and postoperative cross-sectional imaging (CT or MRI) and liver resection of > 100 mL. Liver regeneration was calculated as the liver regeneration ratio (% of regeneration related to the resected liver specimen) based on volumetric data obtained from pre- and postoperative CT- or MRI-data sets. Liver volumes were calculated automatically after marking the liver contours on cross-section images using dedicated software (Myrian©, Intrasense, France).

Results: 51% of patients received chemotherapy before liver resection. 84 patients underwent liver resection of > 100 mL, where the mean resected liver volume was 614 ±367 mL. The regeneration ratio was 67.7 ± 42.7% for patients with preoperative chemotherapy and 67.1 ±41.5% for patients without preoperative chemotherapy. After adjusting the two groups for age, liver fibrosis and size of resection, the adjusted difference of the regeneration ratio between patients with and without preoperative chemotherapy was 3%, which was not significantly different (p=0.78).

Conclusion: Preoperative chemotherapy did not affect liver regeneration after resection of colorectal liver metastases.

B-487   11:24

Fluid-fluid levels: A characteristic sign in liver metastases of neuroendocrine tumors from the gastro-entero-pancreatic system

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Purpose: To analyze and compare MR-morphologic characteristics in liver metastases derived from neuro-endocrine tumors (NET) with liver metastases derived from other primary tumors.

Methods and Materials: Between 2004 and 2009, 59 patients patients (m/f =36/18) with hepatic metastases of NET underwent MRI of the liver using a 1.5 T MR-scanner (Magnetom Avanto, Germany). The imaging protocol included precontrast T2w SSFSE, T2w TSE, T1w 2D and 3D-GRE imaging followed by contrast enhanced imaging with liver-specific contrast agents. 124 MRI examinations were performed and analyzed by two board certified radiologists specified in liver imaging. The signal intensity (SI) characteristics of the liver lesions in T2w and T1w imaging (4-point-scale), presence of central necrosis and fluid-fluid-levels (FFL), otherwise rare in hepatic metastasis, were evaluated in consensus. This was compared to a control group, consisting of 54 patients with primary tumors of other origin; these patients underwent 60 MRI examinations.

Results: SI in T1w imaging did not differ between both groups, however, in T2w imaging, liver metastases of GEP-NET were significantly more often hyperdense or strongly hyperdense than metastases of other origins (p < 0.05). Central necrosis showed a similar frequency in both groups (GEP-NET: 57/124; Control: 29/60).

However, FFL were only observed in the GEP-NET group: 16 of 59 patients with metastases of GEP-NET showed FFL, while none of the control group showed FFL (p < 0.05).

Conclusion: Hepatic metastases from GEP-NET are characterized by high or very high SI in T2w pre-contrast imaging. The occurrence of FFL may be considered a characteristic morphologic sign of this entity.

B-488   11:33

Diffusion-weighted imaging for liver lesion detection in patients with metastatic uveal melanoma: How to detect pseudoprogression under antiangiogenetic therapy?

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Purpose: Patients with liver metastases of uveal melanoma often show new liver lesions at follow-up CT after onset of antiangiogenetic therapy. Our purpose was to differentiate 'real' tumor progression and 'pseudoprogression'.

Methods and Materials: Sixteen patients with liver metastases of uveal melanoma (7 men, 9 women, mean age 63 years) were routinely observed by CT (unenhanced and contrast-enhanced with non-ionic iodine contrast agent, 100 ml i.v., 70 s delay) and additionally by T2- and diffusion-weighted (DWI) MRI. Imaging methods were separately analyzed for differences in lesion detection using a 5-point score characterizing lesion quantity (1=1-5, 2=6-10, 3=11-20, 4=21-50, 5=> 50 lesions). Metastases were confirmed by follow-up CT. Blinded to baseline examinations, in mean 4 liver metastases with the longest axial diameter (mean 2.5 cm) were selected on the first follow-up CT to retrospectively assess lesion visibility on a 4-point score (0=not visible, 1=poorly, 2=sufficiently, 3=excellently visible).

Results: At baseline, DWI (mean score 3.5) detected significantly more metastases than T2-MRI (2.8), unenhanced CT (2.3) or contrast-enhanced CT (2.2) (p < 0.01). Sensitivity, specificity and positive predictive value in lesion detection were 81, 76 and 97% for DWI and 29, 62, 88% for contrast-enhanced CT. Visibility was significantly better in DWI (mean score 2.2) compared to T2-MRI (1.7), unenhanced CT (1.1) and enhanced CT (0.9) (p < 0.01).

Conclusion: DWI yielded the best sensitivity in detecting liver metastases of uveal melanoma and implies that new lesions in follow-up CT frequently reflect a 'pseudoprogression'. Therefore, DWI seems to be helpful to allow an adequate tumor response assessment avoiding wrong withdrawals of therapy.

B-489   11:42

Evaluation of MRI DWI as marker of early response on i.a. ^{90}Y-DOTATATE therapy in patients with advance neuroendocrine carcinomas (GEP-NET) and liver involvement

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Purpose: To evaluate value diffusion-weighted imaging (DWI) as early predictor of response on i.a. peptide receptor radionuclide therapy (PRRT) using ^{90}Y-[DOTATATE], in patients with neuroendocrine carcinomas (GEP-NETs) and liver involvement.

Methods and Materials: Prospective, single institution initial study, performed in 14 patients. MRI using 1.5 T system, including echo-planar DWI, before and 1-3M after i.a ^{90}Y-[DOTATATE] PRRT. The volume of target lesions were evaluated by manual draw of tumor borders on contrast-enhanced T1w images (Primovist). ADC calculated from sections of ADC maps on both DWI scans. Correlation of tumour volume and ADC were analysed and compare to progression free survival (PFS). Additional ADC was correlated with clinical and radiological (RECIST) response on i.a. PRRT.

Results: Clinical follow-up indicated in 3 cases disease progression (DP) other had partial response (PR) or stable disease (SD). RECIST at 6M: 2 pts had PR, 2 had DP rest of them had SD. There was no correlation between changes in tumor volumes and ADC values (P> 0.05 Kendall tau) within 3M of follow-up. There was correlation of ADC value and clinical response during 3 and 6M of follow-up (P < 0.05 Kendall tau). In those patients with DP median PFS was 7M and those with PR and SD PFS was 14M.

Conclusion: DWI can be used as an imaging marker to assess an early response on i.a treatment of ^{90}Y-DOTATATE in patients with advance GEP-NET and liver involvement.

There is no correlation of DWI in further change of the size target and non-target lesions within liver after i.a. PRRT.

Sunday

10:30 - 12:00   Room B

Musculoskeletal

SS 1210

Hip, ankle and foot

Moderators:
G.M. Allen; Oxford/UK
A.N. Fotiadou; Thessaloniki/GR

B-490   10:30

Subtraction computed tomographic perfusion imaging and observation of avascular necrosis of femoral head on dog

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Purpose: To investigate the technical protocols and feasibility of subtraction computed tomography perfusion imaging (sCTP) on observation of avascular necrosis of femoral head (ANFH) on dog.
Methods and Materials: Sixteen laboratory canines underwent CT perfusion imaging (CTP) of femoral head before and after selective femoral circumflex artery embolization, and ANFH were observed. Then new sequence imaging data, created by sources imaging of CT perfusion scan using subtraction software, were analyzed at workstation (AW4.2) with CT perfusion 3 analysis program, and data of sCTP were obtained. The parametric maps and indexes of capillary-level hemodynamics including blood volume (BV), blood flow (BF) and mean transit time (MTT) of CTP and sCTP were compared.
Results: The technical success rate of sCTP post-processing created from CTP sources imaging data was 100%. The values and mappings of BF, BV and MTT of region of interest (ROI) were all obtained from subtraction sequence images data. The post-processing time of sCTP was about 1-5 h. sCTP depicted ANFH well, though the values and mappings of BF, BV and MTT were different from those obtained with conventional bone CTP.
Conclusion: sCTP can be generated with subtraction and perfusion analysis program and techniques. It can be applied to bone CT perfusion imaging and early quantitative diagnosis of osteonecrosis.

B-491   10:39

also EPOS

MR assessment of hip development: 1 year follow-up of a cross sectional cohort from 9 to 16 years

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Purpose: Aim in this prospective study was, to show the bodily changes of the hip during maturation based on cross-sectional examination in asymptomatic hips from children and young adults.
Methods and Materials: 331 pupils from primary- and high-school were asked to take part in this study. Finally 64 asymptomatic pupils aged 7 -17 years we analyzed on MRI-images the femoral changes of both hips between a baseline and a one-year-follow-up appointment and in relation to age, the status of the epiphyseal scar and location. We assessed on 7 radial positions around the femoral neck from anterior to posterior head-radius, neck-radius, tilt-angle, epiphyseal-extension and the alpha angle.
Results: We found for influence of age using ANOVA: head and neck radius increased highly significant ($p < 0.001$) the tilt angle showed no differences ($p = 0.12$), but the epiphyseal-extension changed significantly ($p < 0.001$). Using the Post-Hoc-analyses we found significance ($p < 0.05$) of the tilt angle in every position on both appointments. Tilt angle differences in anterior and superior-anterior position. For the epiphyseal-extension we found significance ($p < 0.05$) for the anterior, anterior-superior, posterior-superior and posterior position. The highest alpha angles are found in anterior-superior ($45.35° \pm 7.27°$) and superior-anterior position ($47.53° \pm 8.87°$). The differences, showing the change between baseline and follow-up, increase the most in superior-anterior ($1.15° \pm 5.14°$) and superior ($1.18° \pm 4.69°$).
Conclusion: We assessed pattern of changes for femoral hip morphology in asymptomatic volunteers. This can be used as normative data in comparison to pathological changes to assess the influence of growth changes.

B-492   10:48

MRI to identify acute hamstring strains of stretching-type

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Purpose: MRI was used to identify a new type of acute hamstring muscle strain injury occurring during stretching-type of motion with the muscles of the rear thigh reaching extensive lengths. MRI-defined characteristics of this stretching-type injury are described and compared to those of the conventional hamstring strain injury occurring during high-speed running.
Methods and Materials: MRI (T1 weighted and STIR images) was performed on 15 professional dancers with acute first time hamstring injuries encountered during slow-speed stretching and on 30 subjects from 21 different sports with injuries of similar etiology (all prospectively included).
Results: The MRI analysis revealed a similar location of the injury in the two groups of patients: The semimembranosus being the most frequently injured muscle (83-87%). This was in contrast to earlier reports on hamstring injuries occurring during high speed sprinting and being located in the long head of the biceps femoris muscle. Further, the MRI analysis demonstrated that in most cases the free tendon of the semimembranosus muscle was involved. Extended recovery periods have earlier been connected to the tendon being injured also in sprinters. Quantitative analysis of the MRI findings showed that there was no correlation between size of the injury and time to return to pre-injury level, which ranged 3-24 months.
Conclusion: Adding MRI to a clinical examination revealed specific characteristics of a novel type of acute hamstring strain injury. This is of high clinical relevance since this stretching-type of injury had prolonged recovery times and, most likely, requires specific rehabilitation regimes.

B-493   10:57

also EPOS

Osteochondral lesions of the talus: Comparison of three-dimensional fat-suppressed fast spoiled gradient-echo MR imaging and conventional MR imaging

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Purpose: To compare three-dimensional fat-suppressed fast spoiled gradient-echo MR imaging in diagnosing osteochondral lesions of the talus with that of conventional MR imaging.
Methods and Materials: Thirty two consecutive patients with clinically suspected cartilage lesions with three-dimensional fat-suppressed FSPGR MR imaging and conventional MR imaging were assessed. Two musculoskeletal radiologists evaluated the status of the articular cartilages and bone marrow beneath the articular cartilages of the talar dome. Sensitivity, specificity and accuracy were determined using arthroscopic findings as the standard of reference for the different imaging techniques. The location of the lesion on the talar dome was recorded by a nine-zone anatomic grid on MRI.
Results: Arthroscopy revealed 21 patients with hyaline cartilage defects and 11 normal ankle joints. The sensitivity, specificity, and accuracy of the two methods for articular cartilage defect were 62, 100, and 75% for conventional MR imaging and 91, 100, 94% for three-dimensional fat-suppressed FSPGR MR imaging. The sensitivity and accuracy of FSPGR imaging was higher than conventional MR imaging ($p < 0.05$). There was no difference of the specificity between these two methods. According to the nine-zone anatomic grid, middle at the medial talar dome was the most frequently involved (16 lesions, 76%). Coronal fat-suppressed FSPGR could not show edema. T1-weighted 3D fat-suppressed FSPGR imaging can demonstrate some subchondral cystic change.
Conclusion: T1-weighted 3D fat-suppressed FSPGR imaging is more sensitive than conventional MR imaging in detecting defects of articular cartilage covering osteochondral lesions of the talus.

B-494   11:06

Long-term survey of three different ultrasound (US)-guided percutaneous treatments of plantar fasciitis: Results of a randomized controlled trial

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Purpose: To compare the short- and long-term outcome of US-guided percutaneous treatment of patient affected with plantar fasciitis based on dry needling and local injection of steroid, compared with similar patients treated with simple steroid injection or dry needling.
Methods and Materials: Among 75 patients referred for US-guided treatment of plantar fasciitis, 25 (12 males; age 43.8±7.6) were treated with dry needling and local injection of steroid together; 25 (12 males; age 46.2±12.3) were treated with dry needling only; 25 (11 males; age 52.7±10.0) were treated only with local injection of steroid. Pain was assessed using the visual analogue scale (VAS) at baseline and at 7, 14, 30, 90, 180, 360 days after the procedure. Kruskall-Wallis test was used.
Results: Patients treated with the complete procedure had a faster and more permanent decrease of symptoms (VAS at 7 days=1.2±0.4 and VAS at 360 days=0.0± 0.1). Patients treated only with injection of steroid had a quick decrease of pain that was not permanent on a long-term basis (VAS at 7 days=1.2±0.6 and VAS at 360 days=5.2± 0.4). Patients treated only with needling had a permanent but very slow

decrease of symptoms (VAS at 7 days=5.7±0.5, at 30 days VAS=2.6± 0.4, at 90 days VAS=0.3±0.8, and at 360 days VAS=0.1±0.2). Difference was statistically significant (p <.001).

Conclusion: Patients treated with the combined procedure had a better outcome than other groups. Pain relief is faster and more permanent compared with slower or not stable results obtained in the other patients.

B-495 11:15

Acute charcot foot: Role of dynamic MRI in the assessment of the disease activity and treatment response

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Purpose: To evaluate usefulness of dynamic Magnetic Resonance Imaging (D-MRI) in assessing level of activity of acute Charcot foot and initial response to limb offloading and in predicting healing time.

Methods and Materials: Forty diabetic patients (M/F: 22/18, mean age 53.8 years) with diagnosis of acute Charcot foot were prospectively enrolled. Patients underwent limb immobilization and were followed every 3 months by clinical examination (measurement of foot skin temperature and circumferences) and MRI. MR protocol included T1 and FSE-IR weighted sequences, and D-MRI (Fast Spoiled Gradient Echo), after gadolinium administration (0.1 ml/Kg). The contrast uptake rate at D-MRI and the Signal Intensity (SI) ratio on FSE-IR sequence were measured.

Results: At baseline, mean contrast uptake rate was 136±49.7% (range 50-295%) and mean SI ratio was 5±3 (range 0.4-14.5); no significant relation was observed between these parameters (P=0.2). A high intra- and inter-observer agreement was found in the measurement of contrast uptake rate, whereas a low agreement was observed for SI ratio. At 3 months follow-up, reduction of contrast uptake rate was observed in all patients with improved clinical findings (n=34), whereas SI ratio was reduced in 15/34 (44.1%) patients. Mean healing time was 8.3 months; it was significantly related to baseline contrast uptake rate (P=0.005); in fact, mean healing time was 5.3±2.7 months in patients with uptake rate lower than 100%, compared to 9.1±2.5 months in the remaining patients (P=0.0003).

Conclusion: D-MRI provides a quantitative, objective and reproducible parameter which is reliable for predicting and monitoring treatment outcome.

B-496 11:24

The clubfoot in fetal MRI

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Purpose: A clubfoot is a common congenital deformity visualized with prenatal ultrasonography. In view of advanced fetal magnetic resonance imaging (MRI), this study evaluates the ability of MRI to delineate a clubfoot.

Methods and Materials: This retrospective study included 26 fetuses with either isolated or complex clubfoot with associated pathologies depicted on fetal MRI and confirmed by clinical or postmortem assessment. Dedicated sequences were applied to image the foot, including a T2-weighted (w) turbo-spin echo sequence, an echoplanar image sequence; a 3D thick-slab T2-w sequence; and a dynamic steady-state free precession sequence. Extremity evaluation was focused on the analysis of the foot position. Furthermore, CNS and extra-CNS abnormalities were evaluated to define clubfoot as isolated or complex, with other associated pathologies.

Results: An isolated unilateral clubfoot was demonstrated in 1/26 fetuses, isolated bilateral clubfeet in 2/26 fetuses, a complex unilateral clubfoot in 3/26 fetuses, and complex bilateral clubfeet in 20/26 fetuses. In complex clubfeet, associated pathologies consisted of congenital abnormalities of the brain (11), arthrogryphosis (five), abnormal/reduced movements (five), facial dysmorphia (five), fetal akinesia-sequence (four), complex heart failure (three), reduced muscular relief (four), scoliosis (two), aortic hypoplasia (two), hydronephrosis (two), double-kidney (one), thanatophoric skeletal dysplasia (one), spina bifida (one), left missing lower extremity (one), situs inversus (one), hydrothorax (one), pulmonary sequester (one), and anotia (one).

Conclusion: Fetal MRI is able to delineate a clubfoot and enables differentiation between isolated foot deformity and complex pathologies that might have an impact on pre- and postnatal management.

B-497 11:33

MR assessment of heel spongy bone in postmenopausal women: A comparison among calcaneus, subtalar calcaneus, and talus regions in healthy, osteopenic and osteoporotic subjects

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Purpose: Recent reports showed the ability of MRI to detect, from the calcanei of postmenopausal women, the presence of peripheral osteoporosis. Moreover, the

subtalar (ST) region, which transmits the stresses imparted by body-weight from the tibia to the heel, was indicated as the most suitable for diagnostic discrimination. The goal of this MRI study was to identify, in vivo, the most promising heel locations to assess the presence of osteoporosis. In the same subjects, T_2, T_2^*, ADC and internal gradient (G_i) were measured from the heel, and correlated with the correspondent BMD obtained by lumbar QCT.

Methods and Materials: Seventy-five heels (twenty-five from osteoporotic, twenty-five from osteopenic and fifteen from healthy women) were investigated using an MR scanner at 3.0 T. FLASH and SE sequences at different TEs, and Diffusion-Weighted images (DWI) using phase diffusion-gradients ("b-values" 0-8000 s/mm²), were collected from each subject. FLASH, SE and DWI were used to derive T_2^*, T_2, ADC and G_i from the calcaneus, ST and talar regions. Statistical group comparisons were performed using Pearson's correlation coefficient.

Results: T_2 values were significantly different, in all locations, among the three groups (p≤0.05). ADC values from ST and talar regions allowed a better discrimination between healthy and osteopenic subjects than those obtained from the calcaneus. G_i from the ST location was the most sensitive (p≤0.0005) parameter to discriminate between healthy and osteopenic subjects.

Conclusion: Our data confirm the ST as the most suitable region to detect osteoporosis, and G_i as the most sensitive parameter for potential early diagnosis of osteoporosis.

B-498 11:42

Comparative study of MRI and power Doppler ultrasonography of the heel in spondyloarthritis patients with and without heel pain and in controls: The ETERS study

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Purpose: Enthesitis of the heel is frequent in spondyloarthritis (SpA). Our purpose was to assess the diagnostic capacities of MRI and of Power Doppler ultrasonography (PDUS) of the heel: a) to distinguish patients with SpA versus controls and b) to distinguish SpA patients with versus without heel pain.

Methods and Materials: Cross-sectional, monocenter study. 72 patients (144 heels) were included: heels of definite SpA patients (n=96) were divided into 3 groups: (1) heels with no history of pain (n=57), (2) heels with history of pain (n=18), (3) heels with current pain related to enthesitis according to clinical examination and expert opinion (n=21). Patients with degenerative low back pain (n=24, 48 heels) group (4) were included as a control group. Bilateral heel MRI and PDUS were performed the same day as clinical evaluation. Imaging analysis was focused on inflammatory signs.

Results: Inferior calcaneus bone edema was the only specific abnormality of SpA (18% of SpA heels vs 4% of controls heels, p=0.020), but with a poor sensitivity. PDUS showed no specific abnormality of SpA, even when using the power Doppler. However, among patients with SpA, painful heels presented more inflammatory abnormalities than painless heels (81 versus 56% in MRI, p=0.045, and 58 versus 17% in PDUS, p=0.008, respectively).

Conclusion: Heel MRI and PDUS show frequent abnormalities in SpA especially in painful heels. However, they are also frequently abnormal in controls. PDUS and MRI may be useful for the assessment of enthesis inflammatory lesions in SpA with heel pain.

B-499 11:51

HR isotropic ankle MRI at 3 T: Initial results - a worthwhile perspective?

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Purpose: High-resolution 3D-isotropic MRI with multi-channel-coils shows promise for routine imaging. We evaluated an optimized 3D-TSE-sequence for MRI of the ankle at 3 T.

Methods and Materials: 15 volunteers and 25 patients were examined at 3 T (Magnetom VERIO, Siemens) with an 8-channel-ankle-coil and a sagittal PDfs-weighted 3D-TSE-sequence (TR1100 ms/TE37 ms/Voxel-size: 0.6³ mm/acquisition-time 6:43 min) with optimized flip angles and radial k-space sampling. Signal- and contrast-to-noise-ratios (SNR; CNR) were calculated with the subtraction method. Using free 3D-reformats, two radiologists independently assessed depiction of cartilage, ligaments and tendons and detection and depiction of lesions of these structures (5-point-Likert-scale) compared to a 2D-TSE-sequence (TR2830 ms/TE27 ms/Voxel-size: 0.3x0.3x3 mm/total acquisition-time 12:40 min) acquired in 3 major anatomical planes. Statistical analysis was performed with paired t-tests, interreader-correlation with weighted-κ-coefficients.

Results: SNR and CNR of fluid and cartilage were not significantly different, whereas SNR of low signal structures (ligaments/tendons/subchondral bone) was significantly lower for 3D-TSE (p < 0.01), leading to significantly higher CNR of, that is, ligament/

Sunday

fat (3D-TSE/2D-TSE: 39/12) or ligament/fluid (3D-TSE/2D-TSE: 208/152) (p < 0.01). Overall depiction of the ankle ligaments was superior with 3D-TSE with significant differences for the calcaneofibular ligament (3D-TSE/2D-TSE: 4.7±0.8/3.6±1.1) and the spring-ligament-complex (4.9±0.4/3.9±0.7) (p < 0.05). Depiction of cartilage was significantly better (5.0±0.0/4.3±0.5), particularly in regions usually suffering from partial volume, that is, the anterolateral talar cartilage. There were no significant differences in the number or the diagnostic confidence of detected cartilage, ligament or tendon lesions. Interreader-correlation was excellent (κ=0.82-0.84) for both sequences.

Conclusion: 3 T and the optimized acquisition-techniques of the evaluated 3D-TSE-sequence allow acquisition of a highly-resolved isotropic dataset with 50% reduction of acquisition-time, free 3D-ligament-tilts, facilitating cartilage and ligament depiction at least comparable to current 2D-protocols.

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

GI Tract

SS 1201b
CT colonography

Moderators:
R. Grassi; Naples/IT
S. Jensch; Amsterdam/NL

B-500   10:30
A comparison of different colon preparations for virtual colonoscopy
R. Ferrari, P. Paolantonio, M. Rengo, D. Caruso, F. Vecchietti, A. Laghi; *Latina/IT (ferraririccardo@gmail.com)*

Purpose: To compare three different colon preparations for virtual colonoscopy (VC).
Methods and Materials: Three groups of 30 pts each underwent VC after a low-fiber diet for the three days before the examination. Three different colon preparations were used: group 1 assumed 180 ml of dimeglumine diatrizoate (DD) the day before the examination; group 2 assumed 100 ml of DD 2 hours before the examination; group 3 assumed motility stimulator over the two days before the examination and 50 ml of DD the day of the examination. VC was performed using a 64-MDCT scanner at the arrival of the patient for group 1 and 2 to 3 hours after the administration of DD for patients in group 2 and 3. A low dose scanning protocol (70 mAs for both prone and supine scans) was acquired. A qualitative analysis of the tagging of fluid and stool residues was performed by two radiologists in consensus using a 4 point scale (1=poor; 4=optimal). Side effects were also registered.
Results: Mean quality values were as follows: group 1: 3.53; group 2: 3.15; group 3: 2.85. Group 3 had the lowest number of side effects (diarrhea) with an average number of evacuation < 3; group 1 has the highest side effects.
Conclusion: Same day preparation is a feasible technique with the lowest number of side effects; the results obtained with a higher dose of dimeglumine diatrizoate administered the day before the examination are however still better.

B-501   10:39
also EPOS

Evaluation of two faecal tagging bowel preparation regimes for CT colonography
A. Pollentine, L. Archer, P. McCoubrie; *Bristol/UK (adrianpollentine@doctors.org.uk)*

Purpose: In our trust, two minimal-prep faecal tagging regimes exist for CT colonography. Both involve a 3 day low-residue diet prior to examination, followed by either a combination of stimulant laxative, barium and Gastrografin for 48 hours prior to examination (regime A) or Gastrografin alone over 24 hours prior to examination (regime B). We aim to establish a standard protocol minimising the volume of faecal and residual fluid and optimising its visualisation.
Methods and Materials: Evaluation of 50 consecutive outpatient CT colonography examinations at each trust using the 2 different preparation regimes by 2 independent radiologists. Residual faecal material and fluid volume and the adequacy of tagging thereof was graded according to established methods by Taylor et al. in each of the standard 6 colon segments.
Results: Regime A results in significant reduction in the volume of residual colonic stool. 90% of colons prepared using regime A have none or scattered stool (score 1) compared to 65% of colons prepared using regime B. Any residual stool was significantly better tagged with regime A, giving an optimum tagging score of 5 in 92% of cases compared to 71% of cases with regime B. Examinations where stool is poorly tagged can lead to poor confidence in the detection of mucosal pathology equating to faecal tagging scores of 1-3. This occurred in 21% of examinations prepared with regime B compared to just 3% with regime A.
Conclusion: Regime A showed significantly better bowel preparation as well as better tagging of residual faecal material.

B-502   10:48
also EPOS

CT colonography: Patient's tolerance of faecal tagging regimen vs cathartic cleansing
D. Buccicardi[1], M. Grosso[1], I. Caviglia[2], A. Gastaldo[1], E. Neri[3], P. Quadri[1];
[1]*Savona/IT*, [2]*Genoa/IT*, [3]*Pisa/IT (buccicardiduccio@hotmail.com)*

Purpose: The aim of our prospective study was to compare patient's tolerance of faecal tagging regimen (FT) vs traditional cathartic cleansing (TC).
Methods and Materials: 264 patients at average risk for colorectal cancer (105 men and 159 woman; mean age 62 y ± 5 sd) underwent 32 rows CTC. Patients were sequentially placed into two study groups: Group 1 (n = 132) followed TC and Group 2 (n = 132) FT. TC consisted of no fiber diet and Phospho-lax® 80 ml in 2 litres of water the day before imaging. FT consisted of no fiber diet and ingestion of 30 ml aliquots of Gastrografin® with meals for 2 days before imaging. All studies were reviewed in a combined fashion, primary 2D followed by dissected views on Advantage 4.2 WS (GE/Healthcare®). After the examination, all patients were asked to provide a feedback about tolerance to the each bowel preparation. The first 30 patients of each group were also investigated with optical colonoscopy as gold standard (Group 1* and Group 2*).
Results: Patients who received FT did not report severe abdominal pain when compared to those of TC (chi squared test p < 0.001). A total of 90 lesions were identified: 18 stenosis, 2 flat lesions and 70 polyps (62 sessile and 8 pedunculated; 28 < 6 mm; 6 mm ≤ 22 ≤ 10 mm; 20 > 10 mm). Group 1* revealed 10 polyps diam. ≥ 6 mm (7 TP; 1 FN; 2 FP), sensibility 88%, specificity 91%, PPV = 0.78, NPV = 0.95, PLR = 9.63, NLR = 0.14 and diagnostic OR 70 (IC95% 5.5 - 896.6). Group 2* revealed 10 polyps diam. ≥ 6 mm (8 TP; 1 FN; 1 FP), sensibility 89%, specificity 95%, PPV = 0.89, NPV = 0.95, PLR = 18.67, NLR = 0.12 and diagnostic OR 160 (IC95% 8.9 - 2880).
Conclusion: FT reduces discomfort and improves diagnostic accuracy of CTC.

B-503   10:57
CT colonography: Prevalence of wall thickening and colonic collapse in patients with diverticular disease and influence on diagnostic quality
F. Cerri, E. Neri, L. Faggioni, F. Turini, E. Picano, P. Vagli, C. Bartolozzi; *Pisa/IT (francerri@gmail.com)*

Purpose: To assess prevalence of wall thickening and colonic collapse on CT colonography (CTC) in patients with diverticular disease and their influence on diagnostic quality.
Methods and Materials: Fifty-one patients with diverticular disease and twenty control subjects underwent low-dose CTC in the supine and prone positions. The degree of diverticular involvement and colonic wall collapse was expressed semi-quantitatively as mild, moderate, and severe. Absolute wall thickening in millimeters was also measured, while diagnostic quality was expressed semiquantitatively through a five-point scale.
Results: Diverticular involvement was mild in 15/51 patients (29.4%), moderate in 25/51 patients (49.0%), and severe in 11/51 patients (21.6%). Colonic wall collapse was mild in 17/51 patients (33.3%), moderate in 25/51 patients (49.0%), and severe in 9/51 patients (17.7%); 11/20 (55%) control subjects had no collapse. Collapse was higher in patients than in the control group (mean ± standard deviation: 1.84 ± 0.70 vs 0.95 ± 1.10, p = 0.0037). In patients, wall thickening was 1.92 ± 0.72 mm, while diagnostic quality was significantly higher in the prone than in the supine position (2.59 ± 1.36 vs 2.18 ± 1.44, p = 0.0039), unlike in control subjects (p = 0.3142). Moreover, severity of diverticular disease correlated with degree of collapse (r_s = 0.6780, p < 0.0001) and wall thickening (r_s = 0.3513, p = 0.0115), and these three parameters correlated inversely with diagnostic quality in both the supine and prone position (p < 0.01).
Conclusion: Diverticular disease is associated with colonic wall collapse and thickening that can compromise the diagnostic quality of CTC images. Still, in patients with diverticular disease, CTC data acquisition is significantly better in the prone than in the supine positions.

B-504   11:06
also EPOS

Transient bacteraemia during CT colonography: Implications for infective endocarditis prophylaxis
C.A. Ridge[1], M. Carter[1], R. Ryan[1], C. Hegarty[1], L. Browne[2], D.E. Malone[1];
[1]*Dublin/IE*, [2]*Houston, TX/US (c.ridge@st-vincents.ie)*

Purpose: The AHA 2008 guidelines indicate that antibiotic prophylaxis is not indicated in at-risk patients before lower GI endoscopy as the risk of a significant bacteraemia and subsequent infective endocarditis are acceptably low. This study was performed to definitively assess the frequency of transient bacteraemia in patients undergoing CT colonography (CTC).

Methods and Materials: The study was approved by the institutional review board and informed consent was obtained. All patients underwent a standard bowel preparation for CTC. Using a 24 Fr rectal tube, 4-6 liters of carbon dioxide were administered with a pressure-regulated pump prior to prone and supine image acquisitions. Blood samples were aspirated from an intravenous cannula at 5, 10 and 15 minutes after CTC using an aseptic technique. Samples were cultured in aerobic and anaerobic media for 5 days. Patients had not received antibiotics for 2 weeks prior to examination.

Results: One hundred patients were recruited over 2 years; 16 had positive blood cultures including skin contaminants, coagulase negative staphylococcus and propionum. No faecal enteric organisms were identified. One patient developed retroperitoneal free air; bacteraemia was not demonstrated in this patient. Based on 95% confidence intervals around extreme results, the lower and upper limits of the possible bacteraemia rate as a result of CTC are 0-3.7%.

Conclusion: The maximum possible rate of transient bacteraemia secondary to CTC determined in this study is similar to the reported incidence of transient bacteraemia following colonoscopy and sigmoidoscopy (2-5%). Antibiotic prophylaxis is therefore not indicated in at-risk individuals undergoing CTC.

B-505 11:15

also EPOS

CT colonography is not sensitive to detect laterally spreading tumors in the colorectum

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Purpose: Laterally spreading tumors (LSTs) in the colorectum, characterized by superficial extension along the colonic lumen are a major target in colon screening, because ≥ 60% of LST contain invasive cancer. However, it is unknown if CT colonography (CTC) can identify LSTs since the majority have a flat appearance. The aim of this study is to investigate the sensitivity of CTC to detect LSTs.

Methods and Materials: April 2008 and May 2009 in one institution, patients with LST measuring ≥ 20 mm on colonoscopy were prospectively enrolled. All patients underwent colonoscopy and subsequent CTC on the same day. After colonoscopy, CTC was performed using 40 or 64 row multi-detector CT without contrast medium in the prone and supine positions. To screen LST, 2 radiologists blinded to the location, size and configuration of the LST reconstructed the virtual endoscopic images as well as 2-D images.

Results: Thirty-nine pathologically proven LSTs measuring ≥ 20 mm were studied. Histology was low-grade adenoma in 13, high-grade adenoma in 16 and cancer in 10. Twenty-two (56%) LSTs were correctly identified by CTC, and the configuration was similar to the colonoscopic appearance in most cases. The correctly identified LSTs had a tendency toward larger size, but the difference did not reach significance. Detection rate for protruded type LST was significantly higher than that of the flat type (70 vs. 25%, p = 0.014).

Conclusion: The sensitivity of CTC to detect LST, particularly flat type, was not acceptable even with advanced lesions.

B-506 11:24

Detection rates of diminutive polyps in CT colonography: Implications for colorectal cancer screening

A. Graser[1], F.T. Kolligs[1], H.-C. Becker[1], M.F. Reiser[1], T. Mang[2]; [1]*Munich/DE*, [2]*Vienna/AT (anno.graser@med.uni-muenchen.de)*

Purpose: To analyze CTC diagnostic accuracy in the detection of polyps ≤5 mm and to assess whether the number of diminutive lesions is a predictor for the presence of larger adenomas.

Methods and Materials: 332 asymptomatic adults (190 men, 142 women, 59.2±7.6 years) underwent same-day CTC and OC. Segmentally unblinded CTC was used as standard of reference. Sensitivity of CTC in the detection of diminutive (≤5 mm) adenomas and larger polyps was calculated. Polyps were resected at colonoscopy and classified as adenomas, hyperplastic, or other polyps. The % probability to detect an adenoma > 5 mm in patients with less than 3 versus 3 and more diminutive polyps was calculated and tested for statistical difference using the Wilcoxon signed rank test.

Results: 530 polyps were detected in 224 patients (226 adenomas, 198 hyperplastic polyps, 106 other polyps). CTC sensitivity for polyps > 5 mm was 90.7% (88/97), 44.4% (126/284) for diminutive non-adenomatous lesions, and 59.1% (88/149) for diminutive adenomas. In patients with less than 3 diminutive polyps, the probability of an adenoma > 5 mm was less than 12.5%; in patients with 3 or more diminutive polyps, it was 35.9%, p < 0.0001.

Conclusion: The number of diminutive polyps is an independent predictor for the presence of larger adenomas. If 3 or more diminutive lesions are identified, the probability of a larger adenoma is over 35%. If several diminutive lesions are identified at CTC, they cannot be ignored.

B-507 11:33

CT colonography: Retrospective evaluation of the performance of computer-aided detection of colonic polyps in tagged and untagged preparation

T. Mang[1], L. Bogoni[2], M. Salganicoff[2], M. Wolf[2], V. Raykar[2], M. Macari[3], A. Graser[4]; [1]*Vienna/AT*, [2]*Malvern, PA/US*, [3]*New York, NY/US*, [4]*Munich/DE (thomas.mang@meduniwien.ac.at)*

Purpose: To retrospectively evaluate the performance of a prototype computer-aided detection (CAD) algorithm in CT colonography (CTC) on a database of patients with and without fecal tagging.

Methods and Materials: Validated CTC datasets from 1849 patients (869 untagged, 980 tagged) that have not been used for training were taken for testing of the CAD algorithm. Patient examinations had been performed at multiple sites in the US, Canada, Asia, and Europe. 4 to 64 detector-row CT scanners from different manufacturers were used, employing a wide range of acquisition parameters. CAD sensitivities were calculated on a per-patient and per-polyp level for polyps ≥6 mm, separately for tagged and untagged datasets.

Results: In 410 out of 1849 individuals, 566 polyps were identified, 351 being small (6-9 mm) and 215 large (10-30 mm). Overall CAD per-patient sensitivity was 87.8% (360/410), 87.0% (199/229) for untagged and 88.9% (161/181) for tagged datasets. For patients with large and small lesions, respectively, per-patient sensitivity was 89.9% (187/208) and 85.6% (173/202). Overall per-polyp sensitivity was 83.9 (475/566), 80.6% (226/330) for untagged and 86.6% (209/236) for tagged examinations. For large and small lesions, per-polyp sensitivity was 82.9% (291/351) and 85.6% (184/215), respectively. The average false-positive rate per volume was 2.55 (2 median) in untagged and 3.81 (3 median) in tagged patient datasets.

Conclusion: CAD polyp detection rates approach expert human reader performance in tagged and untagged CTC examinations. CAD can be applied to CTC scans using a wide range of acquisition parameters.

B-508 11:42

Effect of a concurrent virtual dissection with CAD for CTC interpretation: A multi-reader study evaluating accuracy and interpretation times

A.A. Ahmad[1], M. Macari[1], K.C. Cho[1], J.A. Bonavita[1], E. Robinson[1], L. Bogoni[2], M. Salganicoff[2], M. Wolf[2], V. Raykar[2]; [1]*New York, NY/US*, [2]*Malvern, PA/US (Luca.Bogoni@siemens.com)*

Purpose: To evaluate the interpretation times and accuracy utilizing a primary virtual dissection (VD) with concurrent computer aided detection (CAD) for CTC interpretation.

Methods and Materials: 50 subjects (45 males, 5 females) mean age 58 underwent CTC after bowel cleansing using a low dose CT technique. CTC was followed by same day colonoscopy. 19 subjects had at least one lesion including 3 cancers, 11 large polyps (>= 10 mm); and 11 polyps < 10 mm. 4 different readers participated in this study, 3 readers (R1, R3, R4) had CTC experience while one (R2) was inexperienced. The readers reviewed data using a VD view with concurrent pre-computed CAD findings. Evaluation times were recorded. The sensitivity was computed on per/polyp basis while the specificity was determined per/patient.

Results: The mean interpretation time among the 3 experienced readers was 6.8 mins/case while R2's was 12.3 mins/case. The sensitivity for polyps >= 10 mm were 81.82, 81.82, 72.73 and 90.91% for readers R1, R2, R3, and R4, respectively. The sensitivity for CAD alone was 81.82%. For polyps < 10 mm the sensitivities were 72.73, 81.82, 81.82, and 90.91%. The sensitivity for CAD alone was 100%. Only one of the cancers was detected by R1, R3 and R4 and CAD. The per patient specificity was 100, 87, 97, and 97% for readers R1, R2, R3, R4, respectively. CAD had a mean of 4.12 detections/case

Conclusion: The concurrent use of VD with CAD provides a rapid technique for CTC data review with performance for polyps comparable to recently published studies.

B-509 11:51

3D CT colonography (CTC): Comparison of diagnostic accuracy and interpretation times of a standard and an advanced 3D visualization technique

A. Graser[1], H.-C. Becker[1], M.F. Reiser[1], T. Mang[2]; [1]*Munich/DE*, [2]*Vienna/AT (anno.graser@med.uni-muenchen.de)*

Purpose: To compare the diagnostic accuracy of a standard 3D CTC reading strategy based on bidirectional fly-through (standard view, SV) with a new unfolding technique (panoramic view, PV).

Methods and Materials: 300 CTC datasets of 150 participants from an OC/CTC correlation trial were selected for retrospective evaluation. Segmentally unblinded optical colonoscopy (OC) was used as standard of reference as all patients under-

Sunday

went same-day CTC and OC. All cases were read twice on a dedicated workstation (Siemens MMWP 2008) by two expert readers in two separate sessions: based on a standard 3D review, and after 36-38 weeks using an advanced 3D technique ("panoramic view") that allows visualization of the entire colonic mucosa on a single fly through. Reading times and diagnostic accuracies for the detection of small (≤5 mm), medium (6-9 mm) and large (≥10 mm) adenomas were recorded. Results were tested for statistical significance using the paired t test.

Results: 101 adenomas and 135 hyperplastic polyps were detected in 81 patients. Bidirectional SV reached a per-polyp sensitivity of 92.6% (26/28) for medium and 95.0% (19/20) for large for adenomas. The sensitivity of PV was 89.3% (25/28) and 95.0% (19/20), p> 0.05 for both. Mean CTC interpretation time decreased from a 14.5±2.5 (range, 8.0-20.0) minutes with SV software to 7.0±3.0 (5.0-10.5) minutes using 3D PV software (p < 0.0001).

Conclusion: 3D CTC interpretation using advanced visualization is equally accurate, but significantly faster than an interpretation based on a standard bidirectional fly-through. Advanced visualization can be recommended as standard CTC reading strategy.

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

Cardiac

SS 1203

Cardiac CT: Experimental studies, new developments

Moderators:
N.-E. Klow; Oslo/NO
L.J.M. Kroft; Leiden/NL

B-510   10:30

Quantitative whole heart stress perfusion CT imaging as non-invasive assessment of hemodynamics in coronary artery stenosis: Preliminary animal experience

A.H. Mahnken[1], E. Klotz[2], H. Pietsch[3], B. Schmidt[2], T. Allmendinger[2], U. Haberland[2], W.A. Kalender[4], T.G. Flohr[2]; [1]Aachen/DE, [2]Forchheim/DE, [3]Berlin/DE, [4]Erlangen/DE (mahnken@rad.rwth-aachen.de)

Purpose: The aim of this experiment was to quantify differences in the regional myocardial perfusion of the left anterior descending (LAD) artery in the presence of a stenosis by use of dynamic computed tomography (CT) in an animal model.

Methods and Materials: Ten pigs underwent contrast enhanced whole heart dual-source CT perfusion imaging (Definition Flash, Siemens, Germany) using an ECG-triggered dynamic shuttle mode covering 73 mm. Imaging was performed at rest and during continuous infusion of adenosine (280 µg/kg/min) at 100 kV, 320 mAs/rot with 75 ms temporal resolution. 60 ml Iopromide 300 (Ultravist 300, Bayer-Schering, Germany) were injected at a rate of 6 ml/s followed by 30 ml saline. Five animals served as control (group 1); in the remaining five animals, a 75-85% coronary artery stenosis was induced by partial balloon occlusion of the LAD (group 2). Blood flow was volumetrically quantified. Results were compared using Student´s t-Test.

Results: In group 1, total myocardial blood flow increased from 98.2±18.6 to 134.0±40.1 ml/100 ml/min after adenosine infusion (p < 0.02). In group 2, the post-stenotic territory could clearly be delineated on the blood flow maps after adenosine infusion. Blood flow in the post-stenotic territory was reduced by 37% to 74.0+-21.9 ml/100 ml/min under adenosine stress as compared to 117.4±18.6 ml/100 ml/min in the remaining non-ischemic myocardium (p < 0.005).

Conclusion: Dual-source CT permits quantitative whole heart perfusion imaging. This technique exceeds the present key limitation of cardiac CT, which currently only allows a morphological assessment of coronary artery stenosis.

B-511   10:39

Dynamic iterative beam hardening correction (DIBHC) for an optimized assessment of cardiac perfusion in ECG-correlated CT

P. Stenner[1], B. Schmidt[2], T. Allmendinger[2], T.G. Flohr[2], M. Kachelrieß[1]; [1]Erlangen/DE, [2]Forchheim/DE (Philip.Stenner@imp.uni-erlangen.de)

Purpose: To optimize the assessment of cardiac perfusion by reducing beam hardening artifacts that is caused by large concentrations of an iodine-based contrast agent and by bone.

Methods and Materials: In cardiac perfusion examinations (typically 30 ECG-correlated scans distributed over a total scan time of 20 s), large concentrations of iodine pass through the ventricle and cause beam hardening artifacts yielding incorrect perfusion parameters. Conventional iterative approaches are based on segmentation algorithms that fail to clearly distinguish between iodine and bone.

Our new algorithm, DIBHC, calculates the time-dependent iodine distribution by analyzing the time series of a cardiac perfusion examination. This prior information allows to precisely distinguish between bone and iodine and is key to DIBHC where each iteration consists of a multi-material (soft tissue, bone, iodine) polychromatic forward projection, a raw data comparison and a filtered back projection. Simulations with a semi-anthropomorphic dynamic phantom and clinical scans using a dual source CT scanner (2·128 slices, 100 kV, 180 mAs, 0.28 s) have been carried out.

Results: One iteration of DIBHC removes dark bands that connect large concentrations of iodine in the ventricle and bony structures in the uncorrected images. The CT-value deviations of up to 20 HU in the affected tissues are reduced to 3 HU for the simulations and 10 HU for the measurements. The accuracy for determining the baseline of the TAC has improved considerably (by 50%).

Conclusion: DIBHC significantly reduces the beam hardening artifacts induced by the contrast agent dynamics now allowing for an improved calculation of perfusion.

B-512   10:48

A robust deconvolution model for quantitative whole heart stress perfusion CT imaging with sparse temporal sampling: Animal experience

E. Klotz[1], M. Juergens[1], U. Haberland[1], T. Allmendinger[1], H. Pietsch[2], A.H. Mahnken[3]; [1]Forchheim/DE, [2]Berlin/DE, [3]Aachen/DE (ernst.klotz@siemens.com)

Purpose: The temporal sampling rate in prospectively triggered dynamic CT of the whole heart can be as low as 4 s. We developed a dedicated deconvolution algorithm for this scenario and validated it in an animal model.

Methods and Materials: In five pigs, a 75-85% coronary artery stenosis was induced by partial balloon occlusion of the LAD. Dynamic contrast enhanced dual-source CT perfusion imaging (Definition Flash, Siemens, Germany) was performed with an ECG-triggered dynamic shuttle mode during continuous infusion of adenosine (280 µg/kg/min). 60 ml Iopromide 300 were injected at 6 ml/s followed by 30 ml saline. Data were acquired at alternating table positions with a temporal resolution of 75 ms in endystolic triggering covering a scan range of 73 mm. We implemented a deconvolution algorithm derived from a simplified two-compartment model and calculated volume maps of blood flow (BF), blood volume (BV) and first pass distribution volume (FPDV). We compared parameter mean values in the post-stenotic territory with the ones in the remaining non-ischemic myocardium.

Results: The whole myocardium was covered in all cases. The post-stenotic territory could clearly be delineated on all parameter maps. In comparison with the non-ischemic myocardium, all parameters were significantly reduced. The respective ischemic/non-ischemic values were • BF 74.0±21.9/117.4±18.6 ml/100 ml/min (p < 0.005), • BV 4.9±1.4/8.8±1.9 ml/100 ml (p < 0.005), • FPDV 9.8±2.5/14.9±1.9 ml/100 ml (p < 0.02).

Conclusion: Despite relatively sparse temporal sampling, prospectively triggered dual-source CT in conjunction with dedicated mathematical modelling allows quantitative whole heart perfusion imaging under pharmacological stress.

B-513   10:57

Ex vivo coronary atherosclerotic plaque characterization: Comparison of dual-source and dual energy CT with 16-row multi slice CT and histopathology

T. Henzler, R. Krissak, M. Reichert, S. Porubsky, S.O. Schönberg, C. Fink; Mannheim/DE (thomas.henzler@gmx.de)

Purpose: Several studies have shown the usefulness of non invasive CT for density based characterization of coronary atherosclerotic plaques. DSCT has the advantage of a higher temporal resolution compared to single-source-CT (SSCT). DECT offers new opportunities for cardiac CT imaging e.g. perfusion imaging. Until now it is unclear if the specific geometry of the dual source CT and potential cross-scatter photons influence the density based characterization of coronary atherosclerotic plaques. The purpose of this study was to evaluate whether DSCT and DECT are appropriate for characterization of coronary plaques.

Methods and Materials: In a post mortem study, 17 human hearts were scanned with DSCT and DECT and on a 16-row-multi-slice-SSCT. To simulate arterial enhancement, a mixture of methylcellulose and CT contrast agent was injected into the coronary arteries before imaging. All lesions detected at autopsy were histologically analyzed and classified according to the AHA criteria. Density values of all lesions were measured on DSCT, DECT and 16-row-MSCT images and classified according to AHA criteria.

Results: 59 lesions were detected at autopsy. All 3 CT modalities detected 51 of 59 lesions. The sensitivity for all types of coronary plaque lesions was 86.4%, 96.7% for Type Vb, 58.3% for Type Va, 42.8% for Type IV and 0% for Type III and II. There was no significant difference between the mean values of different plaque types between DSCT/DECT/SSCT (Type IV: 11 HU/8 HU/19 HU, Type Va 44 HU/45 HU/52 HU, Type Vb: 1088 HU/966 HU/1079 HU) (p> 0.05).

Conclusion: DSCT and DECT show similar results for density based plaque characterization as standard single-source CT.

B-514 11:06

Dual energy CT for the assessment of chronic myocardial infarction in patients with chronic CAD: A comparison with 3 T MRI

R.W. Bauer, M. Kerl, N. Fischer, T. Burkhard, M.C. Larson, H. Ackermann, T.J. Vogl; *Frankfurt a. Main/DE (ralfwbauer@aol.com)*

Purpose: To evaluate the performance of dual energy CT (DECT) for the detection of chronic myocardial infarction during first pass coronary CT angiography (cCTA) compared to 3 T MRI late enhancement.

Methods and Materials: Thirty-six patients underwent cCTA for the assessment of coronary bypass graft patency on a dual source CT scanner in dual energy mode. Gray scale images were assessed for areas of hypodense myocardium during arterial phase. Additionally, a color-coded map of myocardial iodine distribution was calculated from the dual energy data for perfusion analysis. DECT data were compared to 3 T MR late enhancement imaging serving as the reference standard for scar detection using the AHA 17-segment model of the left ventricle.

Results: 101/612 (17%) myocardial segments in 22/36 (61%) patients showed LE at MRI. DECT detected these ischemic areas with 80% sensitivity, 96% specificity, 79% PPV, 96% NPV, and 93% accuracy on gray scale images, and with 70% sensitivity, 98% specificity, 86% PPV, 94% NPV, and 93% accuracy on myocardial iodine distribution maps. Band-like artifacts arising from sternal wires and the rib cage were the major limiting factors for the reliable use of iodine mapping. However, whereas on gray scale images excessive window manipulation was necessary to depict infarct areas, perfusion defects were visualized without major user/software interaction on iodine mapping.

Conclusion: Myocardial perfusion analysis with DECT during coronary angiographic phase already shows promising results, but further technical improvements are needed to lower artifact burden and improve sensitivity on myocardial iodine mapping for the detection of chronic infarction.

B-515 11:15

Evaluation of coronary artery stents with 128-slice dual source CT using high-pitch spiral acquisition - comparison with conventional scan modes: A phantom study

F. Wolf[1], S. Leschka[2], C. Loewe[1], P. Homolka[1], C. Plank[1], J. Lammer[1], B. Marincek[2], H. Alkadhi[2], G. Feuchtner[2]; [1]*Vienna/AT*, [2]*Zurich/CH (florian.wolf@meduniwien.ac.at)*

Purpose: To assess the performance of 128-slice-dual-source CT for evaluation of coronary stents in-vitro using the new cardiac high-pitch spiral (HPS) mode (Flash™) compared to sequence and spiral scan mode.

Methods and Materials: Twelve coronary artery stents with different diameters (2.6-5.0 mm) were placed into the drillings of an integrated cardiac/chest phantom. The phantom was scanned oriented in z-axis with a 128-slice dual source CT (Definition Flash ™, Siemens) (128x0.6 mm, 0.28 s rot., 120 kV/320 mAs), using 3 different scan modes: I) high-pitch-spiral (HPS) (pitch 3.4) prospectively ECG-synchronized; II) sequential (SEQ) prospectively ECG-triggered and III) low-pitch spiral (SPIR) (pitch, 0.2) retrospectively-ECG-gated. Image reconstruction was: 0.6 mm slice width/inc.0.3/sharp kernel B46f). Quantitative image quality parameters were measured: artificial in-stent lumen narrowing (ALN), artificial in-stent lumen attenuation (ALA) (=difference (Δ) in HU inside and outside stent), and image noise (SD [HU]) inside stent.

Results: Mean ALN was 46%±9.4 for HPS, 44%±9.2 for SEQ and 47%±7.7 for SPIR without being significantly different (p=0.716). Mean ALA was not different among the 3 modes with 8 ΔHU for HPS; -3 ΔHU for SEQ and -31ΔHU for SPIR (p=0.330). Mean image noise was higher for HPS with 60 SD [HU] compared to SEQ and SPIR (43 SD [HU] and 35 SD [HU], respectively) (p=0.037). Radiation dose (CDTIvol) was lower for HPS (5.17 mGy), as compared to SEQ (9.02 mGy) and SPIR (55.97 mGy), respectively.

Conclusion: Cardiac high-pitch spiral (HPS) mode using 128-slice DSCT provides similar image quality of coronary stents as compared to conventional scan modes; except image noise was higher for HPS. Radiation dose is markedly (up to ~10-fold) reduced using HPS.

B-516 11:24

Evaluation of coronary artery stents with 128-slice dual source CT using high-pitch spiral acquisition: Comparison of 100 and 120 kV tube voltage - a phantom study

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Purpose: To compare evaluation of coronary stents with 100 and 120 kV tube voltage using 128-slice-dual-source CT in cardiac high-pitch spiral (Flash™) mode.

Methods and Materials: Twelve coronary artery stents with different sizes (nominal outer diameter, 2.6-5.0 mm) were placed into the drillings of a combined cardiac/chest phantom. The phantom was scanned oriented in z-axis with a 128-slice dual source CT system (Definition Flash™ Siemens) (128x0.6 mm slice acquisition, 0.28 s gantry rotation time), using the high-pitch-spiral mode (pitch factor, 3.4) and prospective ECG-synchronization. Scans were performed using two recommended standard settings (100 and 120 kV) and standardized image reconstruction parameters (0.6 mm eff. slice width/inc.0.3/sharp kernel (B46f)). Quantitative image quality parameters were measured: artificial in-stent lumen narrowing (ALN), inner stent area (=visible area by CT in % of true inner stent area), artificial in-stent lumen attenuation (ALA) (=difference (Δ) in HU inside and outside stent), image noise (SD [HU]) inside stent.

Results: Mean ALN was 52%±10.1 using 100 kV tube voltage and 46%±9.4 using 120 kV without being significantly different (p=0.158). Mean inner stent area was not different with 32%±7.6 for 100 kV and 31%±7.1 for 120 kV (p=0.668). Mean ALA was not different between 100 and 120 kV with 7 and 8 ΔHU, respectively (p=0.968). Mean image noise was slightly but non-significantly lower for 120 kV (60 SD [HU]) compared to 100 kV (65 SD [HU]) (p=0.386).

Conclusion: 128-slice dual source CT using high-pitch spiral mode does not provide significant differences in image quality of coronary stents when using 120 and 100 kV settings.

B-517 11:33

Comparison of two-phase ECG-gated cardiac CT and nuclear imaging for assessment of myocardial perfusion and viability in chronic ischemic heart disease

I. Lee, E.-A. Park, W. Lee, J. Chung, J. Park; *Seoul/KR (2injoon@hanmail.net)*

Purpose: To evaluate the diagnostic performance of two-phase ECG-gated cardiac CT for assessing myocardial perfusion and viability in comparison with nuclear imaging using dual-isotopes of rest thallium and stress ^{99m}Tc-sestamibi SPECT.

Methods and Materials: Fifty-one consecutive patients underwent two-phase cardiac CT (first-pass and 10 minute-delayed phase) and nuclear imaging. Two blinded observers evaluated early hypoenhancement (EH) and late hyperenhancement (LH) with transmurality in an 20-segment model. CT patterns were classified into: no EH and LH (normal), EH without LH (ischemia), LH with < 50%transmurality (viable infarct), and LH with ≥ 50% transmurality (nonviable). Nuclear imaging patterns were classified into: ≥ 60%uptake on stress images (normal), < 60%uptake on stress images with ≥ 7%redistribution on rest images (ischemia), < 60%uptake on stress images with < 7%redistribution and ≥ 50%uptake on rest images (viable infarct), and < 50%uptake on rest images (nonviable). In each CT group, mean uptake values of rest and stress images were compared using ANOVA and post-hoc multicomparisons. Agreement between CT and nuclear imaging patterns was assessed using weighted kappa.

Results: Mean uptake values of rest and stress images in each CT group were 77.8 and 75.9 in normal, 74.8 and 66.1 in ischemia, 67.2 and 58.8 in viable infarct, and 54.7 and 48.0 in nonviable, respectively. There was the significant difference between each group (all, p < 0.001) except between normal and ischemia on rest images (p = 0.06). The overall agreement of the pattern analysis between CT and nuclear imaging was 64.5%. Moderate concordance was observed (weighted kappa = 0.514).

Conclusion: The pattern analysis using two-phase cardiac CT showed substantial agreement with those of dual-isotopes SPECT and can provide informations on ischemic, viable or nonviable infarct myocardium.

B-518 11:42

Effect of scan parameters and individual factors on X-ray induced DNA double-strand breaks in patients undergoing cardiac CT

M.A. Kuefner[1], S. Grudzenski[2], K. Anders[1], S.A. Schwab[1], L. Häberle[1], S. Achenbach[1], M. Löbrich[2], M. Uder[1]; [1]*Erlangen/DE*, [2]*Darmstadt/DE (michael.kuefner@uk-erlangen.de)*

Purpose: Determination of DNA double-strand breaks (DSBs) provides an accurate estimate of biological radiation effects. The purpose of this study was to investigate the effect of scan parameters and individual factors on the dose length product (DLP) and the DSB levels induced during coronary CT angiography (CTA).

Methods and Materials: 27 patients undergoing cardiac CT using a 64-slice dual-source scanner (100-120 kV, 330-438 mAs/rot, pitch 0.2-0.39, ECG-modulated tube current 40-70% or 70-70%) were included. Blood samples were collected before and 30 minutes after exposure. Lymphocytes were isolated, stained against the phosphorylated histone variant γH2 AX, and DSBs were enumerated using fluorescence microscopy. DLP was recorded as provided by the patient protocol.

Results: DLP ranged from 508 to 1700 mGy*cm. DSB levels 30 minutes after CTA ranged from 0.18 to 0.71/cell. A 100 kV protocol led to a reduction of DLP and DSBs (p> 0.05). The dose reducing effect of higher pitch values was negated by the use of a wider pulsing window required by higher heart rates. CT attenuation determined in the blood in contrast enhanced CT was taken as a surrogate measure of contrast concentration. DSB levels normalized to DLP showed a significant correlation to

the attenuations (ρ=0.53, p=0.01) and a negative correlation to the patients´ body mass index (ρ=-0.37, p=0.06).

Conclusion: X-ray induced DNA damages not only depend on scan parameters but also on individual factors. The γ-H2 AX immunofluorescence microscopy both determines these dose related effects and also considers factors which cannot be monitored by physical dose parameters.

B-519 11:51
Dual energy CT for the assessment of acute and chronic myocardial infarction in a porcine model: Comparison with MRI late enhancement and histopathology

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Purpose: To evaluate the performance of dual energy CT during first pass arterial phase for the detection of acute and chronic myocardial infarct compared with late enhancement MRI and histopathology in a porcine model of reperfused myocardial infarction.

Methods and Materials: MI was induced by 30 min occlusion of the proximal left anterior descending coronary artery in 8 healthy minipigs. DECT was performed 1 hour after myocardial occlusion using a DSCT- scanner in dual energy mode. Repeat DECT, post-contrast LE MRI, and histopathology were performed 60 days after infarct induction. Two experienced radiologists in consensus interpreted all imaging studies in random order for presence of gadolinium uptake at LE MRI indicating infarct and reduced iodine content at DECT using the AHA 17-segment model. Results were compared with histopathology.

Results: Of 136 myocardial segments in 8 minipigs, 44 showed LE at MRI and 43 segments showed chronic infarction on histopathology (κ=0.95). In the acute phase, first pass arterial phase DECT detected segments with verified infarction with 86% sensitivity, 69% specificity, 61% PPV, and 90% NPV. In the chronic stadium, DECT detected segments with verified infarction with 93% sensitivity, 75% specificity, 73% PPV, and 93% NPV. Band-like artifacts arising from the rib cage and dense contrast material in the right ventricle were the major factors limiting the accuracy of DECT.

Conclusion: DECT during first pass arterial phase, which is ordinarily used for coronary artery evaluation, has rather high accuracy for the detection of acute myocardial infarction and even higher for chronic infarct.

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

Computer Applications

SS 1205

Radiology procedures and image processing

Moderators:
P. Peloschek; Vienna/AT
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B-520 10:30
Optimal interpolation for digital medical images

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Purpose: Digital medical images are always displayed scaled to fit particular view. Interpolation is responsible for this scaling, and if not done properly, can significantly degrade diagnostic image quality. However, best interpolation techniques are also the most time-consuming and impractical. We propose a new approach which combines high speed and superior image quality.

Methods and Materials: Current interpolation algorithms employ piecewise-polynomial kernels to achieve suboptimal interpolation quality at reasonably low computational cost. Our novel approach is based on Interpolation Lookup Tables (ILUT) because: 1. Radiological images are usually scaled in small increments, suggesting LUT. 2. ILUTs completely eliminate kernel computations, assuring superior computational speed. 3. Independent on kernel type, ILUT can be built to deliver optimal image quality. We designed optimal ILUT with Fourier analysis. The ILUT size was chosen to support 1% zoom increments, visually undistinguishable from smooth continuous zooming. The performance of ILUT approach was studied qualitatively (visual image assessment) and numerically (speed and Fourier analysis).

Results: We tested our LUT interpolation on a set of 20 radiological images (MR, CT, CR): 1. ILUT image quality visibly better compared to the previous techniques, especially at sharp image edges (such as bones/contrast in CT). 2. For standard N=4 kernel support size, ILUT interpolation was preserving 30% more frequencies than state-of-the-art Keys kernel. 3. Computational speed for ILUT was at least 2X faster.

Conclusion: Optimal Interpolation Lookup Tables (ILUT) permit viewing large image volumes in real-time and with excellent diagnostic quality, greatly facilitating radiological readings.

B-521 10:39
Texture analysis in quantitative osteoporosis assessment: Measuring microarchitecture changes due to osteoporosis

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Purpose: To demonstrate the feasibility of the differentiation between osteoporotic and healthy subjects according to their 3D microarchitecture features in high resolution peripheral quantitative computed tomography (HR-pQCT).

Methods and Materials: The distal radius of 6 female subjects (3 healthy volunteers and 3 patients diagnosed as osteoporotic) was scanned. We performed a 3D co-occurrence matrix texture feature extraction in the entire acquired volume (512x512x110 voxels). The extracted features were clustered with k-medians clustering with two different numbers of categories (k=5.6). A histogram of the cluster occurrence in the volume was calculated and served as a feature vector for the differentiation of osteoporotic and healthy cases. To test the repeatability of the automatic texture classification X-fold cross-validation was performed and repeated measurements were evaluated by the Dice coefficient.

Results: We report quantitative results regarding two questions: 1. can we expect the texture classes to represent true visibly classes in the data? and 2. can we use the frequency of the texture classes to differentiate between healthy and osteoporotic subjects? The texture categories corresponding to the feature clusters are distinguishable between each other. The distribution of texture classes differs between the two groups (mean values of 0.39/0.09 vs. 0.25/0.16). Dice similarity coefficients show high levels of repeatability for our experiments with mean values of texture class overlap ranging from 0.906-0.99 and a standard deviation from 0.002-0.063.

Conclusion: We show that automatically determined texture categories in bone microarchitecture allow for a differentiation between osteoporotic and healthy subject by relying on 3D texture features.

B-522 10:48
Automatic detection and measurement of the IMT in longitudinal sections of ultrasound images of the CCA

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Purpose: This paper details the development of a fully automatic Computer Aided Detection (CAD) tool that is applied to the segmentation and measurement of the Intima Media Thickness (IMT) in 2D ultrasound images of the Common Carotid Artery (CCA). The IMT is an early indicator of arterial degeneration and its accurate identification is a reliable measure used in the evaluation and tracking of the progression of atherosclerotic vascular diseases.

Methods and Materials: The proposed segmentation technique implements a spatially continuous vascular model using statistical solutions for the identification of the two IMT interfaces without any user intervention. The proposed IMT segmentation algorithm was tested on 33 images acquired by clinicians from RCSI Beaumont Hospital, Dublin, from a cohort of women with and without a history of pregnancy induced hypertension using a Philips IU22 ultrasound scanner.

Results: To evaluate the accuracy of the proposed tool, each image was manually segmented by clinical experts and performance metrics such as the point-to-curve errors between the segmentations returned by the proposed method and the ground-truth data were calculated. The results are as follows: the average point-to-curve error for the lumen-intima interface is 0.075 mm, the standard deviation is 0.056 and the root-mean-square is 0.095. For the media-adventitia interface, the average error is 0.075 mm, the standard deviation is 0.058, while the root-mean-square is 0.097.

Conclusion: The experimental results indicate that the developed CAD technique is robust in accurately estimating the IMT even in images with low resolution, poor contrast and high levels of noise.

B-523 10:57
Technique for determining patient lean body weight from a single abdominal CT image

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Purpose: To test the accuracy of a technique for estimation of lean body weight (LBW) from a single multi-detector row computed tomographic (MDCT) abdominal image, using a bioelectrical body composition analyzer scale as reference standard.

Methods and Materials: This IRB-approved retrospective study included 21 patients (10 men, 11 women; age range, 28-75 years) with previously measured LBW (mLBW) before MDCT. CT images were processed using vendor-specific software (AW 4.2; GE Healthcare, Inc). For each transverse image, a fat-fraction was measured as the number of fat pixels (200 to -50 HU) divided by the total number of pixels having an attenuation value equal or greater than -200 HU. Estimated

LBW (eLBW) of five single contiguous sections was calculated in three abdominal regions (upper-mid and lower abdomen) by multiplying TBW by (1 - fat-fraction). Bland Altmann analysis was used to test for agreement between mLBW and eLBW.
Results: The overall mean mLBW was 56 kg (range, 38-75 kg). For the upper-, mid- and lower abdomen, mean eLBW was 47 kg (range, 28-68 kg), 45 kg (range, 30-65 kg), and 57 kg (range, 43-77 kg). Mean differences and limits of agreement for the upper-, mid- and lower abdomen were -8.8 (-25.9,-6.1) kg, -10.2 (-27.9,-6.6) kg, and +0.5 (-12,+13.9) kg, respectively.
Conclusion: eLBW derived directly from preliminary transverse CT image of the lower abdomen can accurately predict mLBW. This technique may be used as an expedited way to estimate LBW as the basis for determining the dose and rate of contrast material for abdominal MDCT.

B-524   11:06
Semi-automatic segmentation of liver lesions in MSCT: Impact of slice thickness on segmentation quality, measurement precision and interobserver variability

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Purpose: Impact of slice thickness on semi-automatic analysis of liver lesions.
Methods and Materials: Portalvenous liver MSCT of 57 patients were reconstructed at 1.5, 3 and 5 mm slice thickness. Two radiologists independently determined long and short axis diameter (LAD, SAD) and volume of 101 liver lesions using semi-automatic segmentation software. Based on contrast to noise ratio (CNR) liver lesions were assigned to three groups: cystic (n=32), hypodense (n=54) and hyperdense (n=15). Necessity of manual correction (NOC= relative difference between uncorrected and corrected volume) and relative interobserver difference (RID) were determined. The precision of segmentation was expressed by relative measurement deviations (RMD) from the reference standard (mean of 1.5 mm datasets). Statistical analysis encompassed t-test and Bland-Altman plots.
Results: NOC was significantly higher for 5 mm than for 3 mm (p=0.03) or 1.5 mm (p= 0.02) independent of liver lesion subtype. The RMD for LAD and SAD were found to be independent of slice thickness. The RMD for liver lesion volume significantly increased (p=0.032) from 8% at 1.5 mm (95%CI: 4.2-12.6%) to 39% at 5 mm (95%CI: 13.6-66.4%). The RID was consistently low for metric and volumetric parameters with no difference in any of the slice thicknesses.
Conclusion: Excessive manual corrections together with significant deviations in liver lesion volume suggest reconstruction of the MSCT data for semi-automatic liver lesion assessment at a slice thickness which does not exceed 3.0 mm.

B-525   11:15
DyCoH (DYnamic COntrast enHancement): An innovative software for contrast enhancement analysis in terminal ileum Crohn's disease patients

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Purpose: To present an innovative tool designed for CE-analysis: DyCoH (Dynamic Contrast Enhancement).
Methods and Materials: 16 consecutive patients with established CD underwent serial bowel D-CE-MRI. Manual-Quantitative-Analysis (MQA) of bowel wall enhancement kinetics was performed basing on signal-to-noise ratio (SNR) of a region-of-interest (ROI). Enhancement curves were obtained at the inner (Mucosa-Submucosa, M-SM) and at the outer (Muscular-Sierosa, Ms-S) parietal layers. Computer-Aided-Quantitative-Analysis (CAQA) was performed using DyCoH system developed in MATLAB environment, which produced four different inspectionable colour-maps underlying the difference in bowel wall contrast enhancement. Basing on DyCoH results, the ROI was manually positioned on the most relevant areas to obtain the dynamic evaluation. Disease activity was defined by post-colonoscopy histological features.
Results: Parietal CE-D-MRI pattern completely correlated with hystologic features (r = 0.8; p < 0.001, Spearman test): 9 patients with active CD showed significant difference in parietal layer enhancement curves (M-SM vs Ms-S, p < 0.03) not observed in 7 patients with inactive disease; M-SM and Ms-S enhanced curves in active patients were significantly different with respect to those of patients with inactive CD (p < 0.001). In all tested cases, there was a complete diagnosis concordance between MQA and CAQA analysis, but DyCoH system proved to be much time-saving.
Conclusion: Clinical tests showed the effectiveness of the software and its capability to concretely support CE diagnoses, providing a simple, standardized, and rapid method of patient assessment.

B-527   11:24
Preoperative planning of complex midfacial fractures: Generation of a virtual, surgical model by registration of a "standard" skull

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Purpose: Preoperative planning of complex maxillofacial trauma by anatomically matching a "standard" skull to patient data using a registration algorithm.
Methods and Materials: 3D models of the skull were derived from multi-detector-row CT data of 4 patients with complex maxillofacial fractures involving both side of the skull. A collimation of 0.625 mm and a reconstruction increment of 0.4 mm were used for the CT scans. Dislocated fractures were removed. The remaining bony parts served as the fixed image for registration. The best matching skull of a data base of 12 "standard" skulls representing a broad range of anatomy served as the moving image for registration. A multi-resolution approach was used for three dimensional image registration consisting of three steps: translation, affine transformation and final non-linear registration using B-spine interpolation and Kappa Statistics as the similarity measure.
Results: Generation of virtual anatomic models was successful in all 4 patients. However, individual adjustment of registration parameters was required to prevent distortions in large defects of the facial skeleton. Computing time for registration was 5 hours and 26 minutes on average (Mac pro, 2 dual-core CPUs, 32 GB RAM).
Conclusion: The proposed method allows for virtual reconstruction of complex maxillofacial fractures by registration of a "standard" skull. The virtual model can be used for preoperative planning.

B-528   11:33
Texture features based on local topological texture analysis of calcaneal X-ray images are correlated with femoral bone mineral density

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Purpose: To obtain texture properties based on the Minkowski Functionals (MF) for quantitative assessment of the trabecular pattern in calcaneal X-ray images and to correlate these measures with femoral bone mineral density (BMD). For reference, linear texture characteristics in analogy to histo-morphometry are obtained from the radiographs.
Methods and Materials: The study comprises 34 post-menopausal women (71.6±9.5 yrs) who had never before been diagnosed with or treated for osteoporosis. Diagnostic work-up included X-ray imaging of the ankle as well as measurement of hip-BMD by DXA. The MF was obtained from binarized, lateral projection images on a local scale within a circular ROI in the posterior part of the heel bone. By integrative filtering based on a sliding-windows algorithm an optimized texture quantity MF2Dloc was extracted. Linear texture quantities corresponding to the apparent trabecular dimensions as depicted radiographically were obtained for reference.
Results: Correlation between femoral BMD and MF2Dloc was $R^2 = 0.80$ (p < 0.001). Performance of linear texture measures was significantly weaker with an R^2 of 0.07 to 0.27 (p= 0.219 to 0.354).
Conclusion: Topological texture features of trabecular bone based on the Minkowski Functionals can be extracted from calcaneal X-ray images. There exists a significant correlation with hip-BMD. In the future, the proposed algorithm may have great potential to supplement screening for osteoporosis in situations where DXA is of limited availability.

B-529   11:42
Automatic registration of whole lungs from inspiration and expiration thoracic CT images

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Purpose: The purpose of this study is to evaluate the performance of an automatic registration method of whole lungs from inspiration and expiration thoracic CT images for pulmonary function analysis.
Methods and Materials: Registration process consisted of two steps. The first step was a global matching processing between inspiration and expiration thoracic CT images for rough registration such as body position. The next step was a local matching processing for fine registration using a finite-element-method (FEM) based algorithm. In this process, a multi-resolution registration process was also performed in order to improve the registration accuracy. The displacement between both lungs was calculated for each point in the lungs, and the displacement map for whole lung was made for pulmonary function analysis. For validation of our method, we compared our registration method with non-registered superimposed method by use of 8 clinical cases.
Results: The mean concordance rate of our registration method was higher than that of non-registered superimposed method (89.1 ± 3.1% vs. 60.9 ± 18.4%;

Sunday

P < 0.01). Also, the mean correlation coefficient of our registration method was higher than that of non-registered superimposed method (0.79 ±0.08 vs. 0.51 ± 0.13; P < 0.01). The abnormal lung lesion such as air-trapping was well visualized on the displacement map.

Conclusion: The concordance rate indicated the correspondence of the surface of lungs, and the correlation coefficient indicated the correspondence of the internal structures such as vessels and bronchus. From both viewpoints, our registration method was superior compared with non-registered superimposed method.

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

Genitourinary

SS 1207

Gynecologic imaging

Moderators:
V. Ene; Bucharest/RO
N.C. Tarhan; Ankara/TR

B-530　10:30

In vivo 3 T magnetic resonance diffusion tensor imaging for detection of fiber architecture of human uterus: A feasibility study
E. Siopis, F. Fiocchi, L. Nocetti, G. Ligabue, P. Torricelli; *Modena/IT (elenasiopis@gmail.com)*

Purpose: To investigate fiber architecture of normal human uterus in vivo by 3 T Magnetic Resonance (MR) Diffusion Tensor Imaging (DTI) with a 3D tractography approach. Fibers' orientation of cesarean sections was studied, as higher incidence of placenta previa-accreta in patients with a scarred uterus is related with the particular architecture of the scar.
Methods and Materials: In vivo MR-DTI was performed on 16 patients (12 normal uteri, 4 cesarean sections; average age of 30 years) using a 3 T Magnet (Philips Achieva). The main diffusion directions reflecting the orientation of structures in the examined uteri were determined using a SENSE single-shot echo planar imaging (sshEPI) with diffusion-sensitized gradients (b=800, b=600 sec/mm^2) along 16, 32, 64 directions and fractional anisotropy (FA) measurements. A fiber tracking algorithm was used to show fibers architecture. Main fiber directions were compared with histological slides (ematossilin eosin staining) of cadaveric uteri.
Results: Significant anisotropy was found in most regions of non scarred examined uteri (12). Two main systems of fibers were found: one running circularly around the uterine cavity and the other running longitudinally in the external layer. On the other hand, uteri with cesarean scar (4) appeared to have not the same directional structure compared to the normal myometrium.
Conclusion: 3 T MR DTI can display the fiber architecture of the human uterus and the particular irregular pattern of cesarean scar fibers. This method could be useful to evaluate the irregularly arranged fibers in patients with previous cesarean section and to predict the subsequent development of placenta previa-accreta.

B-531　10:39　*also EPOS*

Diffusion-weighted imaging in peritoneal carcinomatosis from ovarian cancer: Can apparent diffusion coefficients predict chemotherapy response?
S. Kyriazi, D.J. Collins, V.A. Morgan, S.L. Giles, N.M. deSouza; *Sutton/UK (stavroula.kyriazi@icr.ac.uk)*

Purpose: Diffusion-Weighted Imaging (DWI) explores the impact of tissue microstructure on the thermally driven movement of water molecules. Early changes in the Apparent Diffusion Coefficients (ADC) have been linked to chemotherapy-related apoptosis and can herald macroscopic tumor shrinkage. This study examines the role of ADC in assessing platinum chemosensitivity in peritoneal carcinomatosis from ovarian cancer.
Methods and Materials: Twenty patients with advanced ovarian cancer underwent abdominopelvic conventional MRI and DWI before and after the first and third cycle of platinum-based chemotherapy. ADC maps were generated from four b values (0, 600, 900, 1050 s/mm^2) and regions of interest were drawn semi-automatically in peritoneal lesions. Pre- and post-treatment mean and minimum ADCs and percentage ADC change were compared between responders and non-responders according to a CA125 reduction of > 50%.
Results: Thirty-one lesions in 15 responders and nine lesions in 5 non-responders were evaluated. A significantly higher mean and minimum ADC after the third cycle was observed in responders (1.40 ± 0.38 and 1.28 ± 0.29 x 10^{-3} mm^2/s) than in non-responders (1.10 ± 0.21 and 1.00 ± 0.13 x 10^{-3} mm^2/s) (Mann-Whitney U

test, p < 0.02 and p = 0.05, respectively). Baseline and post-first cycle mean and minimum ADC values and percentage ADC change at each timepoint were not significantly different between the two groups.
Conclusion: Effective chemotherapy in ovarian-related peritoneal carcinomatosis is associated with higher ADC values after the third but not after the first cycle or prior to treatment. These findings may have implications for optimizing the imaging schedule with DWI.

B-532　10:48

GI-RADS - gynecologic imaging reporting and data system: A standardized reporting system for adnexal masses
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Purpose: To develop a standardized sonographic reporting system, similar to that followed in sonomammography, for adnexal masses.
Methods and Materials: A total of 250 women (mean age, 33 years; range, 15-70 years) clinically suspected of having an adnexal mass were evaluated by transvaginal sonography. Subjective Pattern recognition analysis and blood flow pattern were used for determining the presumptive diagnosis. Then, the GI-RADS was used based on the classification system proposed by Juan Luis Alcázar et al: GI-RADS 1, definitively benign; GI-RADS 2, very probably benign; GI-RADS 3, probably benign; GI-RADS 4, probably malignant; and GI-RADS 5, very probably malignant. Patients with GI-RADS 1 and 2 tumors were treated expectantly. A histological diagnosis was obtained in most of the patients classified under the remaining categories either by surgical removal or by FNAC or biopsy. The GI-RADS classification was compared with final histologic diagnosis.
Results: A total of 230 masses were evaluated. Overall GI-RADS classification rates were as follows: GI-RADS 1, 12 cases (5.2%); GI-RADS 2, 60 cases (26.1%); GI-RADS 3, 110 cases (47.8%); GI-RADS 4, 28 cases (12.2%); and GI-RADS 5, 20 cases (8.7%). The sensitivity, specificity, and accuracy were 88, 94 and 92%, respectively.
Conclusion: GI-RADS reporting system has good sensitivity and specificity. The already established results are confirmed by our study too.

B-533　10:57

Magnetic resonance appearances of uterine malignant mixed müllerian tumours (MMMT)
N. Bharwani, A.E. Newland, N. Tunariu, S. Babar, A. Sahdev, A.G. Rockall, R.H. Reznek; *London/UK*

Purpose: Uterine Malignant Mixed Müllerian Tumours (MMMT) are rare, aggressive tumours with a high incidence of lymphatic, peritoneal and pulmonary metastases. Pre-operative differentiation from endometrial carcinoma (EC) would be beneficial as prognosis differs.
Methods and Materials: Retrospective MRI review in 51 patients (mean age 70) with histologically confirmed MMMT reviewed at 2 academic gynaecology units. Tumour size, imaging characteristics and invasion were recorded. Data were compared with appearances of 73 EC (mean age 60).
Results: MMMT mean maximal tumour dimension was 6.3 cm (range 0.4-19.8). On T1-weighting, MMMTs were predominantly isointense to myometrium (77%) and endometrium (71%) with a heterogeneous texture in 33% and hyperintense foci in 31%. On T2-weighting, 92% were hyperintense to myometrium and either hypointense (55%) or isointense (41%) to endometrium. 82% had heterogeneous T2 texture. In 12%, large MMMT obliterated uterine architecture while in 88% the appearances were indistinguishable from EC. Significantly, more MMMT had cervical invasion (p=0.008) and lymph node enlargement (p=0.00008) than in EC. There was no significant difference in the incidence of deep myometrial invasion. Dynamic post-gadolinium images (19/51patients) at 4 mins (n=19) showed tumours to be isointense to myometrium in 56%. This is significantly different to EC where 90% enhance less than myometrium (p=4x10-8).
Conclusion: MMMT does not have a pathognomonic MRI appearance. However, suspicions should increase in the presence of large aggressive tumours or when tumoural enhancement equals or exceeds that of myometrium.

B-534　11:06

Appearance of abdominal wall endometriosis on MR imaging
M.P.H. Busard, V. Mijatovic, C. van Kuijk, P.G.A. Hompes, J.H.T.M. van Waesberghe; *Amsterdam/NL (m.busard@vumc.nl)*

Purpose: Abdominal wall endometriosis (AWE) is defined as endometrial tissue superficial to the peritoneum. AWE is often difficult to diagnose, mimicking a broad spectrum of diseases. The aim of this study is to describe appearance of AWE on magnetic resonance (MR) imaging.

Methods and Materials: MR imaging included T2-weighted imaging and T1-weighted imaging with fat suppression. To assess the value of diffusion-weighted imaging (DWI) in endometriosis, 4 patients underwent additional DWI. Apparent diffusion coefficient (ADC) was calculated using b-values of 50, 400, 800 and 1200 s/mm^2.
Results: We present 12 cases of AWE in 10 patients, the largest group presented in literature, in which MR imaging, including diffusion-weighted imaging in 4 patients, was used for the evaluation of suspected or proved AWE. In most cases, the lesion was located ventrally or dorsally to the aponeurosis of the rectus oblique muscle (n = 6) or in the rectus abdominis (n = 5). In one extraordinary case, the lesion was located in a herniation of the abdominal wall. MR imaging of AWE lesions showed isointense or slightly hyperintense signal compared to muscle on T2-weighted images and isointense or slightly hyperintense signal compared to muscle on T1-weighted images with foci of high signal intensity, indicative of hemorrhage. Spontaneous AWE lesions (n = 2) did not appear different compared to AWE lesions located in surgery scars. Mean ADC value of AWE lesions was 0.93 x 10^{-3} mm^2/s.
Conclusion: MR might be a useful imaging modality to determine the location and depth of infiltration in surrounding tissue preoperatively.

B-535 11:15
MR imaging in the evaluation of (deep infiltrating) endometriosis: The value of diffusion-weighted imaging

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Purpose: To assess the value of magnetic resonance (MR) diffusion-weighted imaging (DWI) in the evaluation of deep infiltrating endometriosis (DIE).
Methods and Materials: In a prospective single center study, DWI was added to the standard MR imaging protocol in 56 consecutive patients with known or suspected endometriosis. Endometriotic lesions as well as (functional) ovarian cysts were analysed for location, size, and signal intensity on T1-, T2-, and DWI. Apparent diffusion coefficient (ADC) values were calculated using b-values of 50, 400, 800 and 1200 s/mm^2. Statistical analysis included the Spearman correlation coefficient, Mann Whitney U and Kruskall-Wallis test.
Results: A total of 112 lesions (62 endometrial cysts and 48 DIE) were detected, 60 of which were large enough to analyse. Mean ADC values of endometrial cysts (2.14 x 10^{-3} mm^2/s) were significantly lower than ADC values of functional ovarian cysts (1.11 x 10^{-3} mm^2/s; p < 0.001). Mean ADC values of DIE retrocervical, infiltrating the colon and bladder were 0.70 x 10^{-3}, 0.79 x 10^{-3} and 0.76 x 10^{-3} mm^2/s, respectively. ADC values of DIE did not show a significant difference between varying pelvic locations (p=0.63). Moreover, we found a highly significant correlation between ADC values and T2SI ratios in endometrial cysts (r=0.77; p < 0.001).
Conclusion: The results of our study suggest that ADC values of DIE are consistently low, without significant difference between pelvic locations. In addition, in the differentiation between endometrial cysts from other pelvic cysts, ADC values show a comparable diagnostic performance as evaluation of the T2- and T1-weighted images.

B-536 11:24
Female infertility assessment: The role of MR-HSG compared to traditional HSG

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Purpose: Female infertility is commonly caused by uterine or tubal factors. MR imaging is proposed as a morphologic and functional diagnostic tool in comparison to HSG.
Methods and Materials: 18 women (29-38 yo) diagnosed of infertility, after exclusion of MR contraindications, pregnancy, sexually transmitted disease, and obtained informed consent, have been submitted to pelvis MR (Sonata Siemens, Erlangen, Germany) with morphologic sequences (FLASH 2D T1w axial, TSE T2w axial and TSE T2w HR sagittal) and with dynamic 3D FLASH T1-weighted during intrauterine administration of 15 cc of a gadolinium contrast 0.5M/saline solution 1:100 (3D dMR-HSG). The images have been then blinded evaluated by two MR and HSG experienced radiologists and compared to HSG results, performed later, considered as a gold standard.
Results: In 3 patients, the catheter dislodged into the vagina during the contrast injection. In 6 patients, the catheter has been misplaced into the uterine cavity. Nonetheless, in 11/18 patients Fallopian tube patency has been proved, and patent tubes have been directly visualized in 6 patients with 3D dMR-HSG. In 14 patients, traditional HSG showed tubal patency; in 4 patients, tubal blockage has been found, as like as in 3D dMR-HSG (Sens 100%, Spec 78.6%, Accuracy 83%, PPV 57%, NPV 100%).

Conclusion: 3D dMR-HSG is a less painful and ionizing radiation free imaging method allowing assessing the uterine morphology and tubal patency. In comparison to traditional HSG it showed high negative predictive and sensibility values to propose it as a first line diagnostic tool in infertility workup.

B-537 11:33
Magnetic resonance imaging in the evaluation of placental abruption: Correlation with color Doppler ultrasound

G. Masselli, R. Brunelli, E. Polettini, E. Casciani, M. Anceschi, G. Gualdi; *Rome/IT (gabrielemasselli@libero.it)*

Purpose: To prospectively compare the value of pelvic ultrasound with color Doppler and MRI in the detection of placental abruption.
Methods and Materials: 60 pts in the third trimester of pregnancy (mean age 31 years; range 22-36 years) with vaginal bleeding and pain underwent pelvic and transvaginal color Doppler US and MRI, performed the same day. Multiplanar HASTE, True Fisp, DWI and 3D T1 GRE sequences were acquired at 1.5 T scanner. Images were interpreted prospectively by two reviewers, who were blinded to results of US. Interobserver agreement was assessed using k-statistics. The results determined by US-doppler and MRI were evaluated for the presence and the topographic level of the marginal, retroplacental end preplacental abruption and were correlated with the surgical results and clinical follow-up (gold standard).
Results: US ruled out correctly the diagnosis of placental abruption in 4/11 (36%) cases. MRI ruled out and correctly identified the diagnosis of in all 11/11 (100%) cases. 3D T1 GRE and DWI sequences were able to visualize the placental abruption in all 11/11 (100%) cases in comparison with HASTE and True Fisp in 8/11 (72%) 9/11 (81%) cases, respectively.
An almost-perfect interobserver agreement of MRI examinations was found (weighted k statistic value of 0.92). A highly significant difference (P < 0.001) between MRI and US-Doppler in detecting the presence of placental abruption was found.
Conclusion: MR is an accurate and reproducible method in evaluating placental abruption. Our results point out that MR is superior to ultrasound with color Doppler in depicting placental abruption.

B-538 11:42
MR imaging in the evaluation of pregnant patient with acute abdominal pain

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Purpose: The diagnosis of pelvic conditions during pregnancy can be challenging. The aim was to assess the performance of MR imaging in the evaluation and triage of pregnant patients presenting with acute pelvic pain.
Methods and Materials: 95 pregnant patients who underwent MR examination because of acute pelvic pain were included in this prospective study. A US examination was performed in all patients before MR. Multiplanar HASTE, TRUE FISP and GRE MR images were obtained on 1.5 T Scanner. The prospective clinical MR interpretations were compared with follow-up and surgical records to determine the correctness of the interpretation.
Results: MR examinations demonstrated abnormalities in 37 patients: adnexal lesions (n = 4), ovarian torsion (n=1), urinary pathology (n = 5), degenerating fibroid (n = 3), placenta abruption (n=7), DVT (n = 2), hernia (n = 1), colitis (n = 1), thick terminal ileum (n = 1), rectus hematoma (n = 1), appendiceal abscess (n=1), appendicitis (n=3), intraabdominal and rectus muscle abscess (n=1), intussusception (n=1), ulcerative colitis (n=1), Crohn's disease with diffuse peritoneal inflammation (n=3), pubic condrosarcoma (n=1). The sensitivity, specificity, accuracy, positive predictive values (ppv), and negative predictive values (npv) of MR imaging were 90.0 vs. 88.9%, 98.1 vs. 95.0%, 97.5 vs. 94.1%, 81.8 vs. 76.2%, 99.1 vs. 97.9%, respectively.
Conclusion: The intrinsic safety of MRI and its ability to accurately show pelvic disease in pregnant patients make it highly useful in the evaluation of these patients.

B-539 11:51
MR-guided focused ultrasound surgery of uterine fibroids: Initial clinical experience of a single European center

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Purpose: To assess technical outcome and clinical response of magnetic resonance imaging-guided focused ultrasound surgery (MRgFUS) of symptomatic uterine fibroids.
Methods and Materials: Between 06/2008 and 04/2009, MRgFUS (ExAblate 2000, InSightec, Haifa, Israel) treatment was performed in 41 women (42±6 y; range 26-55 y) with symptomatic uterine fibroids under conscious sedation. MR

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images obtained before (T2w FSE) and immediately after the treatment (T1w FSE fs with i.v. gadolinium) were used to calculate the number and total volume of uterine fibroids, and the non-perfused volume (NPV) of the treated fibroids, using a standard sum of the slices method. The NPV ratio (%) was calculated as the ratio of the sum of NPV of all treated fibroids divided by the total volume of all uterine fibroids, respectively. Clinical response was assessed with the symptom severity scale (SSS) of the Uterine Fibroid Symptoms Quality-of-Life Questionnaire obtained at baseline and 3 months after treatment. Mean change of the SSS was analyzed using a paired t-test.

Results: MRgFUS treatment was well tolerated by all women. No major complications occurred. Average (MV±SD) number and total volume of fibroids visualized on pre-treatment MR images were 3.2±3.0 (range, 1-10) and 227±192 mL (range, 8-719 mL), respectively. A mean of 2.2±1.9 (range, 1-7) fibroids were treated per patient. Mean NPV was 59.1±19.0% (range, 34.8-100%). Transformed SSS decreased significantly (p <.001) from 62.7±12.7 at baseline to 35.5±10.8 after 3 months.

Conclusion: Our results show that MRgFUS is a safe and effective treatment alternative for symptomatic uterine fibroids, resulting in early and significant symptom relief.

10:30 - 12:00	Room F2

Breast

SS 1202

New developments in breast MRI (part 1)

Moderators:
R.M. Mann; Nijmegen/NL
R. Salvador; Barcelona/ES

B-540 10:30

Lymph-node staging in MR-mammography using an extended scanning protocol: Initial results and diagnostic accuracy in a prospective study of 56 patients

P.A.T. Baltzer, M. Dietzel, T. Vag, M. Gajda, O. Camara, W.A. Kaiser; *Jena/DE*

Purpose: Level-of-evidence is high for accurate preoperative local staging by MR-mammography (MRM). However, knowledge on diagnostic-accuracy of MR-mammography for lymph-node staging (N-staging) is fragmentary. This prospective study was conducted to: (1) design an extended MRM-protocol for combined local and N-staging of breast-cancer using a dedicated whole body scanner and (2) identify diagnostic accuracy of MRM for N-staging.

Methods and Materials: 56 consecutive patients with breast cancer underwent MRM (1.5 T; indication: preoperative local staging) with subsequent surgicopathological N-staging. A dedicated protocol was designed to allow local and N-staging at one step without repositioning the patient (axial: dynamic contrast-enhanced T1w, T2w images covering the whole breast; coronal: T2w, T1w-VIBE covering the whole breast and thorax; TA: 10 minutes). Two experienced radiologists (> 1000 MRM; > 3000 MRI; blinded to histopathological outcome) interpreted the most suspect lymph-node of the ipsilateral axilla in consensus applying predefined descriptors: Margin (irregular), Internal-structure (hetero/homogenous), Nodular-thickening, Infiltration, Edema (Perifocal), Hilus-sign, Rim-enhancement and Solbiati-Index. Binary logistic-regression analysis was performed combining these descriptors; it was followed by receiver-operating characteristics analysis (ROC) to quantify accurate N-Staging as Nodal-positive (N+) or Nodal-negative (N-).

Results: 59 Axillae were evaluated, as 3 patients had bilateral breast-cancer. There were 17 N+ and 42 N-. ROC analysis revealed significant potential (vs. AUC: 0.5; P < 0.0001) to differentiate N- from N+ (AUC: 0.88; CI: 0.77-0.95). Appropriate cut-off values demonstrated sensitivity of 87.5%, specificity of 80.5%.

Conclusion: Applying the given protocol accurate N-staging was possible. This demonstrates the potential of MR-mammography beyond differential diagnosis and preoperative local tumor staging.

B-541 10:39

Quantitative MRI technique for mapping the T1/T2 ratios of benign and malignant breast lesions

M.A. Malikova, J.N. Tkacz, P.J. Slanetz, A. Aakil, H.J. Jara; *Boston, MA/US (mmalikov@bu.edu)*

Purpose: To apply a quantitative MRI technique to obtain T1/T2 ratios for benign and malignant breast lesions.

Methods and Materials: This is a cross sectional study of subjects scheduled to undergo conventional MRI at Boston Medical Center (BMC). This study is approved by BMC Institutional Review Board. Informed consent was obtained prior to any research procedures. Participants were asked to undergo additional 2-10 minutes quantitative MRI (Q-MRI) sequence after conventional MRI is completed. Forty-one females with 46 known or suspected breast mass or lesion were analyzed. Post menopausal status, age, hormone therapy and contraceptives use were recorded. All images were obtained between days 5-10 of menstrual cycle for menstruating women in order to have consistency in MRI data. Images obtained with the mixed-TSE pulse sequence in the coronal plane of the entire breast were post-processed for generating T1 and T2 distributions, which were spatially co-registered. These were used as input for a T1/T2 ratio algorithm for targeted benign and malignant breast lesions.

Results: There is a significant difference in the T1/T2 ratios of benign and malignant breast lesions using Q-MRI (p=0.025).There is also a significant correlation between higher T1/T2 ratio and higher stage of breast cancer determined by histopathology analysis (p= 0.009). Estrogen and progesterone receptors negative status was correlated with higher T1/T2 ratio p=0.060 and p=0.043, respectively. Her2/neu receptor status showed no statistically significant correlation with T1/T2 ratio (p=0.151).

Conclusion: We have successfully applied a Q-MRI technique to evaluate the T1/T2 ratios of benign and malignant breast lesions.

B-542 10:48

Diffusion tensor imaging (DTI) of the breast: Preliminary results of a prospective study on 68 patients

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Purpose: Diffusion weighted imaging has shown a diagnostic value for lesion discrimination in breast MRI. Diffusion Tensor Imaging (DTI) is able to add further information about tissue microstructure describing the three-dimensional shape of diffusion inside a voxel.This investigation on DTI of the breast was performed in order to assess its technical feasibility and diagnostic accuracy for lesion differentiation.

Methods and Materials: 68 patients (mean age 54±16 y) with enhancing lesions in breast MRI (1.5 T) were prospectively investigated using a unilateral DTI sequence (TR 8900 ms, TE 139 ms, 2b values, 6 directions). ADC (Apparent Diffusion Coefficient) as well as FA (Fractional Anisotropy) maps were calculated. ADC and FA values were measured using Regions of Interest (ROI) and compared by nonparametric statistics (Mann-Whithney-U). Receiver Operating Characteristics (ROC) analysis was applied to assess the accuracy of lesion differentiation of ADC and FA measurements.

Results: DTI was technically successful in 60 patients (88.2%) with 73 lesions (56 malignant, 17 benign). Mean ADC values were significantly (P < 0.001) higher in benign (1.56*10-3 mm²/s) compared to malignant (0.85*10-3 mm²/s) lesions whereas FA values were lower in benign (0.17) compared to malignant (0.27) lesions (P=0.001). In ROC analysis, the area under the curve (AUC) for ADC and FA values was 0.901 ±0.056 and 0.756 ± 0.073, respectively.

Conclusion: DTI of the breast was feasible in a majority of cases, leading to quantitative data for lesion discrimination. Not only quantitative diffusibility but also diffusion direction differs significantly between benign and malignant lesions.

B-543 10:57

Role of magnetic resonance imaging (MRI) in the planning of breast conservation surgery in patients with Paget disease of the nipple

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Purpose: To evaluate the role of magnetic resonance imaging (MRI) in the planning of breast-conservation therapy (BCT) in patients with Paget disease of the nipple.

Methods and Materials: 14 patients with biopsy-proven Paget disease of the nipple underwent preoperative mammography and breast-MRI which was performed at 1.5 T using a bilateral breast surface coil. Imaging was obtained in the axial plane using a T2-weighted STIR sequence and 3D dynamic T1-weighted gradient-echo sequence acquired before and after the administration of gadobenate dimeglumine at 0.1 mmol/kg. All patients subsequently underwent surgical intervention.

Results: Surgical pathology identified underlying cancer in 12/14 (86%) patients: 7 DCIS, 3 IDC and 2 DCIS with microinvasion. Ten patients underwent BCT, 2 underwent mastectomy for multifocal disease. 2 patients had positive sentinel lymphnode (SLN) biopsy. 1 patient had a papilloma and the other no-underlying lesions. Mammography detected only 1 case of IDC, because of a small cluster of associated microcalcifications. Breast-MRI identified 12/12 (100%) cancers, demonstrating the extent of disease in all patients. In all 14 patients, breast-MRI identified abnormal nipple enhancement with a thickened nipple-areolar complex and washout kinetics. Furthermore, MRI identified irregular enhancement of enlarged axillary lymphnodes in the 2 patients with axillary metastases.

Conclusion: Breast-MRI is the most accurate technique for assessing the extent of disease in patients with biopsy-proven Paget disease. The possibility to identify otherwise occult lesions aids the surgeon in planning BCT. Breast-MRI should be introduced as the modality of choice in the management of patients with Paget disease.

B-545   11:06
MR imaging in patients with nipple discharge: Should we recommend it?
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Purpose: To compare Contrast-Enhanced Magnetic Resonance Mammography (CEMRM) with mammography and ultrasonography in patients with nipple discharge.
Methods and Materials: between March 2007 and July 2009, 38 women with nipple discharge underwent mammography, ultrasonography and 1.5 T-CEMRM in our department. 23 patients underwent cytological analysis of secretion material, 21 core-biopsy (17 with subsequent excision), 17 were followed-up (mean follow-up: 18 months). Imaging findings and histological diagnosis were compared. Statistical differences in overall sensitivity between CEMRM and both mammography and ultrasonography were assessed with a two-tail Fisher-Exact test.
Results: A malignant lesion was found in 5/38 patients (13.16%; 3 invasive, 2 intraductal; 4 ipsilateral, 1 controlateral to nipple discharge), a High-Risk Lesion (HRL) was found in 14/38 (36.84%; 12 papillomas, 1 papilloma with LCIS, 1 sclero-elastotic lesion; all ipsilateral). 19/38 (50%) patients with negative imaging and benign (7/19) or probably benign (6/19) cytological analysis of secretion material were followed-up. Of 19 patients with neoplasm or HRL, CEMRM found 5/5 cancers and 13/14 HRL (overall sensitivity: 94.74%). 3/5 cancers (1 invasive, 1 in-situ, 1 invasive controlateral) and 2/14 HRL were detected by CEMRM only. Mammography identified 2/5 cancer and 3/14 HRL (overall sensitivity: 26.32%). Ultrasonography identified 1/5 cancer and 11/14 HRL (overall sensitivity: 63.16%). 1/14 HRL was detected by ultrasonography only. Compared to mammography and ultrasonography, CEMRM showed higher overall sensitivity, with a statistically significant difference (p < 0.0001, p=0.0422, respectively).
Conclusion: In women with nipple discharge, CEMRM is more useful than mammography and ultrasonography, and should be recommended when conventional imaging is negative.

B-546   11:15
The effect of neoadjuvant chemotherapy in breast cancer: Correlation of MR imaging and histopathological response according to hormonal status
S. Song[1], O. Woo[1], K. Cho[1], B. Seo[2], A. Yi[2], E. Kang[1]; [1]*Seoul/KR*, [2]*Ansan/KR (akaeuny@hanmail.net)*

Purpose: Contrast-enhanced (CE) MR imaging was used to monitor the response of neoadjuvant chemotherapy (NAC) in breast cancer patients. The purpose of our study is to assess the role of breast MRI in the evaluation of NAC outcome by correlating MR image findings with histopathological response according to hormonal status.
Methods and Materials: 47 consecutive patients who received surgical treatment for primary breast cancer after receiving NAC were reviewed. CE MRI before and after NAC were available in 42 patients. The 42 patients were divided into an ER positive group, an HER-2 positive group or a triple negative group (ER, PR and HER-2). Two radiologists assessed the response to NAC using CE MRI images on consensus.
Results: In total, 42 patients with 48 breast cancers were studied. Tumor characteristics showed as follows: histologic grade 3 (62%): ER positive (29%): HER-2 positive (48%): triple negative (23%). Histopathologically response was as follows: complete response (CR) (29%); partial response (58%); no response or disease progression (13%). MRI diagnosed 20 cases with CR, and the accuracy for predicting CR was 58% in ER positive, 100% in HER-2 positive, and 50% in triple negative cancer. There was agreement between CE MRI findings and the pathology findings in 79%.
Conclusion: CE MRI of breast cancer proved to be a reliable method in predicting histopathological response to NAC. CR determined by MRI was highly correlated in Her-2 positive patients, but had a high false-positive rate in ER positive and triple negative cancer patients.

B-547   11:24
Differential diagnosis of breast lesions ≤5 mm: Is there a role for MRI?
M. Dietzel, P.A.T. Baltzer, T. Vag, T. Gröschel, M. Gajda, O. Camara, W.A. Kaiser; *Jena/DE*

Purpose: According to MRI-BIRADS, FOCI are small enhancing lesions ≤5 mm in diameter. This study was conducted to: (1) Assess morphologic and dynamic profiles in malignant vs. benign FOCI in breast-MRI (MRM). (2) Identify overall diagnostic-accuracy of MRM for differential diagnosis of FOCI.

Methods and Materials: This study was approved by the local IRB; all patients gave written consent. All MRM performed at our institution over a consecutive 12 year-period (T1w-FLASH; 0.1 mmol/kgBW Gd-DTPA; T2w-TSE;) were prospectively evaluated by two experienced (> 500 MRM) radiologists in consensus applying 17 predefined descriptors. A dataset was created by extracting all lesions ≤5 mm with histological verification after MRM (benign: 27; malignant: 61). (1) Accuracy of individual descriptors was assessed (Crosstabs, Chi-Square-test; L+/L-: positive/negative Likelihood-Ratios, DOR: Diagnostic Odd's-Ratio). (2) Binary logistic-regression analysis was applied to calculate overall diagnostic-accuracy using all descriptors combined (ROC-characteristics; AUC-analysis).
Results: Individual descriptors: wash-out was typically associated with malignancy (P: < 0.05; DOR: 3.5). Irregular shape was feasible for differential diagnosis of FOCI (DOR: 7.3), yet a majority of malignancies demonstrated round shape (55.6%). Additional descriptors such as Blooming- (DOR: 4.0, LR+: 2.8), Adjacent-Vessel- (DOR: 4.8, LR+: 4.5) and Root-Sign (DOR: 5.6; LR+: 4.1) showed high accuracy. Overall accuracy: AUC was 0.89 for differentiation of benign vs. malignant FOCI (P: 0.0001).
Conclusion: Assessment of dynamic and morphologic profiles in FOCI ≤5 mm was feasible. Using all 17 descriptors combined, high potential for differential diagnosis of FOCI in MR-Mammography could be identified.

B-548   11:33
Breast MRI: A pilot study estimating sensitivity and specificity of unenhanced MR-mammography (DWI combined with T2w-TSE imaging, ueMRM) for the differentiation of mass lesions
P.A.T. Baltzer, M. Benndorf, M. Dietzel, T. Vag, M. Gajda, O. Camara, W.A. Kaiser; *Jena/DE (pascal.baltzer@med.uni-jena.de)*

Purpose: For a long time, only techniques using contrast agent were considered for breast MRI. The purpose of this study was to identify sensitivity and specificity of a contrast agent free diagnostic approach combining only DWI with T2w images (unenhanced MR-mammography, ueMRM) and compare the results with contrast enhanced MR-mammography (cMRM).
Methods and Materials: Consecutive recruited patients undergoing histopathological verification of mass lesions after breast MRI (dynamic contrast enhanced T1w gradient echo, T2W-TSE, TIRM and EPI-DWI sequences) during a 15 months period were eligible for this institutional review board approved retrospective investigation. Exclusion criteria were medical interventions concerning the breasts before MRI. Two blinded observers, one experienced and one trained in breast MRI, first rated ueMRM and then cMRM according to the BIRADS scale. Lesion size, ADC values and T2w-TSE descriptors were assessed.
Results: 81 mass lesions (27 benign and 54 malignant) were enrolled in this study. Sensitivity of ueMRM was 93% (observer 1) and 86% (observer 2), respectively. Sensitivity of cMRM was 96.5% (observer 1) and 98.3% (observer 2). Specificity was 85.2% (ueMRM) and 92.6% (cMRM) for both observers. The differences between both methods and observers were not statistically significant (P≥0.09). Lesion size measurements did not differ significantly between all sequences analyzed. Tumor visibility was significantly worse using ueMRM for benign (P < 0.001) as well as malignant lesions (P=0.004).
Conclusion: Sensitivity and specificity of ueMRM equals that of cMRM. However, although statistically not significant, a higher absolute number of false findings were seen in ncMRM.

B-549   11:42
Influence of clinical data in the evaluation of breast MRI: Intra and inter-observer variability of BI-RADS
M. Angeletti, V. Barra, N. Ravazzolo, I. D'Ambrosio, P. Lodise, L. Ballesio; *Rome/IT*

Purpose: The aim of our study is to assess whether and/or how the knowledge of clinical information and the mammography and US consultation could influence the final assessment categories of the breast BIRADS.
Methods and Materials: Two radiologists (A, B), reviewed separately 101 breast MR cases in two different step. Exclusion criteria have been previous surgery, and NACT. Cases selected, on the basis of BIRADS classification, were divided into two categories: -Patients with BI-RADS 1-2-3: who will perform a follow-up at 24 months; -Patients with BI-RADS 4-5: who will perform a histological examination. The observers relieved all examinations unaware of the clinical information and of the mammography and US images. The radiologists have subsequently compared the results obtained with those coming from the interpretation effected with the knowledge of the clinical data and of those instrumental ones. Masses were classified according to the BIRADS. Inter- and intraobserver agreement were calculated using Cohen's K.
Results: Intraobserver agreement for the radiologist A was 0.72 (substantial) while B was 0.78 (almost perfect). Then the agreement between A and B resulted 0.58

Sunday

(moderate) without and 0.84 (almost perfect) with clinical data. The study was considered to be statistically significant with a P < 0.05.

Conclusion: Clinical data help in the breast MR diagnosis, reducing the false positive, in fact the agreement between the radiologist A and B was almost perfect with clinical indication while it is moderate without.

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

Contrast Media

SS 1206

Gadolinium contrast: Safety issues

Moderators:
G. Frija; Paris/FR
Y.W. Nielsen; Herlev/DK

B-550   10:30

Activation of NFκB in differentiated normal human macrophages by the gadolinium-based magnetic resonance contrast agent, omniscan: A link with the pathogenesis of nephrogenic systemic fibrosis (NSF)
P.J. Wermuth, F. Del Galdo, S. Addya, P. Fortina, S.A. Jimenez; *Philadelphia, PA/US (sergio.jimenez@jefferson.edu)*

Purpose: NSF is a generalized progressive fibrotic disorder occurring in patients with renal insufficiency exposed to gadolinium based contrast agents (GdBCA). Here, we studied the effects of Omniscan on the expression of NFκB pathway associated transcripts and the activity of the NFκB pathway in differentiated normal human macrophages.
Methods and Materials: Normal human buffy coat monocytes were differentiated into macrophages with IL-10 and M-CSF, exposed to 50 mM Omniscan, and gene expression analyzed employing Ingenuity software. Nuclear localization of activated NFκB was assessed by immunohistochemistry and confocal microscopy. Induction of NFκB dependent respiratory burst was monitored by iNOS determination. The role of NFκB activation was evaluated utilizing an NFκB inhibitory cell permeable peptide.
Results: Omniscan (50 mM) caused strong activation of the NFκB pathway with induction of numerous chemokines and interferon-response genes downstream of NFκB and rapid NFκB nuclear localization (5 min) which was blocked by pre-incubation with the NFκB inhibitory peptide. Omniscan also induced an NFκB dependent increase in iNOS production. Blocking NFκB activation decreased the production of several NFκB pathway chemokines including CCL2/MCP1, CCL8/MCP2 and CXCL10/IP10.
Conclusion: Omniscan induced potent NFκB activation in normal human macrophages as evidenced by profound changes in global gene expression, rapid NFκB nuclear localization, and production of numerous proinflammatory/profibrotic chemokines. NFκB pathway activation was further documented by the induction of NFκB dependent iNOS production. Activation of the NFκB pathway may represent a pivotal event in the pathogenesis of NSF and is an attractive target for therapeutic intervention.

B-551   10:39

Intravenous versus intraarticular delayed gadolinium-enhanced magnetic resonance imaging (dGEMRIC) in the hip
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Purpose: The purpose of this study was to investigate if T1-mapping of hip joint with intraarticular (ia)-dGEMRIC is comparable to the intravenous (iv)-technique (that is already well-established) for assessing different grades of cartilage degeneration.
Methods and Materials: The study cohort consisted of 53 patients with symptomatic femoroacetabular impingement (FAI). Patients were randomly recruited for either iv-dGEMRIC (26) or ia-dGEMRIC (27) studies. For T1 assessment, a dual flip angle (FA) 3D gradient echo (GRE) sequence was used 60 minutes post Gd-DTPA2- administration: (0.78 mm³). T1 could be measured in seven consecutive radial reconstructed regions from anterior to posterior and compared to morphology.
Results: Iv-dGEMRIC T1 mean values in FAI patients varied statistically significant in regions with different extents of cartilage damage (p-values < 0.001). Ia-dGEMRIC T1 mean values in FAI patients also varied statistically significant according to the extent of cartilage damage (p-values: 0.002, < 0.001). Both iv-dGEMRIC and ia-dGEMRIC revealed no significant difference between normal-rated regions and regions with cartilage damage ≤ 0.75 cm. There was no significant difference between iv-dGEMRIC and ia-dGEMRIC T1 mean values in all grades of cartilage findings (p-values: 0.394, 0.400, and 0.173).

Conclusion: Our results demonstrate that the information and mapping values obtained by the ia-technique are not much different than those of the iv-technique. In well selected cases, ia-dGEMRIC mapping may be a potential alternative to iv-dGEMRIC in diagnosis of early osteoarthritis.

B-552   10:48

A comparison of the effects of nine gadolinium compounds on cytokine and growth factor expression by normal human peripheral blood mononuclear cells
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Purpose: Nephrogenic Systemic Fibrosis (NSF) is a progressive and generalized fibrotic disorder occurring in some patients with renal insufficiency exposed to gadolinium based contrast agents (GdBCA). Previous studies have shown that Omniscan activated normal human peripheral blood monocytes, causing them to secrete increased levels of profibrotic and proinflammatory cytokines. Here, we examined the effects of nine Gd compounds on inflammatory cytokine and growth factor expression in normal human monocytes in vitro.
Methods and Materials: Buffy coat-derived monocytes were isolated by plastic adherence and exposed to varying concentrations of nine Gd compounds: gadolinium-diethylene triaminepentaacetic acid [Gd-DTPA] (Magnevist), Dotarem®, MultiHance®, ProHance®, OptiMark®, Omniscan®, gadodiamide, Gd-EDTA and Gd-Citrate as well as to caldiamide, the chelate present in Omniscan. Cytokine and growth factor expression levels were assessed by real-time polymerase chain reaction and their production and secretion was determined by multiplex ELISA of culture media.
Results: All Gd compounds induced increased levels of monocyte cytokine and growth factor expression. Gd-DTPA and Omniscan induced the highest levels of IL-6, IL-13, TGF-β and VEGF, Dotarem produced the greatest increase of IL-4, followed by Gd-DTPA and Omniscan. Caldiamide did not induce expression of any cytokine or growth factor, except for minimal increased expression of IL-6 and VEGF.
Conclusion: All the Gd compounds induced potent cellular responses in normal human peripheral blood monocytes, stimulating the production of several proinflammatory and profibrotic cytokines and growth factors capable of initiating and supporting the tissue fibrosis that is characteristic of NSF.

B-553   10:57

Comparative stability of nonionic linear and ionic macrocyclic gadolinium chelates in renally-impaired rats
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Purpose: To investigate the free vs. chelated status of gadolinium in the plasma, skin and bone of rats with impaired renal function after administration of macrocyclic or linear gadolinium chelates (GC).
Methods and Materials: Wistar male rats with subtotal nephrectomy were allocated to single injections of 2.5 mmol/kg of gadodiamide (Omniscan®), gadoterate (Dotarem®) or saline (n = 8 rats/group) for 5 consecutive days. The gadolinium concentration was measured by ICP-MS in skin, cortical bone and plasma at completion of the study (Day 11) and free Gd³⁺ was measured in the plasma at Day 11 (LC-ICP-MS). Relaxometry was measured (Minispec, 60 MHz) in skin (biopsy at Day 4 and at sacrifice) and bone.
Results: At Day 11, the free Gd³⁺ concentration in plasma was < limit of detection for gadoterate and 1.5 + 0.7 µmol/L in the gadodiamide group, corresponding to 62 + 15% of the total gadolinium concentration. In the skin, the r_1 value increased from 4.8 + 0.7 mM⁻¹.sec⁻¹ at Day 4 to 10.5 + 3.9 mM⁻¹.sec⁻¹ at Day 11 in the gadodiamide group, p < 0.05 (r_1 in ex vivo skin: 3.5 mM⁻¹.sec⁻¹) (no change in the gadoterate group). In the bone, it was higher in the gadodiamide group than in the gadoterate group at Day 11 (8.9 + 2.1 and 2.1 + 1.2 mM⁻¹.sec.⁻¹, respectively, p < 0.05).
Conclusion: Our data indicate gradual in vivo dechelation and release of free Gd³⁺ in renally-impaired rats receiving the linear GC gadodiamide, while the macrocyclic GC gadoterate remained stable.

B-554   11:06

Preclinical assessment of Lanthanides potentially being used as X-ray contrast media as a possible trigger for nephrogenic systemic fibrosis (NSF)
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Purpose: Gadolinium-based-contrast-agents have been identified as being possibly associated with nephrogenic systemic fibrosis (NSF). Due to their high atomic numbers, lanthanides such as gadolinium or holmium might be more suitable as

absorbing elements in CT-contrast agents than Iodine. The aim of this preclinical study was to investigate the potential of several lanthanides to induce NSF-like skin lesions in rats. Additionally, the imaging efficacy of lanthanides as CT-contrast agents was assessed in vitro.

Methods and Materials: Han-Wistar rats received single injections of 2.5 mmol Ln/kg (Ln-DTPA-BMA complexes of praseodymium, europium, gadolinium, holmium) into the tail vein on five consecutive days. Animals were examined daily for clinical findings. Afterwards, the Ln-tissue concentrations were measured in different organs. The complex stability was assessed in vitro. X-ray attenuation at different tube voltages was measured in vitro by using a 64-slice CT.

Results: In vitro differences in the complex stability of Pr-, Eu-, Gd- and Ho-DTPA-BMA-complexes were observed. Corresponding differences in Ln-concentration in organ tissues were observed. Three of the four Ln-complexes caused NSF-like skin changes in rats. X-ray attenuation of Lanthanides in CT was up to 50% higher than that of Iodine.

Conclusion: This preclinical study suggests that Lanthanides may be more suitable for higher X-ray tube voltages, particularly for CT and that the stability of Lanthanide complexes may be an important factor in evaluating in vivo safety. Furthermore, the results suggest that the entire class of Lanthanides has the potential to trigger NSF-like skin lesions in rats.

B-555 11:15

Immediate hypersensitivity reactions to iodinated or gadolinated contrast media: Ongoing results of the CIRTACI study, a French prospective multicenter trial

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Purpose: The CIRTACI is a prospective multicenter study exploring immediate reactions after contrast media.

Methods and Materials: Thirty-one investigation centers including allergologists were set in university hospitals. The following data were obtained: - clinical severity according to the Ring and Messmer classification: from grade 1 (diffuse urticaria) to grade 4 (cardiovascular arrest) - plasmatic levels of tryptase and histamin immediately and 2 hours after the reaction - allergological skin tests. Either 5 Gd chelates or 10 iodinated agents were tested. The final diagnosis concerning the culprit contrast agent had to be made between allergic and non-allergic hypersensitivity reaction based on these criteria. The initial diagnosis of the primary investigator on site was compared to the one of a consensus expert panel who reviewed all available cases and interpreted skin tests based on photographs or drawings. The study lasted 4.5 years and was terminated in March 2009. All the cases are still being reviewed by the expert panel.

Results: At the end of the study, 330 patients were included. There were 180 Grade 1, 85 Grade 2, 43 Grade 3 and 6 Grade 4 and 15 undetermined. There were 267 reactions after an iodinated contrast agent, and 48 with gadolinium chelates. Detailed results of the study will be presented at the meeting.

Conclusion: Patients presenting an immediate reaction to a contrast media (either iodinated or gadolinated) should be explored with proper biological and allergological tests in order to elucidate the mechanism.

B-556 11:24

Nephrogenic systemic fibrosis: Have we only seen the tip of the iceberg?

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Purpose: The aim was to identify patients with nephrogenic systemic fibrosis (NSF) among patients with severe kidney disease, to whom MRI scan with gadolinium based contrast agent (GBCA) has been administered at least once at our University Hospital, during the period 01.01.97 to 01.02.09.

Methods and Materials: Case study. 565 patients with kidney disease, who had been exposed to different GBCAs: Omniscan®, Dotarem®, Magnevist®, Vasovist®, Multihance®, and Gadovist® were included in this study. Careful inspection of patient records revealed 32 patients where the suspicion of NSF was raised. The patients have been thoroughly examined by an experienced dermatologist.

Results: Interestingly, 18 patients were diagnosed with NSF, mean age 53 years and subjected to 1-5 consecutive dosages of GBCA. The 18 patients were differently affected with NSF: from minor skin changes to major disseminated lesions, joint restrictions and pain. Among deceased patients there has been a suspicion of NSF in 16 cases. We found three patients where Gadovist or Dotarem seemed to be the main cause of NSF.

Conclusion: This retrospective investigation has surprisingly revealed 18 new cases of NSF (3.2%). As consequence, a national investigation in Denmark is now initiated. Gadovist® or Dotarem® has not previously been the main course of NSF.

B-557 11:33

Effects of gadolinium contrast agents of different stability on viability and collagen production of human fibroblasts

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Purpose: The purpose of this study was to look at the direct effects of gadolinium contrast agents (Gd-CA) of different stability on proliferation and collagen production of human dermal fibroblast.

Methods and Materials: Fibroblasts were cultured in DMEM medium and exposed to a range of concentrations of Omniscan (low stability non-ionic linear chelate, GE Healthcare, USA), Dotarem (high stability ionic macrocyclic agent, Guerbet, France) or Gd-EDTA (very low stability linear Gd-chelate, positive control) for 3 or 7 days. Cell proliferation was assessed by MTT colorimetric assay and collagen production by Sirius Red.

Results: Indicative results were seen at 3 days, but clearly significant results were obtained after 7 days' exposure. Gd-EDTA had 15% stimulatory effect on cell proliferation and collagen production at 0.1 mM but higher concentrations significantly reduced both by 10% at 1 mM and by 80% at 10 mM in comparison to control group (only culture medium). Dotarem at 0.01 to 1 mM concentrations had no marked stimulatory effect, but at 10 mM reduced both proliferation and collagen production by approximately 20%. Omniscan concentrations as low as 0.01 mM stimulated proliferation and collagen production and a maximum increase of 30 - 50% was observed with 1 mM concentration.

Conclusion: The low stability Gd-CA Omniscan had direct stimulatory effects on fibroblast proliferation and collagen production. The highly stable macrocyclic agent Dotarem had no marked stimulatory effects on fibroblasts. The study offers some support for the importance of the stability of Gd-CA in the pathogenesis of NSF.

B-558 11:42 EPOS also

Safety of cardiovascular magnetic resonance gadolinium chelate contrast agents in patients with hemoglobinopathies

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Purpose: To investigate the possible risks of Gd-chelates in a large cohort of patients with haemolobinopathies studied with delayed enhancement cardiovascular magnetic resonance (CMR).

Methods and Materials: We administered Gd-chelates contrast agents in 475 thalassemia/sickle cell disease patients enrolled in the Myocardial Iron Overload in Thalassemia study. Patients > 18 years (N = 426) were injected with gadobutrol (0.2 mmol/kg) and patients < 18 years (N = 49) were injected with Gd-DTPA (0.2 mmol/kg). Kidney function was assessed by means of the Modification of Diet in Renal Disease formula or by Schwartz formula. Nature and severity (mild, moderate and severe) of AEs were recorded in a central database via web and were monitored up to the analysis of the data. The mean time of the follow-up was 13 ± 7 months, and the 28 % of the patients had undergone CMR more than 18 months before.

Results: Among patients injected with Gd-DTPA none manifested AEs. 4 of 426 patients injected with gadobutrol manifested mild AEs (0.84% of study population). The 4 patients were females with a mean age of 35 ± 4.1 years and had thalassemia disease, and 3 of them showed a moderate reduction of GFR. Although 150 (32%) patients injected with Gd chelates had moderate to severe chronic kidney disease, no cases of NFS have been detected to date.

Conclusion: In a large cohort of thalassemia and sickle cell disease patients, the use of gadopentate dimeglumine and gadobutrol in CMR seems to be safe with a risk comparable to general population.

B-559 11:51

Hyperphosphataemia reveals skin lesions in gadodiamide-treated renally-impaired rats

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Purpose: Investigate the clinical consequences of hyperphosphataemia in renally-impaired rats after administration of gadodiamide.

Methods and Materials: Wistar rats with subtotal nephrectomy (n = 7- 8/group) received a normal or high-phosphate diet, allocated to single injections of 2.5 mmol/kg of gadodiamide (Omniscan®) or saline for 5 consecutive days. The gadolinium concentration was measured by ICP-MS in skin and plasma at sacrifice (Day 11) and free Gd^{3+} measured in the plasma at sacrifice (LC-ICP-MS). Daily clinical examinations were performed.

Sunday

Results: At Day 0, the plasma phosphate level was higher in the high phosphate diet group (2.4 + 0.4 mmol/L vs. 1.9 + 0.2 mmol/L, p < 0.01). No skin lesions were observed in the normal diet, gadodiamide-treated group while 4 out of 7 hyperphosphataemic rats showed macroscopic skin lesions. Histologically, epidermal necrosis, increase in dermal cellularity, more abnormalities in dermal collagen fibres and higher TGFβ-1 immunostaining were observed in the gadodiamide + hyperphosphataemia group vs. the gadodiamide and control groups. In the gadodiamide + hyperphosphataemia group, the total plasma gadolinium concentration was higher in rats experiencing skin lesions than in those without lesions (2.4 + 0.2 vs. 1.4 + 0.06 µmol/L respectively, p < 0.01) as well as the free Gd^{3+} concentration (1.1 + 0.08 vs. 0.85 + 0.07 µmol/L respectively, p < 0.05). The skin concentrations of gadolinium were respectively 677 + 183 nmol/g and 443 + 104 nmol/g, NS).

Conclusion: Hyperphosphataemia enhances histological lesions and reveals macroscopic skin lesions associated with an increase in plasma gadolinium concentration in renally-impaired rats receiving gadodiamide.

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

Physics in Radiology

SS 1213

Image reconstruction and post-processing

Moderators:
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B-560 10:30

also EPOS

High temporal resolution dual energy CT of the heart using a hybrid image reconstruction algorithm: Initial experience

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Purpose: Dual energy CT (DECT) has been proposed for the comprehensive assessment of coronary artery stenosis and myocardial perfusion. However, DECT requires reducing the temporal resolution of cardiac studies from 83 to 165 msec. We evaluated a reconstruction algorithm that preserves high temporal resolution at cardiac DECT.

Methods and Materials: 12 consecutive patients with abnormal SPECT underwent invasive coronary angiography (ICA) and cardiac DECT. DECT studies were reconstructed using the conventional algorithm with 165 msec temporal resolution and a hybrid algorithm combining quarter- and half-rotation reconstruction with high- and low-pass filtering techniques, preserving the 83 msec temporal resolution of dual-source CT. Two blinded, independent observers rated all reconstructions for overall image quality and coronary artery motion artifacts. Accuracy for stenosis detection was compared with ICA. DECT and SPECT were compared for perfusion defects.

Results: 204 coronary segments were evaluated. Overall image quality was rated significantly (p < 0.005) better with hybrid reconstruction compared with conventional reconstruction. 57 (28%) coronary artery segments showed motion artifacts with conventional reconstruction, compared with 19 (9%) using hybrid reconstruction (p < 0.001). Compared with ICA, DECT with conventional reconstruction (versus hybrid) had 90% (98%) sensitivity, 94% (96%) specificity, and 93% (95%) accuracy for detection of > 50% stenosis. Compared with SPECT, DECT had 100% sensitivity, 93% specificity, and 93% accuracy for the detection of myocardial perfusion defects.

Conclusion: Hybrid image reconstruction eliminates the previous limitations in temporal resolution of cardiac DECT and strengthens the potential role of this technique for the comprehensive analysis of coronary artery morphology and myocardial perfusion with a single modality.

B-561 10:39

A fully automatic forward projection-based metal artefact reduction method for flat-detector CT

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Purpose: Metal implants cause non-linear artefacts in CT images. We evaluated the efficiency of a fully automatic forward projection-based metal artefact reduction approach for flat-detector CT (FD-CT).

Methods and Materials: First, an initial CT image volume is reconstructed. Second, a raw data-based 3-dimensional interpolation scheme (3D-LI) corrects for the most severe metal artefacts, using a fully automatic metal detection algorithm. Third, a forward projection of the images thus corrected includes lost edge information in the interpolated metal traces and allows for a more precise artefact correction reducing the amount of secondary artefacts. Performance was evaluated by phantom, cadaver and patient measurements on a C-arm FD-CT system (Artis Zeego, Siemens Healthcare, Germany). Data were acquired for tissue-equivalent phantoms and different human body regions. Accuracy of correction (CT value consistency, image noise) was investigated in different regions of interest and by comparison with reference images without metal inserts. Spatial resolution was assessed in corresponding subtraction images.

Results: Metal artifacts were efficiently reduced in all studied cases. Comparison of CT values of the corrected with reference images confirmed consistent CT values (deviations of up to 800 HU were reduced to below 30 HU). Noise reduction was achieved in a similar manner. No significant resolution losses were caused. The fully automatic metal detection proved to be a promising addition without the need of complex parameter adjustment. Comparison to standard 3D-LI showed higher accuracy in CT values and a reduction of secondary artefacts.

Conclusion: MAR can improve the quality of FD-CT images containing metal artefacts.

B-562 10:48

What is an appropriate strength of iterative reconstruction and filter back projection blending on image quality and artifact in abdominal CT?

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Purpose: Our purpose was to assess effect of different levels of blending of ASIR and FBP reconstruction techniques on image quality of abdominal CT.

Methods and Materials: In an IRB approved prospective study, raw data of 22 patients (mean age 60.1 years, M: F 10:12) scanned on 64-MDCT scanner (GE Discovery CT750 HD) were reconstructed at different levels (30, 50, 70%) of ASIR and FBP weighted blending. Each dataset were acquired at 200, 150, 100 and 50 mAs. Images were assessed in blinded randomized manner by two radiologists for image noise, artifacts. SD. and HU were measured in liver and aorta. Data were analyzed using ANOVA tests.

Results: Subjective noise with 70% ASIR-FBP blending was significantly better than at 50 and 30%. No major artifacts were seen, except for mild blotchy pixilated appearance on ASIR 70% images. Objective noise at 30, 50, and 70% of ASIR (11.1 ± 2.9, 9.2 ± 1.9, 7.2 ± 1.9) were significantly lower than FBP (14.4 ± 3.2) for all 22 image sets. Objective noise was measured at three different levels of ASIR 30, 50, and 70 at 150 mAs =15.9 ± 3.6, 13.2 ± 3.3, 10.6 ± 2.8; at 100 mAs= 18 ± 3.2, 14.5 ± 2.2, 11.2 ± 2.1 and at 50 mAs= 25.6 ± 6.2, 20.6 ± 5.8, 16.2 ± 4.6), respectively (p < 0.0001).

Conclusion: At 30-50% ASIR-FBP blending, ASIR technique is suitable for dose reduction of up to 50 mAs for abdomen CT. Higher blending results in minor blotchy pixilation artifacts, careful application of blending is critical to obtain suitable noise reduction.

B-563 10:57

Image quality in dose-reduced CT of the upper abdomen: Potential of an adaptive postprocessing filter

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Purpose: To evaluate effects of a non-linear adaptive post-processing filter (2D-NLAPF) on image quality in dose reduced MDCT of the upper abdomen.

Methods and Materials: MDCT of the upper abdomen was simulated at a 64-slice scanner using a multi-modal anthropomorphic phantom (CIRS, Norfolk, USA). Keeping collimation and pitch unchanged, tube current (100-500 mAs) and tube potential (80-140 kVp) were varied to perform MDCT as high dose (CTDI > 20), middle dose (CTDI 10-20) and low dose (CTDI < 10) level protocols. Four independent blinded radiologists evaluated axial 7 and 3 mm thick images concerning the presentation of "mesenteric low contrast lesions", "liver veins", "liver cysts", "renal cysts" and "big vessels". Subjective image quality of original data and post-processed images using a 2D-NLAPF (SharpViewCT, Linköping, Schweden) was graded on a 5-point scale (from "1" not visible to "5" excellent) and statistically analyzed. Effective dose (E) was estimated using commercial software (CT-EXPO).

Results: For all protocol groups, 2D-NLAPF led to significant improvement of subjective image quality for all examined lesions (p < 0.01), particularly at protocols of middle dose (E: 5-8 mSv) and low dose level (E: 1-5 mSv). A maximal effect was seen in middle dose protocols for "low contrast lesions" (score "3.3" with filter versus "2.5" without) and "liver veins" ("4.5" versus "3.9").

Conclusion: The phantom study indicates a potential of up to 50% dose reduction in MDCT of the upper abdomen by use of a 2D-NLAPF, which should be further examined in clinical trials.

B-564 11:06

also EPOS

Can additional dose associated to magnification mammography be reduced through post-processing? Effect of contrast enhancement on Monte Carlo simulated images

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Purpose: Magnification represents the most common technique to investigate suspicious lesions identified in standard mammograms. It provides improved detail visibility at the expense of an increase in breast dose contributing to an increased risk of radiation-induced cancer. Image post-processing techniques are revealing as a powerful tool for the improvement of mammographic image quality. However, they are frequently underlooked as such optimisation approaches, when applied, usually address full-field mammograms, not magnification images. This study investigates the effect of contrast enhancement on geometrically magnified mammograms.

Methods and Materials: A Monte Carlo simulation model was used to derive mammograms under magnification conditions. A wavelet-based spatially adaptive method for mammographic contrast enhancement was applied to the simulated mammograms and the impact on contrast improvement, noise amplification and contrast-to-noise ratio was investigated.

Results: Results revealed a contrast improvement index for the contrast-enhanced mammograms of approximately 8.4, 6.0 and 1.0 for magnification factors of 1.0, 1.5 and 2.0, respectively. The technique provided improved results for low-factor magnification mammograms (approximately up to 1.4), compared to the corresponding results for higher (approximately 1.8) magnification factor (non-processed) images. This increase in image quality showed that low dose magnified mammograms can be post-processed to evidence image quality characteristics comparable to that associated to unprocessed images produced at higher dose.

Conclusion: The results of this study confirmed an effective benefit of post-processing tools pointing towards the need to further explore their potential to improve image quality, particularly in their application to enhance image characteristics commonly found only through geometrical magnification techniques.

B-565 11:15

Sequence scan reconstruction with improved dose usage and increased scan coverage

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Purpose: To improve dose usage and increase axial coverage for flat detector cone-beam CT sequence scans.

Methods and Materials: We developed a new sequence scan reconstruction method that generates a new virtual scan from the acquired scans which use all rays of all scans to reconstruct a voxel. This leads to a larger overlap region and the possibility to use an axial range which is not reconstructable with the conventional method that simply combines separately reconstructed volumes. Therefore, patient dose is better used. To evaluate our method, we used the Varian OBI flat-detector CT scanner, which has an axial coverage of 169 mm for a single volume. Simulated and measured patient data are evaluated at varying table increment values. Image noise, spatial resolution and artifacts are quantified.

Results: At constant spatial resolution and artifact level, the proposed method allows using a table increment that is up to 21 mm larger than with a conventional reconstruction. Additionally, at constant table increment, the axial overlap region is increased by over 50 mm which leads to reduced noise in the overlap regions.

Conclusion: While retaining image quality and dose the new reconstruction approach allows to increase the scan length or to have an increased overlap region, which leads to improved image quality (in terms of image noise) and therefore to a better patient dose usage.

B-566 11:24

also EPOS

Towards automatic medical image segmentation using shape particle filters

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Purpose: Segmentation approaches based on Shape Particle Filters deliver promising results for the localization of anatomical structures in medical images. They are used for the segmentation of human vertebrae, lungs and hearts, and are especially well suited to cope with the high levels of noise encountered in MR data and overlapping structures with ambiguous appearance in radiographs. They require a region template of the appearance features which allow estimating the confidence in the hypotheses generated during the search. Currently, these templates are created manually, which introduces a bias, and leads to particularly sub-optimal results in complex anatomy.

Methods and Materials: A differential evolution based segmentation scheme where the optimal number of template regions is derived automatically from a set of training images is employed. The method was evaluated using: a) manual and b) automatic region maps on two annotated data sets: 1) hand radiographs, 2) heart MRI slices. The distance between segmentation results and ground truth was measured.

Results: The median/mean/std pixel distance for 1) was: a) 10.12/12.51/9.88 and b) 4.94/7.21/6.92 and for 2) was: a) 5.80/8.96/11.26 and b) 4.36/5.10/3.59. Results using an automatic region map outperformed those with manual region maps in all experiments.

Conclusion: By using automatically derived region maps, the laborious estimation of suitable manual region maps through trial and error is eliminated, paving the way to rapid application of shape particle filters in clinical scenarios. Future work will focus optimal feature selection and extending the method to 3D.

B-567 11:33

Beam hardening correction with spectral imaging on HDCT: A phantom study

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Purpose: To investigate the ability of the Discovery CT750HD (HDCT) with the spectral imaging capability to correct for beam hardening artifacts

Methods and Materials: Two 5 mm diameter cylinders filled with high concentration iodine solutions with CT values of about 2000 HU at 120 kVp were placed 3 cm apart and sandwiched between two saline bags. They were immerged in a water bath and scanned at same CTDI with both the regular helical CT mode at 120 kVp and the spectral imaging mode on HDCT with instantaneous 140 and 80 kVp switching. Images were reconstructed into regular and single energy representation. Five region-of-interest (ROI) were placed between (A: water), below (B: water), on the two sides of (C and D: saline) and in the background (E: water) away from the two iodine cylinders, respectively. The mean CT values and standard deviations from the two image sets within the ROI were measured and compared.

Results: In the regular kVp images, dark band was formed between the two iodine cylinders, with artificial CT number increase or decrease surrounding them. In the single energy (95 keV) images, dark band was totally eliminated with much more uniform overall CT number distribution. The paired CT numbers for the five ROIs with regular and spectral imaging were (-119.8, 5.6), (-16.3, -1.8), (73.0, 15.1), (50.8, 5.8), and (1.5, 0.8), respectively. Average image noise was the same for both images sets.

Conclusion: The single energy reconstruction using spectral imaging on HDCT eliminates beam hardening artifacts and maintains similar image noise.

B-568 11:42

Reduction of radiation dose in CT with an FBP-based iterative reconstruction

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Purpose: To present an FBP-based iterative reconstruction scheme for CT with a high potential for dose reduction at same image noise and sharpness.

Methods and Materials: Based on the Weighted Filtered Backprojection (WFBP) reconstruction for cone-beam CT data, we implemented a WFBP-based iterative reconstruction (I-WFBP) with fast convergence due to a pre-filtration of projection data in the update equation. Image noise and sharpness are controlled almost independently by regularizing update images. The regularization prior is a linear combination of a smoothing and an edge enhancing term. Update images are filtered nonlinearly and anisotropic, achieving contrast dependent sharpness. Moreover, almost any desired target CT noise appearance can be reproduced within the regularization procedure.

Results: The effectiveness of I-WFBP is demonstrated both with simulated and clinical data. Contrast dependent sharpness is verified by evaluating the edge MTF at different contrast levels. Cardiac dual source CT (DSCT) data are evaluated showing the high potential of noise and/or dose reduction and substantial reduction of blooming of calcified lesions. For data from an abdominal scan, we further demonstrate the reduction of radiation dose by 60% while preserving image noise and sharpness.

Conclusion: The results show artefact and significant noise reduction, increased image sharpness at high contrasted objects and dose savings, making I-WFBP a promising candidate for introduction into clinical practice.

Sunday

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

Pediatric

SS 1212

Musculoskeletal and oncology imaging

Moderators:
M.B. Damasio; Genoa/IT
O.E. Olsen; London/UK

B-569 10:30

Normal development and ossification variations of the upper spine: A CT study
G. Karwacki, J.F. Schneider; *Basle/CH (jacques.schneider@ukbb.ch)*

Purpose: To assess the normal ossification variations of the atlas and axis by computed tomography (CT).
Methods and Materials: We retrospectively reviewed craniocervical CT scans in 550 patients (2 days-17 years) with no evidence of cervical spine trauma or malformation. Atlas arches were analyzed on axial scans, and axis parts on at least to perpendicular planes.
Results: Atlas: Two ossified lateral masses are present at birth. Posterior arch ossifies from lateral masses and closure occurs at 5 years. Anterior arch shows three ossification variants: singular midline centre (35%), two symmetric centres (16%), and multiple asymmetric centres (3%). Definitive closure occurs between 4 and 9 years. Persistent medial cleft occurs in 2%. Axis: Five ossified (1-5) and one cartilaginous (6) components are present at birth: two lateral masses (1, 2), a centrally located basal body (3), two centres for the dens already fused (4, 5), and a separate dens tip (6). Disc remnants separate the body from the dens (dentobasal synchondrosis -DBS) and the dens from the tip (apicodental synchondrosis -ADS). DBS and ADS fuse simultaneously with the five axis elements between 7 and 10 years. The dens tip has a heterogeneous ossification pattern, mainly from posterior with assimilation after 11 years.
Conclusion: Ossification of atlas and axis is more heterogeneous than previously described. Normal variants and ossification milestones are important to recognize and differentiate from traumatic lesions.

B-570 10:39

Is routine screening for hip dysplasia with ultrasound indicated in infants born after successful external cephalic version of a breech position?
S.E.H. Cremers[1], A.F. Lambeek[2], G.S. Kooi[1], I. Hellendoorn[1], M.P. den Breejen[1], E.M.J. Brouwers[1]; [1]*Dordrecht/NL*, [2]*Rotterdam/NL (simonecremers@hotmail.com)*

Purpose: Children born in breech position have an increased risk of congenital hip dysplasia (CHD) (3-6/100 versus 1/100 in the general population). We investigated whether infants born after successful external cephalic version of a breech position have an increased risk of CHD.
Methods and Materials: During the period 03/2006 to 10/2008, all healthy pregnant women in our clinic with a baby in breech birth position with a pregnancy duration of more than 34 weeks were included (n = 248). In total, 195 women (79%) underwent external cephalic version. At 3 months, all infants (142 boys, 106 girls) underwent a hip sonography. The α angle was estimated according to Graf's method. Statistical analysis was carried out with the log likelihood ratio test.
Results: In total, 79 (41%) of the 195 women underwent a successful external cephalic version. This means that 79 (32%) of the 248 babies that had been in breech position were born head down. The other 169 (68%) babies were born in breech birth position. Of these, 10 infants (5.9%) had CHD. Of the infants born after successful cephalic version 1 (1.3%) had CHD. This difference was significant (p < 0.001).
Conclusion: Infants who are born after a successful external cephalic version in the third quarter of the pregnancy do not have a greater risk of congenital hip dysplasia. Routine sonographic screening of these infants is therefore not indicated.

B-571 10:48

Influence of professional sports training for development of femoro-acetabular impingement (FAI): MRI and clinical findings in basketball players
F. Ferner, S. Fritsch, K.A. Siebenrock, S. Werlen, T.C. Mamisch; *Berne/CH (mamisch@bwh.harvard.edu)*

Purpose: In order to analyze the influence of elite sports to development of FAI, we investigated clinical and MR findings in young semi-professional basketball players (9 - 18 years) compared to an age matched control group.

Methods and Materials: 76 hips in 40 male basketball players (start of training with latest at 8 years, minimum of 3 workouts each week) were investigated and underwent MRI. For the control group, we chose volunteers not participating in higher level sporting activities (less than 2 hours training a week), without history pain. We assessed history of pain, internal rotation and impingement test. MRI for assessment of alpha angle and head-neck offset was performed using standard hip protocol with radial planes rotating clockwise in 30° intervals around the femoral neck.
Results: The impingement test was positive in 43 and negative in 33 hips. In both groups, internal rotation decreases significant with age (p < 0.001). In the sports group with open physis and all non-professionals the alpha angle remains below normal (55). Within the basketball group, the alpha angle in hips with closed physis was increased at 2, 1, 12 and 11 o`clock position (p=0.035).
Conclusion: We found a significant increase of alpha angle between the elite sports and the asymptomatic group, indicating an influence of elite sports for development femoral changes. These changes occurred at closure of the epiphysis, which has to be further investigated.

B-572 10:57

Ultrasound of Poland syndrome
M. Valle, A. Baban, M. Calevo, M. Torre, P. Tomà, C. Martinoli; *Genoa/IT (maura.valle@libero.it)*

Purpose: Poland syndrome is a multifaceted disorder with a wide range of underdevelopment or absence of the pectoralis complex, the ribs and webbing of the fingers. This paper describes the ultrasound (US) findings in patients with Poland syndrome.
Methods and Materials: We examined n=150 consecutive patients (age range, 8 months to 25 years; mean, 6 years) affected by Poland syndrome with 12-5 and 17-5 MHz US. In each study, US provided information about: 1) status of any of the three heads (clavicular, sternocostal, abdominal) of the PMaj; 2) presence and size of the PMaj tendon; 3) status of the pectoralis minor (Pmin); 4) vessel size and blood flow characteristics from the ipsilateral subclavian, axillary and internal mammary arteries; 5) status of the latissimus dorsi. US data were matched with clinical findings. Statistics were performed with multivariate regression analysis.
Results: Complete agenesis of the PMaj was found in 82/150 cases (bilateral in one). These patients had the highest rate of costal and hand abnormalities. Agenesis of the latissimus dorsi was observed in 5% of them. In other 68/150 cases, the clavicular head of the muscle and a rudimentary tendon were present. An underdeveloped stenocostal head was also detected in 7 of these patients. The Pmin was present in only 4 cases. All patients with destrocardia had partial agenesis of the PMaj. No side difference in blood vessel size and arterial blood flow was observed.
Conclusion: US can complement clinical examination to assess abnormalities of the pectoralis complex in patients with Poland syndrome.

B-573 11:06

Carpal "erosions" in children with juvenile idiopathic arthritis: MRI vs radiography
P. Boavida, L.-S. Ording, K. Rosendahl; *London/UK (pboavida@gmail.com)*

Purpose: To compare MRI and plain radiography in the assessment of carpal depressions in children with JIA and to determine whether these represent destructive changes or normal variation.
Methods and Materials: Twenty-nine radiographs and MRIs obtained on the same day in patients included in an ongoing multi-centre JIA study were analysed. Bone depressions were recorded as either focal or tubular on MRI (3DT1SE weighted sequence) for each of five carpal bones. The radiographs were scored by the same observer in a blinded design. To assess whether the depressions were likely to represent erosions or not, we registered, in a later session, whether there was associated inflammatory (effusion and or pathological synovial enhancement and/or surrounding bone oedema on MRI) or destructive (reduced joint space on X-ray) change.
Results: A total of 61 focal and 112 tubular depressions were identified in 145 carpal bones on MRI of which 23 and 14 were seen radiographically in each group, respectively. Only ten depressions were seen on radiographs alone. 27.9% of the focal depressions and 10.7% of the tubular depressions seen on MR were associated with inflammatory change and/or destructive change, consistent with JIA, while 42.6% of focal and 78.6% of tubular depressions contained vessels. No explanation was found for 21.4% of depressions. Of the depressions seen radiographically, 29.7% had associated findings suggestive of JIA while 54% contained vessels.
Conclusion: Nearly one-fifth of depressions identified on MR and plain radiography were likely to represent destructive erosions with the remainder likely to represent normal variation.

B-574 11:15
Paediatric fracture diagnosis with ultra-low dose CT, a sufficient method?
J.D. Moritz, B. Hoffmann, D. Sehr, K. Keil, J. Eggerking, H. Bolte, M. Heller; *Kiel/DE (joerg.d.moritz@rad.uni-kiel.de)*

Purpose: Due to its high radiation load, CT is used with caution in paediatric radiology. Ultra-low dose CT was checked for paediatric fracture diagnosis and the lowest dose level sufficient for diagnostics was determined.
Methods and Materials: 19 specimens with 51 bones of young pig cadavers were examined. A 64 multi-detector CT was used with 36 different dose levels resulting from systematic alteration of kVp (120, 100 or 80 kVp), mAs (100, 50, 40, 30, 20 or 11 mAs), and pitch (0.9 or 1.5). Two radiologists evaluated the blinded and randomized CT examinations. The criteria examined were the identification of the fracture, the diagnosis of the correct fracture type as well as the dislocation, the diagnostic certainty and the image quality. A success rate of 95% was considered as sufficient.
Results: All but the lowest dose level were sufficient for identification of the fracture. Only two ultra-low dose levels (80 kVp, 11 mAs, pitch 0.9 or 1.5) were insufficient for detection of the fracture type. All dose levels were adequate for the characterization of the dislocation as well as for the overall diagnostic certainty. The lowest dose level, sufficient for diagnostics, was 120 kVp, 11 mAs, and pitch 1.5, its success rate was 96% for the overall result.
Conclusion: Ultra-low dose CT with a CTDIvol of 10% of a standard dose enables a sufficient diagnosis of paediatric fractures.

B-575 11:24
Whole body MRI including DWIBS sequences for disease detection and staging in pediatric oncological patients
S. Savelli, M. Basile, M. Mortilla, A. Tamburrini, M. Aricò, C. Fonda; *Firenze/IT (sarasavelli@hotmail.it)*

Purpose: Whole body MRI provides excellent tissue contrast and morphological information. Moreover, diffusion-weighted imaging (DWI) adds functional information. Our purpose was to assess the overall diagnostic capability of whole body MRI with diffusion-weighted imaging with background body signal suppression (DWIBS) for disease detection and staging in pediatric oncological patients.
Methods and Materials: 24 pediatric patients (14 men, 10 women; age range 4-17 years) with oncological solid tumors (15) or lymphoma (9) prospectively performed a whole body MRI study including short tau inversion recovery (STIR) T2 sequences, DWIBS sequences with multistack acquisitions and T1 sequences before and after Gadolinium injection and fluorodeoxyglucose (FDG) based PET/CT scan. DWIBS images were compared with standard T1 and STIR images using PET/CT images and lung-CT scans as standard of reference. Statistical analysis was performed and diagnostic accuracy assessed. Two experienced radiologists read DWIBS images independently and interobserver agreement was measured.
Results: Whole body MRI protocol provided reliable images in all but two. DWIBS showed a good diagnostic accuracy. Both STIR and DWIBS had high sensitivity for depicting bone and liver metastases but DWIBS provided better tissue contrast than STIR and T1w in detecting lymph nodes metastases. A less diagnostic accuracy was obtained for lung parenchyma metastases and brain metastases with all images. Interobserver agreement was very good for DWIBS.
Conclusion: Whole body MRI protocol provides a whole body examination with lack of ionizing radiation and appears a promising alternative to a multimodality approach with PET/CT, brain-MRI and lung-CT, especially among young patients with oncological diseases.

B-576 11:33
Value of different ultrasonographic modalities (2D, color Doppler, 3D) in pediatric oncology patients with hemorrhagic cystitis (HC)
U. Zaleska-Dorobisz, E. Gorczynska, D.M. Sokolowska, A. Biel, A. Dyla, M. Pietkiewicz; *Wroclaw/PL (a_palka@wp.pl)*

Purpose: To assess the usefulness of 2D sonography, color Doppler and 3D ultrasound in detecting, therapy monitoring and follow- up of haemorrhagic cystitis (HC) in pediatric oncology patients. HC may results in serious complications following allogenic bone marrow transplantation (allo-BMT), chemotherapy, and/or radiation therapy.
Methods and Materials: We analyzed clinical and ultrasound results of examinations in the kidneys and bladder in 89 children with haemorrhagic cystitis both before and after treatment. All of these patients were transplantation of haematopoietic cells recipients. The diagnosis of HC was performed on the basis on 2D, color and power Doppler and 3D sonography. Detailed bladder wall evaluation included: thickness, echogenicity and hypervascularity of the bladder wall, size of the clots. Size of renal pelvis and ureter, renal blood perfusion were evaluated. Correlation with cystoscopic and pathologic findings was presented in selected cases.

Results: All 89 children after allo-BMT revealed HC symptoms between 2nd and 124th day after transplantation. In early HC, the bladder wall was focally thickened, in severe and longer lasting HC the bladder wall was diffusely thickened. 3D was particularly helpful in cases of unclear clinical and 2D picture. Power doppler sonograms showed hypervascularity of the bladder wall while color Doppler demonstrated focal areas of active bleeding.
Conclusion: HC in children after allo-BMT is an extremely severe disease, which, if not cured, is terminal. Color and power doppler sonography are necessary to diagnose HC, to monitor the therapy and to chose the proper method of treatment (invasive or noninvasive).

B-577 11:42
Value of the ultrasonographic evaluation in patients after bone marrow transplantation (BMT) complicated by venooclusive disease of the liver (VOD)
U. Zaleska-Dorobisz, A. Biel, D.M. Sokolowska, A. Dyla, M. Pietkiewicz; *Wroclaw/PL (a_palka@wp.pl)*

Purpose: Hepatic veno-occlusive disease (VOD) is one of the most serious complications following BMT and is associated with a very high mortality. It appears in post-BMT early period when affected children are not candidates for any invasive or long lasting diagnostic procedures. We assessed the usefulness of gray-scale and Doppler ultrasound in detecting, therapy monitoring and follow-up of VOD in pediatric patients after BMT and correlated specific echographic signs related to VOD with clinical criteria of the disease severity and further prognosis.
Methods and Materials: 33 children with diagnosed VOD classified as mild (14), moderate (8), severe (6) and very severe (5). We estimated the correlation between echographic findings (liver echogenicity and measurements, portal flow parameters, splenomegaly, gall bladder wall thickness, patent umbilical vein, ascites) with laboratory and clinical criteria. A statistical analyze was performed.
Results: We found significant correlation between liver size, gall bladder wall thickness and the presence of ascites with clinical severity of the disease. In 40% of children, all these parameters were abnormal. Laboratory parameters of liver showed also important correlation with ultrasound picture, particularly with Doppler criteria. In 57% of children, a reversed flow in portal vein was detected, correlating strongly with clinical outcome and further prognosis.
Conclusion: Conventional ultrasonography of the abdominal cavity accompanied by Doppler assessment is a very sensitive and clinically effective method of VOD assessment. It shows important correlation with clinical and laboratory parameters and has a significant prognostic potential. The method is harmless and uninvasive being an excellent choice in monitoring of the disease.

B-578 11:51
Liver MRI with DWI for early detection of hepatic fibrotic changes in children
S. Savelli, G. Indolfi, A. Ciccarone, M. Esposito, M. Resti, C. Fonda; *Firenze/IT (sarasavelli@hotmail.it)*

Purpose: To evaluate the apparent diffusion coefficient in pediatric patients with liver disease.
Methods and Materials: From May to September 2009, we enrolled 12 pediatric patients (age range 12-19 years, mean 14 years) with liver disease at possible fibrotic evolution (chronic liver infectious disease, Wilson's disease, portal vein thrombosis, biliary atresia) scheduled for liver biopsy. Prior to biopsy all these patients underwent clinical examination, laboratory tests for assessment of hepatic function, US with Doppler evaluation and liver MRI. Liver MRI consisted in standard T1 and T2 weighted sequences and diffusion weighted Echo Planar sequences in three diffusion directions: in order to reduce eddy current and movement artifacts, diffusion images were obtained turning on positive diffusion gradients firstly and negative diffusion gradients secondly for each diffusion direction, for a total of six global gradients in three directions. ADC map was calculated and mean liver ADC value was measured. The results were correlated with laboratory results, clinical score and histological findings.
Results: Histological specimens showed fibrotic changes in 8/12 patients. Laboratory tests detected an abnormal liver function in 4/12. Liver MRI with standard sequences showed an alteration of the signal intensity in 1 patient; DWI sequences showed a low mean ADC value in 6 patients. 5/6 patients with low mean liver adc value had also fibrotic changes at biopsy.
Conclusion: Although preliminary, our results highlight the possibility to detect hepatic fibrotic changes in patients with liver diseases by means of DWI earlier than with standard T1 and T2 sequences.

Sunday

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

Radiographers

SS 1214

Evidence and quality in service

Moderators:
L. Goswell; Poole/UK
C. Hohl; Siegburg/DE

B-579   10:30

A collaborative initiative to develop evidence-based practice in radiographers

N. Richli Meystre[1], S. Ding[1], B. Kiszio[1], O. Emmanuelle[1], A. Ramelet[1], S. Weyermann-Etter[2]; [1]*Lausanne/CH*, [2]*Fribourg/CH (nrichli@hecvsante.ch)*

Purpose: Despite an increasing interest in evidence-based practice (EBP) in many health practitioners, we observe that radiographers rather ask a more experienced colleague than search for research evidence. The lack of time, knowledge, and skills represent important barriers to implement EBP for radiographers as well as for many other health practitioners. The purpose of this presentation is to offer insight in the development of an original initiative, aiming to expand EBP in health professions in the French speaking part of Switzerland.
Methods and Materials: Conscious of the importance and the difficulties to implement EBP in the clinical area, three tertiary health schools with radiology, nursing, midwifery and physiotherapy curriculum and one teaching referral hospital in Switzerland collaborated to develop the "BEST" project (Bureau d'Echange des Savoirs pour des praTiques exemplaires de soins) to assist practitioners in the EBP process. A two-year pilot study is currently conducted to test the feasibility of the different stages of the "BEST" project.
Results: The BEST received numerous questions from practitioners and notably from radiographers, indicating their interest. Several clinical questions were selected, either for a systematic review or for a contextual translation into clinical practice of an existing systematic review.
Conclusion: This presentation illustrates the early stages of the "BEST" project as well as the interests and barriers to EBP for radiographers. With support of project such as the "BEST", radiographers are likely to benefit from the EBP process, from identifying a clinical question, and gathering evidence to the stage of implementation of recommendations.

B-580   10:39

Evidence based practice in paediatric radiography: Improved quality of the radiographic service

N. Kleven-Madsen, M. Namtvedt; *Bergen/NO (nina.kleven-madsen@helse-bergen.no)*

Purpose: Through various systematic activities, we have focused on implementing EBP in radiography. Both the department of radiology and the institute of radiography are committed to continuously implement evidence based practice (EBP) both in teaching and in practical work.
Methods and Materials: Radiographers, students and management systematically planned, carried out and evaluated possible ways of establishing EBP in all diagnostic radiography at the section for paediatric radiography. Action evaluation was used. Development of tools to continuously focus on EBP in radiography as a necessary and integrated part of the service provided by radiographers was demonstrated. Students, radiographers and university librarian cooperated in literature research, procedure evaluation and implementing best available practice; regarding both educational aspects and imaging. Selected areas of imaging were focused on in the project. Students from the 2nd and 3rd year of the bachelor programme in radiography and dedicated radiographers from HUH participated in the project. Project supervision was from BUC.
Results: An overall evaluation showed that much of the established practice was in line with EBP; radiographers are skilled and seek best available methods, but more systematic work is needed to: 1) establish consensus on practice, 2) raise level of awareness of importance of EBP in radiography in particular, and imaging in general, 3) involve and make students accountable during practical placements.
Conclusion: Using EBP in radiography will raise the quality of the service provided by the radiographers, and thus benefit patients. It will also improve the learning environment for students.

B-581   10:48

Ethical dilemmas in radiographer's work in diagnostic radiography

K. Paalimäki-Paakki, A. Henner, S.-M. Ahonen; *Oulu/FI (anja.henner@oamk.fi)*

Purpose: The purpose is to describe ethical dilemmas in radiographer's work in diagnostics. The aim of the study was to create new information since there is comparatively little research focusing on this subject.
Methods and Materials: Data were collected during spring and summer 2008 and consisted of thematic interviews of radiographers (N=8), whose working experience varied from 4 to 31 years. Data were analysed with qualitative inductive content analysis.
Results: Ethical dilemmas were found to consider the use of radiation, patient care, and radiographer's work community. In the use of radiation, implementation of justification and optimisation principles were found to be lacking. Dilemmas in patient care appeared as challenging patients, and as feeling of insufficiency. Dilemmas in work community consisted of problems among employees and insufficient practice. Background factors of these dilemmas were found to be both dependent on and independent of the employee, resulting in worsened well-being at work and seeking for change. Current processing methods of dilemmas were found to be insufficient, and suggestions for better processing methods were made.
Conclusion: Daily ethical considerations were described by respondents, but not recognised as ethical dilemmas. Ethics in work as a concept may seem separate and distant, despite the fact that in most cases, ethical dilemmas occur in everyday situations. Recognition of dilemmas is important in order to be able to intervene in them. Respondents repeatedly described powerlessness and inability to intervene in ethical problems.

B-582   10:57

also EPOS

To explore teaching qualifications of radiography lecturers and teachers across Europe

M.D.J. Davis; *Dublin/IE (michaela.davis@ucd.ie)*

Purpose: To research the teaching qualifications of radiography lecturers and teachers across Europe. To identify the qualifications and requirements for publication before and once in post. To ascertain the range of hours individuals teach across the week. To explore the different requirements needed to remain in lecturing posts across Europe.
Methods and Materials: A self completion questionnaire was devised by members of HENRE Sub group 2 and translated into a variety of languages including Slovenian, French and German. The self completion questionnaires were distributed via the HENRE Website. The results were collected and collated after 3 weeks and subjected to thematic analysis.
Results: Responses were received from 13 different countries. The results revealed that individuals had been working between 2 and 17 years as a radiographer before going into lecturing. Teaching commitments varied between 8 and 40 hours per week. The results revealed varying requirements to publish, maintain CPD, and maintain clinical commitments.
Conclusion: The results demonstrated a vast array of different requirements to obtain and maintain a radiography lecturing post. These included obtaining a further qualification such as a MSC or PhD, as well as teaching qualifications. CPD requirements were also highlighted.

B-583   11:06

Radiography and trauma team

I.-J. Aandahl; *Oslo/NO (Ingrid-Jannicke.Aandahl@hf.hio.no)*

Purpose: Trauma care saves life. It is unknown how radiographers themselves express their role as members of trauma teams and how they conduct radiography. How do they communicate and how do they express their participation while acting professionally in the emergency room? Does the culture govern their behaviour and do symbols have implicit understandings while working in the emergency room?
Methods and Materials: Focus group interviews were carried out with two groups of radiographers at two different hospitals both having numbers of casualties. Transcription was put into categories and analyzed by using four frames outlined in Reframing Organizations: The structural, the human resource, the political, and the symbolic frame by Bolman and Deal (2004).
Results: Radiographers express they are mechanically working within the trauma teams and they experience their role as important, challenging and crucial for patients' outcome. Radiographers communicate mainly with trauma leader. In daily communication with colleagues, radiographers refer to patients as biological units using Latin words for organs and take this culture into the emergency room. Training is given by experienced radiographers teaching students and new colleagues in

A&E and thereby transfer the culture of radiography performances in the profession.
Conclusion: The trauma team was found using single strict hierarchic structure which means one-to-one way communication, from trauma leader to the team members. Radiographers do not involve in patients' suffering; however, see themselves as providers of diagnostics imaging. They are focused on the technology equipment they supervise.

B-584 11:15

The impact of radiographer immediate reporting on patient outcomes and service delivery within the emergency department: A randomised controlled trial

M. Hardy[1], B. Snaith[2], C. Wyton[1]; [1]*Bradford/UK*, [2]*Wakefield/UK*
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Purpose: The introduction of the immediate reporting of trauma radiographs has been advocated by the Audit Commission and radiology and radiography professional body in the UK to reduce image interpretation errors in the emergency department and appropriately inform patient management. In order to establish the impact of the implementation of immediate reporting on patient outcomes and service costs, a multi-centre randomised controlled trial was undertaken.
Methods and Materials: Patients with musculoskeletal injuries were recruited and randomly assigned to immediate or delayed reporting arms on X-ray registration. Assuming a 5% difference in ED recall rates between the groups, a total sample of 1242 patients (90% power) was required. Patient journey time, ED patient recall rates and self re-presentation for same injury were all recorded. Health status was evaluated using the EQ-5D questionnaire and statistical analysis and economic evaluation were undertaken.
Results: This is an ongoing study and initial findings will be presented describing patient attendance and recall statistics across the study arms. Preliminary findings related to errors in image interpretation and their impact on patient management and service delivery will also be explored.
Conclusion: The immediate reporting of musculoskeletal trauma radiographs by radiographers is a natural extension to the current scope of radiographer reporting practice in the UK. However, implementation must be justified and supported by research evidence and resourced appropriately.

B-585 11:24

Do radiologists agree on findings in radiographer-acquired ultrasound exams?

C. Stenman[1], L. Thorelius[2], A. Knutsson[1], S. Jamil[1], Ö. Smedby[1]; [1]*Linköping/SE*,
[2]*Herlev/DK (carina.stenman@liu.se)*

Purpose: The ultrasound method is usually regarded as very observer dependent. A report from a less experienced examiner is considered less reliable, with very limited possibility to re-evaluate the ultrasound examination. A recently introduced method uses documentation with cine loops acquired in a standardized way, resulting in all patients being examined in a similar way, with offline workstation access to the cine loops after the examination. The aim of this study was to evaluate the intra- and inter-observer agreement in offline reading of the standardized cine loops in ultrasound liver examinations.
Methods and Materials: The liver of ninety-eight out-patients was examined by a radiographer using the standardized method. The examinations were read by three different radiologists. When reading the examinations, the radiologists filled out a predetermined protocol. After 4 weeks the reading was repeated, using the same evaluation protocol. The protocols were compared for intra- and inter-observer agreement.
Results: For focal changes, which were found in 13-26%, the agreement between observers was 82-96% (kappa 0.37-0.85) and the intra-observer agreement 88-97% (kappa 0.67-0.89). For increased echogenicity, seen in 38-42%, inter-observer agreement was 70-84% (kappa 0.51-0.74) and the intra-observer agreement 70-91% (kappa 0.51-0.86). For polyps in gallbladder, seen in 5-14%, inter-observer were 88-99% (kappa 0.48-0.93) and the intra-observer agreement 92-97% (kappa 0.57-0.86).
Conclusion: The result in this study shows a fairly good inter-observer agreement. In general, intra-observer agreement was higher than inter-observer agreement.

B-586 11:33

Work-related musculoskeletal disorders amongst diagnostic medical sonographers: Implications for diagnostic imaging departments

C.M. Moran, L.A. Rainford, M. Mc Caffrey; *Dublin/IE (clairemoran@ucd.ie)*

Purpose: This study evaluated the incidence of work-related musculoskeletal disorders (WRMSDs) amongst diagnostic sonographers and the relationship of these symptoms to ergonomic factors and work practices.

Methods and Materials: Assessment of the work practices of sonographers (n=22, 10 institutes) was performed using standard criteria. Each sonographer also completed a modified Nordic Musculoskeletal Questionnaire, addressing personal attributes, employment information, work habits, musculoskeletal symptomatology and information on management of WRMSDs. The relationship between work habits and musculoskeletal complaints was analysed by logistic regression models adjusted for gender, age, and duration of scans.
Results: The mean number of scans per sonographer per day was 17 while mean time per scan was 18 minutes. 100% of sonographers demonstrated an inadequate ergonomic approach. 91% (n=20) reported scanning in an uncomfortable position due to time constraints. 82% (n=18) complained of WRMSDs (Neck (83%/n=15), shoulder (72%/n=13) and hand/wrist pain (67%/n=12)). All sonographers affected stated that symptoms were worse at the end of the day. The results showed that non-ergonomic work practices and increased time spent scanning were related to WRMSDs. Finally, 96% (n=21) sonographers reported that they had received no formal education relating to ergonomics in ultrasound while only 1 department had an official risk assessment performed on the ultrasound working environment.
Conclusion: There is a high incidence of WRMSDs amongst diagnostic sonographers that may be resulting from increased work load and time pressure. This has significant implications for the operation of modern diagnostic imaging departments and the need to establish ergonomically sound work practices and protocols.

B-587 11:42

Reliability of the image evaluation system PGMI

N. Richli Meystre[1], J.-L. Bulliard[1], C. Ducros[1], E. Guerry[2], V. Ledermann[3],
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Purpose: Many countries used the PGMI (P=perfect, G=good, M=moderate, I=inadequate) classification system for assessing the quality of mammograms. Limits inherent to the subjectivity of this classification have been shown. Prior to introducing this system in Switzerland, we wanted to better understand the origin of this subjectivity in order to minimize it. Our study aimed at identifying the main determinants of the variability of the PGMI system and which criteria are the most subjected to subjectivity.
Methods and Materials: A focus group composed of 2 experienced radiographers and 2 radiologists specified each PGMI criterion. Ten raters (6 radiographers and 4 radiologists) evaluated twice a panel of 40 randomly selected mammograms (20 analogic and 20 digital) according to these specified PGMI criteria. The PGMI classification was assessed and the intra- and inter-rater reliability was tested for each professional group (radiographer vs radiologist), image technology (analogic vs digital) and PGMI criterion.
Results: Some 3,200 images were assessed. The intra-rater reliability appears to be weak, particularly in respect to inter-rater variability. Subjectivity appears to be largely independent of the professional group and image technology. Aspects of the PGMI classification criteria most subjected to variability were identified.
Conclusion: Post-test discussions enabled to specify more precisely some criteria. This should reduce subjectivity when applying the PGMI classification system. A concomitant, important effort in training radiographers is also necessary.

B-588 11:51

Forensic imaging: New challenges for radiographers

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Purpose: Cross-sectional imaging techniques have pioneered forensic medicine. The involvement of a radiographer and formation of "forensic radiographers" allows an improvement of the quality of radiological examinations and facilitates the implementation of techniques, such as sample collections, and the performance of post-mortem angiography.
Methods and Materials: During a period of three months, five radiographers with clinical experience have undergone a special training in order to learn procedures dedicated to forensic imaging. These procedures involved: I). acquisition of MDCT data, II). sample collection for toxicological or histological analyses by performing CT-guided biopsies and liquid sampling, III). post-mortem angiography and IV). post-processing of all data acquired. To perform the post-mortem angiography, radiographers are in charge of the preparation of the perfusion device and the investigated body. Therefore, cannulas were inserted into the femoral vessels and connected to the machine. For angiography, the radiographers had to synchronize the perfusion with the CT-acquisitions.
Results: All five radiographers have acquired new skills to become "forensic radiographers". They were able to perform post-mortem MDCT, sample collection, post-mortem angiography and post-processing of the acquired data all by themselves. Most problems have been observed concerning the preparation of the body for post-mortem angiography.

Conclusion: Our experience shows that radiographers are able to perform high quality examinations after a short period of training. Their collaboration is well accepted by the forensic team and regarding the increase of radiological exams in forensic department, it would be nonsense to exclude radiographers from the forensic-radiological team.

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

Neuro

SS 1211

Stenting and interventional procedures

Moderators:
U. Ernemann; Tübingen/DE
M.H.J. Voormolen; Edegem/BE

B-589   10:30

Stenting in near occlusion of internal carotid artery

M. Aguilar Perez[1], A. Lopez Rueda[2], F. Moniche[1], J. González Marcos[1], A. Mayol Deyá[1], A. Gil-Peralta[1], A. González García[1]; [1]Seville/ES, [2]Lerida/ES (martaaguilarperez@yahoo.es)

Purpose: The management of patients with carotid near occlusion has been controversial over time, in spite of secondary analyses from NASCET and ECST suggesting that these patients do not require urgent surgery. We prospectively evaluated the safety and efficacy of endovascular treatment in these patients.
Methods and Materials: One hundred and nine patients with ICA near occlusion were treated. Most of them were men (84.4%) and mean age was 65.8 years (range 40-82). Ninety-eight patients were symptomatic (89.9%). Fifty-six (51.3%) had ≥ 3 vascular risk factors. Patients were treated if symptoms persisted under treatment, in cases of stroke in evolution, contralateral occlusion, poor colateralization or exhausted vascular reserve. Eight patients (7.3%) had contralateral ICA occlusion and 24 (22.9%) a 70-95% stenosis. In 27 of 80 patients (33.7%), vasoreactivity to apnoea was minimal or absent. Thirty-two patients (29.3%) showed string ring. The collateral flow patterns were via anterior communicating artery in 96 patients (88.1%), posterior communicating arteries in 60 (55%), leptomeningeal flow in 27 (24.8%) and retrograde ophthalmic artery in 28 (25.7%). Stent was placed in 107 patients (98.2%) and distal protection was used in 86 (78.9%).
Results: Thirty-days morbimortality was low, with only 3 TIA (2.8%) and 1 invalidating stroke (0.9%). There was no death or myocardial infarction. Transient hemodynamic changes were common: hipotensión (37.6%), bradycardia (49.5%), asystole (23.2%) and syncope (12.8%), without clinical consequences.
Conclusion: Carotid stenting in patients with carotid near occlusion shows a low morbimortality and should be considered as an efficacious treatment in these patients.

B-590   10:39

Cerebral hyperperfusion syndrome (CHS) after PTA and stenting (CAS) of the internal carotid artery (ICA): Frequency and risk factors

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Purpose: We review our CAS series to evaluate frequency and risk factors involved in CHS.
Methods and Materials: Between 1991 and 2009, 1023 CAS were performed (80.5% symptomatic; mean age 65 years old). Mean arterial pressure during CAS was 102 mmHg.
Results: Nine patients (1%) had CHS after CAS, all of them in the first 48 hours. Imaging presentation (CT) were 3 normal, two cerebral edema, three intraparenquimatous hemorrhage and one subaracnoid hemorrhage. When comparing patients with CHS and without CHS, exhausted cerebrovascular reserve was more frequent (40 vs. 12.5%) but without significance (p=0.1) in the CHS group. The mean age (71 vs 65), mean arterial pressure during the procedure (115 vs 102 mm Hg) and mortality (44.4 vs 0.7%) was more frequent in the CHS group and statistical significance (p> 0.08, p> 0.05 and p> 0.001, respectively). However, sex, clinical presentation, vascular risk factors, degree of carotid stenosis, contralateral carotid occlusion, angiographic characteristics of the stenosis, number of dilatations, and final angiographic result showed no differences between both groups.
Conclusion: CHS after CAS is rare but it has high mortality. The risk factors are elderly patients, exhausted cerebrovascular reserve and high mean arterial pressure during CAS.

B-591   10:48

Prevalence of in-stent wall adherent thrombi directly seen after carotid artery stenting depicted by high resolution CT-angiography: A potential risk for stroke?

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Purpose: Carotid artery stenting (CAS) is an emerging therapy for carotid artery stenosis. However, it is associated with method inherent risk of embolic stroke not only during the interventional procedure but also in the first hours after the intervention. The purpose of the present study was to investigate the prevalence of early in-stent thrombi as potential embolic source.
Methods and Materials: CTA was performed in 50 patients within 3 days after CAS. All patients were pretreated with a combination of 2 antiplatelet agents (Clopidogrel and Aspirin) starting 2 days before the intervention and received intravenous heparin during and for 24 h after the intervention. All patients were examined on a 40-channel MD-CT with 0.67 slice thickness and a matrix of 768x768 after intravenous bolus injection of iodine based contrast medium. Original images and curved, multiplanar reformations were reviewed by two experienced readers for wall-adherent structures within the stent lumen equivalent to thrombi which were classified by size.
Results: CTA detected 7 small and 1 medium sized thrombus within the stent lumen after CAS in 8 out of 50 patients (16%). The patient with the medium sized thrombus experienced a symptomatic stroke.
Conclusion: High resolution CTA is able to depict early in-stent thrombi after carotid artery stenting, which are associated which a certain risk of embolic stroke. Thrombi may be found frequently despite a combination of antiplatelet therapy and intravenous heparin. More aggressive antiplatelet therapy and screening for aspiring resistance might be indicated in this subgroup of patients after CAS.

B-592   10:57

Does stent cell design influence DWI ischemic event rate?

I.Q. Grunwald[1], C. Krick[2], K. Karp[2]; [1]Oxford/UK, [2]Homburg/DE (i.grunwald@web.de)

Purpose: This study examines whether there exists a correlation among closed, semi-closed and open-cell stent design and cerebral ischemic lesions identified by diffusion-weighted magnetic resonance imaging (DW-MRI) after carotid artery stenting (CAS).
Methods and Materials: A retrospective review was conducted of a nonrandomized cohort of 194 patients treated with CAS and evaluated by cerebral DWI before and after the intervention. The mean age of these patients was 68.0 ± 0.6 years and the mean degree of stenosis on the dependent side was 87.2 ± 0.7%. Three stent designs were studied: closed-cell (Wallstent), semi-closed-cell (Smart) and open-cell (Zilver). A non-parametric correlation (Spearman's Rho) was performed between the stent free cell area and the number and area of ischemic lesions found after the intervention. Adverse events and neurological assessment were evaluated.
Results: A significant correlation was found between the stent free cell area and the number and area of new cerebral ischemic lesions detected on DW-MRI (P = 0.023). There were significantly fewer new lesions with an open cell design (Zilver; 12.76 mm² free cell area) than with a closed cell design (Wallstent; 1.08 mm² free cell area). However, there was no significant difference in clinical outcome between the three stent groups.
Conclusion: Open-cell stent design is related to fewer cerebral ischemic lesions after CAS. However, clinical outcome, measured by incidence of adverse events and clinical neurologic assessment, is not significantly different between patients with different stent designs.

B-593   11:06

In hospital complication rates after treatment of intracranial atherosclerotic stenoses using balloon expandable and self expanding stents: Do differences exist?

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Purpose: High complication rates are one of the main hazards of intracranial stenting. Published case series suggest a superiority of self expanding stents (SES) over balloon expandable stents (BES) although no comparative studies exist up to now. We analyzed the data of the European multicentric INTRASTENT registry comparing in hospital complication rates of both devices.
Methods and Materials: The registry contains prospectively and retrospectively collected consecutive cases. Elective treatments of symptomatic atherosclerotic stenoses with > 50% luminal narrowing were included. Clinical events during hospital stay were documented distinguishing nondisabling events (discharge mRS < 2), disabling stroke (discharge mRS >= 2) and patient death. BES and

SES were tested for differences in any of the predefined outcome categories and combined disabling stroke and death rate by means of chi-square-test with a p value cut off < 0.05.

Results: We included 396 patients treated for 409 intracranial stenoses. BES was used 245 times, SES for 155 lesions. Event rates for BES were 5.7% (14) nondisabeling, 3.7% (9) disabeling strokes and 0.8% (2) deaths. After treatment with SES, we saw 5.3% (8) nondisabeling, 5.9% (9) disabeling strokes and 4.0% (6) patient deaths. The differences in complication rates were not significant testing each category separately but combined stroke and death rate was significantly higher using SES (p=0.03).

Conclusion: The data of the INTRASTENT registry do not support the hypothesis that self expanding stents reduce the acute complication rates of intracranial stenting. Purely prospective and randomized studies are needed for further testing of different devices.

B-594 11:15

Revascularization in acute ischemic stroke using the penumbra system

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Purpose: This is the first single center experience illustrating the effectiveness of the Penumbra System (PS) in the treatment of large vessel occlusive disease in the arena of acute ischemic stroke. The PS is an innovative mechanical recanalization device, employed in the revascularization of large vessel cerebral occlusions in patients via the utilization of an aspiration platform.

Methods and Materials: This is a prospective, non-randomized controlled trial evaluating the clinical and functional outcome in 29 patients with acute intra-cranial occlusions consequent to mechanical recanalization. Patients were evaluated by a neurologist and treated by our in house interventional neuro-radiologists. Primary end-points were revascularization of the occluded target vessel to TIMI grade 2 or 3 and functional outcome following the intervention as measured by a decrease in the NIH Stroke Scale (NIHSS) score.

Results: Complete recanalization (TIMI 3) was achieved in 21/29 (72.4%) of patients. Partial recanalization (TIMI 2) was established in 4/29 (13.8%) of patients. Recanalization failed in 4 (13.8%) patients. 19 patients (65.5 %) had a 4 point improvement in NIHSS scores. There were no device related adverse events. Symptomatic hemorrhage occurred in 7% of patients.

Conclusion: The Penumbra System has the potential of exercising a significant impact in the interventional treatment of stroke in the future.

B-595 11:24

Endovascular coiling of very small (≤3 mm) intracranial aneurysms: A single center experience

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Purpose: Endovascular coiling of very small (maximum dome diameter ≤3 mm) aneurysms is considered controversial because of a high risk for procedural rupture and technical difficulty. We report clinical and angiographic results of coiling of these aneurysms.

Methods and Materials: Between August 2005 and July 2009, a total of 297 intracranial aneurysms were selectively occluded with coils. Of them, 44 (15%) aneurysms in 39 patients (13 males and 26 females; mean age: 54 years) were very small. Of 44 aneurysms, 22 (50%) had ruptured and 22 (50%) had not ruptured. We assessed initial angiographic results, procedural complications and clinical condition with initial Hunt and Hess (HH) grade and Glasgow outcome scale (GOS) at discharge. Follow-up results were also evaluated with conventional angiography and/or TOF-MRA.

Results: Initial aneurysmal occlusion was total in 28 (64%) aneurysms and subtotal in 16 (36%). 11 aneurysms (25%) were treated with balloon- and/or stent-assisted technique. There were 2 procedural ruptures (5%) and 6 thrombosis (14%), but there was no definite adverse effect on clinical outcome. Of 39 patients, 4 patients (10%) were HH grade 3 and 6 (15%) were HH grade 4 at admission. 32 patients (82%) had good or excellent outcome (GOS score > 4) at discharge. 6-month or more follow-up angiography and/or TOF-MRA were available in 26 (15 total and 11 subtotal initial occlusion) aneurysms (59%) in 23 patients and revealed stable occlusion in 19 aneurysms (73%), minor recanalization in 3 (12%), and progressive total occlusion in 4 (15%).

Conclusion: Coiling of very small aneurysms is technically feasible with favorable clinical and angiographic results.

B-596 11:33

Void artifacts at 3D time-of-flight (TOF) and contrast enhanced (ce) MR angiography following coil embolisation of intracranial aneurysms with new coil types

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Purpose: MR angiography is widely used for the follow-up of intracranial aneurysms after coil embolization. However, with the use of different new coil types, we increasingly observed signal voids at MRA, rendering the studies non-diagnostic with respect to aneurysm occlusion and vessel patency. This study aimed at clarifying relationships between coil type and void artefacts at both 3D-TOF and ce MRA.

Methods and Materials: 48 patients were examined with 3D-TOF and ce MRA following coil embolisation of intracranial aneurysms. Different coil types had been used according to availability and to the decision of the interventionalist. TOF and ce MR angiographies were examined for artefacts limiting the diagnostic value, depending on the coil types used in these patients.

Results: At 3D-TOF MRA, severe void artefacts were present in 15/48 (31.25 %) of aneurysms. 13 aneurysms with artifacts had been treated with ev3 Nexus coils, out of a total 19 aneurysms treated with these coils (68.4%). No artefacts occurred in aneurysms treated with GDC coils (different types) and Dendron/ev3 T10 TS coils. At ce MRA, artefacts were less pronounced but still severely present in 10 aneurysms treated with Nexus coils (52.6%).

Conclusion: Nexus coils are associated with a high number of non-diagnostic MRA studies for the follow-up of coiled intracranial aneurysms. Artifacts are more pronounced at 3D-TOF, but still present at ce MRA. To avoid DSA examinations, instead of MRA during follow-up, coil types with a low incidence of artefacts at MRA should be preferred.

B-597 11:42

Susceptibility-weighted imaging predicts favorable post-embolized ischemic status beyond the dynamic perfusion-weighted imaging in giant meningioma

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Purpose: Although preoperative adjuvant embolization is effective for mitigating blood loss in giant meningeal tumors, hemodynamic changes are greatly affected by the extent of embolization and collateral development. This study aimed to evaluate if signal changes on Susceptibility-Weighted Imaging (SWI) adequately depict post-embolized ischemic status.

Methods and Materials: Eight giant meningeal tumors underwent MR study at 3-T and two at 1.5-T before and after the preoperative transarterial embolization therapy using polyvinyl alcohol particle (> 100 μ). After obtaining pre contrast-enhanced (CE) 3D gradient-echo T1-weighted images (T1) and pre-CE SWI, dynamic EPI Perfusion-Weighted Imaging (PWI), post-CE T1 and post-CE SWI were acquired consequently. The rCBV maps on PWI and minimum intensity projection images (mIP) on post-CE SWI were reconstructed. Perfusion signal (PS) on rCBV and susceptibility effects (SE) on mIP after embolization were visually scored as significantly decreased = -2, mildly decreased = -1, no change = 0, mildly inceased = +1, or significantly increased = +2 in the intratumoral and peritumoral regions. Histopathology was correlated with MR findings.

Results: Intratumoral PS decreased in 9/10 (90%) of lesions; peritumoral PS did not change in 6/10 (60%) and mildly increased in 2/10 (20%). Intratumoral SE increased in 9/10 (90%); peritumoral SE decreased in 8/10 (80%). SWI better demonstrated oligemia at the drainer side in addition to reduced blood flow at the feeder side compared to PWI. Histopathology revealed no coagulative necrosis or massive hemorrhage, but only partially occluded microvessels.

Conclusion: SWI demonstrated intra- and peritumoral hemodynamic changes beyond PWI and contributed to the global assessment of post-embolization oligemia.

B-598 11:51

Changes of blood flow patterns along the intracranial internal carotid artery: A 4D PC MRI study

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Purpose: This study was designed to evaluate arterial blood flow patterns at inflow and outflow of the parasellar internal carotid artery (ICA) in order to detect possible changes in arterial pulsatility along the structure of the carotid siphon.

Methods and Materials: Arterial flow patterns of the large intracranial arteries were analyzed using ECG-gated, flow-sensitized 4D PC MR imaging at 3 T in 17 healthy volunteers. Time resolved blood flow velocity were retrospectively extracted

Sunday

from the data at the C4 and C7 segment of the ICA. We calculated pulsatility index (PI), resistance index (RI) and peak acceleration (PA) and corresponding time-to-peak (TTP) values using time resolved flow volume. Furthermore, 3D blood flow visualization was performed for all 34 internal carotid arteries.

Results: PI, RI and PA were significantly lower at the C7 segment compared to the C4 segment of ICA ($p < 0.0001$). Helical flow patterns were observed in 10 internal carotid arteries (5 patients).

Conclusion: The significant decrease in arterial pulsatility along the relatively short distance from C4 to C7 suggests an especially high vascular compliance of the intermediary arterial segment. Flow-sensitized 4D PC MRI is a suitable method to detect changes in blood flow patterns along the internal carotid artery.

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

Interventional Radiology

SS 1209

MR and CT guided interventions

Moderators:
R.W. Günther; Aachen/DE
D. Kuhelj; Ljubljana/SI

B-599   10:30

also EPOS

First multimodal embolization particles being visible in MRI and CT

S.H. Bartling[1], J. Budjan[1], H. Aviv[2], H.J. Michaely[1], W. Semmler[3], S.O. Schönberg[1], S. Diehl[1], S. Margel[2], M. Sadick[1]; [1]Mannheim/DE, [2]Ramat-Gan/IL, [3]Heidelberg/DE (soenkebartling@gmx.de)

Purpose: To develop and test the first multimodal embolization particles being visible within CT and MRI. Its usage might be beneficial within multimodality angiography setups, therapy control, long-term follow-up of embolization therapy, future transition to interventional MRI and research of novel embolization concepts.

Methods and Materials: CT visible iodine was combined with MRI visible iron in a macroparticle (diameter 50-250 µm). Its core - consisting of copolymerized monomer MAOETIB [2-methacryloyloxyethyl (2.3,5-triiodobenzoate)] - was coated with paramagnetic iron oxide nanoparticles (USPIO). After ex-vivo testing, including SNR measurements (n=5), its ability to embolize tissue was tested in an established tumor embolization model in rats (2) and rabbits (5). X-ray angiography, CT and MR imaging was performed on clinical scanners (Dual-source Definition CT, 3 Tesla Magnetom Tim Trio MRI, Siemens) before, during and after application of particles to the catheterized renal artery. Histology was prepared.

Results: The particles provided a sufficient image contrast in both CT (SNR: 14±4) and MRI (SNR: 14±1). Successful embolization of renal tissue was confirmed by particles residing within the kidney as seen in corresponding areas in MRI and CT. Histology allowed a direct visualization of the residing particles as well as associated thrombosis in kidney arteries. Successful embolization was confirmed by inflammation and necrosis in treated kidneys while the control kidneys were unaltered.

Conclusion: A multimodality embolization material was successfully developed and tested in animal models. Its consistence of clinically used substances might ease approval.

B-600   10:39

MR guided angioplasty of peripheral arteries at 3 T for delivery of drug containing solutions to the vessel wall

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Purpose: To assess the distribution of MR-guided delivery of a contrast-medium containing solution to the vessel wall during MR-guided angioplasty at 3 T.

Methods and Materials: In 6 pigs, surgically created bilateral stenoses in the external iliac artery were dilatated with a porous balloon catheter with a diameter of 8 mm. A contrast-medium-doped solution (0.05 mmol/ml Gd-DTPA, 3% Evans blue dye) was delivered through the micropores of the balloon into the vessel wall. Catheter placement was monitored using a steady-state free precession real-time imaging sequence. Contrast enhanced MR-angiography was performed prior and after the interventions using intraarterial injection of 0.4 mmol/Gd-DTPA to assess the degree of the stenosis. In all animals, the vessel wall was delineated prior and after dilatation using a T1-weighted gradient echo sequence.

Results: Dilatation could be carried out with no complications in all animals and MRA demonstrated technical success in all cases. The delivered contrast medium could be depicted in the vessel wall of the arteries on the T1-weighted GE. MR images and local signal intensity in the vessel wall increased significantly in the dilated segments after the intervention. Post-mortem the vessel wall was intact and the dye was distributed in all wall layers.

Conclusion: MR-guided delivery of a contrast-medium containing solution and on-line assessment of its distribution to the vessel wall during angioplasty in peripheral arteries is feasible at 3 T. This technique might be valuable for monitoring of the distribution of a drug containing solution applied to prevent restenosis.

B-601   10:48

3 T MRI for guiding endovascular interventions

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Purpose: To assess the feasibility of MR-guided endovascular interventions at 3 T regarding different clinical scenarios including assessment of procedural complications.

Methods and Materials: Interventional procedures were performed in 12 pigs as follows: In 4 animals, surgically induced stenosis of both femoral arteries were dilated using a balloon catheter. In 4 pigs, stents were deployed in one iliac artery. In the remaining 4 animals, one renal artery was embolised with 0.5 ml butylcyanoacrylate, mixed with lipiodol and iron particles. A non-metallic guide wire and non-braided catheters doted with iron-particles were used for the interventions. Catheter manipulations were monitored with a real-time true-FISP sequence.

Results: During the different interventions, the guide wire and catheters were clearly visible on the real time images and could be followed during all manipulations by on-line changing the slice position and imaging plane. In the animals with stenosis in the iliac arteries, the stenosis could successfully be passed with the guide wire and dilated. The stents were deployed in the iliac arteries at the target region. The renal arteries could be probed with a cobra-configurated catheter and embolisation successfully performed. Complications were not encountered during the procedures on MR imaging or later at autopsy.

Conclusion: Endovascular interventions are feasible at 3 T using real-time imaging and MR-compatible, iron marked catheters and guide wires. This is the technical prerequisite to develop dedicated interventions as to guide the local delivery of labeled substances to selectively marked targets. Such interventions would directly benefit from the SNR gain of 3 T.

B-602   10:57

Open MR imaging-guided brain metastasis tumor cryoablation

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Purpose: To evaluate the initial feasibility of MR guided transcranial cryoablation of metastasis intracranial tumors.

Methods and Materials: An approval from the local ethics committee and individual patient consent was acquired before the procedure. In 7 sessions, 7 brain metastasis tumors in 6 patients were treated. Procedures were performed under local anesthesia and conscious sedation. A 0.23 T open MRI device mounted with optical tracking system was used in procedural planning, instrument guidance, and real-time MR imaging for intraprocedural monitoring the ice ball formation. Cryoablation was performed using MR-compatible, argon-based cryoablation system with 2 mm or 1.47 mm diameter cryoprobes depending on the size of the tumor. Two freeze-thaw cycles were performed for each cryoablation site.

Results: The cryoprobes were successfully inserted into target once. Intraprocedural MRI clearly visualized the ice ball formation and monitored tumor totally evolved by ice ball. On the follow-up MR imaging, 3 days and 7 days after cryoablation, the cryoablation area showed appearance of typical coagulation necrosis. It was isointense signal on T1WI, and slightly high intensity or isointense signal with high intensity edema signal rim on T2WI. One and half months later, the size of cryoablation area decreased and the edema rim disappeared.

Conclusion: MR-guided and monitored brain metastasis cryoablation is technically feasible in selected patients, which provides an alternative treatment.

B-603 11:06

Magnetic resonance-guided upper abdominal biopsies in high field open wide-bore 3 T-MRI-system: Feasibility, handling and needle artifacts

J.P. Kühn, S. Langner, S. Soltesz, R. Puls, N. Hosten; *Greifswald/DE (kuehn@uni-greifswald.de)*

Purpose: To investigate the feasibility and handling of abdominal MR-guided biopsies in an open wide-bore high-field 3 T MR scanner.
Methods and Materials: First, scannings were obtained in a phantom (16G Somatex biopsy handy) with 43-minute continuous temperature measurement and artifact size measurement at different angles to the B0 magnetic field (0-180°). Second, 40 abdominal biopsies were obtained in 38 patients in a high-field open wide-bore MR scanner (Verio, Siemens) with a large bore diameter of 70 cm. Lesions in different abdominal organs [liver (37), spleen (1), kidney (2)] were biopsied using a standardized coaxial technique with a 16G biopsy needle guided by contrast-enhanced T1-weighted GRE sequences. Sensitivity, specificity, accuracy, complexity, complication rate, and needle artifacts were evaluated.
Results: No relevant temperature change was observed in the phantom experiment. Needle artifacts increased about 12 times from 0 to 90° to B0 in the phantom. The first biopsy was diagnostic in 38/40 MR-guided patient biopsies. Sensitivity was 0.94, specificity 1.0, and accuracy 0.95. Pathology revealed 32 malignant and 6 benign lesions. Mean lesion diameter was 3.1 cm (±2.9 cm) and 57% were smaller than 2 cm. The mean length of the needle tract was 10.3 cm (±2.8 cm). There was a minor complication rate of 7.5% and no major complications. Median table time was 39 min (±17 min) with an intervention time of 10 min (±8 min).
Conclusion: MR-guided biopsy using wide-bore 3 T-MRI combines the advantages of high-field MRI with easy handling because of the wide bore diameter. Large needle artifacts seem to limit accuracy when small lesions are biopsied.

B-604 11:15

Automated CT guided biopsies with precise CT guided arm: Our initial experience

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Purpose: To demonstrate the efficacy of the automated CT guided planner in doing the CT guided biopsies in different locations with high accuracy.
Methods and Materials: The clinical trial was done in our institution from November 2008 to April 2009 which included 26 patients. The study included seventeen males and nine females with age group ranging from 11 to 56 years. Among the 26 lesions, 11 were in lung, 5 in abdomen and 6 in vertebrae. All the procedures were done using PIGA (Precise CT Guided Arm) machine in a 8 slice CT scanner. After marking the point of entry and target lesion, path of the needle is confirmed on the console. System calculates coordinates angle and depth and positions the biopsy arm.
Results: The mean lesion size was 2.3 cm. All the biopsies yielded sufficient tissue for pathological evaluation (yield rate 100%). We did not encounter any complications in our study. PIGA helps in precise placement of needle in complex angulated approaches. The average procedure time and radiation exposure is reduced by 50% as compared to the routine manual method. Automated planning scores over manual planning in terms of technical difficulty, number of needle passes, time consumed, number of check scans and hence the patient's radiation dosage.
Conclusion: This clinical trial depicts the advantages of the automated CT guided planner in reducing the procedure time and radiation dose and ensuring patient safety, thus making it acceptable for the routine clinical practice.

B-605 11:24

CT-guided coaxial biopsy of mediastinal and pulmonary hilar lesions: A new approach through extrapleural space

N.-E.A. Nour-Eldin, V. Jacobi, T. Lehnert, N.N.N. Naguib, T.J. Vogl; *Frankfurt a. Main/DE (nour410@hotmail.com)*

Purpose: To evaluate the efficacy and safety of core biopsy from mediastinal and central hilar pulmonary lesions through extrapleural space approach using coaxial-technique.
Methods and Materials: This prospective study was approved by the institutional ethical committee board; informed consent was waived. The study included 20 consecutive patients (12 males and 8 females) with mean age 56 years SD: 5 years. The study included 20 consecutive CT-guided coaxial core biopsies for 10 hilar pulmonary lesions and 10 central mediastinal lesions including: subcarinal, paratracheal and paracardiac lesions near the cardiac root. Using coaxial needle sheath system (17G) through the paravertebral space, continuous expansion of the extrapleural space was carried out by injection of normal saline (mean: 60 ml, range: 50-120 ml), followed by progressive gradual advancement of the coaxial

needle in steps till the lesion is approached. Then, 18G core biopsy needle was introduced through the sheath to obtain the biopsy material. Two or three biopsy materials were obtained and fine needle aspiration for serological investigation was also obtained when indicated.
Results: The mean time to accomplish the procedure was 15 minutes (SD: 7.2). The material obtained was histopathologically conclusive in 95% (19 out of 20). There were 12 (60%) malignant and 7 (35%) benign lesions. Chronic obstructive pulmonary disease (COPD) was associated in 40% (8 out of 20 patients). The incidence of pneumothorax was 0%. Inaccessibility of the lesion experienced in one case (5%) due to the intervening position of azygos vein. The complications encountered: post-biopsy pain (10%), subcutaneous hematoma (10%), and minimal pleural effusion.
Conclusion: The extrapleural space approach for central pulmonary and mediastinal lesions can be effectively and safely utilized to minimize the incidence of pneumothorax and pulmonary haemorrhage by avoiding traversing pulmonary parenchyma in the biopsy track.

B-606 11:33

Multislice computed tomography: A tool for noninvasive temperature measurement?

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Purpose: To investigate the potential of multislice computed tomography (MSCT) as a tool for non-invasive temperature measurement.
Methods and Materials: Samples of water, 0.9% saline, sunflower oil and dilutions (1:32, 1:64, 1:128) contrast agent (Iopromite 370, BayerSchering Pharma, Berlin, Germany) were heated in a plexiglass phantom. In a first setup, samples of 0.9% saline solution were scanned at defined temperatures (25 -75 °C; 5 °C intervals) using a clinical CT-scanner. Scan parameters (tube current-time product, tube voltage, collimation, slice thickness) were systematically varied. In a second setup, samples of the different fluids (water, sunflower oil, contrast agent dilutions) were scanned using the following scan protocol: 250 mAs, 140 kV, 1.2 mm collimation, 9.6 mm slice thickness. Attenuation CT-values were measured in reconstructed axial images at the different temperatures. A regression analysis was performed to investigate the relationship between temperature and CT-value.
Results: Standard deviation of measured CT-values decreased with increasing tube current-time product, increasing tube voltage, thicker collimation and higher slice thickness. Regression analysis showed an inverse relationship between temperature and CT-value for all fluids with regression coefficients of -0.471 (0.9% saline), 0.447 (water), -0.679 (sunflower oil), -0.420 (contrast agent 1:32), -0.414 (contrast agent 1:64) and -0.441 (contrast agent 1:64), respectively.
Conclusion: Multislice computed tomography can depict thermal density expansion of different fluids.

B-607 11:42

Efficacy of C-arm CT for tracheobronchial stenting

J. Koizumi, S. Tajiri, T. Hashimoto, K. Myojin, T. Ichikawa; *Isehara/JP (jkoizumi@is.icc.u-tokai.ac.jp)*

Purpose: To guide accurate and safe stenting into the tracheobronchial tree, the visualization of the three dimensional (3D) structure is very helpful and CT with 3D reconstructions prior to stenting has been applied. Here, we evaluated the efficacy of C-arm CT for tracheobronchial stenting.
Methods and Materials: Seventeen patients (42-77 y/o, male 13, female 4) with malignant tracheobronchial stenosis were included in this study. C-arm CT (Artis dTA, Siemens) was performed before stenting and the stenotic diameters were measured with the surrounding normal calibers on multplanar reconstructions or volume renderings. After the observation by bronchoscopy through intubation, bare stents (spiral Z stent; 24) or covered stents (covered spiral Z stent; 3, Ultraflex; 3) were deployed. The patients were evaluated on repeat C-arm CT and followed by additional procedures if necessary.
Results: Dyspnea improved in thirteen patients after initial stenting. In the other four patients, inadequate expansion of misplaced stents due to patients' movements was revealed on FACT and additional stenting allowed satisfactory improvements. In two patients with massive atelectasis, C-arm CT after aspiration of sputum and air injection via a negotiated catheter identified the true stenotic lesions on site leading precise stenting. Over all, significant dilatation (p <.00001) of the stenoses was confirmed on C-arm CT from 4.1±2.8 mm before stenting to 11.2±3.1 mm after stenting.
Conclusion: C-arm CT is an effective tool during tracheobronchial stenting.

Sunday

B-608 11:51

Development of new display method and needle aspiration system for multi slice CT fluoroscope

K. Tsujioka, H. Otsubo, K. Akebo, Y. Takahashi, M. Niwa, S. Shimizu, M. Tanase; *Toyoake/JP (tsujioka@fujita-hu.ac.jp)*

Purpose: Developments in CT fluoroscope technology and multi slice CT scanning have enabled us to conduct CT scanning in multi sections. However, the current method used with multiple displays makes it difficult to recognize the needle point's three-dimensional location instantly, because we are unable to observe multiple images simultaneously. To overcome this problem, we have developed a new display method and needle aspiration assistance system for multi slice CT fluoroscopy. In addition to this, we have also created a training tool to be used just before the patient is examined.

Methods and Materials: In our system, the location of the needle is displayed in color and the intended aspiration route is displayed on the screen; the operator runs the needle aspiration according to direction and distance. An alarm sounds when the needle point is not positioned in the intended target section or aspiration route.

Results: It can display and guide the needle point position in one image, improves the precision and safety of needle aspiration. With the alarm system in particular, the operator is able to run the system in a prompt and safe way. The multi slice CT fluoroscope is an effective technology, but it requires experienced operators. Lack of experienced operators is successfully compensated for by use of the training tool we have developed.

Conclusion: Our system allows all operators, including inexperienced ones, to complete quick and accurate needle aspiration, thus reducing examination times and lowering radiation exposure levels for patients and operators.

Monday, March 8

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

Musculoskeletal

SS 1610

Bone marrow and trauma

Moderators:
M. Epermane; Valmiera/LV
M.C. Wick; Innsbruck/AT

B-609 10:30

An analysis of clinical negligence claims in radiology

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(dinaawad21@yahoo.co.uk)

Purpose: The financial burden of litigation has risen steadily over the last decade in England culminating in a cost of over 633 million GBP in 2008 alone. Evidence suggests that this rise in litigation is also affecting radiology, but to date, there has been little examination of the subject in the UK. This study analyses clinical negligence claims involving radiology in England with the aim of identifying methods to prevent future litigation.
Methods and Materials: All clinical negligence cases involving radiology in England between 1995 and 2008 were obtained from the National Health Service Litigation Authority. Claims were categorised according to cause, radiology subspecialty and associated costs.
Results: In total, 763 claims were made, of which 598 (78.4%) had been settled. Three hundred and twelve (52.2%) were found to be in the claimant's favour to a total cost of 26 million GBP. Breast and musculoskeletal radiology were the commonest specialties involved in successful claims accounting for approximately 20% of all cases each. Antenatal radiology accounted for 4.2% of all successful claims, resulting in the highest mean payout of 421,400 GBP per case. Overall, the commonest causes for successful claims were missed diagnoses (59.0%) followed by protocol failures (11.0%) and interpretation errors (10.0%).
Conclusion: Employing methods to reduce missed diagnoses particularly in breast and musculoskeletal radiology may help to significantly reduce the rate of future litigation in radiology.

B-610 10:39

Application of the finite element method (FEM) to high resolution (HR) MRI of the distal radius in the context of osteoporosis

D. Mueller[1], I. Sidorenkeo[2], J.S. Bauer[1], R. Monetti[2], M. Matsuura[1], E.J. Rummeny[1], F. Eckstein[3], T.M. Link[4]; [1]*Munich/DE*, [2]*Garching/DE*, [3]*Salzburg/AT*, [4]*San Francisco, CA/US (dmueller@roe.med.tu-muenchen.de)*

Purpose: Nonlinear structure measures, based on the Scaling Index Method (SIM), as well as Minkowski Functionals (MF) have been successfully applied for the characterization of trabecular bone structure in osteoporosis. In this study, we applied the finite element Method (FEM) to HR MRI of the distal radius and compared it with the SIM, the MF and morphometric parameters in the prediction of osteoporotic spine fractures.
Methods and Materials: Forty-six post-mortem distal forearm specimens were scanned with a 1.5 T MR scanner using a dedicated wrist-coil and an optimized gradient echo sequence. After segmentation, the FEM, the SIM, the Minkowski-Functionals and the standard histomorphometric parameters were determined completely automated. BMD measurements were obtained using dual energy X-ray-absorptiometry (DXA). Fracture status of the spine was classified on conventional radiographs. Diagnostic performance in differentiation of donors with and without vertebral fractures was assessed using receiver-operator-characteristics (ROC) analysis.
Results: The FEM as well as all other structure parameters and BMD showed significant differences between the group with and without osteoporotic spine fractures. Using the FEM slightly higher area under the curve value (AUC=0.73) for the ROC-analysis was calculated compared to BMD with an AUC value of 0.66. Significantly higher values were achieved for the scaling index method (AUC=0.85) and for the Minkowski Functionals (AUC=0.81).
Conclusion: The FEM is a powerful method to differentiate donors with and without osteoporotic spine fractures. However, the best results were achieved for the nonlinear SIM and for the MF, which performed significantly better than BMD.

B-611 10:48

Contrast enhancement and quantitative signal analysis using whole body MR imaging in patients with systemic mastocytosis

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Purpose: To evaluate signal intensity measurements in unenhanced and enhanced MR imaging studies of the spine and to correlate them with clinical and laboratory data in patients with systemic mastocytosis (SM).
Methods and Materials: 38 patients with SM underwent T1-weighted spin echo and short tau inversion recovery (STIR) MR imaging (MRI) of the whole body on a 1.5 T scanner. In addition, sagittal T1-weighted and STIR images of the whole spine were acquired. In 34 patients, T1-weighted images of the spine were obtained after administration of gadolinium. Quantitative signal analysis was performed and correlated with serum tryptase levels as a marker for mast cell burden and bone mineral density (BMD) measurements of the spine.
Results: The mean level of contrast enhancement was elevated to 42.7%. According to the serum tryptase level, there was a significant difference between the subgroup with low to intermediate levels (34.1%) compared to patients with a high mast cell burden (47.2%). 21/30 patients showed reduced BMD measurements reflecting osteopenia or osteoporosis. However, there was no significant correlation between BMD values and the level of contrast enhancement.
Conclusion: Gadolinium-enhanced MRI demonstrated an increased contrast enhancement in patients with systemic mastocytosis. By using signal intensity measurements, subgroups with different extent of mast cell burden according to serum tryptase level can be differentiated. Although pathologic BMD measurements were found for the majority of patients, there was no correlation with the extent of bone marrow involvement.

B-612 10:57

also
EPOS

Whole-body MRI in multiple myeloma: Spectrum of findings in patients with negative PET/CT scan after allogeneic stem cell transplantation

K. Peldschus, M. Regier, T. Derlin, N. Kröger, G. Adam, S. Klutmann, C. Weber; *Hamburg/DE*

Purpose: To evaluate imaging findings of whole-body magnetic resonance imaging (MRI) in multiple myeloma patients with negative F-18 FDG PET/CT after allogeneic stem cell transplantation (allo-SCT).
Methods and Materials: Patients with negative F-18 FDG PET/CT and whole-body MRI within one month during follow-up after allo-SCT were retrospectively identified. Whole-body MRI was acquired on a 1.5 T scanner (Achieva, Philips Medical Systems) with a stepping table technique. The protocol consisted of coronal T2 STIR TSE, T1 TSE and contrast-enhanced water-selective T1 TSE sequences. Bone involvement was characterized in terms of pattern, size and contrast enhancement in 10 regions of the skeleton. Extraosseous lesions were likewise classified. Data sets were analyzed by to radiologists in consensus.
Results: Nineteen patients (11 male/8 female, age 38-73 y, mean 51.7 y) with complete (16) or partial (3) remission regarding serum markers were included. In 63.2% of patients, a total of 22 osseous lesions (18 focal/4 diffuse pattern) were identified. The average size of focal lesions was 2.2 ± 0.95 cm. After contrast material administration, lesions revealed on average a signal enhancement of 48.7 ± 34.1%. In 81.1% of lesions, the signal enhancement was more than 10%. Extraosseous lesions were not detected. 25% of patients with bone involvement revealed partial remission whereas all patients without bone involvement showed complete remission regarding serum markers.
Conclusion: The results justify for larger prospective studies to identify the relevance of MRI findings in multiple myeloma patients after allo-SCT.

B-613 11:06

Whole-body muscular MRI at 1.5 and 3 T in 20 patients with Pompe disease (or acid maltase deficiency)

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Purpose: The aim of this study was to show the typical patterns of muscles involvement from mild to severe forms of Pompe disease.
Methods and Materials: Examinations were performed in 20 patients aged 37 to 75 (mean 52) on 1.5 T or 3 T systems. Five patients were bed ridden and ventilated. A protocol using axial and frontal T1 TSE sequences and axial or frontal STIR sequences was defined. Feasibility, quality and duration of the examinations were assessed. A scoring of 47 muscles was performed using the Mercuri classification. A muscular specialized testing was obtained. Analysis was done to determine most often involved muscles and to compare involvement to clinical and functional parameters.

Results: Complete head to toe studies were obtained in 20 patients. The mean in-room time was 38 minutes. STIR sequences showed no abnormally. On T1 weighted sequences, muscle alterations consisted essentially of bright signal resulting from fatty replacement without severe retraction of the muscles corpus. Previous descriptions of muscles alterations were in agreement with the findings of this study for spine extensors and pelvic girdle but not for thigh. This study gives additional information about early and very suggestive alterations especially for tongue and subscapularis muscle. Agreement between MRI scoring and muscular testing seems to be satisfactory except for thigh muscles.

Conclusion: Whole-body muscular MRI is a safe, fast and feasible technique which allows complete muscle cartography in patients with Pompe disease. It may have a diagnostic impact of severity of the muscles involvement and the progression of the disease.

B-614   11:15
Comparison of diagnostic accuracy between dynamic cine-arthrography and wrist MRI with or without intra-articular contrast injection in the diagnosis of intrinsic ligament tear or TFCC tear, based on arthroscopic findings of the wrist

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Purpose: To compare the diagnostic accuracy between dynamic cine-arthrography (DCA) and conventional MRI (c-MRI) or MR arthrography (MRA) for diagnosis of intrinsic ligament tear or triangular fibrocartilage complex (TFCC) tear, based on arthroscopic findings.

Methods and Materials: A total 52 patients who underwent both DCA and wrist MRI using 1.5 T or 3 T were included and arthroscopic operations were done in all patients. DCA was performed as follows: after puncture of radiocarpal joint by 22G needle, 2 cc contrast solution was slowly injected on continuous fluoroscopic guidance during passive wrist exercise. In 28 cases of total 52 wrists, MRA was also done. We reviewed DCA, c-MRI and MRA findings, blinded to the arthroscopic or other imaging findings and described about the existence of intrinsic ligament (scapholunate ligament and lunotriquetral ligament) tear or TFCC tear. Based on arthroscopic findings, we measured the diagnostic accuracy of DCA, c-MRI and MRA and compared the diagnostic values between DCA and c-MRI in total 52 cases and between DCA and MRA in 28 cases.

Results: For scapholunate ligament tear, DCA showed higher accuracy (78.8%) than c-MRI (59.6%) and also better accuracy (75%) than MRA (64.3%). For lunotriquetral ligament tear, DCA showed slightly better accuracy (78.8%) than c-MRI (73.1%) but same accuracy as MRA (89.3%). For TFCC tear, DCA showed a little higher accuracy (88.5%) than c-MRI (86.5%) but lower accuracy (92.9%) than MRA (96.4%).

Conclusion: We conclude that the DCA is valuable for diagnosis of scapholunate ligament tear, compared with c-MRI or MRA.

B-615   11:24
How to evaluate the quality of fracture reduction and fixation of the wrist and ankle in clinical practice? A Delphi consensus

S. Beerekamp, R. Haverlag, D.T. Ubbink, J.S.K. Luitse, K.J. Ponsen, M. Maas, J.C. Goslings; Amsterdam/NL (M.S.Beerekamp@amc.uva.nl)

Purpose: The radiological evaluation of the quality of fracture reduction and fixation of the ankle and wrist is based on the surgeons' and/or radiologists' frame of reference. A generally accepted scoring protocol is not yet available. The aim of this study was to obtain consensus regarding the evaluation criteria for this purpose.

Methods and Materials: A Delphi study was conducted consisting of a bipartite online questionnaire, focusing on the interpretation of intra- and postoperative X-rays and CT-scans of the ankle and the wrist. A sample of 70 radiologists, 75 trauma and 80 orthopaedic surgeons in The Netherlands were invited to respond. Questions addressed imaging technique, aspects of the anatomy, and fracture reduction and fixation. Agreement was expressed as the percentage of respondents with similar answers. Consensus was defined as an agreement of at least 90%.

Results: In three Delphi rounds, 64, 74, and 62 specialists responded, respectively. Agreement was reached for 3 out of the 14 (21%) imaging techniques, 11 out of the 13 (85%) aspects of the anatomy, and 13 out of the 22 (59%) items for the fracture reduction and fixation. All but one aspect of the anatomy could be evaluated at face value, and consensus was reached for only one measurement.

Conclusion: In contrast with previous scoring systems, this clinically based consensus includes evaluation of fracture reduction and fixation. Measurements do not take a prominent place in the evaluation of the anatomy and more aspects were considered important. In addition, it shows the existing difference in imaging policy.

B-616   11:33
Acute effects of traction on blood circulation of femoral head with neck fracture: Study by superselective digital subtraction angiography

X.-J. Yang, J. Xiao; Shanghai/CN (yangxiujun@online.sh.cn)

Purpose: To investigate the early influence of traction on blood supply to the femur head with femur neck fracture (FNF).

Methods and Materials: Nine patients with FNF were studied. Group A (n=9) consisted of the fractured hips before traction. Group B (n=7) was composed of the fractured hips during traction. Group C (n=8) comprised hips of the unfractured legs. All patients underwent selective angiography of the medial and lateral femoral circumflex artery (FCA) in neutral position. Blood circulation of the femoral head was evaluated by observing morphology of its feeding arteries, its perfusion, venous drainage, architecture of tiny vessels and time of circulation.

Results: Compared with the DSA findings obtained in the absence of traction, all RAs but the inferior one under traction were depicted few branches and poor femoral head perfusion in all the 9 patients, remarkably that of the medial FCA. When traction was applied in neutral position, the veins were demonstrated poorly or delayed with the same injection speed and volume of contrast medium. These signs became more obvious as the traction force increased from 3 to 5 kg in all 4 cases. There were significant difference in changes in femoral head perfusion and circulation time between those with and without traction (P < 0.05).

Conclusion: Skin traction impairs blood perfusion to main parts of the femoral head, and blood flow in major RAs were reduced or even lost to be displayed. Traction might be one of the important causes of avascular osteonecrosis of the femoral head after FNF.

B-617   11:42
3 T diffusion weighted WB-MRI vs radiographic skeletal survey in the evaluation of patients with multiple myeloma

E. Squillaci, C. Cicciò, G. Manenti, M. Rascioni, G. Nano, G. Simonetti; Rome/IT (ettoresquillaci@tiscali.it)

Purpose: To assess the feasibility of 3 T Whole-Body Magnetic Resonance Imaging (WB-MRI) in the diagnosis and staging of patients with Multiple Myeloma (MM).

Methods and Materials: 30 patients (23 male and 7 female) with MM underwent 3 T WB-MRI (Philips Achieva, Best, The Netherlands) for assessment of bone and extra-bone involvement. Images were obtained with multi-stacks approach from six body regions on coronal plane (T1w TFE, T2W STIR and DWIBS) and axial plane (THRIVE). All patients were staged according to Durie and Salomon system (8 patients stage I, 13 patients stage II, 9 patients stage III). Images were independently analyzed by two reviewers, using kappa analysis for interobserver agreement. Skeletal Survey (SS) and PET/CT were used as standard of references in addition to imaging follow-up.

Results: In 30 patients, 72 malignant and 18 benign bone lesions were detected. WB-MRI achieved a sensitivity of 95% (68/72) while PET/CT and SS, respectively, showed 79% (57/72) and 62% (45/72). Specificities were 72% (13/18) for both WBMRI and PET/CT while SS achieved 55% (10/18). Diagnostic accuracy were, respectively, 90% (81/90), 78% (70/90) and 55%. WB-MRI revealed additional extra-bone focuses due to high soft tissue resolution and missed 5 lesions localized in rib cage (n=3) and skull (n=2). Good agreement was reported by two observers in imaging analysis (k > 0.61)

Conclusion: WBMRI is a reliable method for diagnosis and staging of MM patients proving to be a fast and reliable alternative to SS; in selected cases, PET/CT can provide additional clinical information.

B-618   11:51
Added diagnostic benefit of 16-row spiral CT in patients with multiple trauma differentiated by body region and injury severity according to the ATLS© concept

M.H. Maurer, S. Knopke, R.J. Schröder; Berlin/DE (martin.maurer@charite.de)

Purpose: To determine the added diagnostic benefit of using MS-CT in multiple-trauma patients by severity of injury and affected body region.

Methods and Materials: In 275 multiple-trauma patients (73% male, 27% female; age 39.6 ± 18.9 years), the adjunct and new findings with 16-row whole-body-spiral-CT findings were compared to the findings obtained by conventional projection radiography and abdominal ultrasound in the emergency room. These were stratified by body region (head, face, chest, pelvis, abdomen, spine) and the degree of life threat according to the ATLS© concept (class 1: simple injury, 2: potentially life threatening, 3: immediately life threatening).

Results: A total of 921 additional findings were obtained by MS-CT in all patients. The distribution by number of patients and body region was as follows: 22 neck, 76

face, 125 chest, 112 abdomen, 50 pelvis, and 91 spine. Most additional findings were categorized as potentially life threatening (ATLS class 2). Beyond that, there were 439 completely new findings, involving the head in 128 patients (mostly ATLS class 3), the face in 18, the chest in 47, the abdomen in 26, and the spine in 9 patients. Most new findings involving the face, abdomen, and spine were ATLS class 2 injuries. **Conclusion:** Compared with conventional radiography and ultrasound, 16-row whole-body-spiral-CT yields numerous adjunct and new findings in different body regions in patients with multiple trauma. New findings primarily involved the head, adjunct findings the chest, pelvis, and spine. Most findings obtained with CT were potentially life threatening (ATLS class 2).

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

Abdominal Viscera (Solid Organs)

SS 1601a

CT matters: Detectors, energy sources and quantitation

Moderators:
K. Coenegrachts; Bruges/BE
I. Lupescu; Bucharest/RO

B-619   10:30

also EPOS

Assessment of lesion in hepatic dome or inferior margin using curved planar reformations in 320-slice CT hepatic perfusion
Z. Wen, J. Liu, Z. Zhang; *Beijing/CN (wenzhaoying@gmail.com)*

Purpose: To investigate the clinical application and value of 320-slice CT hepatic perfusion curved planar reformations (CPR) for assessment of lesion in hepatic dome or inferior margin.
Methods and Materials: 30 patients (hemangioma, 18, hepatic cancer, 4, metastasis, 8) with lesions in hepatic dome or inferior margin were analyzed retrospectively. All patients underwent dynamic volume scan (0.5 slice thickness, 100 KV, 75 mAs, 0.5 s per 360° rotation), 25 low-dose CT volume acquisitions with a time interval of 2 or 5 s of the liver were acquired, radiation dose was 938 DLP. Same slice axial and CPR was reconstructed separately to acquire same slice perfusion.
Results: The HAP, PVP measured from normal liver was: CPR, 15.57±6.05, 62.41± 16.62; Axial, 17.31± 6.35, 64.96±15.31, respectively. The HAP, PVP value of the axial and CPR perfusion was no significant difference (p> 0.05). It was different to analyze perfusion of lesion in hepatic dome or inferior margin with axial image. But perfusion of all 30 lesions in hepatic dome or inferior margin can be well analyzed by CPR images. The TDC curves of all lesions were intact and smooth.
Conclusion: There were no differences between the 320-slice axial and CPR perfusion in diagnosing liver diseases. But aorta, portal vein, spleen and lesion in any position of the liver can be shown in one CPR perfusion image. It has advantage for 320-slice CPR perfusion in analyzing lesions in hepatic dome or inferior margin.

B-620   10:39

Preliminary experience with dual energy CT (DECT) of the liver:
Real versus virtual non-enhanced images
C. De Cecco, V. Buffa, S. Fedeli, A. Vallone, R. Ruopoli, V. David; *Rome/IT (carlodececco@gmail.com)*

Purpose: The aim of this work was to compare mean image quality, noise and dose reduction of real non-enhanced (RNE) and virtual non-enhanced (VNE) liver images in patients underwent abdominal Dual Energy CT (DECT).
Methods and Materials: Twenty consecutive patients underwent abdominal DECT for liver evaluation. In kernel D30f, 80 Kv, 140 Kv and merged images were generated. Axial RNE and VNE images were reconstructed using a section thickness and an increment of 5 mm. Mean image quality and noise were analyzed by two radiologists in separate reading sessions. The effective radiation dose in millisieverts was estimated for each phase and the effective dose of a triple-phase protocol (RNE, arterial and DE portal phases) were compared with that of a dual-phase protocol (arterial and DE portal phases).
Results: Virtually non-enhanced images could be generated for all patients and were of diagnostic quality. No significant difference (p> 0.05) in mean image quality was observed between VNE (4.00±0.85) and RNE images (4.35±0.58). Also no significant difference in mean image noise was observed between VNE (2.4 HU±0.6) and RNE (3.1 HU±0.8). A significative dose reduction was observed by omitting the non-enhanced acquisition (13.8±3.8 vs 9.8±2.8 mSv).
Conclusion: Virtually non-enhanced images can be obtained with DECT with similar image quality as real non-enhanced images. This approach means a significative reduction in patient radiation dose.

B-621   10:48

Dual energy multiphasic CT of the liver: Comparison of virtual noncontrast and standard nonenhanced phase: Quantitative analysis and dose reduction in cirrhotic patients
D. Geiger, G. De Filippis, M. Di Martino, M. Del Monte, R. Di Miscio, C. Catalano, R. Passariello; *Rome/IT (danielgeigermd@gmail.com)*

Purpose: To evaluate liver virtual noncontrast technique and standard liver unenhanced phase in terms of attenuation values correlation and radiation dose saving.
Methods and Materials: Fifty-seven cirrhotic patients (40 men: age-range, 32-83 yrs) underwent surveillance multiphasic abdominal dual energy (DE) CT examination (Siemens Definition) during the unenhanced, DE arterial, portal-venous and equilibrium phases using attenuation-based angular modulation technique (CAREDose4D™). High concentration c.m. (Iopamiro400, Bracco®) was injected at 3.5-4.5 ml/s followed by a 30 ml of saline flush at the same injection speed, adjusting the dose to patient weight. DE FOV (field of view) positioning was adjusted to patient abdominal morphometry to achieve maximal liver volume fitting. Arterial phase was acquired in the DE mode and post-processing of virtual noncontrast (VNC) phase performed (LeonardoSyngoCT2008G). Cross-linking of standard unenhanced acquisition and virtual unenhanced phases was performed. Following a four segments liver distribution Right Posterior, Right Anterior, Left Medial, Left Lateral), four ROIs (Regions of Interest) per slice in three consecutive slices for both standard unenhanced and VNC phases were placed to assess quantitative analysis. ROIs were copied between the two phases to achieve equal size and positioning avoiding operator measurement error. Effective Dose (E=Edlp*DLP) for each phase of the multiphasic study was calculated.
Results: Quantitative ROI based statistical analysis using PairedSamples-T-Test over a total number of 1368 ROIs demonstrated a significant (p=0.0001) positive correlation coefficient (r=0.872) between liver standard unenhanced and VNC attenuation values. Effective dose calculation for standard unenhanced, DE arterial, venous-portal and equilibrium phases led to a mean effective dose respectively of 3.7, 4.5, 4.1 and 4.0 mSv per exam (Total Mean Effective Dose per Multiphasic Exam: 16.3 mSv).
Conclusion: Liver VNC technique and standard unenhanced phase showed significant quantitative positive correlation. Performing DE arterial phase with liver VNC technique in a routine multiphasic liver CT examination can lead to a radiation dose reduction of 23% with a 3.7 mSv mean dose saving per exam.

B-622   10:57

2nd generation abdominal dual energy CT with tin filtering: Assessment of image quality and radiation exposure
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Purpose: To assess image quality, noise, and effective radiation exposure in abdominal dual energy CT (DECT) on a dual source scanner equipped with a tin filtering system for improved material separation.
Methods and Materials: 42 patients underwent abdominal DECT on a new DSCT (Definition Flash, Siemens). One tube employed a tin filter and was operated at 140 kVp for improved separation of its spectrum from the other tube at 100 kVp. 42 age-, sex-, and weight-matched patients scanned on a previous system (Siemens Somatom Definition Dual Source) served as comparison. Image quality was rated on a five-point-scale (1=excellent to 5=not acceptable). Noise was measured as standard deviation of retroperitoneal fat density. Using virtual non-contrast images from which iodine was subtracted, densities of kidney and liver parenchyma were measured. Effective radiation dose was derived from DLPs. Mann Whitney U test and t test were used to test for significant differences between cohorts.
Results: Image quality improved (mean, 1.22±0.21 versus 1.55±0.59, p < 0.001) and noise decreased (new system: 16.89±4.45 and 14.55±3.91 HU; previous system: 23.25±8.11 and 19.91±7.55 HU, p < 0.01 for both). Stability of CT numbers on VNC images was greater using tin filtering (kidney: 31.47±3.19 vs 31.59±7.9 HU; liver, 59.2±4.4 and 57.8±10.1 HU, respectively). Effective DECT radiation doses were comparable (10.63±3.19 vs 9.88±4.22 mSv, p> 0.05).
Conclusion: Tin filtering and use of 100/Sn140 kVp on the two tubes of the system significantly improves image quality and reduces image noise in abdominal DECT; measured CT numbers are more stable than previously reported.

B-623 11:06

Dual energy CT-cholangiography in potential donors for living-related liver transplantation: Initial experience

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Purpose: To report our initial experience with dual-energy CT-cholangiography in potential donors for living-related liver transplantation.
Methods and Materials: Seventeen potential donors for living-related liver transplantation (6 women and 11 men; average age 37.8±10.4 years) underwent intravenous dual-energy CT-cholangiography. A dual-energy CT scan of the liver was carried out with simultaneous acquisition of two raw datasets at tube currents of 140 kV and 80 kV, respectively. A third weighted average dataset was obtained from these raw datasets (weighting ratio: 70% 140 kV, 30% 80 kV). Iodine images and contrast-optimized images were reconstructed applying post-processing tools on the basis of the dual-energy application. Analysis of all datasets comprised determination of bile duct visualization scores, maximum bile duct diameters and bile duct attenuation.
Results: Highest bile duct visualization scores were detected for optimized-contrast images and 80 kV dataset, intermediate for iodine images and weighted average dataset and lowest for 140 kV dataset with significant differences. Highest maximum bile duct diameters were detected for optimized-contrast images and 80 kV dataset, intermediate for iodine images and weighted average dataset and lowest for 140 kV dataset with significant differences. Highest bile duct attenuation was detected for optimized-contrast images and 80 kV dataset, intermediate for iodine images and weighted average dataset and lowest for 140 kV dataset with significant differences.
Conclusion: Dual-energy CT-cholangiography in potential donors for living-related liver transplantation is reasonable. Iodine images and contrast-optimized images, reconstructed applying post-processing tools on the basis of the dual-energy application, allow precise analysis of the biliary system.

B-624 11:15

Fading hemangiomas on multiphasic CT

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Purpose: The degree of enhancement of hepatic hemangiomas is known to be similar to that of the vascular pool on CT. The purpose of this study is to describe fading hemangiomas (substantially lower attenuation [> 30 HU] than vascular pool on portal venous phase [PVP]) and to determine their incidence and characteristics on multiphasic CT.
Methods and Materials: The study population comprised of 220 hemangiomas (≥5 mm) in 132 consecutive patients which were imaged on multiphasic CT and also proved by diagnostic findings on MRI. The size of hemangiomas and CT attenuation number of the enhancing area within the hemangioma, liver parenchyma, and portal vein were measured on both arterial phase (AP) and PVP. The speed of enhancement (slow-, < 50%; rapid-, 50-99%; flash-filler, 100% filling on AP) and association with arterioportal shunting (APS) were also determined by two independent reviewers. Imaging features were compared between fading and non-fading hemangiomas using Fisher Exact test.
Results: 83/220 (37.7%) hemangiomas were fading (hemangioma 143±38 HU; PV 209±36 HU). 23/83 (27.7%) fading hemangiomas even showed lower attenuation than liver parenchyma. The size of fading hemangiomas (17.9±4.5 mm) was smaller than that of non-fading (24.2±3.6 mm) (p=.032). Fading hemangiomas were seen in 61/134 (45.5%) slow-fillers, 9/57 (15.8%) rapid-fillers, and 13/29 (44.8%) flash-fillers. There was no significant difference in the incidence of APS between fading (31.3%, 26/83) and non-fading hemangiomas (36.5%, 50/137) (p=.086).
Conclusion: Contrary to the common belief, hemangiomas frequently show substantially lower attenuation than vascular pool on multiphasic CT. Flash-filling hemangiomas with fading may cause diagnostic challenges in patients suspected to have hypervascular malignancy.

B-625 11:24

Hepatic tumor density quantification on MDCT: Reproducibility of manual two-dimensional region of interest and volumetric measurements

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Purpose: The purpose of this study was to evaluate the reproducibility of tumor density quantification performed by the routinely used manual two-dimensional (2D) region of interest (ROI) measurement and a semi-automated volumetric approach.

Methods and Materials: This retrospective study was IRB approved. A total of 135 hepatic metastases from colon cancer were evaluated before and after 90-Yttrium treatment. Tumor density was quantified by using a single 2D ROI, average of three 2D ROIs on a single slice and semi-automated segmentation of the entire tumor volume. Interobserver reproducibility was evaluated for each method by two observers. Measurements were repeated after 30 days to assess for intraobserver reproducibility. P < 0.05 was considered significant.
Results: A significant difference was observed between the mean of 2D ROI and volumetric measurements (P < 0.01). Intraobserver reproducibility was good for all three methods. However, a better interobserver reproducibility was observed for volumetric density than for 2D ROI measurements. Volumetric measurements had a lower coefficient of variation (%CV: 2.5%) and higher correlation coefficient (r=0.98, P < 0.01) than single 2D ROI and average of three 2D ROI measurements (%CV: 11.5 and 7.5%, respectively; r=0.88, P < 0.01 and r=0.92, P < 0.01, respectively). Bland-Altman plot showed a better agreement for volumetric density measurements with the narrowest confidence interval (bias: -0.78 HU, 95%CI: -5.31/6.88 HU) when compared with 2D ROI measurements (single ROI bias: -2.15 HU, 95%CI:-15.2/10.9 HU and three 2D ROIs bias: -0.24, 95%CI:-10.9/11.4 HU). Repeatability coefficient was lower for volumetric density, suggesting better reproducibility.
Conclusion: Quantification of tumor density on MDCT is reproducible. Whole lesion density (volumetric density) demonstrated better interobserver reproducibility than 2D ROI measurements.

B-626 11:33

Doppler perfusion index in focal hyperechoic lesions of the liver: Correlation with CT volumetric measurements

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Purpose: To investigate the diagnostic value of Doppler Perfusion Index (DPI = the ratio of hepatic arterial to total liver blood flow) to demonstrate benign or malignant nature of hyperechoic liver lesions with respect to their volumes.
Methods and Materials: The DPI was measured by color Doppler ultrasound in 46 patients, aged 29-83 years, representing up to four focal hyperechoic liver lesions in ultrasound examination. They comprised histopathologically proven liver metastases of colorectal (19 cases) and gastric (10 cases) adenocarcinoma along with 17 subjects with hemangioma. All patients underwent volumetric assessment using multislice CT to calculate total volume of hepatic lesions.
Results: The mean DPI of patients with colorectal (0.36 ± 0.11) and gastric (0.39 ± 0.2) metastases were significantly higher than those with hemangioma (0.14 ± 0.09) (both P < 0.001), whereas metastatic groups did not exhibit any difference in terms of mean DPI. Statistically significant correlations were found between DPI values and calculated total volume of lesions in patients with colorectal and gastric metastases (r = 0.55, P = 0.01 and r = 0.85, P = 0.002, respectively) while this correlation was not demonstrated in hemangioma group. Simple linear regression analysis revealed that every 1 cm^3 increment in total volume of metastatic lesion would increase DPI by 0.32 (95% CI, 0.27-0.36, P = 0.003).
Conclusion: DPI measurement could be a valuable method to distinguish hemangioma from hyperechoic metastatic lesions. DPI changes were directly correlated with total volume of metastatic deposits. Higher degree of correlation in gastric compared with colorectal metastases could be attributed to either hypovascularity or microscopic necrotic changes of the latter group in this study.

B-627 11:42

Detection of malignant focal hepatic lesions: Comparative study between contrast enhanced MRI and intra-arterial contrast enhanced C-arm CT

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Purpose: To compare the performance of intra-arterial contrast-enhanced C-arm-CT (IA-CE C-arm-CT) performed during transarterial chemoembolization (TACE) versus contrast enhanced MRI (CE-MRI) in detecting focal hepatic malignant lesions.
Methods and Materials: The prospective study was approved by the IRB and informed consent was obtained from all patients. Included were 40 patients (25 females, 15 males, mean age: 60 years) with primary malignant hepatic lesions (n=10) or metastatic lesions (n=30). Overall 347 lesions were evaluated. IA-CE C-arm-CT was done by direct injection in the hepatic artery during TACE. Evaluations were performed separately by two radiologists using schematic drawing of liver segments. A third radiologist revised the reason for non detection of lesions either in CE-MRI or in IA-CE C-arm-CT without modifying the results.
Results: Lesions were located in the right lobe (n=245), left lobe (n=97) and caudate lobe (n=5). CE-MRI successfully identified 341 lesions, 6 undetected lesions,

5 were < 8 mm in diameter and all were identified at follow-up. One lesion detected by IA-CE C-arm-CT not identified on follow-up and was regarded as artifact. IA-CE C-arm-CT successfully identified 319 lesions. 28 unidentified lesions; 16 located in left lobe, missed because of contrast injection in right hepatic artery, 9 located in liver-dome, missed because of cone artifact, and 3 were missed because of delayed acquisition of images. CE-MRI showed overall 98.5% sensitivity and 100% positive predictive value while IA-CE C-arm-CT showed 91.9 and 99.7%, respectively.
Conclusion: CE-MRI showed higher sensitivity and positive predictive values compared to IA-CE C-arm-CT in detection of malignant focal hepatic lesions.

B-628   11:51

Is routine early contrast-enhanced CT cost-effective in patients with acute abdomen? A prospective randomized controlled study

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Purpose: It is unclear whether routine computed tomography (CT) is justified and cost-effective in the assessment of the acute abdomen. We studied the costs of treatment and the use of hospital resources in a prospective randomized study comparing routine CT and current standard practice (SP) in patients with acute abdomen.
Methods and Materials: Altogether, 156 patients with acute abdomen admitted to the emergency department were assigned either to: 1) local current standard practice (imaging based on clinical grounds, e.g. ultrasonography, plain radiographs, or CT) or 2) routine contrast-enhanced CT (within 24 hours of admission). Institutional review board approval and informed consent were obtained. Total costs of treatment for each patient were calculated using the actual production costs for each procedure from hospital registers. Length of hospital stay, number and type of diagnostic, surgical and rehabilitation procedures were registered. The t-test was used for statistical analysis.
Results: The groups were homogenous in terms of age, gender and distribution of diagnoses. CT and SP groups did not differ in the length of hospital stay (mean 4.2/4.1 days, p=0.860), number of procedures (mean 10.0/9.6, p=0.797) or the total cost per patient (mean 7.7/7.5 ln /patient, p=0.155). Operation rate (CT/SP) was 33.3/26.7% (p=0.397). However, in the SP group, two patients underwent unnecessary explorative surgery (acute pancreatitis, negative appendicectomy) compared with one in the CT group (negative appendicectomy, p=0.266).
Conclusion: In the assessment of the acute abdomen, early routine CT does not raise the total costs of treatment and may help to avoid unnecessary explorative surgery.

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

GI Tract

SS 1601b

Tumor outside the tube

Moderators:
R. Bouzas; Vigo/ES
C. Kulinna-Cosentini; Vienna/AT

B-629   10:30

Multimodality imaging of peritoneal carcinomatosis with pathologic correlations: Preliminary results of a prospective study

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Purpose: To compare the performances of different imaging modalities in the evaluation of patients under consideration for heated intraperitoneal chemotherapy (HIPEC).
Methods and Materials: Prospective study started in February 2009 of 40 consecutive patients with peritoneal carcinomatosis (PC) of various origins: pseudomyxoma peritonei (n = 16), colorectal (n = 11), ovarian (n = 9) and gastric (4) carcinomas. Within the same day before surgery, a MRI with diffusion weighted images (DWI), a contrast enhanced CT and a PET/CT scans were performed for every patient. For each imaging modality, a preoperative single-observer expert report was provided (peritoneal cancer index and resecability possibilities assessment). Then a postoperative mutli-observer consensus was correlated with surgical exploration and pathologic data, from which statistics were carried out.
Results: Average sensitivities and specificities were, respectively, 91 and 96% for CT, 95 and 87% for MR/DWI and 84 and 86% for PET/CT. A good inter-observer reproducibility was found for advanced disease. PET/CT appears to be of modest interest for pseudomyxoma but very useful for colorectal cancer. CT has an excellent

specificity and DWI seems to provide the best overall sensitivity. The incompleteness of cytoreduction possibility of a pseudomyxoma had been suggested only by DWI.
Conclusion: These preliminary results highlight the excellent specificity of CT, the interesting performances of PET/CT, especially in colorectal cancer and mostly the outstanding overall sensitivity of DWI in the preoperative evaluation of PC. Further patients will be included in order to allow a better selection of HIPEC candidates which will necessarily increase benefit and decrease morbi-mortality.

B-630   10:39

The role of 64-slice CT in the preoperative diagnosis of peritoneal carcinosis - could we establish a radiological peritoneal cancer index? Correlation between radiological and surgical findings

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Purpose: The Peritoneal Cancer Index (PCI) is an important prognostic factor in patients affected by peritoneal carcinomatosis. It is determined during the surgical exploration and used to select patients for cytoreductive surgery. The aim of our study was evaluate the possibility of measuring the PCI on CT scan prior to surgery, in order to establish an accurate evaluation of patients status.
Methods and Materials: CT datasets of 20 patients, with suspected or known peritoneal carcinosis, were prospectively and blindly evaluated by two radiologists with 15 and 10 years of experience in abdominal imaging. All patients underwent preoperative 64-slice CT (Sensation 64, Siemens) and surgical procedures within 33 days. The PCI could vary from 0 to 39: it was determined by dividing the abdominal cavity into 13 regions (0-12), assigning each region a score varying from 0 (no tumor present) to 3 (tumor lesion greater than 5 cm), and it was calculated by adding all lesions size score. At the time of surgery, the intraoperative PCI was also determined and then compared with the two radiological PCI. The Wilcoxon test was used for statistical analysis.
Results: No significant differences were reported between the two radiological PCI, with a slightly higher value for the first observer. However, both radiological PCI were significantly lower than the surgical one (P=0.005 and 0.002).
Conclusion: CT accuracy in the determination of PCI is significantly low. Therefore, it cannot surrogate the intraoperative PCI in the accurate selection of patients to candidate for peritonectomy procedures and hyperthermic intraperitoneal chemotherapy.

B-631   10:48

MDCT of peritoneal carcinomatosis: Correlation with intraoperative findings and evaluation of observer performance related to diagnostic experience

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Purpose: To assess the performance of preoperative MDCT in the detection of peritoneal carcinomatosis (PC) by comparing three readers with different diagnostic experience.
Methods and Materials: Thirty patients with PC from ovarian (n=20) and colorectal (n=9) tumors and from uterine sarcoma (n=1) underwent preoperative MDCT and cytoreductive surgery plus hyperthermic intraoperative peritoneal chemotherapy within 15 days. Three readers (abdominal, general and a 4 year training radiologist) independently evaluated axial and multiplanar reconstructed MDCT images obtained during the portal venous phase of contrast material enhancement, with a collimation of 4x2.5 mm and a slice-width of 3 mm. The extent of PC was assessed using the peritoneal cancer index combining the distribution of tumor throughout 11 abdomino/pelvic regions with a lesion size score. CT results were compared in all patients with intraoperative findings. Agreement between readers was assessed using the Kappa index and the chi-square test.
Results: The presence of PC was correctly determined on MDCT in 30/30, 27/30, 25/30 patients for the three readers, respectively. MDCT understaged PC in 18/30, 26/30, 28/30 patients and overstaged in 2/30, 3/30 and 2/30 patients, respectively. Statically significant interobserver differences were noted (p=0.04) (k=0.35), particularly for tumor localization on mesentery and small bowel and for lesion size.
Conclusion: MDCT detection of peritoneal carcinomatosis is highly dependent on radiologist experience; more specific training, also by using peritoneal cancer index, may improve the diagnostic performance of MDCT in preoperative evaluation of peritoneal carcinomatosis, specially in order to predict a successful cytoreductive surgery.

B-632 10:57

Detection of peritoneal carcinomatosis: Does the association of late Gd-enhanced and diffusion-weighted echo-planar MR images work better than late phase Gd-enhanced MR images alone?

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Purpose: To evaluate the usefulness of 500-1000 s/mm² value diffusion-weighted magnetic resonance imaging (DWI) when added to late Gd-enhanced MR images in the detection of peritoneal carcinomatosis.

Methods and Materials: Diffusion-weighted echo-planar imaging using two different b values (500-1000 s/mm²) as well as conventional MR images (T1-weighted SGE, T2-weighted FSE, 0- and 5-minute delayed gadolinium-enhanced imaging) at 1.5 T were performed in 24 patients with neoplastic peritoneal implants undergoing cytoreductive surgery and HIPEC. Two radiologists evaluated MR images in three reading sessions: A) MR conventional images; B) MR conventional plus 500 s/mm² value DW images; C) MR conventional plus 1000 s/mm² value DW images. Readers were asked to record site and size of peritoneal implants. Statistical values were calculated per patients and per lesion.

Results: On a per patient basis, no significant differences were found. On a per lesion basis, conventional MR images combined either with 500 or 1000 s/mm² DWI led to a significant increase of sensitivity and AZ values (p=0.001). The contribution of DWI resulted to be more prominent for small lesions (≤2 cm). When considering the overall number of implants, no significant differences were found between session B and C. Conversely, when considering patients with ascites as well as implants located on the bowel serosa, there was a trend towards a reduction of FN cases in session C.

Conclusion: Adding DWI to conventional MR imaging allows to increase the detection rate of peritoneal implants and this is more prominent when a b value of 1000 s/mm² is used.

B-633 11:06

The efficacy of MDCT in the diagnostic work-up of peritoneal carcinomatosis in patients with gastric and distal esophageal cancer

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Purpose: To evaluate the efficacy of MDCT in the detection of peritoneal carcinomatosis (PC) in patients with distal esophageal or gastric cancer using postoperative histopathology or explorative laparoscopy as a gold standard.

Methods and Materials: A total of 170 patients (62 female and 108 male) with a median age of 65 years (range, 27-89 years) were included in the study. Two readers rated the presence of PC on a five-point scale (none-very strong) in consensus, by evaluating these variables: presence or absence of ascites; parietal peritoneal thickening or enhancement; mesenteral thickening; small-bowel wall distortion; and peritoneal nodule or omental cake. Descriptive statistical analysis was performed for all criteria using dichotomized ratings (0 absent; 1-4 present), and area under the ROC curve was calculated. Furthermore, a binomial regression analysis was calculated.

Results: Sensitivity was highest for mesenteral thickening at 87.80% [74.46-94.68], while the highest specificity was for peritoneal enhancement at 91.47% [85.38-95.17] and the presence of omental nodules at 91.47% [85.38-95.17]. The positive predictive value ranged between 43-65% and was highest for omental nodules, 65.62% [48.31-79.59]. The negative predictive value was, again, highest for mesenteral thickening at 94.38% [87.51-97.58]. The area under the ROC curve was highest for mesenteral thickening at 0.7646.

Conclusion: Using these criteria, MDCT is an effective technique in the diagnostic work-up of peritoneal carcinomatosis from gastric or distal esophageal cancer.

B-634 11:15

Benign regional lymph nodes in gastric cancer on MDCT: Comparison with healthy population

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Purpose: The purpose of this study was to assess benign regional lymph nodes (LNs) in gastric cancer patients compared with those in healthy population.

Methods and Materials: Between August 2005 and June 2009, 177 patients with surgically proven gastric cancer without LN metastasis (T_{any}N0M0) who had undergone preoperative multi-detector row CT (MDCT), and 168 healthy patients who visited health care center and underwent abdominal MDCT were included in this retrospective study. An abdominal radiologist evaluated the distribution of regional LN and measured the short diameter of LN ≥ 6 mm and LN ≥ 8 mm. The numbers of LN ≥ 6 mm and LN ≥ 8 mm in short diameter were compared between the two groups, and the distribution of LN according to the T stage of gastric cancer was also evaluated.

Results: At least one LN ≥ 6 mm and LN ≥ 8 mm was detected in 63.8% (113/177) and 22.0% (39/177) of gastric cancer group, respectively, and 29.8% (50/168) and 4.8% (8/168) in healthy group, respectively. The difference between the two groups was statistically significant (P < 0.0001 in both). The LN ≥ 6 mm was found in 60.4% (81/134), 75.0% (27/36), 71.4% (5/7), and 0% (0/0) in T1, T2, T3, and T4 cancer, respectively. The LN ≥ 8 mm was found in 14.9% (20/134), 47.2% (17/36), 28.6% (2/7), and 0% (0/0) in T1, T2, T3, and T4 cancer, respectively. T1 cancer showed a significantly lower incidence of LN ≥ 8 mm compared with that of ≥ T2 cancer (P=0.0005).

Conclusion: Benign regional LNs ≥ 6 mm are more frequently detected in gastric cancer patients than in healthy population, and benign LNs ≥ 8 mm is more frequently detected in advanced gastric cancer than in early cancer.

B-635 11:24

The relationship between cancer amount in lymph node metastasis of esophageal cancer and contrast enhanced MDCT pattern and FDG-PET uptake and its clinical significance

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Purpose: Currently, the estimation of cancer amount in lymph node metastasis is considered to be important as the prognostic factor. In this study, the relationship between cancer amount in each metastatic lymph node and its contrast enhanced MD-CT pattern and FDG uptake were investigated by dissected lymph nodes specimen histologically and compared to their prognosis.

Methods and Materials: 49 cases of esophageal cancer with lymph node metstasis who underwent esophagectomy with 3 field lymph node dissection. Total number of dissected metastatic nodes was 134. Contrast enhanced MD-CT (media: 2 ml/kg body, 3 ml/sec i.v., delay time 50 sec) and whole body PET (FDG: 370 MBq, delay time 60 min) were done before esophagectomy. Enhanced pattern of ymph nodes by MD-CT were classified into three types (Plain, Irregular, Rim) and uptakes of FDG were evaluated quantitatively. After operation, the cancer amount in each metastatic node in pathological specimen was examined and compared with its MD-CT pattern or FDG uptake, and compared with each prognosis.

Results: The cancer amount of the each MD-CT pattern is 16.7±25.2% in Plain type, 44.0±32.6 in Irregular type and 70.4±37.8 in Rim type. The uptakes of FDG and the diameter × cancer occupying ratios were significantly correlated (r=0.47, p < 0.001), and the uptake of the SUV > 3.0 cases showed significantly higher early recurrent ratio (69.3% in a year) than SUV < 3.0 cases (27.1%) (p < 0.05).

Conclusion: The amount of metastatic cancer cells in the lymph node of esophageal cancer case can be diagnosed by contrast enhanced MD-CT pattern or FDG-PET uptake and its evaluation has clinical significance as the prognostic factor.

B-636 11:33

Diffusion weighted MR imaging for prediction of nodal status in rectal cancer: A lesion by lesion validation study

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Purpose: To assess the value of diffusion weighted MR-imaging (DWI) in addition to standard T2-weighted MRI for nodal staging in rectal cancer.

Methods and Materials: 35 patients underwent MRI consisting of T2-weighted, 3D-isotropic-T1-weighted sequences and DWI (b-values 0, 500, 1000 s/mm²) prior to surgery. The 3DT1W-images were used for identification of nodes and matching with T2W-MRI/DWI. Nodes identified on T2W-MRI were scored using a confidence level (0=definitely benign to 4=definitely malignant). Mean apparent diffusion coefficient (ADC) was measured for each node identifiable on DWI by drawing an ROI and copying it to the ADC-map. For interobserver reproducibility, ADCs of 20 patients were double-measured by two additional independent readers. An anatomical template was used for lesion-by-lesion matching with histology. Mean-ADC was compared for benign/malignant nodes. ROC-analyses were performed to compare the diagnostic performance on a per lesion basis.

Results: 279 nodes were identified, of which 39 were pN⁺. T2W-MRI identified 136/279 nodes (59%), whereas DWI detected 195/279 (70%). Mean-ADC for N⁺ nodes was significantly higher than that of N⁻ nodes (1347±364 vs 1109±209 *10⁻⁶ mm²/s, p < 0.001). Area under the ROC-curve was 0.75 for T2W-MRI only, 0.70 for ADC only and 0.85 for T2W+ADC combined. AUC for combined T2W+ADC was significantly better than for T2W-MRI or ADC only (p=0.01/0.006 respectively). Reproducibility was good between the 3 readers (interclass correlation coefficient 0.74).

Conclusion: 1. Addition of ADC to standard MRI significantly improves a radiologist's performance for nodal staging. 2. Addition of DWI improves the detection level for rectal cancer lymph nodes. 3. Mean-ADC of malignant nodes is significantly higher. 4. ADC-measurements are reproducible.

B-637 11:42

CT staging of colorectal cancer: What do you find in the chest?

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Purpose: The chest is routinely included in the CT staging of colorectal cancer (CRC), although pulmonary metastases are only seen in 2-4% of patients and usually occur in the presence of metastatic disease beneath the diaphragm. To characterise the thoracic findings in this patient group, a large cohort of staging CT examinations was reviewed.
Methods and Materials: Patients with colorectal adenocarcinoma undergoing standard CT staging over a three-year period were included. All examinations were performed within a single NHS Trust using the same CT scanner and protocol. Two primary outcomes were assessed: the presence of thoracic metastatic disease and the identification of a significant non-metastatic abnormality within the chest.
Results: 514 patients underwent CT staging from 2005 to 2007. 353 (68.7%) had no evidence of metastases within the thorax, 130 (25.3%) had indeterminate pulmonary nodules and 31 patients (6%) had lung metastases. In 4 patients (0.8%), metastatic disease was confined to the chest. 37 subjects (7.2%) had significant non-metastatic findings in the chest including 9 patients (1.8%) with a synchronous primary thoracic malignancy (5 bronchus, 2 breast, 1 oesophagus, 1 mesothelioma) and 6 patients (1.2%) with pulmonary emboli.
Conclusion: Thoracic CT findings altered the initial staging of less than 1% of colorectal cancer patients, although a large number of patients had indeterminate pulmonary nodules likely to require CT follow-up. A small but significant minority of patients have important non-metastatic findings within the chest, which may considerably alter oncological management.

B-638 11:51

Whole body diffusion weighted imaging for distant staging in colorectal cancer: Feasibility and future challenges

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Purpose: To evaluate the feasibility of whole-body diffusion-weighted imaging (WB-DWI) for (local and) distant staging in rectal cancer and compare the lesion detectability with conventional distant staging techniques (CT and/or PET/CT).
Methods and Materials: 6 volunteers and 9 rectal cancer patients with known distant metastases underwent WB-DWI (DWIBS-method, b-values 0.800 s/mm^2, scantime 16 minutes). Five patients were scanned at primary staging, 2 after chemoradiation and 2 both pre- and post-chemoradiation. 3D-MIP-reconstructions in inverted greyscale were generated for image evaluation. Two readers (in consensus) analysed all images for suspected lesions. Histology was the reference for the rectal tumors and CT (n=5), PET/CT (n=4) and/or histology (n=4) for distant metastases.
Results: Image quality was good in all 15 subjects. All rectal tumors were visualised on WB-DWI. On (PET-) CT, the 9 patients had a total of 62 distant metastases (43 liver metastases,19 lymph-node metastases),of which 13 were histologically confirmed. 53/62 lesions (85%) could be identified with WB-DWI. In two patients after chemotherapy, residual liver lesions (3-17 mm) that were still visible on CT and histologically confirmed after liver surgery could not be identified on DWI. In all volunteers and patients, pronounced axillary and inguinal lymph nodes were visible. These nodes visually resembled the metastatic nodes along the abdominal and inguinal vessels as seen in patients and could harbour a risk for false positives.
Conclusion: WB-diffusion images of adequate quality can be obtained within an acceptable timeframe. Lesion detection is promising, but with a risk for false positives. After chemotherapy WB-DWI seems to have limitations in detection of residual lesions.

Chest

SS 1604

Diffuse lung disease

Moderators:
P.-Y. Brillet; Bobigny/FR
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B-639 10:30

CT quantification of pulmonary emphysema: A mirror for a piece of the genome

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Purpose: It has been shown that specific single nucleotide polymorphism (SNP), rs1051730 variants on the 15q24/25 chromosome are associated with lung cancer. The aim of this study was to examine whether presence and degree of emphysema visually scored with CT is also associated with variants of rs1051730.
Methods and Materials: 589 patients underwent chest CT and genetic analysis. Two chest radiologists performed independently a visual assessment of the emphysema on three levels. The degree of emphysema was estimated using 5 categories: group 0: no emphysema, group 1: 1-24%, group 2: 25-50%, group 3: 51-75% and group 4: > 75% of the lung involved. Agreement of emphysema scoring between the radiologists was assessed using intraclass correlation coefficient (ICC) analysis. Emphysema scores were compared with the presence of genetic SNP using a Mann-Whitney-Wilcoxon (MWW) test.
Results: Agreement between the two radiologists was very good (ICC> 0.84, p < 0.0001). The group of patients carrying the rs1051730 SNP had a significantly higher percentage emphysema than the group that did not have the variants of rs1051730 (mean, range: 19.8%, 0-83% versus 1.7%, 0-99%) (MWW test p < 0.001). The SNP incidence was significantly progressive with increasing degree of emphysema. It was 9.9% in group 0, 17.4% in group 1, 18% in group 2, 22% in group 3 and 24.4% in group 4 (Chi-square test, p < 0.023).
Conclusion: Patients with emphysema on CT have a significantly higher chance of having the rs1051730 variants than those who do not have emphysema. This chance increases with increasing severity of the emphysema.

B-640 10:39

Emphysema and pulmonary fibrosis in cigarette smokers: Quantification with HRCT scoring system

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Purpose: To investigate whether HRCT can predict the pattern of pulmonary fibrosis in heavy smokers depending on the presence of emphysema.
Methods and Materials: 54 cigarette smokers (53 male, mean age: 65 yrs) with evidence of pulmonary fibrosis on HRCT were retrospectively evaluated. Patients had no clinical evidence of infection, collagen vascular disease, drug toxicity or environmental exposure. Patients were stratified into 2 groups according to presence of emphysema on HRCT: 1) < 5% presence of emphysema, 2) > 5% presence of emphysema. HRCT scans were scored at 5 predetermined levels with a 15 point scale scoring system for coarseness of fibrosis (Coarseness) and to the nearest 5% for other six HRCT variables: extent of emphysema (emphysema), total extent of interstitial lung disease (Tot Ext ILD), extent of reticular pattern non otherwise specified (RetNOS), extent of ground glass opacity with traction bronchiectasis (ext GGO Bx), extent of pure ground glass opacity (GGO), extent of honeycombing (HC). Emphysema was correlated with HRCT variables and HRCT mean scores were compared between the 2 groups.
Results: Mean HRCT scores were: 5.52 (Coarseness), 13.54% (emphysema), 63% (Tot Ext ILD), 25.65% (RetNOS), 18.23% (ext GGO Bx), 17.48% (GGO), 3.28% (HC). Presence of emphysema correlated significantly with GGO (r=0.814, p < 0.036), ext GGO Bx (r=-0.614, p < 0.042), and coarseness (r=-0.578, p < 0.039). GGO was significantly higher in Group 2 than in Group 1: p < 0.037.
Conclusion: Presence of emphysema on HRCT in smokers? lungs with pulmonary fibrosis is associated with a higher proportion of ground-glass opacity and less coarseness of reticular disease.

B-641 10:48

Ultra-short TE MR imaging on 3 T system: Pulmonary functional loss assessment by using regional T2* measurement in COPD subjects

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Purpose: To determine the capability of regional T2* measurement by using ultra-short TE (uTE) imaging on 3 T MR system for pulmonary functional loss assessment in COPD subjects.
Methods and Materials: Five consecutive normal volunteers and 15 COPD patients underwent the quantitative T2* measurement at 3 T MRI and pulmonary functional measurements (FEV_1/FVC, FEV_1% and %DL_{CO}). All MRI were performed on a 3 T MR system by using a 3D refocused radial imaging sequence with uTEs with the following parameters. From the signal intensity-time course curve of MR data in each subject, a regional T2* map was generated by pixel-by-pixel analyses for each slice. Regional T2* values in each lung filed were determined by ROI measurement, and averaged to determine the mean T2* value in each subject. To compare mean T2* values between normal and COPD subjects, mean T2* values were statistically compared with Student's t-test. To assess the capability for pulmonary functional loss assessment, mean T2* value was correlated with FEV_1/FVC, FEV_1% and %DL_{CO}.
Results: The mean T2* value of normal volunteer (0.58±0.03 ms, mean±standard deviation) was significantly longer than that of COPD patient (0.41±0.04 ms, p < 0.05). The mean T2* value had significantly positive correlation with FEV_1/FVC (r=0.92, p < 0.05), FEV_1% (r=0.84, p < 0.05) and %DL_{CO} (r=0.84, p < 0.05).
Conclusion: Regional T2* measurement by using uTE imaging on 3 T MR system was useful for pulmonary functional loss assessment in COPD subjects.

B-642 10:57

Dual energy CT for the assessment of lung morphology, ventilation, and perfusion

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Purpose: To evaluate the feasibility of functional imaging including pulmonary perfusion and ventilation by dual energy CT.
Methods and Materials: 10 patients were examined in general anesthesia with artificial respiration. Two CT scans were obtained on a dual source CT in dual energy mode at 140 and 80 kVp tube voltages and 14 x 1.2 mm collimation. Tube currents were adjusted to obtain a CTDI of 7.7 mGy / cm. One scan was performed after xenon ventilation at 30% expiratory concentration, a second one after intravenous iodine contrast administration in pulmonary arterial phase. Post processing was performed using a three material decomposition to quantify the content of xenon or iodine in the lung tissue. Color maps were generated to visualize the distribution of xenon and iodine.
Results: The exams were obtained without any complications. Sufficient concentrations of xenon and iodine were obtained to make a three material decomposition feasible. Xenon and iodine maps represented the ventilation and perfusion well: in areas of dystelectasis or close to effusions, ventilation was restricted. Distal to pulmonary emboli, there were perfusion defects in the corresponding segments.
Conclusion: Dual energy CT with xenon ventilation and iodine contrast makes it possible to combine the information on morphology and high-resolution parenchymal structure with functional information on ventilation and perfusion. This opens up new perspectives of a comprehensive assessment of pulmonary diseases in CT.

B-643 11:06

also EPOS

Depiction of lung parenchyma by high pitch dual-source CT in patients breathing during acquisition

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Purpose: To prospectively investigate the diagnostic accuracy of DSCT in the high pitch mode (HPM, pitch 3.2) for the assessment of pulmonary parenchyma with and without breathing during CT acquisition.
Methods and Materials: Forty consecutive patients underwent clinically indicated thoracic-abdominal 128-slice DSCT angiography consisting of an unenhanced, an arterial, and a venous contrast phase acquisition. The acquisitions were performed in a HPM during breathing (group A), a HPM without breathing (group B), and at a standard pitch (pitch 0.8) without breathing (group C) randomly assigned to the three phases in each patient. Two blinded readers independently evaluated among the three CT acquisitions the image quality of 5 areas of the lung parenchyma using a 4-point-scale, the lung volume, and the size of pulmonary nodules.

Results: A total of 400 lung areas in each acquisition phase were evaluated. Inter-observer agreement for image quality ratings was excellent (κ=0.91). Average lung volume in group A (ie, during breathing) was 75%±15 of that in deep inspiration. Image quality other than excellent or good was found in 2.5% (5/200) of evaluated lung areas in group A, 1.5% (3/200) in group B, and 5.5% (11/200) in group C. Image quality impairment in group C was mainly due to cardiac pulsation artifacts. There was no significant difference in the size of pulmonary nodules among the three acquisitions (p=0.94).
Conclusion: DSCT examinations in the HPM during breathing provide diagnostic visualization of the lungs superior to that achieved in standard pitch CT during breath-hold.

B-644 11:15

Thin-section chest CT findings in systemic lupus erythematosus with antiphospholipid syndrome: A comparison with systemic lupus erythematosus alone

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Purpose: Systemic lupus erythematosus (SLE) with antiphospholipid syndrome (APS) patients have an increased risk for major vascular thromboses and organ infarction. Although thin-section chest CT is of proven value in assessing many diffuse pulmonary diseases, there is no report specifically detailing the thin-section CT findings in SLE with APS. The purpose of our study was to assess thin-section chest CT findings in SLE with APS and to compare with the findings in SLE without APS.
Methods and Materials: We retrospectively reviewed the medical records and thin-section CT findings of 17 consecutive patients with an established diagnosis of SLE with APS between 2004 and 2008, and compared these findings of 37 consecutive SLE patients without APS. Patients who had other autoimmune disease were excluded. No statistical differences were seen between the two groups in age, gender, smoking habits, or history of steroid pulse and biological therapy. CT images of 2 mm thickness obtained with a 16- or 64- detector row CT were retrospectively evaluated by two radiologists in consensus.
Results: The frequency of thin-section CT abnormalities was higher in SLE with APS group (82%) than in SLE without APS group (43%). Ground-glass opacity (59%), architectural distortion (47%), reticulation (41%), enlarged peripheral pulmonary artery (29%), and mosaic attenuation (29%) were significantly more common in the SLE with APS group than those in the SLE without APS group (Fisher's exact test, p < 0.01).
Conclusion: SLE patients with APS have increased prevalence of thin-section chest CT abnormalities than those without APS.

B-645 11:24

Interstitial lung diseases in a lung cancer screening trial

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Purpose: To determine the prevalence and the evolution of interstitial lung disease (ILD) in a population of smokers included in a lung cancer screening trial.
Methods and Materials: Two observers, blinded to any information, independently reviewed for the presence of ILD the low-dose thin-section CT scans of 692 consecutive heavy smokers (age ≥ 49 yrs, with ≥ 20 pack-years of smoking history) recruited by the Multicentric Italian Lung Detection (MILD) trial. The observers recorded the CT abnormalities and assigned a CT diagnosis of the disease. Subsequently, the observers evaluated the evolution of the abnormalities in the available CT scans obtained after three years.
Results: In 158 out of 692 (22.8%) cases were recorded the presence of CT abnormalities consistent with ILD. In these cases, the CT diagnoses were respiratory bronchiolitis (RB)-like (109/692, 15.7%), nonspecific interstitial pneumonia (NSIP)-like (26/692, 3.8%), usual interstitial pneumonia (UIP)-like (2/698, 0.3%), and indeterminate (21/698, 3%). After three years, 40/44 (90.1%), 2/44 (4.5%), 2/44 (4.5%) RB-like cases and 9/14 (64.3%), 3/14 (21.4%), 2/14 (14.3%) NSIP-like cases showed no changes, an increase and a decrease in the extent of the abnormalities, respectively. Among the indeterminate CT diagnoses, the abnormalities remained stable, resolved and increased in 8/14 (57.2%), 4/14 (28.5%), 2/14 (14.3%) cases at follow-up.
Conclusion: Thin-section CT features of ILD, probably representing smoking-related ILD, are not uncommon in a lung cancer screening population and should not be overlooked.

Monday

B-646 11:33

Comparison of CT lung volume assessment and measured lung volumes in 100 lung transplant candidates

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Purpose: To compare the accuracy of CT volume measurement of total lung volume (TLV) with total lung capacity (TLC) as measured with traditional lung function tests in prospective lung transplant candidates.
Methods and Materials: One hundred consecutive lung transplant candidates, with obstructive, restrictive or mixed-pattern lung diseases, were retrospectively evaluated. Each patient underwent volumetric chest CT and lung function testing (including TLC assessment with helium dilution) as part of their routine transplantation work-up. TLVs were calculated from existing CT data by two independent operators (E.T.; A.M). using existing software (Vital Images, Minneapolis, USA).
Results: There was a strong correlation between TLV measured by both operators and TLC (E.T.: r=0.825, p < 0.001; A.M.: r=0.784, p < 0.001) with no significant difference between individual operators. There was a strong correlation between TLC and calculated TLV when data were stratified into patients with obstructive (n=65, r=0.762, p < 0.001) and restrictive (n=30, r=0.893, p < 0.001) lung disease. The calculated TLVs were generally larger than TLCs (Bias: 954±2168 mls). This was more so in obstructive disease (Bias: 1199±2467 mls) compared to restrictive disease (Bias: 446±959 mls). These observations were in keeping with the known limitations of helium dilution, especially in subjects with severe lung disease.
Conclusion: The results of this study show that CT volume measurement correlates well with our existing gold standard and is a useful tool in the assessment of lung transplant candidates who cannot undergo full lung function testing.

B-647 11:42

Quantification of lung tissue damage in multiple trauma patients: Final results of the correlation between CT-findings and circulating Clara cell-protein 16 (CC16) plasma levels

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Purpose: To analyse the correlation of initial circulating Clara Cell-Protein 16 (CC16) levels with the amount of lung tissue damage observed in CT-diagnostics and to evaluate if CC16 plasma levels, produced by Clara Cells located in the respiratory system, can be used to indicate and quantify lung injury in multiple trauma patients.
Methods and Materials: CC16 serum levels upon admission from 76 patients with multiple trauma (ISS ≥16) were analysed by ELISA. Patients were divided into those without lung tissue injury (NLI, n=23) and those with a verified lung contusion in the initial CT scan (LI, AIS_{chest} ≥3, n=53). Values were compared to those of ten healthy non-smoking volunteers. One-way ANOVA with post-hoc pairwise testing (Tukey) was used for statistical analysis (p value < 0.05 was considered significant).
Results: Patients with CT confirmed lung tissue injury showed significantly higher CC16 levels than multiple trauma patients without lung tissue injury and healthy controls (Contr. 5.5 ± 1.4 ng/ml [SD], NLI 6.9 ± 3.2 ng/ml, LI 11.5 ± 8.1 ng/ml; p overall = 0.0085, Contr. Vs. LI p=0.02, Contr. Vs. NLI p=0.20; NLI vs. LI p < 0.01).
Conclusion: Elevated CC16 levels indicate lung tissue injury in multiple trauma patients and correlate with the amount of lung tissue damage observed in CT-diagnostics. This might be used for therapeutic guidelines, e.g. when deciding on kinetic positioning during ICU treatment.

B-648 11:51

also EPOS

Micro-CT of pulmonary fibrosis in mice induced by adenoviral gene transfer of biologically active transforming growth factor-beta1

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Purpose: Somatic cell gene transfer of biologically active transforming growth factor-ß1 (AdTGF-ß1) has recently been described to trigger pulmonary fibrosis development in rodents. Here, we evaluated Micro-CT as novel non-invasive tool to assess progression of pulmonary fibrosis in mice over time.
Methods and Materials: 30 female C57BL/6 mice were infected with AdTGF-ß1 (n=18) or control vector AdDL70-3 (n=12). In groups of mice, respiratory gated and ungated micro-CT (80 kV, 450 μA, 0.094 mm effective pixel size) was obtained at 1, 2, 3 and 4 weeks after adenoviral transfer. In parallel, animals were euthanized and histology was obtained to determine the degree of fibrosis using an Ashcroft-based fibrosis scoring system. Visual assessment of both image quality and degree of fibrosis was performed by 3 blinded observers using a 5-point rating scale. A semi-automated, region-growing segmentation was applied to quantify consolidations.
Results: Highly significant correlations were found between histologic Ascroft scale values and results obtained from visual image assessments for all observers and examination techniques employed (i.e. with or without respiratory gating). Semi-automated segmentation results showed highly significant correlations to histologic values for both respiratory gated (p=0.04) and ungated data (p=0.06). Impact of respiratory gating on image quality, development of fibrosis over time and inter-/intra-observer variability were statistically evaluated.
Conclusion: Respiratory gated/ungated micro-CT allows valid in vivo evaluation of the degree of pulmonary fibrosis in mice challenged with AdTGF-ß1 both using visual assessment or semi-automated quantification algorithms.

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

Vascular

SS 1615

Imaging atherosclerosis, plaques and vessel wall inflammation

Moderators:
C. Delgado; Vigo/ES
E. Di Cesare; L'Aquila/IT

B-649 10:30

Potential of ^{18}F-FDG PET and multidetector-row CT in identifying vulnerable carotid plaques

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Purpose: Plaque inflammation and composition can be assessed noninvasively by ^{18}F-fluoro-2-deoxyglucose positron emission tomography (^{18}F-FDG PET) and multidetector-row spiral computed tomography (MDCT), respectively. We aimed to investigate whether ^{18}F-FDG PET and/or MDCT can detect differences between carotid plaques ipsilateral to the side of symptoms and contralateral asymptomatic plaques of TIA/stroke patients.
Methods and Materials: Fifty TIA/stroke patients with an ipsilateral carotid plaque causing < 70% stenosis and a plaque on the contralateral asymptomatic side underwent ^{18}F-FDG PET and MDCT. The findings of both sides were compared by Wilcoxon signed rank analysis.
Results: ^{18}F-FDG standard uptake values (SUVs) did not significantly differ between ipsilateral and contralateral plaques. MDCT-assessed vessel wall and lipid-rich necrotic core (LRNC) volumes were larger in ipsilateral plaques (982.3 vs. 811.3 mm³, P=0.016, and 164.7 vs. 134.3 mm³, P=0.026).
Conclusion: Compared to contralateral asymptomatic plaques, MDCT detected larger vessel wall and LRNC volume in ipsilateral plaques, whereas ^{18}F-FDG PET did not detect significant differences. MDCT may be useful for identifying vulnerable carotid plaques, whereas ^{18}F-FDG PET may be of limited value.

B-650 10:39

The detection of inflammation within carotid artery plaque in humans using late phase contrast enhanced ultrasound

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Purpose: Preclinical studies have shown that non-targeted microbubbles can adhere to inflamed endothelium. This study aimed to determine whether late phase imaging with contrast enhanced ultrasound (LP CEUS) can be used to identify inflammation within carotid artery atherosclerotic plaques in humans.
Methods and Materials: LP CEUS was performed in 20 symptomatic and 25 asymptomatic patients with > 50% carotid stenosis, 6 minutes following 2 ml bolus of SonoVue at intermediate-high MI using Philips US scanner iU22 with an L12-5 probe. Qlab software was used to draw ROIs and quantify the degree of microbubble accumulation in the plaque. The signal from the plaque was normalised to the lumen, and the normalised plaque signal intensity was compared between the two groups (symptomatic and asymptomatic). Grey Scale Mean (GSM) score was also calculated. Raw linear data was log transformed for statistical analysis. T-tests and Pearson correlations were calculated using where appropriate.
Results: Normalised plaque signal was significantly greater for the symptomatic vs the asymptomatic group (+0.39 vs -0.69; p < 0.0005). GSM also differed between the two groups (symp vs asymp: 12.9 vs 26.6; p = 0.02). There was a weak correlation between the two (p = 0.0056; r = -0.4565). There was a subset of asymptomatic patients whose normalised plaque values overlapped those of the symptomatic group.

Conclusion: LP CEUS may have the ability to detect inflammation, and these data show that indeed LP CEUS plaque signal is greater in symptomatic vs asymptomatic patients. A comparison between signal and histology is warranted to confirm that LP CEUS can detect inflammation.

B-651   10:48

also EPOS

Magnetic resonance imaging (MRI) of carotid plaque: Is carotid plaque enhancement (CPE) associated with inflammatory cell infiltration (ICI) at histopathology?

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Purpose: To assess the association between CPE at MR imaging and ICI at histopathology.

Methods and Materials: We prospectively studied 28 patients (67±9 years) scheduled for thromboendarterectomy with 1.5-T MRI using: (a) unenhanced axial T1-weighted gradient-echo sequence on carotid bifurcations, with/without fat-sat; (b) MR angiography (MRA) with 0.1 mmol/kg gadobenate dimiglumine; (c) repetition of (a), without fat-sat, three minutes after contrast injection. High-sensitivity-C reactive protein (hs-CRP) serum level was obtained immediately before MRI. We used a 3-point score (0=absent; 1=focal; 2=wide) for both CPE at MRI subtracted images and ICI at histopathology. Stenosis degree was measured on MRA. Agreement between CPE and ICI was evaluated using Cohen kappa. Diagnostic performance was obtained collapsing the 3-point scores in a dichotomous variable. Mann-Whitney and Chi-square tests were used.

Results: ICI was absent in 16 patients, focal in 8, wide in 4. Six MRI studies were discarded due to patient movements; of the remaining 22 patients, CPE was absent in 13, focal in 6, wide in 3 (k=0.57, moderate agreement). Sensitivity, 0.78 (7/9); specificity, 0.85 (11/13); accuracy, 0.82 (18/22); positive predictive value, 0.78 (7/9); negative predictive value, 0.85 (11/13). hs-CRP level showed no correlation either with ICI (p=0.945, n=28) or CPE (p=0.647, n=22). Stenosis degree was moderate in 7 and severe in 21, without correlation either with ICI (p=1.000, n=28) or with CPE (p=1.000, n=22); a borderline correlation with hs-CRP serum level (p=0.062, n=28) was found.

Conclusion: CPE using 0.1 mmol/kg of gadobenate dimeglumine can be used as a marker of ICI.

B-652   10:57

Symptomatic patients with mild to moderate carotid stenosis: Plaque features at MRI and association with cardiovascular risk factors

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Purpose: In symptomatic patients with mild to moderate carotid stenosis, the balance between benefit and risk of carotid endarterectomy is small. The objective was to assess plaque characteristics in this population and to investigate associations with cardiovascular risk factors.

Methods and Materials: One hundred patients underwent MR plaque imaging. Carotid plaque characteristics of patients with mild and moderate carotid stenosis were assessed and compared by independent-samples T-tests and Pearson chi-square tests. Associations between plaque characteristics and cardiovascular risk factors were assessed by multivariate logistic and linear regression.

Results: Patients with moderate stenosis had plaques with a higher prevalence of intraplaque hemorrhage (IPH) (46.2 vs. 16.4%, P=0.001) as well as a thin and/or ruptured fibrous cap (FC) (61.5% vs. 36.1%, P=0.013), a larger lipid-rich necrotic core (LRNC) percentage (12.3% vs. 6.8%, P=0.042) and smaller fibrous tissue percentage (82.7 vs. 88.4%, P=0.024). Increasing age was positively associated with IPH (odds ratio [OR] [per year]=1.07 [95% CI, 1.01 to 1.13], P=0.019). Statin use was negatively associated with IPH (OR=0.28 [95% CI, 0.08 to 0.90], P=0.033) and a thin and/or ruptured FC (OR=0.33 [95% CI, 0.13 to 0.85], P=0.022), and with LRNC percentage (B=-8.17 [95% CI, -13.78 to -2.56], P=0.005). Statin use was positively associated with fibrous tissue percentage (B=8.08 [95% CI, 2.77 to 13.40], P=0.003).

Conclusion: We found that symptomatic patients with moderate stenosis have a higher prevalence of complicated plaques than patients with mild stenosis. Increasing age was positively associated with IPH, whereas statin use was negatively associated with complicated plaque features.

B-653   11:06

Atherosclerosis-imaging using FDG-PET/CT: Correlation of morphologic and metabolic vessel wall lesions

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Purpose: The aim of this study was to determine the incidence of atherosclerotic vessel wall changes and focal tracer uptake in the aorta and pelvic arteries in FDG-PET/CT to identify active plaque.

Methods and Materials: In this retrospective study, we included 350 patients (mean age 56 ± 14 years, 164 female, 186 male) referred for tumor staging with whole-body PET between January 2003 and January 2005 using 18 F-fluorodeoxyglucosis [FDG]. The whole-body CT data were used to identify atherosclerotic changes (aneurysm, thrombus, non-calcified and calcified plaque) in the different segments of the aorta (ascending, arch, descending, abdominal aorta, iliac arteries). Metabolic data were analyzed for focal tracer uptake using a threshold of the standardized uptake value [SUVmax] of 1.7. Findings were correlated with clinical follow-up and cardiovascular events (stroke, myocardial infarction, coronary bypass surgery).

Results: Mean follow-up time after imaging was 19.8 ± 21 months. 241 of 350 patients died from progressive oncologic disease. 13 patients had a cardiovascular event with 10 consecutive deaths. 215 patients (61%) showed 729 wall pathologies with 85 of these (12%) having a focal increased metabolism. The most common wall pathologies were calcified plaques (91%), the most often affected segment were the iliac arteries (43%). All patients with cardiovascular events had atherosclerotic wall lesions, 12% of these lesions showing focal tracer uptake.

Conclusion: Combined PET/CT imaging detected focal tracer uptake in 12% of all atherosclerotic vessel wall lesions, suggesting active plaque. There was no difference in the percentage of active plaques in patients with cardiovascular events.

B-654   11:15

In vivo quantification of total atherosclerotic burden: Prognostic value of whole body CTA in relation to traditional cardiovascular risk index, risk stratification and 4-year follow-up

A. Napoli, M. Anzidei, F. Zaccagna, B. Cavallo Marincola, G. Brachetti, L. Molisso, G. Cartocci, C. Catalano, R. Passariello, R. Passariello; *Rome/IT (napoli.alessandro@gmail.com)*

Purpose: To determine whether WB-CTA in asymptomatic adults provides prognostic information superior to traditional method of risk stratification and can more accurately guide primary preventive strategies in patients with CHD risk factors.

Methods and Materials: 341 patients with CV risk factors (mean age 63.39±10.4 [34-89]) underwent WB-CTA. Data sets were obtained using a 64x0.6 mm detector configuration and an adapted contrast injection protocol (Iomeprol-400, 400 mgI/ml; 70+50 ml@4 ml/s). The coronary arteries were divided into 15 segments and the extra-coronary arteries into 32 segments for evaluation. Detected stenoses were graded using a 5 point scale (0-4 normal-occlusion; 5 aneurysm). An atherosclerosis burden score (ABS) was generated for each individual and correlated to traditional cardiovascular (CV) risk (Framingham risk index; FRI). Event-free survival for patients stratified using both ABS then FRI was compared using Kaplan-Meier curves. Stepwise multivariable Cox proportional hazards regression models was used to determine independent predictor of future CV events.

Results: Patients were contacted 47.7±8.7 months after WB-CTA to determine health status during follow-up period. Mean ABS was 19.5±20.1 and mean FRI was 12±10.7. Mean event-free time was of 48.11±1.7 m for ABS< 10, 44.13±1 m for 10<ABS20. Event-free time was significantly different between patients groups stratified with ABS (p=0.018). Mean event-free time was 46±0.5m for FRI mild-risk group and 44.7±0.9 m for high-risk group without significant differences between the two groups (p=0.054). When a stepwise multivariable model was used, only age (p=0.011), ABS score (p=0.000) and therapy (p=0.001) predicted hard events.

Conclusion: WBCTA-derived ABS reflects actual atherosclerotic burden and provides superior risk stratification and event analysis with respect to FRI; hard event prediction was significantly associated to age, ABS and therapy but not to FRI.

B-655   11:24

Association among risk factors, cardiovascular events, and aortic wall thickness (AWT) at contrast-enhanced 64-MDCT

S. Tresoldi, E. Zoffoli, A. Munari, G. Di Leo, F. Sardanelli, G. Cornalba; *Milan/IT (silvia.3soldi@gmail.com)*

Purpose: To assess the association among risk factors, cardiovascular events, and AWT at contrast-enhanced 64-MDCT.

Methods and Materials: One hundred and forty-eight consecutive patients (78 males; 67±12 years) underwent chest contrast-enhanced 64-MDCT (70-130 ml of Ultravist370, collimation 64×0.6, slice thickness 5 mm, 300 mAs, 120 kVp). Using

images reconstructed perpendicularly to the aortic axis, we measured the maximum AWT in the slice where it visually seemed to be maximal. On axial images, we visually scored the calcium content of each of the six aortic segments as absent=0, moderate=1, severe=2 (total calcium score, TCS, from 0 to 12). For each patient, we collected clinical cardiovascular history and risk factors. Correlation analysis and Kruskal-Wallis and Mann-Whitney tests were used.

Results: Out of 148 patients, 88 reported sedentary life-style, 65 hypertension, 48 smoking, 34 hypercholesterolemia, 20 family history, 18 diabetes, and 15 BMI > 30 kg/m^2; 13 reported myocardial infarction, 12 aortic aneurism, 12 revascularization, and 4 stroke. TCS was: 0 in 36 patients, from 1 to 4 in 73, from 5 to 8 in 36, and $\geq$ 9 in 3. AWT was not assessable in 11 patients; for the remaining 137 patients, mean AWT (3.4±1.6 mm) correlated with age (r=0.581, p < 0.001) and hypertension (p < 0.001). Patients without cardiovascular events had a mean AWT of 3.3 mm, while those with at least one event of 4.3 mm (p < 0.001); 2.5 and 3.6 (p=0.019) for the TCS, respectively. AWT also correlated with calcium content (r= 0.630, p < 0.001).

Conclusion: Among risk factors, age and hypertension affect the maximum AWT. Patients with AWT > 3 mm have a high probability for cardiovascular events.

B-656 11:33

Atherosclerotic carotid plaques in asymptomatic patients have more calcium than atherosclerotic carotid plaques in symptomatic patients: An analysis with multidetector CT angiography

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Purpose: Calcification in atherosclerotic carotid plaques has been associated with carotid plaque stability. We therefore hypothesize that asymptomatic patients have higher calcium volumes in their atherosclerotic plaques than symptomatic patients.
Methods and Materials: 132 asymptomatic patients (74% male, age 70±8 y) and 346 symptomatic patients (60% male, age 62±14 y) with cerebrovascular symptoms in the territory of the carotid artery underwent Multi-detector CT Angiography of the carotid arteries. Asymptomatic patients were scanned using a 4-slice scanner (Philips MX8000, Best, The Netherlands). Symptomatic patients were scanned using a 16-slice MDCT scanner (Siemens, Sensation 16, Forchheim, Germany). We evaluated all carotid arteries for the presence of atherosclerotic plaque, and stenosis degree was measured. Images of carotid arteries containing plaque were analyzed using a custom-made image analysis software for calcium volume and plaque volume. The cut-off value for calcifications was > 130 HU. The two groups were compared adjusting for age, sex and cardiovascular risk factors.
Results: Atherosclerotic carotid disease was present in 53% of asymptomatic patients and in 80% of symptomatic patients. Stenosis degree was 23±29% in symptomatic patients and 27±22% in asymptomatic patients, which was not significantly different. Plaque volume in the 185 symptomatic patients was 873±655 and 1012±548 mm^3 in the 105 asymptomatic patients, which was not significantly different. The contribution of calcium to plaque volume was 14±13% in symptomatic patients and 24±17% in asymptomatic patients which was significantly different (p < 0.001).
Conclusion: The calcified part of atherosclerotic carotid plaque in asymptomatic patients was significantly larger than in symptomatic patients. Calcium contributes to plaque stabilisation.

B-657 11:42

also EPOS

Comprehensive assessment of Takayasu arteritis with whole-body MRA and vessel wall imaging

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Purpose: The purpose of this study was to assess vessel involvement and activity of Takayasu arteritis (TA) with whole-body MRA and vessel wall imaging.
Methods and Materials: Whole-body MRA was performed in 34 patients with TA. Image quality of each station was assessed. In 18 of all patients, precontrast and postcontrast high-resolution vessel wall imaging were also acquired. Then, these 18 patients, including 20 examinations (2 patients had repeated follow-up MRA), were divided into two groups: active/persistent (n=14) and remissive group (n=6), according to the Birmingham Vasculitis Activity Score in 2003. Vessel wall thickness and postcontrast signal intensity of vessel wall relative to psoas muscle were analyzed.
Results: Whole-body MRA yielded a dedicated image of systemic and pulmonary artery. A total of 1583 arterial segments were assessed. The average score of visibility and venous contamination were 2.88±0.03 and 0.69±0.04, respectively. In all patients, whole-body MRA depicted various pathological entities. In 29 cases, these vessel lesions were located in multiple territories and could not be included in mono-station MRA. For vessel wall imaging, wall thickness of the active/persistent group (5.4±1.21 mm) was thicker than the remissive group (3.7±1.15 mm; P

= 0.01,< 0.05), and postcontrast signal intensity ratio was significantly different between two groups (active/persistent vs remissive, 1.47±0.49 vs 1.19±0.31; P = 0.001, < 0.01).
Conclusion: Whole-body MRA combined with vessel wall imaging had the potential for a comprehensive assessment of vessel involvement and activity of TA, which may be very useful in diagnosis and follow-up.

B-658 11:51

Spontaneous cervical artery dissection, an inflammatory disease? Results of a prospective observational PET/CT and MRI study

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Purpose: Spontaneous cervical artery dissection (sCAD) is a frequent cause of ischemic stroke in young adults. The pathogenesis of sCAD is poorly understood. However, several observations suggest an inflammatory component. High-resolution MRI and F18-FDG-PET/CT may non-invasively detect perivascular inflammation. The aim of this study was to use PET/CT and MRI to estimate the prevalence of perivascular inflammation in sCAD.
Methods and Materials: In this prospective monocentric observational study, 33 consecutive patients with sCAD received a high-resolution black-blood contrast enhanced cervical MRI at 3 Tesla (best in-plane resolution 0.5 x 0.5 mm^2; fat-saturated pre- and post contrast T1w-, T2w- and TOF images) in combination with PET/CT. Patients demonstrating perivascular uptake of gadolinium (MRI) and/or FDG-uptake (PET/CT) were reassessed by MRI and/or PET/CT after three months.
Results: 27 patients (82%) PET/CT demonstrated significant perivascular FDG-uptake at the site of the arterial dissection, which in 7 patients (21%) was not confined to the site of the dissection. There was a strong positive correlation between the presence of a dissection and perivascular contrast enhancement (R=0.73; p < 0.001) and edema (R=0.65; p < 0.001) as assessed by MRI. In all patients with positive MRI and/or PET findings, follow-up examinations revealed spontaneous normalization or partial resolution of perivascular abnormalities.
Conclusion: This study demonstrates that inflammatory changes at the site of the arterial dissection are common in sCAD patients. In a subset of these patients, perivascular inflammation was not confined to the site of the dissection, suggesting that vessel wall inflammation might play a role in the pathogenesis of sCAD.

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

Genitourinary

SS 1607

Kidney

Moderators:
A.L. Baert; Kessel–Lo/BE
M. Baramia; Tbilisi/GE

B-659 10:30

DTI of the kidney at 3 T: Feasibility, protocol evaluation and comparison to 1.5 T

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Purpose: To assess the feasibility of DTI of the kidney at 3 T. We compared fractional anisotropy (FA) and apparent diffusion coefficients (ADC) of various acquisition protocols at 1.5 T and 3 T and determined reproducibility of these measurements.
Methods and Materials: Ten healthy volunteers were examined with an Echo-Planar-Imaging-sequence (TR1800/TE58/b=0/300) at 1.5 T and 3 T (Magnetom Avanto/Verio, Siemens). Measurements were performed with respiratory-triggering, during free-breathing or breath-hold, in 6 or 12 directions and with an additional b-value b=50. Signal- and contrast-to-noise-ratios (SNR; CNR) were calculated with the subtraction-method. Statistical analysis was performed with Wilcoxon-signed-rank-tests, Intrareader-correlation with Weighted-κ-coefficients and reproducibility with the root-mean-square-average- and the Bland-Altman method.
Results: SNR and CNR cortex and medulla were significantly higher at 3 T, leading to improved corticomedullary discrimination. FA of the medulla was significantly higher than that of the cortex. No significant FA- and ADC differences could be found between 1.5 T and 3 T. Three b-values led to lower ADC-values, whereas 12 diffusion-directions resulted in lower cortical FA-values. FA and ADC of breath-hold- and free-breathing-protocols were significantly higher and less reproducible than

those of respiratory-triggered protocols. Variance was highest for medullary FA in all protocols with reproducibility-coefficients ranging from 0.36 to 0.46. Intrareader-correlation was excellent with $\kappa=0.82$-0.94.

Conclusion: DTI of the kidney at 3 T is feasible. FA- and ADC-values do not significantly differ to 1.5 T at significantly higher SNR and CNR. Values and reproducibility of FA and ADC vary with applied respiratory motion-compensation-method, number of b-values and diffusion directions. We recommend a respiratory-triggered protocol due to improved image quality and reproducibility.

B-660 10:39
Renal cell carcinoma and renal angiomyolipoma: Differential diagnosis with real-time contrast-enhanced ultrasound
H.-X. Xu, Z.-F. Xu; *Guangzhou/CN (xuhuixiong@hotmail.com)*

Purpose: To evaluate the usefulness of contrast-enhanced ultrasound (CEUS) in differentiating renal cell carcinoma (RCC) from renal angiomyolipoma (RAML).
Methods and Materials: One hundred and nineteen patients with 126 renal lesions (33 RAMLs and 93 RCCs) who had undergone CEUS examination were retrospectively recruited between September 2004 and November 2008. All the lesions were histopathologically or clinical proved. CEUS was performed using low acoustic power modes and ultrasound contrast agent of SonoVue. The tumor enhancement pattern, extent, and dynamic change were recorded. The diagnostic efficacy of CEUS in differentiating the two diseases was computed and compared.
Results: On CEUS, the features of washout from hyper- or iso-enhancement to hypo-enhancement over time (observed in 3.0% of RAMLs and 71.0% of RCCs; P < 0.001), heterogeneous enhancement (observed in 12.1% of RAMLs and 74.2% of RCCs; P < 0.001) and perilesional enhanced rim (observed in 3.0% of RAMLs and 79.6% of RCCs; P < 0.001) achieved significant difference between RCCs and RAMLs. Early washout and heterogeneous enhancement or peritumoral rim enhancement yielded the highest diagnostic capability in differentiating RCC from RAML. The corresponding sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 88.2% (82/93), 97.0% (32/33), 98.8% (82/83), 74.4% (32/43) and 90.5% (114/126), respectively.
Conclusion: The CEUS features of early wash out, heterogeneous enhancement and peritumoral enhanced rim highly suggest RCCs, whereas homogeneous enhancement and prolonged enhancement are characteristic manifestations of RAML. CEUS is valuable in differentiating RCC from RAML.

B-661 10:48
Renal masses with equivocal enhancement at CT: Evaluation at CEUS
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Purpose: To investigate the role of contrast enhanced ultrasound (CEUS) in characterization of renal masses equivocal for enhancement at CT.
Methods and Materials: From October 2003 to September 2009, 30 consecutive patients (23 Men, 7 women, mean age, 64 years, range: 37-83 years) with renal masses who had equivocal enhancement at CT and did not present as simple cysts at grey-scale US underwent CEUS. All patients had at least an unenhanced examination followed by a contrast material-enhanced scan during the nephrographic phase, by using a scanning delay of 90-100 seconds. Equivocal enhancement was defined as a difference of 10-20 HU between the unenhanced and the contrast-enhanced images. After preliminary grey-scale and color Doppler US, CEUS was performed using low acoustic power, contrast specific modes. A bolus of SonoVue was injected to examine the lesion, followed by a saline flush. All examinations were digitally recorded for retrospective evaluation.
Results: After microbubble administration, 14 lesions were characterized as solid vascularised masses. 10/14 has histological confirmation. There were 6 papillary cancers, 1 chromophobe tumor, 1 metanephric adenoma, 1 metastatic tumor, 1 oncocytoma. 16 lesions were complex cystic masses. There were 9 Bosniak category IIF cysts (1 benign at surgery, 8 stable after follow-up of 1-3 years). Two Bosniak category III and 5 Bosniak category IV cysts were malignant at surgery.
Conclusion: CEUS allows differentiation between pseudoenhancement and presence of enhancing tissue in renal lesions presenting at CT with equivocal enhancement (10-20 HU).

B-662 10:57
CT guided percutaneous core-biopsy of renal masses: Short-term complications, a prospective study
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Purpose: To determine the short-term clinical complications of CT-guided percutaneous core-biopsy of renal masses.
Methods and Materials: This is a prospective ongoing study from 01/07. All biopsies were performed with an automatic 18G core-biopsy needle. The number of cores taken per patient (1-4, Av. 2.5±0.9) and a categorized measure of largest mass diameter (< 4, 4-7, > 7 cm) were reviewed for association with complications.
Results: Fifty-two patients (31 males (60%), ages 34-86, average 66.6) underwent renal biopsies. Twenty-one (40%) were without complications. Twenty-nine (56%) patients developed clinically insignificant local hematoma: Fourteen (27%) were directly discharged and fifteen (29%) were hospitalized (< 48 hr). Two (4%) patients developed pneumothorax, one of which required chest-tube insertion. All patients were hemodynamically stable. No patient required blood transfusion, angiography or surgery. There were no case fatalities. The risk and extent of local hematoma increased with the number of cores from 1 to 3 (complication free: 67, 29 and 29%, respectively). Four cores were generally taken from large lesions, mostly carried out without complications (80%). Although the average number of cores increase with size from 2.1 (< 4 cm) to 2.5 (4-7 cm) to 3.1 (> 7 cm), complication-rate decreased with size from 68% to 56% to 45%, respectively.
Conclusion: The most prevalent short-term complication post CT-guided percutaneous renal core-biopsy is clinically insignificant local hematoma. Only one patient (1.9%) needed minor surgical intervention (chest tube). Hematoma rate rises with number of cores and is inversely associated with lesion size. The larger the lesion, the safer is the procedure.

B-663 11:06
also EPOS
CT texture and enhancement: Potential predictive imaging biomarkers of response to treatment in metastatic renal cancer
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Purpose: This pilot study assessed whether measurements of texture and enhancement of renal cancer metastases on CT have the potential to act as predictive biomarkers before or during treatment with the multi-targeted tyrosine kinase inhibitors sunitinib or cediranib.
Methods and Materials: CT texture and enhancement were retrospectively evaluated in contrast enhanced CT images from 20 patients with metastatic renal cancer. A total of 48 metastases were analysed before and after two cycles of treatment. Texture analysis comprised band-pass image filtration to highlight image features at different spatial frequencies between = 0.5 (fine detail) and = 2.5 (coarse features) with quantification of mean intensity in the filtered images. Tumour enhancement was expressed as the tumour:aortic enhancement ratio. The potential prognostic power of CT texture, enhancement and conventional anatomical response criteria (RECIST) were assessed by correlation with time to progression (TTP) following completion of therapy.
Results: The median (range) for TTP was 398 (57-900) days. CT texture before treatment and percentage change in enhancement ratio after treatment correlated with TTP (=1.8, r = -0.55, p < 0.02, and r = 0.49, p < 0.05, respectively). There was no significant correlation with TTP for baseline enhancement ratio, change in texture or RECIST.
Conclusion: CT texture before treatment and change in tumour:aorta enhancement ratio after two cycles of treatment have the potential to be predictive imaging biomarkers of response to treatment in renal cancer, providing greater prognostic potential than conventional anatomical response criteria.

B-664 11:15
Relationship between kidney volume and glomerular filtration rate in hypertensive patients
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Purpose: Kidney volume is known to be correlated to glomerular filtration rate (GFR) in healthy adults. The goal of the study was to assess if such an association could also be found in hypertensive patients in whom pathological changes may influence this relationship.
Methods and Materials: Institutional review board approval was obtained for this study. Retrospective analysis was performed for 33 patients examined using MRI for suspicion of renovascular disease. Cortex and medulla volumes were measured

twice with validated segmentation software. GFR was calculated using the four-variable Modification of Diet in Renal Disease (MDRD) formula. The relationship between GFR and total kidney volume (TKV), as well as total cortex volume, was examined using linear regression methods. Pearson's partial correlation coefficients were used to characterize the association of GFR with TKV adjusted for age.
Results: For the 66 kidneys studied, the median length and total volume were 11.1 cm (interquartile range [IQR]: 10.4 - 11.7) and 144.5 mL (IQR: 120.3 - 167.0), respectively. Age was found to exhibit a significant correlation with GFR ($p < 0.05$). Ignoring the influence of age, TKV showed a direct correlation with GFR ($r = 0.47$, $p = 0.006$). However, after controlling for patient age, the association between TKV and GFR was no longer significant ($p = 0.290$).
Conclusion: The correlation between kidney volume and GFR appears to be weaker for hypertensive patients than has been reported for healthy subjects. In particular, no significant correlation between TKV and GFR was observed after controlling for age.

B-665 11:24
Renal blood oxygenation level dependent (BOLD) and diffusion weighted imaging (DWI) MRI in adult patients with diabetic nephropathy: Initial study at 3.0 Tesla

F. Zhang, L. Yang; *Beijing/CN (fanzradiology@126.com)*

Purpose: To evaluate whether renal BOLD-MRI and DW-MRI could distinguish normal and DN kidney.
Methods and Materials: Thirty healthy volunteers (mean age 36) and fourteen DN patients (mean age 42) were included in this prospective study. DN patients graded into three groups: phase III (6 cases), phaseIV (4 cases), phaseV (4 cases) according to the microalbumin level in 24h urine (phase III: 30~300 mg/24 h, phase IV: > 300 mg/24 h, phaseV: uremia). BOLD-MRI was performed in coronal position, and the R2* value (s^{-1}) were measured in cortex, outer medulla, medulla and mean of whole kidney, respectively. T2*SPGR sequence was performed. DW-MRI was performed in coronal position using 3 noncollinear directions of diffusion sensitization, and the apparent diffusion coefficient (ADC) value (mm^2/s) was measured in cortex and medulla. Single shot spin-echo EPI sequence was performed using three different b-values (300, 600, 800 s/mm^2).
Results: R2*of cortex, outer medulla, medulla and mean value in volunteers were (13.739 ± 1.748), (18.157 ± 1.726), (26.417 ± 2.779), (22.130 ± 1.759), respectively. R2* was significantly different between volunteers and DN patients of three phases ($P < 0.01$). ADC from b=300 to 800 s/mm^2 of cortex and medulla in volunteers were (3.93 ± 0.14), (3.14 ± 0.27), (2.77 ± 0.06), (3.04 ± 0.21), (2.58 ± 0.16), (2.22 ± 0.07), respectively. ADC was significantly different between volunteers and DN patients in three phases ($P < 0.05$), and the ADC in 800 s/mm^2 was P < 0.01.
Conclusion: Renal BOLD-MRI and DW-MRI could distinguish normal and DN kidney when patients got worse into clinical proteinuria phase. And ADC value was more sensitive if b=800 s/mm^2 was used.

B-666 11:33
Nonenhanced functional MRI of transplanted kidneys with diffusion-weighted imaging (DWI) and quantitative perfusion imaging using arterial spin labeling (ASL)

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Purpose: To investigate mono- and biexponential diffusion weighted imaging (DWI) and quantitative perfusion imaging using arterial spin labeling (ASL) for functional assessment of transplanted kidneys.
Methods and Materials: Functional MRI was performed in 41 renal allograft recipients at 1.5 T. Recipients were divided into four groups: patients with a stable allograft function for at least 6 months (a), patients with an acute deterioration of allograft function (b) and patient who recently underwent transplantation (< 14 days) with good (c) or decreased (d) allograft function. A coronal DWI sequence with16 b-values (b=0-750 s/mm^2) was used. ASL was performed using a paracoronal FAIR TrueFisp sequence. ROI-based analysis of cortical ASL perfusion and mono- and biexponential apparent diffusion coefficients (ADC) was performed. Perfusion fraction (F_P), ADC of diffusion (ADC_D) and perfusion (ADC_P) were calculated for the biexponential approach.
Results: ADC_{mono} was 1961 ± 97, 1785 ± 132, 2080 ± 163 and 1658 ± 194 (x 10^{-6} mm^2/s) for groups (a), (b), (c) and (d), respectively. Mean allograft perfusion was 278 ± 50.7, 220.8 ± 58.8, 296.6 ± 58.3 and 189.2 ± 76.4 (ml/(100 g x min)) for groups (a), (b), (c) and (d), respectively. Differences in cortical ADC_{mono} and ASL perfusion were statistically significant between group (a) and (b) as well as (c) and (d) ($p < 0.05$). No statistically significant inter-group differences were found for ADC_D and ADC_P.

Conclusion: Nonenhanced functional imaging of renal allografts with DWI and ASL is feasible. Larger scaled studies are required to assess its clinical value in monitoring allograft recipients.

B-667 11:42
also EPOS

Single-phase vs. triple phase 16-row multidetector computed tomography angiography for preoperative evaluation of vascular anatomy in living kidney donors

A. Mishra, E.F. Ehtuish, T.S. Abdelmola, A. Elusta, T. Shawish; *Tripoli/LY*

Purpose: To compare single-phase and triple-phase protocols for 16-MDCT angiography with operative findings, and its impact on post-processing time and radiation dose in adult renal donors.
Methods and Materials: 48 donors were divided into two groups: Group A of 20 underwent single-phase 16-MDCT and Group B of 28 underwent triple-phase scan as preoperative work-up for donor nephrectomy. Technique in single-phase: 30 cc iodinated contrast (300 mg I/mL) 10 minutes prior followed by 90 cc contrast injected at 4 cc/sec with acquisition in late arterial-venous phase. Triple-phase: 120 cc contrast injected at 5 cc/sec. Other constant scanning parameters were: voltage 120 kVp; detector collimation 0.625 mm; table feed 9.375 mm/rotation; gantry-rotation time 500 ms; automatic current tube modulation (ATCM) using noise index=15. Time was noted for post-processing of 3D-images on workstation. Two observers evaluated image quality of the axial and 3D images. Radiation dose measurements were based on the scanner-generated CT-dose index volume (CTDI (vol)). p value of < 0.05 was considered significant.
Results: Differences in quality of axial and 3D images existed between both groups ($p > 0.05$). Both groups had 100% diagnostic accuracy in identifying the number of renal arteries. The mean radiation dose was: 12 ± 3 mGy (group A) and 28 ± 3 mGy (group B) ($p < 0.001$). Average time for post-processing in group A: 25 minutes±5 minutes and in group B: 12 minutes±3 minutes ($p < 0.01$). Interobserver agreement for quality assessment was within acceptable range (kappa=0.42-0.80).
Conclusion: Image quality and diagnostic accuracy are comparable in single-phase and triple-phase 16-MDCT scan protocols with significant dose reduction in single-phase, despite more time at workstation.

B-668 11:51
also EPOS

The anterior tunnelled percutaneous nephrostomy: Initial experience of a new technique

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Purpose: Improving the quality of life in patients with malignant or benign ureteric obstruction who are not usually suitable for surgical urinary diversion is desirable. A new procedure, 'The Anterior Tunnelled Percutaneous Nephrostomy' (ATPCN), achieves an anterior exit site for the drainage catheter giving these patients more independence and comfort.
Methods and Materials: Prospective collection of data from review of clinical notes and imaging, recorded patients' diagnosis, previous interventions and complications. We measured procedure time, pain score, immediate and delayed complications, repeat procedures, nephrostomy replacements and patient survival.
Results: 29 ATPCNs were performed, 27 considered primary (initial procedure as anterior tunnelled) and 2 secondary (initial posterior nephrostomy with later revision into anterior tunnelled). 16 patients had malignant primary disease, 2 had benign disease. There were no significant early complications (such as haemorrhage, septicaemia, visceral damage, urinoma, clot obstruction). Delayed complications included blocked systems (two at 2 months; two at 4 months), which were treated successfully. Three patients were treated for urinary infection with oral antibiotics.
Conclusion: Where ureteric stent placement is not possible or has failed to establish adequate upper tract drainage and medium or long term nephrostomy drainage is required, the use of ATPCN should be considered as an attractive management option. This is particularly important when palliating malignant obstruction but is also an option in some cases of ureteric obstruction from benign causes such as benign retroperitoneal fibrosis. ATPCN has been shown to improve quality of life in patient care and to be a safe and technically feasible procedure.

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

Breast

SS 1602

New developments in breast MRI (part 2)

Moderators:
I. Pereira; Ourém/PT
G.M. Villeirs; Gent/BE

B-669   10:30

Artificial intelligence in MR mammography: Analysis of a fully-automatic CAD system for the detection and classification of contrast-enhancing lesions

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Purpose: The value of computer-assisted-diagnosis (CAD) systems for magnetic resonance mammography (MRM) as a primary diagnostic tool or second reader is currently a subject of controversy. This study evaluates the potential of a fully-automatic analysis for MRM in correlation to histology.
Methods and Materials: Dynamic MR examination (1.5 T; 0.2 mmol/kg bw Gd-DTPA) of 80 patients with 101 histologically verified mass-like lesions (63 malignant, 38 benign) were analysed. The CAD system (Breast MRI Carebox; Bracco Imaging, Milan, Italy) evaluated the images by automatically performing the following steps: motion correction, image segmentation with detection of ´lesions, calculation of several dynamic and morphologic parameters and lesions´ classification. As a final result, the system categorized the masses by defining the probability of malignancy; this so-called morpho-dynamic index (MDI) ranged from 0 to 100%.
Results: The CAD system achieved a sensitivity of 96.8% and a specificity of 78.9% in predicting the dignity of the enhancing lesions. The mean MDI of the benign lesions (23 fibroadenomas, 10 adenosis, 3 atypical ductal hyerplasias, 1 papilloma, 1 benign phylloides tumour) was 39.1% (±18.7%); the malignant tumours (43 invasive ductal, 13 lobular, 4 tubular, 2 medullary, 1 mucinous carcinomas) reached a mean index of 88.6% (±14.7%). This mean difference was high statistically significant (p < 0.001).
Conclusion: These results reveal that the evaluated software considering dynamic and morphologic parameters is capable of classifying the dignity of enhancing lesions. The very high sensitivity indicates that fully-automatic CAD may be a promising additional tool for the diagnosis of MRM in clinical routine.

B-670   10:39   *also EPOS*

Breast cancer screening in women following irradiation for Hodgkin's disease: A preliminary study

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Purpose: The aim of this study was to evaluate breast cancer (BC) screening in women who received irradiation for Hodgkin's disease (HD) and their relative risk to develop a radiation-induced BC.
Methods and Materials: We retrospectively studied 43 women who had been all treated with irradiation between 1980 and 2009 (median age 38.2 years, range 25-80). Women aged ≤ 30 years were screened with clinical breast examination, ultrasound and, if necessary, mammography; women > 30 years had clinical breast examination, ultrasound and mammography. Two women had magnetic resonance (MR) too.
Results: Six breast invasive cancers were detected by mammography in 5/43 women included in the study (incidence, 11.6%). The median age at diagnosis was 28.5 years for HD and 41.5 for BC. BC was diagnosed following a median latent period from radiotherapy of 13.3 years. Mean radiation dose was 33.6 Gy while, in women who developed BC, it was 37.9 Gy (range 36-40); 2 women received Sub Total Nodal Irradiation with 40 Gy and 3 a mediastinic irradiation with 36 Gy.
Conclusion: In our study, women who were exposed to irradiation for HD had a relative risk 7.7 greater than the general population of developing BC; our results, as reported in literature, suggested the need for an appropriate BC surveillance. Considering young age and high breast density, women aged ≤ 30 years should be monitored by ultrasound and MR; women aged > 30 years should be monitored by ultrasound, mammography and MR, when necessary.

B-671   10:48

Intraindividual comparison of 1.5 T and 3.0 T breast MR imaging and further influence on therapy

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Purpose: To prospectively and intraindividually compare the extent of tumor between 1.5 T and 3.0 MRI and to assess any differences in detecting additional cancers in the ipsilateral or contralateral breast influencing further breast surgery.
Methods and Materials: 24 women underwent MRI examination (1.5 T and 3.0 T) twice. Images were evaluated for image quality and lesion detection classified in mass and non-mass-like enhancement (NMLE). Mass lesions were evaluated according to morphologic (shape, margins, internal enhancement) and kinetic criteria (initial and postinitial enhancement), NMLE according to distribution and internal enhancement.
Results: 42 mass lesions were detected with 1.5 T and 51 with 3.0 T (36 confirmed as being malignant), moreover, 40 NMLE lesions with 1.5 T and 37 with 3.0 T (17 confirmed as being DCIS). Multicentricity was found in 13, multifocality and contralateral cancer in one patient, respectively. Image quality was proven to be better with 3.0 T than with 1.5 T (p= 0.0001). 1.5 T yielded a sensitivity, specificity, PPV and accuracy for mass lesions of 72, 50, 87, and 68% and for NMLE of 76, 29, 72, and 63%, respectively, compared to 3.0 T with 97, 63, 92, 91%, and 82, 29, 74, and 67%, respectively. Sensitivity and accuracy was significantly better with 3.0 T (p= 0.0144, p= 0.008), changing surgical treatment in 6 patients compared to 1.5 T (1 tumorectomy, 3 quadrantectomy, 2 mastectomy).
Conclusion: Detection of breast lesions and accurate identification of malignant lesions was superior with 3.0 T than with 1.5 T, changing surgical treatment substantially.

B-672   10:57

Predictive value of magnetic resonance imaging in patients classified as BI-RADS™ 1 to 3

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Purpose: The aim of this study was to evaluate the negative predictive value (NPV) of magnetic resonance imaging (MRI) in patients classified as BI-RADS 1-3.
Methods and Materials: In this single center study, we retrospectively analyzed 1237 patients (mean age, 50±13 years; range 15-89 years) who underwent breast MRI between May 2000 and May 2007. The initial breast MRI findings were matched with the follow-up information derived by histopathology and mammography and/or MRI. Patients were followed over a time interval of at least 2 years (range, 2-9 years).
Results: 740 patients were included in this analysis. 248 patients, classified as BI-RADS 1-3 with adequate follow-up, have been analyzed until now. By histopathology, 149 lesions were classified as benign and 15 lesions were classified as malignant. The remaining 84 patients without histopathologic evaluation of the breast lesion did not exhibit significant changes in symptoms or imaging findings during the follow-up period and were therefore classified as benign. The NPV of breast MRI in lesions classified as BI-RADS 1-3 was 93.9%. A subgroup analysis revealed that no patient (0.0%) with BI-RADS 1, 4 patients (1.6%) with BI-RADS 2, and 11 patients (4.4%) with BI-RADS 3 developed a malignant breast lesion.
Conclusion: Breast MRI shows a high NPV in patients classified as BI-RADS 1-3. Lesions classified by MRI as probably benign lesions (BI-RADS 3) showed a higher frequency of developing malignant disease compared to lesions classified as BI-RADS 1-2.

B-673   11:06

Assessment by MRI and diffusion-weighted imaging of locally advanced breast cancer response undergoing neoadjuvant chemotherapy

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Purpose: Neoadjuvant chemotherapy has become the standard treatment for patients with locally advanced breast cancer (LABC). However, a technique that can accurately differentiate responders from non-responders has still to be identified. Our purpose was to evaluate the capability of conventional MRI and diffusion weighted imaging data to predict and monitor response of patients LABC to neoadjuvant chemotherapy.
Methods and Materials: Thirty-seven patients with histology proven LABC were carried out at 1.5 T using diffusion-weighted imaging (DWI) and MRI prior to treatment, every three months during treatment and following the final cycle of chemotherapy. For each tumour, volume, maximum diameter, apparent diffusion coefficient (ADC) values, and kinetic values for percent initial rapid enhancement were measured with a computer-aided evaluation program.

Results: Twenty-five patients were classified as responders and twelve as non-responders based on total tumour volume reduction. A highly significant increase in ADC values and decrease mean percent of enhancement (p < 0.001) were noted for responders between the pre-treatment and early treatment time points. Likewise, tumour mean ADC values demonstrated significant differences between responders and non-responders in the first 3 months (p < 0.001) of treatment.

Conclusion: Quantification of dynamic contrast enhancement parameters and ADC values could be useful for differentiating responders from non-responders early during the treatment in patients with LABC.

B-674   11:15

Assessment of morphologic profiles beyond MRI BIRADS - is the necrosis sign feasible for differential diagnosis in MR-mammography? Diagnostic accuracy of a new descriptor in 1084 histologically verified breast lesions

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Purpose: Necrosis-sign is a new descriptor for differential diagnosis of breast lesions in MR-Mammography (MRM). This prospective study was designed to: 1) analyze diagnostic accuracy of Necrosis-sign in a collective of 1084 histologically verified breast lesions and to 2) assess performance in subgroups.

Methods and Materials: This study was approved by the local ethical committee. All histologically verified lesions (malignant: 648, benign: 436) having undergone MR-Mammography at our institution over 12 years were prospectively evaluated by experienced radiologists (> 500 MRM) according to standard protocols and study design (T1w; 0.1 mmol/kgbw Gd-DTPA; T2-TSE). Patients with history of breast biopsy (surgically, minimal-invasive), radiation- or chemotherapy <= 1 y before MRM were excluded. Necrosis-sign was prospectively assessed on T2w-TSE sequences and was rated positive if a hyperintens center in a hypointense lesion could be visualized (Pearson's Chi-square-test).

Results: Necrosis-sign was significantly associated with malignancy (p < 0.001) providing high specificity (96.1%) and positive-predictive-value (78.8%). Malignant lesions > 20 mm presented significantly more often Necrosis-sign (p < 0.001) than cancers <= 20 mm. There was no difference regarding prevalence of Necrosis-sign in benign lesions > 20 vs. <= 20 mm (n.s.), leading to significant better performance in lesions > 20 mm (PPV: 87.8%). Correlation between Necrosis-sign and Grading of invasive carcinomas was significant (p < 0.05).

Conclusion: In this study of 1084 lesions, Necrosis-sign was a specific and positive predictive feature for differential diagnosis in MRM. This particularly counts for advanced lesions. As Necrosis-sign correlates with Grading, it could be used as an initial estimate of patient's prognosis.

B-675   11:24

also EPOS

Computer aided magnetic resonance imaging guided radioguided occult lesion localisation (ROLL) application: First experience

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Purpose: Our purpose is to report our first experience with preoperative localization of MRI detected breast lesions using MRI and CAD guided radioguided occult lesion localization (ROLL) technique.

Methods and Materials: Since January 2009, we have performed ROLL in 9 patients who had suspicious lesions that could be detected only by MRI. We used 7 channel biopsy breast array coil and computerized diagnose workstation (Dynacad, Invivo) for the procedure. The patients were examined first with T1W Flair 3D sequence sagittal images to assess applicability of the process, after which three phased dynamic contrast enhanced axial images were taken. Three dimensional coordinates were determined at the diagnostic workstation using CAD software and an 18G coaxial needle was placed in the exact position. After verifying the position of the needle, Tc99m marked macroalbumine aggregate containing 0.2 ml saline followed by 1/200 diluted MR contrast material were injected. Post-procedure MR scans were used to confirm correct localization. Time needed ranged between 26-40 minutes.

Results: All procedures were technically successful. Histopatological evaluation revealed invasive lobular carcinoma, invasive ductal carcinoma (n: 2), atypical lobular hyperplasia and sclerosing adenosis, sclerosing adenosis (n: 3), and intraductal epithelial hyperplasia (n: 2). Patient tolerance was very good. One patient complained about tolerable pain.

Conclusion: Sonographic and mammographic guided ROLL is well documented in the literature for preoperative localization of nonpaplpable breast lesions. We believe that this is the first report documenting its use under MRI guidance. In our experience, it is very efficient and a good alternative to needle localization under appropriate circumstances.

B-676   11:33

Meta-analysis of quantitative diffusion-weighted MR imaging in the differential diagnosis of breast lesions

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Purpose: To determine, in a meta-analysis, the diagnostic performance of quantitative diffusion-weighted (DW) MR imaging in patients with breast lesions.

Methods and Materials: English and Chinese studies to assess the diagnostic performance of quantitative DWI in patients with breast lesions were reviewed with reference to the inclusion and exclusion criteria. The homogeneity test, pooled weighted sensitivity and specificity, summary receiver operating characteristic (SROC) curve and sensitivity analysis were adopted by using Meta-Disc version 1.4.

Results: Of 65 eligible studies, 13 were included in the original mete-analysis, among which heterogeneity arising from factors other than threshold effect was explored (P=0.0012, I^2=53.9%). The pooled weighted sensitivity and specificity with corresponding 95% confidence interval (95%CI) in one homogenous subgroup of studies using maximum b=1000 s/mm^2 were 0.84 (0.81-0.87) and 0.83 (0.78-0.87); expressed as the area under curve of SROC was 0.9108. Sensitivity analysis demonstrated that the pooled estimates were stable and reliable.

Conclusion: Quantitative DWI has a better specificity to differentiate benign and malignant breast lesions compared to contrast-enhanced MRI. However, large scale RCT studies are necessary to assess its clinical value because of unified b factor and diagnosis threshold.

B-677   11:42

Machine learning and MR-mammography, a perfect pair for differential diagnosis in MR-mammography? Initial study using the K-nearest neighbor algorithm in 1084 histologically verified lesions

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Purpose: Machine-learning is a subfield of artificial intelligence. Machine-learning algorithms are able to automatically perform differential-diagnosis. K-nearest-neighbor algorithms (kNN) are an example of Machine-learning, providing potential for fast and accurate differential-diagnosis of MR-mammograms. However, to date there is no large study addressing the use of kNN in MR-mammography. Thus, this study was performed to: 1. Train kNN using predefined descriptors in MR-mammography. 2. Evaluate diagnostic-accuracy for differential diagnosis.

Methods and Materials: Firstly, a database was created containing 1084 histologically verified breast-lesions having undergone MR-mammography at our institution over 12 years (648: malignant, 436: benign). All cases were prospectively evaluated by experienced radiologists (> 500-MRM-exams) according to standard protocols (1.5 T; T1w: dynamic scans/GRE: 0.1 mmol/kg BWGd-DTPA;T2-TSE). In all lesions, 17 morphological and dynamic descriptors were assessed and documented as categorical variables. Secondly, kNN were designed to process the database. Applying k-fold-Cross-Validation the performance of kNN was prospectively evaluated. Finally, diagnostic-accuracy of kNN for differential-diagnosis of breast-lesions was statistically assessed: AUC (95% Confidence-Interval/CI), Positive vs. Negative Likelihood-Ratio (L+ vs. L-); Sensitivity/Se, Specificity/Sp, Positive-Predictive-Value /PPV. For each case post-processing-time/PPT was documented.

Results: - kNN performed differential-diagnosis with high significance-level α (P: < 0.00001), providing AUC of 87.3 (CI: 85.2-89.2). - Depending on the cut-off of the ROC-curve statistical parameters reached as follows: Se (86.0%), L+ (3.5), L- (0.19), PPV (83.9%), and Sp (75.5%). - PPT was < 0.1 s.

Conclusion: The K-nearest-neighbor algorithm demonstrated high diagnostic-accuracy and speed for differential-diagnosis of breast lesions in MR-mammography. Thus, machine-learning is a promising method to interpret MR-mammograms and is feasible to provide the radiologist a second reader opinion in clinical routine.

B-678   11:51

Usefulness of breast MRI in patients with flat epithelial atypia

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Purpose: To evaluate the usefulness of MRI in patients with flat epithelial atypia (FEA).

Methods and Materials: From September 2003 to January 2009, we studied 147 consecutive patients with FEA with breast MRI and surgery. Seven patients were excluded because the MRI results were impossible to evaluate. We recorded the results at core biopsy, enhancement and size at MRI, and definitive histological findings.

Results: Core biopsy found isolated FEA in 81/140 (57.86%) patients, FEA associated with atypical ductal hyperplasia (ADH) in 55 (39.28%), and FEA associated with atypical lobular hyperplasia (ALH) in 4 (2.86%). The definitive histological examination found 21 malignant neoplasms (15%), including 5 classified at core biopsy as isolated FEA (6.2%), 14 as FEA associated with ADH (25.42%), and 2 as FEA associated with ALH (50%). Most lesions without associated malignant neoplasms (67.5%) had no enhancement on MRI. Differentiated enhancement without an associated malignant neoplasm was seen in 25 cases (17.85%) and 11 (7.85%) malignant neoplasms did not enhance. Most malignant lesions without enhancement were low grade tumors less than 12 mm. MRI also detected 3 malignant neoplasms unrelated to FEA that were not visible on mammograms.

Conclusion: MRI's sensitivity and specificity are lower in this context because these are small, low-grade lesions and the histological findings associated with FEA can enhance. Nevertheless, when FEA is encountered at core biopsy, excision often shows a more advanced lesion, and MRI allows evaluation of lesion extension and of multicentricity not visible with conventional imaging techniques.

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

Physics in Radiology

SS 1613

Dose and image quality optimisation

Moderators:
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B-679   10:30

Assessment of image quality and dose for CT acquisitions with organ-based tube current modulation

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Purpose: To assess the potential for reducing dose while maintaining image quality when performing an organ-based tube current modulation in combination with a dedicated reconstruction technique (DRT).

Methods and Materials: Recent publications and ICRP recommendations indicate that the relative risk from X-ray exposure for certain organs (e.g. breasts) is higher than previously assumed. To reduce breast dose, tube current can be reduced during each rotation for anterior projections, while maintaining the same total mAs per rotation as a non-modulated scan. Since this type of modulation is not based on attenuation, projections with high tube current must receive during the reconstruction a higher weight than those acquired with low tube current (DRT). Using a SOMATOM Definition Flash (Siemens) the impact of an organ-based modulation on breast dose was investigated by performing TDL measurements on anthropomorphic phantoms. On the other side the impact of DRT on noise was investigated using different phantoms.

Results: For circular phantoms noise increases in the periphery without DRT by 1, 17 and 57% when reducing tube current in the low dose plateau down to 50, 30 and 10%, respectively. Applying DTR, noise increase is significantly less, e.g. by factor of about 2 at 10%. Similar values for noise reduction by DRT are obtained for the anthropomorphic phantom. Dose reductions were in the range up to 30-40%.

Conclusion: Noise-optimized image reconstruction techniques in combination with organ-based tube current modulation reduces noise nearly to the level achieved using constant tube current, while reducing breast dose by about 30%.

B-680   10:39

Automatic exposure control in standard CT scans of children and adults: What is the reduction in organ and effective dose?

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Purpose: The aim of this study was to estimate the effective dose and organ dose reduction in automatic exposure control (AEC) activated multidetector-CT examinations of children and adults.

Methods and Materials: Five physical anthropomorphic phantoms that simulate the average individual as neonate, 1-year, 5-years, 10-years-old child, and adult were employed. A 16-row CT scanner equipped with an x-, y-, and z-axis modulation based AEC mechanism was used. Thermoluminescence dosimeters were used to determine absorbed dose at all radiosensitive organs. Each phantom was first scanned with fixed tube current and then with the AEC activated. Organ dose (OD) and effective dose (ED) were estimated for head, thorax, and abdomen and pelvis standard scans, based on ICRP 103. OD and ED reduction were compared to the corresponding mAs reduction.

Results: ED reduction for head, thorax, and abdomen and pelvis scans was 34, -17, and 16% for neonate, 17, 15, and 26% for 1-y, 11, 10, and 3% for 5-y, 18, 0 and -14% for 10-y, and 17, 16, and 52% for adult. The absolute difference between ED and OD reduction was up to 40%. Percent ED reduction agreed well with percent mAs reduction (P < 0.001).

Conclusion: AEC is an efficient tool for reducing patient radiation burden in MDCT scans. However, it is less efficient in children compared to adults. AEC should be deactivated in neonate thorax, and abdomen and pelvis of 10-years old children scans to avoid a potential ED increase.

B-681   10:48

Comparison of image quality and radiation dose between combined automatic tube current modulation and fixed tube current in CT of abdomen and pelvis

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Purpose: To compare image quality, diagnostic acceptability, and radiation dose of the combined automatic tube current modulation (ATCM) technique with those of a fixed tube current (FTC) technique in CT of abdomen and pelvis performed with a 16-section multidetector row CT system.

Methods and Materials: We retrospectively searched of 100 consecutive patients who underwent follow-up CT of abdomen and pelvis with a 16-section multidetector row CT scanner by using both FTC techniques and combined ATCM in the same patient. Other parameters including kilovolt, gantry rotation time, section thickness, and pitch were identical. For each patient, images obtained with combined ATCM were compared with previous images obtained with FTC. We recorded objective image noise in liver parenchyma, subjective image noise and diagnostic acceptability by using a five-point scale (1, unacceptable; 3, acceptable; 5, excellent), radiation exposure doses (CT dose index volume and dose-length product), and body mass index (BMI, kg/m^2). Data were analyzed with parametric and nonparametric statistical tests.

Results: No significant difference was detected in image noise and diagnostic acceptability between two techniques. Most subjects (99/100, 99%) had acceptable subjective image noise. Significant reduction in radiation dose (45.25% reduction) was noted with the combined ATCM technique (P < 0.001). A significant linear statistical correlation was found between patient BMI and dose reduction (r= -0.78, p < 0.05).

Conclusion: The combined ATCM technique for CT of abdomen and pelvis substantially reduced radiation exposure dose but maintained diagnostic image quality, and patients with lower BMI showed more reduction in radiation dose.

B-682   10:57

CT colonography: Population-based calculation of radiation risk

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Purpose: To calculate the risk of radiation-induced cancer from low dose CT colonography (CTC).

Methods and Materials: Calculations were based on a population of 307 asymptomatic adults (139 females, 168 males) who underwent same-day low dose CTC (supine: 120 mAs, 120 kV; prone: 40 mAs, 120 kV) and optical colonoscopy. Total mAs, DLPs, CTDIvol, and patient weight were recorded. The ImPACT CT Dosimetry Calculator was used to compute individual organ doses for a 70 kg patient at CTC. We computed the typical radiation doses to relevant radio-sensitive organs (bone marrow, colon, liver, stomach, bladder) in CTC scans and the corresponding average radiation risks using BEIR VII radiation risk factors.

Results: Median organ doses in mGy for males/females were: liver 12.4/13.0; stomach 13.6/14.3; colon 12.4/13.0; bone marrow 5.9/6.2; bladder 14.4/15.5. Respective risks for radiation-induced cancer per 100,000 individuals for males and females were: liver 1.6/0.9; stomach 2.6/3.7; colon 11.0/7.9; bone marrow 4.8/3.5; bladder 9.1/9.6; total risk for all sites 31.8/32.8. The corresponding risk of cancer-related death for all sites was 18.2/20.0 per 100,000.

Conclusion: The risk of radiation-induced cancer from low dose CTC is very small. Therefore, even without taking into account the risks of complications from optical colonoscopy, the benefit of early detection of colorectal cancer using CTC likely substantially outweighs the risk of radiation-induced cancer.

Monday

B-683 11:06
Dual energy CT: How about the dose?
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Purpose: To assess dose and image noise of dual energy CT with reference to a standard scan and compare contrast to noise ratios (CNR) of spectral information with different combinations of X-ray spectra.
Methods and Materials: An Alderson phantom was assembled with thermoluminiscent detectors and its chest scanned on a Dual Source CT Definition in dual energy mode at 140/80 kVp with 14x1.2 mm collimation. The same was performed on a Definition Flash at 140 kVp with tin filter (Sn) and 100 kVp at 128x0.6 mm collimation. Reference scans were obtained at 120 kVp with 64x0.6 mm at equivalent CTDI of 5.4 mGy*cm. Syringes filled with water and iodine were scanned with the same settings. Dose was calculated from the TLD measurements and the DLPs. Noise was measured in the phantom scans and CNR was determined in the iodine and water samples.
Results: Measured effective dose was 2.57, 2.64 and 2.67 mSv for the 140/80 kVp, the 140 Sn/100 kVp and the 120 kVp scans. Respective calculated doses from the DLP amounted to 2.43, 2.80 and 2.49 mSv. Image noise in the average images of the phantom scans was 11.0, 10.7 and 9.9 HU, respectively. Respective CNR values of iodine were 14.6, 11.1 and 14.6. With non-linear image blending, CNR was 30.7 at Sn140/100 kVp and 33.4 at 140/80 kVp.
Conclusion: Dual energy CT is feasible without additional dose and can replace standard scan protocols. Noise and CNR for iodine are similar at both combinations of spectra and at 120 kVp. Thus, the additional spectral information is available without additional dose or compromises in image quality.

B-684 11:15
DLP derived effective dose is an underestimate of the effective dose based on Monte Carlo calculations for anthropomorphic phantoms
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Purpose: To investigate how well a DLP derived estimate of Effective Dose (ED) predicts the ED as obtained by Monte Carlo calculations in male and female anthropomorphic mathematical phantoms for typical CT scans.
Methods and Materials: The effective dose was computationally determined for clinically utilized scanning protocols of head, neck, chest, abdomen and pelvis using two methods. The first method was based on Monte Carlo calculations in anthropomorphic mathematical male and female phantoms that yielded absorbed organ doses and estimated ED (WinDose 2.1a, Institut fur Medizinische Physik Universitat Erlangen-Nurnberg, Deutschland). The second method derived effective doses from the DLP values for each protocol, by using published conversion factors. The null hypothesis that "there is no difference in the two sets of results" was tested using a paired, 2-tail Student's t-test.
Results: The ED was statistically significantly different for the two methods, for both male (p < 0.004) and female (p < 0.003) scans. The ED from the DLP method was consistently less than that from the Monte Carlo method. The degree of underestimation ranged between 18 and 55%, with a mean of 39% and a median of 40%.
Conclusion: While any method for determining an effective dose necessarily results in an estimate of true ED in patients, the use of DLP-to-ED conversion factors to provide such an estimate leads to an underestimation of the effective dose for any given scan. Use of DLP based methods to assess an individual patient's radiation dose should not be used in lieu of more robust techniques.

B-685 11:24
Recent international developments within automated collection and distribution of estimated patient radiation exposures
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Purpose: A new profile that simplifies automated gathering and distribution of parameters relating to patient radiation doses has been developed by Integrating the Healthcare Enterprise (IHE). The Radiation Exposure Monitoring (REM) profile handles estimated patient radiation doses from CT, mammography, fluoroscopy and conventional X-ray.
Methods and Materials: The REM profile utilizes DICOM Radiation Dose Structured Reports (Dose SR). These dose reports may be created, stored, queried, retrieved, processed, de-identified and displayed much like other DICOM objects such as images. Furthermore, the REM profile describes how dose reporting systems may transfer dose reports to central dose registers such as might be run by radiation safety authorities or national quality registers. The IHE initiative comprises of both a process and a forum. The goal is to support integration between informa-tion systems within modern healthcare. IHE's approach is to encourage and clarify the use of established standards, instead of defining new standards.
Results: The first version of the technical framework REM was defined 2008. During 2009, the REM profile has undergone IHE's testing process at Connectathons in North America, Europe and Japan.
Conclusion: The industry has shown interest for the REM profile and the possibilities that it creates for monitoring radiation doses. Commercial products supporting the REM profile have already started appearing on the market.

B-686 11:33
Cardiac CT angiography on a 256-slice CT scanner: Are associated radiation risks acceptably low?
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Purpose: To assess the absorbed doses to primarily exposed radiosensitive organs from coronary CT angiography (CCTA) performed on 256-slice CT scanner and estimate the associated radiation risks for cancer induction.
Methods and Materials: A Monte Carlo CT dosimetry software which builds patient specific voxelized phantoms, accurately simulates CT exposures and generates dose-images depicting the energy deposition on the exposed region used. The standard retrospectively and prospectively ECG-gated CCTA acquisition exposures on a 256-slice scanner were simulated on 52 modeled individuals in order to derive normalized organ dose data. Normalized organ dose values were correlated to patient body size using linear regression analysis. Lung, breast and esophagus dose values were determined in a series of 113 patients undergoing CCTA. Risks for radiation-induced cancer were estimated using sex-, age- and organ-specific cancer risk factors provided by Biological Effects of Ionizing Radiation (BEIR) VII phase 2 report.
Results: Normalized organ dose values were found to depend on patient body size (p < 0.0001). The risk of developing radiation-induced cancer following CCTA decreased significantly with age at exposure. Compared to male, risks for female patients were found to be higher. For female patients undergoing retrospectively gated CCTA, the mean radiation risks for lung, breast and esophagus cancer were 18, 49 and 5 per 100,000 individuals, respectively. The corresponding values for prospectively gated CCTA were 6, 18 and 2 per 100,000 individuals.
Conclusion: Less than three radiation induced cancers are expected per 10,000 patients undergoing prospectively gated CCTA studies on a wide-area 256-slice CT scanner.

B-687 11:42
Low-dose CT angiography of the abdomen: Cross-over study with quantitative assessment of standard 120 kV vs. low-dose 80 kV protocols using different tube current settings
E. Maffei, C. Martini, T. Arcadi, A. Clemente, E. Emiliano, A. Cuttone, F. Cademartiri; *Parma/IT* (ericamaffei@gmail.com)

Purpose: To evaluate the impact of 120 vs. 80 kV tube voltage during Computed Tomography Angiography (CTA) of the abdomen using different tube current settings.
Methods and Materials: In a cross-over study, we prospectively enrolled 60 consecutive patients undergoing abdominal CTA (Sensation 64, Siemens; Iomeprol 400 mgI/ml). In each patient, we performed a standard CTA with 120 kV/200 mAs and a low-dose CTA with 80 kV/300 mAs (Group 1; n. 20), 80 kV/400 mAs (Group 2; n. 20), 80 kV/500 mAs (Group 3; n. 20). We measured effective radiation dose, aortic attenuation, noise and signal/noise (S/N).
Results: The average effective radiation dose was 9.7±2.7 mSv for 120 kV (entire population) and 3.6±0.8 mSv for Group 1 (80 kV), 5.0±0.6 mSv for Group 2 (80 kV), 5.9±1.2m Sv for Group 3 (80 kV), respectively. The average vascular attenuation, noise and S/N in each group were: 328±40 HU (120 kV) vs. 494±61 HU (80 kV), 30±4 HU (120 kV) vs. 69±15 HU (80 kV), 11±2 (120 kV) vs. 7±2 (80 kV) for Group 1, 353±77 HU (120 kV) vs. 551±117 HU (80 kV), 32±4 HU (120 kV) vs. 68±10 HU (80 kV), 11±2.8 HU (120 kV) vs. 8.4±2.6 (80 kV) for Group 2, 389±55 HU (120 kV) vs. 598±117 HU (80 kV), 29±7.1 HU (120 kV) vs. 57±17 HU (80 kV), 15±5 (120 kV) vs. 12±5 (80 kV) for Group 3, respectively (p < 0.05). Only the correlation between S/N and weight was good (r = -0.58 at 120 kV; r= -0.53 at 80 kV).
Conclusion: The use of 80 kV for CTA of the abdomen is viable and allows reducing the dose by 50% with preservation of S/N.

B-688 11:51

Comparison of radiation exposure of whole-body CT in major trauma patients with 4- and 64-row MDCT

M. Körner, S. Wirth, I. Knebel, M.F. Reiser, U. Linsenmaier; *Munich/DE* (markus.koerner@med.uni-muenchen.de)

Purpose: To compare radiation exposure of a 4- and 64-row whole-body major trauma CT protocol.

Methods and Materials: Dose reports of dedicated whole-body (head, chest, abdomen/pelvis) CT protocols were compared in 84 patients using 4- (n=42) and 64-row (n=42) MDCT. Scan length, dose-length-product (DLP) and CT dose index (CTDI) were recorded for head, chest, and abdomen separately. For statistical analysis, the Mann-Whitney-U test was used.

Results: With 64-row MDCT, scan length and DLP were significantly higher in head (+23 and +37%, $p < 0.001$), abdomen/pelvis (+9 and + 12%, $p < 0.02$) and total scan (+10 and + 20%, $p < .001$). Chest scan length and DLP were, however, lower (-6 and -9%, $p > 0.05$). CTDI was higher for head ($p < 0.001$), lower for chest ($p < 0.001$), and equal for abdomen/pelvis ($p > 0.05$). Dose calculation with conversion factors showed an increase of 7% with 64-row MDCT with mean total exposure of 23.54 (SD ± 7.50) mSv for 64-row MDCT and 21.83 (SD ± 6.08) mSv for 4-row MDCT. An increase in DLP with 64-row MDCT was observed mainly because of a different scan protocol (helical scan mode including midface vs. axial scan mode without midface) and increased scan length of head and abdomen/pelvis.

Conclusion: The use of 64-row MDCT for whole-body CT does not obligatorily result in an increase of exposure even when high-resolution acquisition protocols were used. The increase in scan length with the faster 64-row CT was the main factor contributing to the increase of total radiation exposure.

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

Pediatric

SS 1612

Cardiac and chest (pre- and post-natal) imaging

Moderators:
A.D. Calder; London/UK
C.J. Kellenberger; Zurich/CH

B-689 10:30

Prenatal prediction of chronic lung disease based on fetal MR lung volumetry in survivors with congenital diaphragmatic hernia

A. Debus, C. Hagelstein, A.K. Kilian, K.A. Büsing, T. Schaible, S.O. Schönberg, K.W. Neff; *Mannheim/DE* (angelika.debus@umm.de)

Purpose: To predict chronic lung disease (CLD) in survivors with congenital diaphragmatic hernia (CDH) based on the results of antenatal observed to expected MR fetal lung volume measurements (o/e MR FLV).

Methods and Materials: Absolute and o/e MR FLV was calculated in 172 fetuses with CDH between 23 and 39 weeks gestation (33.5 ± 2.6 weeks) using multiplanar T2-weighted half-fourier acquired single-shot turbo spin echo (HASTE) imaging. A three-fold grading (mild, moderate and severe) of CLD was performed based on the need for supplemental oxygen at days 28 and 56 after delivery.

Results: Survival at discharge was 86.0% (148/172 patients). 82/148 survivors (55.4%) developed CLD. Mean o/e MR FLV of patients with CLD was significantly smaller (24.1 ± 7.5%) compared to the mean o/e MR FLV of 66 patients who did not develop CLD (38.8 ± 12.4%, $p < 0.05$). Grading of CLD revealed significant differences ($p < 0.05$) of the o/e MR FLV between 46 patients with mild CLD (26.3 ± 7.8%) compared to 23 patients who developed moderate CLD (21.7 ± 6.3%) and 13 patients with severe CLD (20.2 ± 5.0%). No statistically significant differences in FLV could be demonstrated between the stages moderate and severe of CLD.

Conclusion: The prenatally assessed o/e MR FLV is a reliable and significant predictor of an impaired lung development with CLD in survivors with CDH. Parental counseling and early neonatal therapeutic decisions can additionally be based on the prenatally determined FLV.

B-690 10:39

Prenatal prediction of survival and need for ECMO therapy in fetuses with congenital diaphragmatic hernia (CDH) with logistic regression analysis based on relative lung-to-head ratio (r LHR)

A.K. Kilian, K.A. Busing, R. Schaffelder, S.O. Schönberg, T. Schaible, K. Neff; *Mannheim/DE*

Purpose: Besides MR imaging with fetal lung volumetry, ultrasound-based measurement of the lung-to-head ratio (LHR) is up to now the method of choice to predict clinical outcome in children with CDH. The purpose of the presented study was to use logistic regression analysis of the LHR to provide a prenatal estimation of individual prediction for survival and the need for extracorporeal membrane oxygenation (ECMO) for fetuses with CDH.

Methods and Materials: The rLHRs (observed/expected LHR) of 90 fetuses with CDH were calculated between 23 and 39 weeks gestation (mean 31.4). Logistic regression analysis was used to assess the prognostic value of the rLHR measurements for prenatal prediction of fetal survival and need for neonatal ECMO therapy.

Results: Relative LHR was significantly higher in survivors than in non-survivors (p=0.0005). Similar results were found for the need of ECMO therapy (p=0.004). Fetuses with a rLHR of 60% showed a survival rate of 95% and ECMO requirement of 16%; however, fetuses with a rLHR of 5% demonstrated a survival rate of 7% and ECMO requirement of 85%.

Conclusion: Logistic regression analysis based on rLHR is highly valuable to calculate the individual prediction for survival and need for neonatal ECMO therapy in fetuses with CDH. This method is feasible to improve parental counseling and provides individualized information on the expected clinical course of the fetuses including postnatal therapeutic options.

B-691 10:48

Repetitive MRI measurements of lung volume in fetuses with CDH to investigate the serial time course of pulmonary hypoplasia during gestation

A. Kilian, K.A. Busing, A. Bauer, T. Schaible, S.O. Schönberg, K. Neff; *Mannheim/DE*

Purpose: The individual development of lung volumes in fetuses with congenital diaphragmatic hernia (CDH) in serial time course of pregnancy is unknown. The purpose of the presented study was to investigate the degree of impairment of pulmonary development with fetal lung hypoplasia using serial MRI to evaluate fetal lung volume (FLV) during gestation.

Methods and Materials: 43 fetuses with CDH with a gestational age of 23-38 (mean 29.7) weeks were examined with MRI to measure the FLV. FLV was calculated absolutely and additionally was expressed as a proportion of the age-related predicted data (observed/expected FLV=relative FLV, rFLV). All 43 fetuses received a minimum of two MRI examinations during pregnancy with at least 4 weeks between the examinations.

Results: In all 43 fetuses, there was an increase of 9% (range 1.5-24.3%) of the absolute FLV. 28/43 fetuses showed a decrease of the mean rFLV from 32.7 to 24.6% (difference 8.1%, range 1.1-13.7%). 12 fetuses showed increasing mean rFLV from 27.1 to 31.9% (difference 4.8%, range 1.7-10.4%) and 3 revealed stable values in rFLV. Overall, there was a difference in individual values of rFLV up to 75%.

Conclusion: There is a wide variation in fetal lung volume development in children with CDH in serial time course during pregnancy. In our cohort, there are decreasing, stable and increasing rFLVs up to an individual difference of 75%. All fetuses showed an increase of the absolute FLV, but 2/3 of the fetuses had decreasing relative FLVs, which has to be considered in therapeutic options.

B-692 10:57

Right versus left-sided congenital diaphragmatic hernia: Postnatal outcome at a specialized tertiary care center

T. Schaible[1], T. Kohl[2], L.M. Wessel[1], J. Brade[1], S.O. Schönberg[1], K.A. Büsing[1]; [1]*Mannheim/DE*, [2]*Bonn/DE* (karen_buesing@hotmail.com)

Purpose: In congenital diaphragmatic hernia (CDH), the impact of the location of the defect on neonatal outcome is still uncertain. We therefore performed a matched pair analysis to systematically compare survival, extracorporeal membrane oxygenation (ECMO) requirement, and the development of chronic lung disease (CLD) in infants with right versus left-sided CDH.

Methods and Materials: We assessed 106 neonates with CDH. For 17 of 18 infants with right-sided CDH (r-CDH), we were able to allocate infants with left CDH (l-CDH) with no relevant difference in previously described prognostic factors such as pulmonary hypoplasia, birth weight, and prematurity.

Monday

Results: There was a strong trend toward better survival in infants with r-CDH than in l-CDH (94 versus 70%; p = 0.07). In l-CDH, more neonates died of severe pulmonary hypertension despite ECMO therapy. In r-CDH, less neonates died yet higher degrees of pulmonary hypoplasia and oxygen requirement were observed despite ECMO therapy. Overall, CLD was associated with a higher degree of pulmonary hypoplasia and oxygen requirement (p = 0.016).

Conclusion: In CDH, the location of the defect may have a substantial impact on postnatal survival and the development of CLD. In l-CDH, dextrocardia probably interferes with prenatal pulmonary perfusion inducing pulmonary hypertension resistant to therapeutic management including ECMO. R-CDH infants have an increased benefit from ECMO but the better survival entails a higher pulmonary morbidity.

B-693 11:06

also **EPOS**

Oxygen-enhanced functional MRI of the human lung at an open-design 0.2 T MR system in cystic fibrosis

C. Wirth, S. Brenner, M. Oechsner, H. Hebestreit, H. Köstler, D. Hahn, M. Beer; *Würzburg/DE*

Purpose: To evaluate the clinical relevance of functional pulmonary MRI in CF patients in relation to pulmonary function tests (PFT).

Methods and Materials: 14 patients and 19 healthy volunteers were included. All examinations were performed on a Magnetom Open 0.2 Tesla Scanner (Siemens Medical Solutions, Germany). Sagital slices of both lungs were acquired while the patients and volunteers alternately breathed room air and 100% oxygen. Based on a series of gradient echo tomograms acquired after a single inversion pulse, T1 parameter maps were obtained in inspiration. T2* was measured using a multi gradient echo sequence. All data were retrospectively gated and only data in expiration were used for image reconstruction. All images were fitted pixel by pixel and T1 and T2* parameter maps were generated. The relative changes of the average pulmonary relaxation times were related to PFT.

Results: For volunteers, evaluation resulted in mean relative change of T1 values of 10.0±1.4 and of T2* 9.8±2.3. Patients were divided in two subgroups according to PFT **Results:** One group with FEV1 > 70% and one ≤70%. The first subgroup showed T1 values of 9.6±1.0 and T2* values of 10.4±3.4. No significant differences could be found in comparison to the volunteers. The second subgroup had significant lower T1 values compared to volunteers (6.9±0.6; p < 0.002), T2* values were not significantly changed.

Conclusion: Analysis of pulmonary function in CF patients is possible using oxygen-enhanced functional MRI in a open-design 0.2 T MR system. T1 mapping detects abnormalities in patients with decreased PFT.

B-694 11:15

Low-dose prospective ECG-triggering dual-source CT angiography in infants and children with complex congenital heart disease: First experience

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Purpose: To explore clinical value of low-dose prospective ECG-triggering dual-source CT (DSCT) angiography in infants and children with complex congenital heart disease (CHD).

Methods and Materials: Fifteen children (mean age: 10 months, range: 2 months-3 years; male 9; mean weight: 8.5 Kg) were performed by low-dose prospective ECG-triggering DSCT angiography. Palliative or corrective surgeries were performed in all patients. The accuracy of DSCT in detecting cardiovascular deformities was calculated based on the results of surgical findings. The imaging quality of over-all and coronary artery segments was evaluated using grading scales by two experienced reviewers. Radiation dose values were calculated.

Results: A total of 60 separate cardiovascular deformities were confirmed by surgeries. The accuracy of prospective ECG-triggering DSCT angiography in diagnosing separate cardiovascular deformities was 98.3% (59/60). The overall deformity-based sensitivity, specificity, positive predictive value and negative predictive value were 98.3, 100, 100 and 99.6%, respectively. The average subjective image quality score was 4.1±0.5. The percentage of images of diagnostic quality was 70.3% (95/135) for the whole coronary artery and 100% (60/60) for the origin and proximal four segments of coronary arteries. The mean effective dose of the protocol was 0.46±0.12 mSv.

Conclusion: In summary, our findings demonstrate the usefulness of low-dose prospective ECG-triggering DSCT angiography in infants and children with complex congenital heart disease.

B-695 11:24

Self-gating MR imaging of the fetal heart in comparison with MR imaging with cardiac triggering: A feasibility study in the sheep fetus

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Purpose: To perform fetal cardiac MR imaging using the self-gating MRI technique and to compare it with MR imaging with triggering of the fetal heart beat in utero in a sheep model.

Methods and Materials: Images were performed on 6 pregnant ewes at a 1.5 T scanner (Siemens). The fetuses were chronically instrumented with a carotid catheter to measure the fetal heart frequency for cardiac triggering. Self-gating MRI and pulse wave triggered, breath-hold cine MRI with steady-state free precession of the fetal heart was achieved simultaneously in different views. From the short-axis, the left and right ventricular volume and thus the function was measured and compared.

Results: The fetal heart frequencies were between 130 and 160 beats per minute. It was possible to perform both self-gated and triggered fetal cardiac MRI in all fetuses. The contraction was shown and the average blood volumes could be measured in both techniques: at end systole 3.1 ml (SD±0.2), at end diastole 4.9 ml (±0.2); with ejection fractions between 38.6 and 39%. Although the mitral, the tricuspid, aortic and the pulmonary valves as well as the foramen ovale were clearly observed with the pulse wave triggering technique, the images with the self-gating techniques were slightly inferior due to blurry artifacts. Especially, the atrial septum was not clearly depicted with the latter technique.

Conclusion: Both self-gating and pulse-wave triggered cardiac MRI allowed an evaluation of anatomical structures and functional information, although the images obtained with self-gating technique was slightly inferior than the pulse-wave triggered MRI.

B-696 11:33

Functional insights into patients with native and corrected aortic coarctation by use of multidirectional MR phase-contrast flow measurements

J. Ley-Zaporozhan[1], F. Rengier[1], M. Fischer[1], J. Eichhorn[1], S. Ley[1], R. Unterhinninghofen[2]; [1]*Heidelberg/DE*, [2]*Karlsruhe/DE (julia.leyzaporozhan@gmail.com)*

Purpose: Multidirectional MR phase-contrast flow measurements allow for assessment of vectorial velocity information. This information can be visualized using streamlines, particle traces or vector maps to enhance different aspects of flow. The goal was to characterize different aspects of flow like turbulences, helical flow profiles, and local velocity inhomogeneities in patients with native or corrected aortic coarctation (CoA). Furthermore, a quantitative flow map of the whole aorta was generated to visualize changes of the normal velocity distribution after surgery.

Methods and Materials: Using a 1.5 T MRI (Magnetom Avanto, Siemens), a stack of phase-contrast FLASH 2D sequences with tridirectional flow acquisition was used to cover the whole aorta (1.6x1.6x2.1 mm). 13 patients (6 female, mean age 17 years) with CoA (native: n=2, post surgery (different techniques): n=11) were examined. Flow visualization and quantification were performed using in-house developed software (Mediframe).

Results: All datasets were eligible for evaluation. All patients showed a maximum peak velocity in the area of the descending aorta due to a right-angled aortic arch, anatomic remnants of the CoA or at the connection site of the vascular homograft (mean velocity 272 cm/s). The jet was directed to the dorsal part of the aortic wall. Furthermore, the coherence of flow was reduced, compared to the ascending and more distal aorta.

Conclusion: Multidirectional MR flow measurements allow for the first time visualization of complex local flow phenomena. The morphological changes after surgical repair of CoA lead to a local increase of flow with potential risk for the dorsal aortic wall.

B-697 · 11:42

Impact of cardiovascular magnetic resonance imaging in patients with inherited Marfan syndrome

D.M. Renz[1], T. Elgeti[1], E. Ghadamgahi[1], P. Freyhardt[1], J. Böttcher[2], M.L. Schäfer[1], F. Berger[1], B. Hamm[1], R. Röttgen[1]; [1]Berlin/DE, [2]Gera/DE (diane.renz@charite.de)

Purpose: Cardiovascular involvement in Marfan syndrome (MFS) is mainly characterized by progressive aortic dilatation and valvular complications. Possible dysfunction of the left and right ventricle has not been analysed by using magnetic resonance imaging (MRI) in detail. This study evaluated the potential of cardiovascular MRI in Marfan patients.
Methods and Materials: Twenty-two patients (12 females, 10 males; mean age 16.8 ± 8.6 years) with genetically proven inherited MFS were studied using a 1.5 T scanner. The function of the left and right ventricle including end-diastolic volume (EDV) and ejection fraction (EF) was quantified by acquiring multislice-multiphase SSFP sequences. Transverse PD-weighted images and contrast-enhanced MR angiography were used to measure the width and configuration of the thoracic aorta. Possible impairment of the aortic valve was estimated by performing velocity-encoded flow measurements in the ascending aorta including calculations of the regurgitation fraction.
Results: According to normative values, EDV of the left ventricle was slightly increased (mean EDV/BSA 110 ± 31 ml/m^2); the left ventricular systolic contractile function was slightly reduced with an average EF of $57 \pm 5\%$. End-diastolic volume and ejection fraction of the right ventricle were quantified as normal: EDV/BSA 80 ± 15 ml/m^2 and EF $63 \pm 3\%$. In eight Marfan patients, no aortic valve insufficiency was detected; the aortic valve insufficieny was categorized as mild in eight and moderate in four patients; two subjects showed a severe aortic valve insufficiency.
Conclusion: These results indicate that MRI seems to have the potential to non-invasively determine possible cardiac and aortic complications in patients with Marfan syndrome.

B-698 · 11:51

Prospective electrocardiography-triggered CT angiography of the thoracic great vessels in pediatric patients with congenital heart disease: Feasibility and image quality

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Purpose: To prospectively investigate feasibility and image quality and to calculate radiation dose estimates for computed tomography angiography (CTA) of the thoracic great vessels in pediatric patients using prospective electrocardiography-triggered sequential dual-source data acquisition in end-systole.
Methods and Materials: 10 children (6 female, 4 male, mean age 4.6 ± 3.8 years, range 3 months - 11 years, mean body weight (kg) 15.3 ± 7.1) underwent prospective ECG-triggered sequential dual-source CTA (Somatom Defintion, Siemens) with tube current (250 mAs/rot) centered at 250 ms past the R-peak in the cardiac cycle (end-systole). Tube voltage was set to 80 kV. CT image quality was evaluated by two readers in consensus using a five-point grading scale (5 = excellent image quality, no artifacts, 1 = non-diagnostic). Radiation dose estimates were calculated from the dose length product.
Results: All CT images showed diagnostic image quality with no examination rated non-diagnostic (mean subjective image quality score 4.3 ± 0.8). More pronounced step-artifacts were present in two patients, not impairing the assessment of anatomical relationships clinically required. Mean heart rate (bpm) was 99 ± 13 (73-117), mean heart rate variability (bpm) was 3.4 ± 2.6 (1-8). Mean scan length (mm) was 101 ± 21 (84-134). Mean dose length product (DLP) was 8.9 ± 2.9 mGy*cm, mean estimated effective dose was 0.36 ± 0.14 mSv.
Conclusion: Prospective ECG-gated sequential dual-source CTA in pediatric patients with congenital heart disease is feasible despite heart rates > 80 bpm, making motion-free imaging of the thoracic great vessels possible at a considerable low radiation dose.

10:30 - 12:00 — Room L/M

Molecular Imaging

SS 1606
Experimental and PET

Moderators:
P.N. Fencl; Prague/CZ
M. Kooi; Maastricht/NL

B-699 · 10:30

Radiopeptide therapy of neuroendocrine tumors with Y-90 DOTATOC: Is treatment response predictable by pretherapeutic uptake of Ga-68 DOTATOC?

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Purpose: To analyze whether pretherapeutic Ga-68 DOTATOC-PET/CT is able to predict response to radiopeptide therapy with Y-90 DOTATOC for somatostatin-receptor expressing neuroendocrine tumors (NET).
Methods and Materials: Forty patients with advanced stage NET were treated with Y-90 DOTATOC. Prior to therapy, each patient received PET/CT with 150 MBq Ga-68 DOTATOC. Treatment results were evaluated after 3 months by CT, tumor markers, and clinical course and correlated with Ga-68 DOTATOC uptake (SUV) and the assumed uptake of Y-90 DOTATOC (MBq/g) in tumor manifestations.
Results: According to conventional criteria (tumor shrinkage, decrease of tumor markers, clinical condition), 20 patients were classified as responders, 16 as non-responders, and in 4 patients follow-up findings were equivocal. Using a SUV > 20 as cut-off for favorable outcome, PET was able to predict treatment response of all responders and 15/16 non-responders. Only one non-responder presented with SUV > 20. All patients with equivocal findings showed SUV < 20 with tumor progression in the follow-up period. The assumed uptake of Y-90 DOTATOC in tumor manifestations using a cut-off > 1.5 MBq/g as a predictor of therapy response was able to correctly classify 16/20 responders and 15/16 non-responders. In all patients with equivocal findings, the assumed uptake of Y-90 DOTATOC was below 1.5 MBq/g.
Conclusion: Pretherapeutic Ga-68 DOTATOC tumor uptake (SUV > 20) as well as assumed uptake of Y-90 DOTATOC (> 1.5 MBq/g) are strongly associated with the results of subsequent radiopeptide therapy. This might provide the rationale for prospective studies to evaluate individual dosing and selecting patients with high likelihood of favorable treatment outcome.

B-700 · 10:39

68Ga-DOTATOC-PET/CT imaging and somatostatin (sst) receptor-fingerprints in physiological human tissues: SUVmax meets mRNA-expression

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Purpose: To provide an atlas of physiological SUVmax values on 68Ga-DOTATOC-PET/CT-scans and to correlate the results with the regional mRNA expression of the somatostatin (sst) receptors 1-5.
Methods and Materials: SUVmax values were obtained from 100 oncological patients (mean age: 54 y, 19-83 y, SD: 13.5 y, 46 men, 54 women) who underwent whole-body 68Ga-DOTATOC-PET/CT. Normal SUVmax values were documented for different physiological tissues not affected by tumor spread or inflammation. SUVmax values were correlated with mRNA expression of sst receptors 1-5 measured independently in pooled normal tissue by real time polymerase chain reaction (RT-PCR). Results were correlated by using the Spearman´s rank correlation coefficient.
Results: SUVmax values (mean $\pm$ SD) for normal tissues were heterogenous [e.g., spleen 30.3 ± 10.3; kidney 16.8 ± 5.0; liver 12.6 ± 3.5; pancreas 8.7 ± 3.8; stomach 6.9 ± 3.0; small bowel 4.7 ± 1.8; bone 3.9 ± 1.4; muscle 2.1 ± 0.5; lung 0.7 ± 0.3; parotid gland 1.9 ± 0.6]. SUVmax values correlated significantly with the mRNA expression of sst receptor 2 in physiological tissues ($r = 0.846$, $p < 0.001$), whereas there was no correlation with the expression of the other four subtypes.
Conclusion: Physiological SUVmax values show a wide range on 68Ga-DOTATOC-PET/CT scans. Parenchymal organs not affected by tumor may have high SUVs on image assessment. In vivo, the molecular target of 68Ga-DOTATOC is limited to only one sst receptor subtype, the sst receptor 2. The knowledge of 68Ga-DOTATOC tracer binding to sst receptor 2 may improve the diagnostic work-up and molecular therapy of sst receptor expressing neuroendocrine tumors in vivo.

Monday

B-701 10:48

Large vessel inflammation detected by [¹¹C]-PK11195 PET/CT angiography

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Purpose: Vascular inflammation plays a key role in triggering fatal cardiovascular events. In this proof of principle study, we investigated whether positron emission tomography/CT angiography (PET/CT) using [11C]-PK11195, a selective ligand for peripheral benzodiazepine receptors expressed in activated macrophages, could detect vascular inflammation in patients with large vessel vasculitis.
Methods and Materials: Thirteen patients with systemic inflammatory disorders (4 consecutive symptomatic patients with clinical suspicion of active vasculitis and 9 asymptomatic patients) underwent PET with [11C]-PK11195 and CT angiography. [11C]-PK11195 uptake was measured by calculating target-to-background ratios (TBR) of activity normalized to venous blood. Co-registration of PET with contrast-enhanced CT angiography facilitated localization of [11C]-PK11195 arterial wall uptake.
Results: Visual analysis revealed focal [11C]-PK11195 uptake in the arterial wall of all 4 symptomatic patients, but in none of the asymptomatic patients. Whilst serum inflammatory biomarkers (C-reactive protein, erythrocyte sedimentation rate, white cell count) did not differ significantly between both groups, symptomatic patients had higher [11C]-PK11195 TBRs (2.51 ± 1.91 versus 0.98 ± 0.10; P=0.005) compared to asymptomatic patients.
Conclusion: [11C]-PK11195 PET/CT angiography enables identification of active large vessel vasculitis. These preliminary results warrant further studies to evaluate the use of [11C]-PK11195 PET/CT for the noninvasive measurement of inflammation in the atherosclerotic plaque.

B-702 10:57

Imaging of alphavbeta3 in experimental breast cancer bone metastases using ⁶⁸Ga-DOTA-E-(cRGDfK)2 as a PET tracer

U. Muehlhausen, D. Komljenovic, M. Eisenhut, W. Semmler, T. Baeuerle; *Heidelberg/DE (u.muehlhausen@dkfz-heidelberg.de)*

Purpose: Integrin $\alpha v \beta 3$ is expressed in breast cancer bone metastases and is therefore a promising target for the detection and characterization of these lesions using PET. The aim of this study was the evaluation of gallium-68 labeled DOTA-E-(cRGDfK)$_2$ with high affinity for $\alpha v \beta 3$ in nude rats with breast cancer bone metastases.
Methods and Materials: The labeling with gallium-68 and isolation of ⁶⁸Ga-DOTA-(cRGDfK)$_2$ was optimized and this radiotracer was evaluated in 15 nude rats bearing breast cancer bone metastases. The ex vivo tumor and tissue distribution of ⁶⁸Ga-DOTA-(cRGDfK)$_2$ was determined as 0.5, 1, 2 and 3 h p.i. (n=3 animals, respectively). In a blocking experiment, an $\alpha v \beta 3$ antagonist in excess was co-injected with the radiotracer and the biodistribution was determined at 1 h p.i. (n=3). In two animals, microPET scans (µPET, Siemens) were performed.
Results: ⁶⁸Ga-DOTA-(cRGDfK)$_2$ was obtained in a radiochemical yield of $60 \pm 6\%$ and a radiochemical purity of > 99.5% (HPLC analysis) was determined. The ex vivo biodistribution showed a tumor-blood-ratio ranging from 5 (0.5 h p.i). up to 27 (3 h p.i). Blocking with an $\alpha v \beta 3$ antagonist decreased all uptake values significantly (up to ninefold) except for the kidneys. In microPET scans, bone metastases could be clearly visualized and discerned from the surrounding tissues in vivo.
Conclusion: The peptide ⁶⁸Ga-DOTA-(cRGDfK)$_2$ can be synthesized reproducibly in good radiochemical yields and with excellent radiochemical purities. The results from in and ex vivo experiments allow the conclusion that ⁶⁸Ga-DOTA-(cRGDfK)$_2$ is a promising PET tracer for the imaging of $\alpha v \beta 3$ in breast cancer bone metastases.

B-703 11:06

Anti-MRP14-Cy5.5: A novel tracer for in vivo monitoring of inflammatory bowel disease (IBD) with optical imaging methods

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Purpose: A method enabling for continuous surveillance of inflammation is desired for examination of murine models of disease. Activated macrophages have been shown to play a crucial role in initialisation and maintenance of inflammatory process. Specific targeting of macrophage-related Myeloid-Related-Protein (MRP) 14 should therefore provide specific and non-invasive visualisation of inflammation activity.
Methods and Materials: MRP14-antibody or Immunoglobulin G (control for non-specific label distribution) was Cy5.5-labelled (2 nmol per animal, 24 h prior to FMT). IBD was induced in C57BL/6 WT mice by addition of 2% DSS to drinking water. The course of IBD was monitored by weight loss. Fluorescence mediated tomography (FMT) was performed at definite times before and after DSS-application (1) or weight-loss-dependant (2). Some animals received an antibiotic therapy (Vancomycin, Imipenem). For correlation of imaging findings, immunohistochemistry was performed. Colonic changes were scored histologically. Statistical analysis: student-t-test (1) or one-way-ANOVA with Bonferroni-correction (2).
Results: Animals with severe inflammation - strong weight loss and histologic evidence of colitis - showed about two-fold higher fluorescence intensity after application of anti-MRP14-Cy5.5 than after injection of IGG-Cy5.5 (92.4 vs. 52.9; p < 0.05). Rapid weight-loss correlated with strong fluorescence in FMT (89.5; histologically strong coilitis), while mice presenting with slow weight-loss showed only moderately elevated MRP-fluorescence (64.3; rare signs of inflammation). Antibiotic therapy reduced weight loss and correlative MRP-fluorescence. Healthy animals showed no significant tracer-uptake.
Conclusion: Anti-MRP-Cy5.5 combined with FMT allows sensitive and specific detection of phagocyte activity in vivo and can therefore be regarded a suitable probe for in vivo-examination of inflammation.

B-704 11:15

11C - metomidate positron emission tomography after dexamethasone suppression for detection of small adrenocortical adenomas in primary aldosteronism

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Purpose: To evaluate if dexamethasone suppression treatment can improve 11 C-metomidate (MTO) positron emission tomography (PET) detection of small adrenocortical adenomas in primary aldosteronism (PA).
Methods and Materials: The study included 13 patients with small adrenocortical tumours diagnosed by CT (mean 1.7 cm; range 1-2.5 cm). Eleven patients with proven PA (Conn adenomas) and two patients with non-hyperfunctioning adrenocortical incidentalomas underwent MTO-PET before and 3 days after administration of oral dexamethasone suppression treatment (0.5 mg x 3 for 3 days). PET data 15-45 minutes after MTO administration were summed to create "average" image volumes and small "hot-spot" regions of interest (ROIs) comprising 4-pixels (0.64 cm²) were placed in the tumour area of the highest radioactivity concentration and in contra-lateral normal adrenal cortex, respectively. The respective standardized uptake value (SUVhs) and the pixel with the highest value (SUV max) was recorded.
Results: All tumours were detected with a high tracer uptake and thus categorized by MTO-PET as being of adrenocortical origin. SUVhs and SUVmax were higher in Conn adenomas compared to non-functional adenomas. Normal adrenal cortical MTO uptake was significantly suppressed by the dexamethasone pre-treatment (p < 0.05). However, the SUVs in both Conn tumours and non-functional tumours were unchanged (p> 0.05) as was the tumour-to-normal adrenal ratio (p> 0.05).
Conclusion: MTO-PET is a highly sensitive method for detecting and categorizing even small adrenocortical tumours in PA. Dexamethasone suppressed MTO-PET could not in this series increase the tumour-to-normal-adrenal ratio to further facilitate detection of small adenomas in PA.

B-705 11:24

Incidental head and neck FDG uptake on PET without corresponding CT lesion: Early predictor of cancer development?

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Purpose: The aim of this study was to determine whether increased FDG uptake on PET without a correlating lesion on fully-diagnostic CT may indicate the development of head and neck (h&n) malignancies in FDG-PET/CT scans.
Methods and Materials: In 590 oncological patients (mean age 55.4 ± 13.3 years) without known h&n malignancies, FDG uptake at the Waldeyer´s ring, the oral floor, the larynx, and the thyroid gland was rated as qualitatively absent (group A) or present (group B) and quantified by measuring the SUVmax. Differences of the SUVmax between groups A and B were tested for significance with the U-test (p < 0.05). A follow-up of more than 1 year (29.5 ± 13.9 months) served as the reference standard to determine whether patients developed h&n malignancies.
Results: Waldeyer´s ring: mean SUVmax of group A (n = 326): 3.0 ± 0.9, B (n = 264): 4.5 ± 2.2, p < 0.01. One patient from group B developed a palatine tonsil carcinoma (SUVmax: 3.2). Oral floor: mean SUVmax of group A (n = 362): 2.8 ± 0.7, B (n = 228): 4.7 ± 2.6, p < 0.01. One patient from group B developed an oral floor carcinoma (SUVmax: 3.7). Larynx: mean SUVmax of group A (n = 353): 2.8 ± 0.8, B (n = 237): 4.2 ± 2.1, p < 0.01. No patient developed a laryngeal carcinoma. Thyroid: mean SUVmax of group A (n = 404): 2.4 ± 0.6, B (n = 186): 3.0 ± 1, p < 0.01. No patient developed a thyroid malignancy.

Conclusion: Elevated h&n FDG uptake without a correlating CT lesion is common and does not predict cancer development in patients without h&n tumors. In populations endemic for goiter, thyroid uptake is common and not associated with cancer.

B-706 11:33

Diagnostic benefit of 131-I-SPECT/CT over 131-I-scintigraphy after therapy of differentiated thyroid cancer

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Purpose: The aim of this study was to evaluate whether a post-treatment low-dose 131-I-SPECT/CT can offer additional information over whole-body 131-I-scintigraphy for locoregional staging of differentiated thyroid cancer patients, if the anatomical location of scintigraphic findings remains unclear.
Methods and Materials: 200 post-treatment whole-body 131-I-scintigraphies of 164 patients (mean age: 51 ± 15 years) with differentiated thyroid cancer were evaluated for the existence of residual locoregional disease and metastases. In case of unclear anatomical location of findings on scintigraphy, an additional low-dose 131-I-SPECT/CT scan was performed. The number of scans in which SPECT/CT was able to accurately locate a 131-I-positive lesion was reported.
Results: In 27 131-I-scintigraphies, the location of an iodine-avid finding remained unclear and an additional 131-I-SPECT/CT was performed. In 20/27 cases (74%), the organ harbouring the iodine uptake was identified by SPECT/CT: In 7 scans, a malignant lesion was detected (local recurrence: n = 1, cervical lymph node metastases: n = 3, lung metastases: n = 2, brain metastasis: n = 1). In 1 case, a hiatus hernia was detected. In the remaining 6 cases, tracer uptake was allocated to physiologic organs and rated as "unspecific". In 7/27 cases (26%), no organ was identifiable by SPECT/CT.
Conclusion: 131-I-SPECT/CT seems to be a valuable method to morphologically locate indeterminate findings on 131-I-scintigraphies. In about three-fourths of cases, a definite anatomical correlate was detectable. 131-I-SPECT/CT is a valuable adjunct to 131-I-scintigraphy in the work-up of patients with differentiated thyroid cancer. It may be used in cases where 131-I-scintigraphy is indeterminate.

B-707 11:42

Quantifying vascularity in human tumor xenograft models using clinical scanners

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Purpose: To investigate the feasibility of clinical imaging protocols quantifying parameters of vascularity in human tumor xenografts.
Methods and Materials: Human NSCLC-cells (H1299) were subcutaneously injected in eight rats (HT) and co-injected with rat endothelial cells and growth factors in seven rats (EHT) to improve vascular growth and blood supply as shown before. Tumor xenografts were nurtured to a size of 20 mm and subsequent multimodality imaging included diffusion-weighted MRI (DWI-MRI), dynamic-contrast-enhanced-computed-tomography (modified Patlak-algorithm, DCE-CT) and fluoro-dexoyglucose-positron-emission-tomography. Estimated parameters of vascularity and metabolism were: (1) apparent diffusion coefficient at high b-values interrogating motion of free water (ADC-diff), (2) ADC at low b-values indicating vascular supply (ADC-perfusion), (3) relative tumor blood volume (rTBV), (4) k_{trans} (to estimate vessel wall permeability) and maximum-standard-uptake-value (SUV_{max}; to show glucose metabolism), respectively.
Results: Vascular density was significantly different higher in the co-injected EHT rats as proven by open surgery (visual inspection) and histology. rTBV and ADC-perf were significantly higher (0.009, p=0.02) in EHT (4.6 ml/100 ml; 494 mm²/s) as compared to HT (1.8 ml/100 ml; 374 mm²/s). Furthermore, median SUVmax was significantly different (p=0.001) between HT (1.9) and EHT (3.4). ADC-diff and k_{trans} did not show significant differences, indicating similar tumor biology for these properties.
Conclusion: Clinically applicable DWI-MRI and DCE-CT are capable of quantifying differences in tumor vascularity, even in rodents. Preferable parameters are ADC-perf and rTBV. The relation between vascular density and glucose metabolism is to be clarified. Since chemotherapy and radiotherapy influence tumor vascularity, acquisition of these parameters might influence clinical decisions before and during therapy.

B-708 11:51

The use of TCL-SPION (thermally cross-linked superparamagnetic iron oxide nanoparticles) on MR imaging for detection of lymph node metastases in murine melanoma models: In vivo and ex vivo studies

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Purpose: To assess the feasibility of Thermally Cross-Linked Superparamagnetic Iron Oxide Nanoparticles (TCL-SPION) on MR imaging for detection of metastatic lymph nodes in murine melanoma models.
Methods and Materials: B16 F1 human melanoma cells were injected into the thigh of C57BL/6 mice subcutaneously (N=10). MR imaging was performed 3 weeks after tumor injection using 4.7T MR scanner. In vivo and ex vivo MR images for both inguinal lymph nodes with T2 weighted fast spin echo and gradient echo sequences were obtained before and after intravenous injection of TCL-SPION. MR signal intensity and size were measured in each inguinal lymph nodes and the relative contrast enhancement ratio (CER) was calculated. H&E staining was performed on all resected lymph nodes to prove melanoma metastasis. And we added Prussian blue staining to prove the uptake of TCL-SPION in normal lymphoid tissue.
Results: Histopathology confirmed 12 metastatic lymph nodes in 20 inguinal lymph nodes. The CER of metastatic lymph nodes were significantly higher than that of non-metastatic lymph nodes in both in vivo and ex vivo MR images. But there was no significant difference in size between metastatic and non metastatic lymph nodes.
Conclusion: TCL-SPION enhanced MR imaging could detect early lymph node metastasis non-invasively both in vivo and ex vivo studies.

10:30 - 12:00	Room N/O

Neuro

SS 1611

Spine and spinal cord imaging

Moderators:
P.R. Algra; Alkmaar/NL
N. Limbucci; L'Aquila/IT

B-709 10:30

also **EPOS**

Proton MR spectroscopy of cervical spinal cord tumors: A study of 47 cases

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Purpose: To assess the role of MRS in the management and diagnostic characterization of cord tumors.
Methods and Materials: 22 normal age and sex matched controls and 47 patients in the age range of 25 to 67 years with M:F distribution of 3:2 were included in the study. All the patients were imaged on a 3 T Philips Achieva System with a 2D PRESS MRS single/multi Voxel. The MR spectra of IntraSpinal tumor categories were overlaid on post contrast and T2 image data sets.
Results: Astrocytomas: Choline elevation with a mean choline creatine ratio of 1.9 reduced NAA. Maximum elevations occurred at the poles of the tumor>matrix. Ependymomas: Elevation of Total Choline was demonstrable in all except for two cases. Metastases: grossly reduced/absent NAA with Lipid peak, Minimal elevation of Choline. Neurogenic tumors: elevation of total choline with lipid resonances. Neuro enteric cysts: no choline elevation with Normal NAA. The mean choline creatine ratio was 2.8. Mean Choline/NAA ratio was 1.9. Epidermoids and neuro enteric cysts showed no choline but a lipid peak with a small AA peak at 1.2 ppm in neuro enteric cysts. Marix choline and perituomoral zone Choline ratio was > 2 in ependymomas and haemangioblastomas, 1.3-1.8 in metastases with edema, < 1 in astrocytomas.
Conclusion: Proton MR spectroscopy (single and multivoxel) at 3 T can be routinely used as a mainstay tool in the diagnostic characterization and management of cord tumors.

B-710 10:39

Evaluation with MRI of patients with hematopoietic neoplasms and spinal epidural and leptomeningeal spread: Comparison with the results of lumbar puncture

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Purpose: To evaluate with MRI the spinal epidural and leptomeningeal infiltration in patients with lymphoma and leukemia and correlate the results with lumbar puncture.
Methods and Materials: 50 patients with acute lymphocytic leukemia, acute myelogenous leukemia and non-Hodgkin lymphoma and with clinical suspicion of spinal extra-medullary intra-dural spread underwent MRI. All the patients underwent lumbar puncture within two days after MR examination.
Results: We detected 10 patients with positive features of spinal epidural and leptomeningeal infiltration on MRI. The major patterns of leptomeningeal tumor spread are: focal lumbosacral mass lesions located at the level of the epidural space, nodular or plaquelike deposits intimately related to the conus or cauda equina and clumping and crowding and diffusely thickened lumbar nerve roots with root sleeves obliteration. Among these 10 patients, only 7 had a positive lumbar puncture. The most sensitive MRI sequence in the detection of spinal epidural and leptomeningeal involvement has been considered the sagittal T1-weighted scans performed after i.v. administration of Gadolinium-DTPA. Lumbar puncture was negative when the neoplastic infiltration involved the epidural space and the nerve roots.
Conclusion: In our limited experience, MRI was more sensitive than lumbar puncture in the detection of spinal epidural and leptomeningeal spread by hemopoietic tumors. In hematology, the diagnosis of leptomeningeal spread is fundamental because it modifies the therapeutic measures, in patients with hemopoietic neoplasm and strong clinical suspicion of spinal epidural or leptomeningeal infiltration, when lumbar puncture is negative, MRI should be performed.

B-711 10:48

Combined morphology-hydrodynamic criterion for adult Chiari I malformation

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Purpose: Chiari Malformation (CM) is diagnosed by tonsilar herniation. However, patients with minimal or no herniation can have severe symptoms while patients with severe herniation may suffer only mild or no symptoms. Radiological evidence suggests that CM is associated with small posterior fossa (PF) and altered CSF flow dynamics. This study aims to characterize the relationship among PF morphology, intracranial hydrodynamics, and symptoms in the same patient cohort to identify the strongest markers for symptomatic CM.
Methods and Materials: Anatomical, CSF, and blood flow information were extracted from MRI studies of 54 symptomatic CM patients and 31 healthy individuals. The size of the PF was estimated using eight anatomical markers, trans-cranial CSF and blood flow information was used to quantify eleven hydrodynamic parameters. Symptoms type and severity were documented using a questionnaire. A logistic regression followed by discriminate analysis was applied to determine the combination of parameters that best distinguish CM from normal individuals.
Results: A model incorporating three morphological parameters (clivus and supra-occiput lengths, and CSF area at C2), and five hydrodynamic parameters (maximal intracranial volume change, MRICP, intracranial compliance index (ICCI), max. cord displacement, and peak-to-peak cervical CSF pressure gradient) correctly discriminate between healthy and CM with an average accuracy of 92%. In addition, ICCI was significantly lower only in the CM subgroup who reported headaches.
Conclusion: A combination of anatomic and hydrodynamic features, rather than a single anatomical feature, most accurately distinguishes symptomatic CM from healthy. Further, reduced intracranial compliance is strongly associated with presence of headaches.

B-712 10:57

Cervical spinal canal stenosis correlates with spinal cord white matter integrity in patients with cervical spondylosis: A diffusion tensor imaging study

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Purpose: Our purpose was to investigate the relation between the degree of cervical spinal canal stenosis and spinal cord white matter integrity.
Methods and Materials: 18 patients with cervical stenosis and 11 healthy subjects were studied using a 1.5 T MR scanner. Diffusion tensor imaging (tractography) was used for quantification of spinal white matter integrity (fractional anisotropy, FA) of whole spinal cord at C2-C3, C4-C5, and C6-C7 levels. Sagittal T2w MR images allowed for calculation of spinal canal stenosis (ratio) at C3, C5 and C7 levels.
Results: FA was lower at all cervical levels in patients compared to controls (C2-C3: 0.53±0.04, 0.56±0.04, C4-C5: 0.51±0.05, 0.55±0.04, C6-C7: 0.46±0.08, 0.50±0.06, respectively). The patients had significantly lower FA at C2-C3 and C4-C5 levels (p < 0.05). Patients also had increased spinal canal stenosis at C3, C5 and C7 levels compared to controls (p < 0.05). When averaged across all cervical levels the mean degree of spinal canal stenosis correlated with mean FA (R=0.71, P < 0.001), i.e., that patients with least cervical canal space had lowest FA values of the whole cervical spinal cord.
Conclusion: Our results suggest that cervical spinal canal stenosis may underlie spinal cord white matter degeneration in patients with cervical spondylosis. These changes are visualized and quantifiable with diffusion tensor imaging.

B-713 11:06

Features of Hirayama disease on fully flexed position cervical MRI

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Purpose: To explore the features of Hirayama disease on cervical MRI with fully flexed position.
Methods and Materials: Axial and sagittal MRI examinations in fully flexed neck position were performed on13 cases of Hirayama disease and 12 young normal control subjects. In sagittal position, we measured the angles formed by two lines extending from posterior borders of the adjacent cervical bodies of the patients. Patients and subjects were evaluated for localized lower cervical cord atrophy; cord flattening, abnormal signals appeared in the posterior epidural space. We measured anterior-posterior diameter of the cervical cord at the superior margin of the C6 vertebral body.
Results: (1) For the angles, there was difference in total comparison (F=7.83, p < 0.05). Ac5-6 was the largest and showed difference from other groups (p < 0.05). (2) The levels of damaged cervical cords were localized in C6 (13 cases), C5 (12 cases), C7 (5 cases) and C4 (1 cases). All patients have C6 cord lesions. (3) The anterior-posterior diameters of the cervical cord in patients and controls were (4.75±0.41 mm) and (6.24±0.49 mm) (U=- 4.25 p < 0.01), respectively. (4) There were significant difference between patients and controls in two aspects of neuroradiologica findings: localized lower cervical cord atrophy (13 cases (100%) in patients group, none in control subjects group), and cord flattening (13 cases (100%) in patients and none in control subjects). (5) There were crescent-shaped high-intensity mass on T2WI in the posterior epidural space (9 cases (69%) in patients and none in control subjects).
Conclusion: There were variable specific imaging features of Hirayama disease on fully flexed MRI. Cervical MRI with fully flexed position has significant values in the clinical diagnosis of Hirayama disease.

B-714 11:15

Preoperative mapping of spinal cord blood supply in patients with thoracoabdominal aortic aneurysm using MR-angiography with gadofosveset trisodium at 3 Tesla: Preliminary experience

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Purpose: The surgical repair of a thoracoabdominal aortic aneurysm carries up to 5% risk of postoperative spinal cord ischemia causing paraplegia. Preoperative mapping of the arterial spinal cord supply including the Adamkiewicz artery can reduce postoperative ischemic complications. Steady-state MR angiography (MRA) provides a high spatial resolution, while gadolinium-based blood-pool-agent gadofosveset allows extended blood-plasma retention time.
Methods and Materials: Fourteen consecutive patients underwent a preoperative spinal MRA in a 3-Tesla-scanner (MAGNETOM Verio, Siemens). The sequence applied was a steady-state coronal 3D-FLASH MRA with 0.7-mm isotropic voxels after injecting gadofosveset trisodium at 3 ml/sec. Postprocessing included multiplanar reconstructions and maximum-intensity-projection for the Adamkiewicz artery and its segmental artery mapped from aortic origin to the spinal canal entry. Assessment of the images was performed by three independent observers.
Results: Identification and localization of the Adamkiewicz artery and its segmental artery as major arterial supply of the spinal cord was successful in all patients including the level of aortic origin and spinal canal entry. The interobserver variance for the overall image quality and anatomy depiction was 0.874 and 0.738, respectively. Low agreement between the observers was noted regarding the venous overlap with the spinal arteries (variance 0.267).
Conclusion: Preoperative 3-Tesla-MRA with gadofosveset provides a non-invasive and efficient tool for identification of the Adamkiewicz artery and its segmental artery with regard to the level of aortic origin and spinal canal entry. Further optimization is needed to combine steady-state and time-resolved MRA to overcome the venous overlap.

B-715 11:24

Results of combined intradiscal and periganglionic injection of medical ozone and periganglionic administration of steroids and anesthetic for the treatment of lumbar disk herniation: Effects on disk size and lumbar radiculopathy in 227 patients

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Purpose: To evaluate the therapeutic benefit and morphologic changes in herniated lumbar disk after CT-guided intradiscal and periganglionic ozone-oxygen injection combined with a periganglionic administration of steroids and anesthetic.
Methods and Materials: 227 patients with lumbar radiculopathy received an intradiscal (3 mL) and periganglionic (7 mL) injection of an ozone-oxygen mixture (ratio 3:97), followed by a periganglionic injection of corticosteroid (1 mL of Celestan® Depot, ESSEX PHARMA, Munich, Germany) and anesthetic (2 mL of Carbostesin® 0.25%, AstraZeneca, Wedel, Germany) in the same session. Under CT guidance, intradiscal and periganglionic injection was administered by means of an extraspinal lateral approach, using a 22-gauge spinal needle. 6 months after treatment, clinical outcome was assessed by applying the modified MacNab method.
Results: Treatment was successful in 164 patients (72.3%). In the remaining 63 patients (27.7%), treatment was considered to have failed. Among the patients whose treatment was a success, outcome was excellent in 91 patients (55.5%) and good in 73 patients (44.5%). Among the patients whose treatment was a failure, this was poor in 49 patients (77.8) and poor with recourse to surgery in 14 patients (22.2%). 6 months after treatment, in patients with excellent outcome, disk volume reduction was 5.66-22.31% (mean, 15.03%), in patients with good outcome 3.64-16.92% (mean, 8.69%) and in patients with poor outcome 0.29-8.02% (mean, 4.57%).
Conclusion: Our study shows that the combined intradiscal and periganglionic injection of medical ozone and periganglionic injection of steroids affects both the mechanical and the inflammatory components of pain caused by disk herniation.

B-716 11:33

A case-control study of cerebellar tonsillar ectopia and cervical spine trauma

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Purpose: There are a number of reports in the literature relating traumatic injury of the head and neck and cerebellar tonsillar ectopia (CTE), also known as Chiari Type I. No prior investigations have compared the rate of CTE between traumatic and non-traumatic populations, however.
Methods and Materials: A case-control study of CTE in traumatic versus non-traumatic populations via recumbent and upright MR imaging was undertaken. Two blinded radiologists interpreted each of the films. Cervical MRI scans for 1200 consecutive neck pain patients ≥ 15 years of age were obtained and reviewed: 600 trauma (cases) and 600 nontrauma (controls). Half of the cases and controls were scanned in a recumbent position and half were scanned in an upright position.
Results: A total of 1195 of 1200 scans were considered interpretable for cerebellar tonsil level, grouped in "stations." Significant intergroup differences were seen in the proportion of scans with CTE; 5.7 and 5.3% in the recumbent and upright non-trauma groups, respectively, versus 9.5 and 23.7% in the recumbent and upright trauma groups (p = 0.0001).
Conclusion: The results described in the present investigation are the first to demonstrate a neuroanatomic difference between neck pain patients with and without a recent history of trauma. Upright MR imaging appears to increase the sensitivity to CTE in recent trauma cases by a factor of 2.5. Further investigation including study of the effects of whiplash trauma on CSF pressure and dural integrity as well as clinical studies correlating CTE with symptom severity, distribution, and persistence are needed.

B-717 11:42

also EPOS

The morphologic changes of the motor cortex and motor pathways following spinal cord Injury: Voxel-based morphometry and diffusion tensor imaging study

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Purpose: To evaluate the anatomic changes within motor cortices and descending motor pathways in thoracic spinal cord injury (SCI), to further elucidate the mechanism of the motor function injury and recovery.
Methods and Materials: Thirty patients with complete SCI at the thoracic segments were scanned with the T1-weighted three dimensional magnetization prepared rapid acquisition gradient echo sequences and single-shot echo planner diffusion tensor imagings (DTI) for whole brain. Ten healthy volunteers act as control group. The gray matter (GM) and white matter (WM) volume of motor cortex was assessed by Voxel-Based Morphometry (VBM), and the fractional anisotropy (FA) of the motor cortex and descending motor tracts were evaluated by DTI. Tractography of the corticospinal and corticopontine tracts were also evaluated.
Results: The GM volume and FA value in the bilateral primary motor cortex, the medial prefrontal, and adjacent anterior cingulate cortices were significantly reduce in SCI subjects compared with controls (P < 0.05). The WM volume in this area was no significant difference between the patients of SCI and healthy volunteers. There were no structural abnormalities in the corticospinal and corticopontine tracts of the SCI subjects revealed by tractography, but the FA value of this tract was significant decreased than control group (P < 0.05).
Conclusion: The reduce of the gray matter volume and decrease of FA value in the motor cortex and the descending motor pathways could be explain the mechanism of the motor dysfunction after SCI, may be in objectively monitoring the effects of various therapeutic interventions and rehabilitation program in SCI.

B-718 11:51

also EPOS

The biochemical changes in the motor cortex after spinal cord injury: Proton magnetic resonance spectroscopy (1H MRS) study

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Purpose: To evaluate the correlation between the biochemical changes in the motor cortex and the function state after spinal cord injury.
Methods and Materials: One hundred and eighteen patients with thoracic spinal cord injury (SCI) from 8 days to 4 years before the day of MRS study was divided into grade A (27 cases), B (26 cases), C (37 cases) and D (28 cases) groups according to the American Spinal Injuries Association standard. Ten healthy volunteers act as control group. MRS data were collected from a plane at the level of the centrum semiovale by using a single voxel stimulated echo acquisition mode pulse sequence. The NAA, Cho, Cr, AspNAA, and Glx were measured using the linear combination model software.
Results: The mean level of NAA ratio in the motor cortex of the patients of A, B, C, D group and the control group was 1.08±0.03, 1.41±0.12, 1.86±0.08, 2.86±0.13, 2.79±0.20, respectively. There was significant different among SCI group (D>B>C>A, P < 0.05); there was no significant different between the D group and control group. NAA/Cr ratio was 13% lower (p < 0.05) in the motor cortex of D group than in the control group, but, 70, 52 and 43% higher (p < 0.05) than in the A, B, C groups, respectively. There was no other metabolite level different among the SCI groups or between SCI and the control group.
Conclusion: NAA and NAA/Cr ratio are correlation with the function state of spinal cord injury. MRS can evaluate the degree of functional recovery after spinal cord injury and can be the useful tool to monitor the prognosis.

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

Cardiac

SS 1603

MRI and MDCT: Pre-interventional assessment of valve disease

Moderators:
S. Baumüller; Zurich/CH
M. Pasowicz; Krakow/PL

B-719 10:30

The concept of the energy loss coefficient: Is it applicable to the MRI assessment of aortic stenosis severity?

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Purpose: Besides the extent of stenosis, dilatation of the ascending aortic is crucial for hemodynamics of aortic valve disease. The purpose was to investigate the application of the echocardiographic concept of the Energy Loss Coefficient (ELCo) and its impact on hemodynamic evaluations of patients with severe aortic stenosis using cardiac MRI.
Methods and Materials: 32 patients (23 male, 9 female; 69±10 years) with severe aortic stenosis (orifice area< 1.0 cm²) were examined using a 1.5 T MRI scanner. To estimate the post-stenotic pressure, recovery diameters of the ascending aorta were measured at the sinotubular junction. Velocity-time integrals and LVOT-areas were used to calculate effective orifice areas (EOA) based on the continuity equation. EOA was corrected for the pressure recovery phenomenon calculating the ELCo using EOA and aortic cross-sectional areas. The results were compared to identify impacts on the disease severity classification.

Monday

Results: Diameters of the ascending aorta were 2.8±0.5 cm (three-chamber-view) and 2.7±0.5 cm (LVOT-view). Calculations of ELCo resulted in increased (p < 0.001) diameter-based areas from 0.8±0.3 cm^2 (EOA) to 1.0±0.4 cm^2 (ELCo). These changes had the following effect on the stenosis severity classification: EOA classified 24/32 patients to severe stenosis, whereas ELCo led to a down-grading of further 7 patients (17/32 patients with severe stenosis).

Conclusion: The theory of post-stenotic pressure recovery is applicable using MRI. This is achieved by exact determination of diameters of the ascending aorta, which delivers a new option to estimate the extent of pressure recovery. It could be a promising approach to understand the underestimation of EOA calculated by the continuity equation.

B-720 10:39

Mitral valve geometry in ischemic cardiomyopathy: MRI evaluation

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Katowice/PL (KJgruszczynska@gmail.com)

Purpose: To assess mitral valve (MV) apparatus geometric changes in ischemic cardiomyopathy.

Methods and Materials: Thirty-six patients with ischemic cardiomyopathy underwent ECG-gated cine-MRI. Short axis, two-chamber and four-chamber views were used to measure: mitral annulus area and diameters, anterolateral and posteromedial papillary muscle (PM) tips distance from annulus saddlehorn, PM tips and bases distance, mitral valve tenting area and tenting distance, length of coaptation, angles of both PM long axes and annulus plane. Left ventricular global and segmental function was assessed. Eighteen patients had no or trivial mitral regurgitation (MR-), and 18 had moderate to severe mitral regurgitation (MR+) on echocardiography.

Results: LV EF (24±4.5 vs. 20.3±5.9%; p=0.3), EDVI (149±26 vs 157±65 ml/m^2; p=0.2) and ESVI (113±21 vs 124±57 ml/m^2; p=0.2) did not differ between groups. MR+ patients had larger diastolic mitral annulus area index 4.9±0.9 vs 4.6±0.7 cm^2/m^2 (p=0.005), bigger indexed PM bases distance 1.95±0.50 vs 1.86±0.28 cm/m^2 (p=0.03), smaller coaptation length 5.0±1.3 vs 6.6±1.6 mm (p=0.02) and smaller systolic angle between posteromedial PM long axis and mitral annulus plane in two-chamber view 67±9° vs 85±10° (p=0.002). Postermedial PM bearing LV wall segments were thinner in MR+ patients: 6.8±1.4 vs 9.0±2.3 mm (p=0.008). In multivariate analysis, only angle between posteromedial PM long axis and mitral annulus plane (OR 0.86; p=0.02) and postermedial PM bearing LV wall segments thickness (OR 0.33; p=0.04) turned to be significant predictors of mitral regurgitation.

Conclusion: Thinning of LV wall segments bearing posteromedial PM and resulting in its external displacement are involved in the development of MR in ischemic cardiomyopathy.

B-721 10:48

also EPOS

Cardiac computed tomography for the differentiation between bicuspid and tricuspid aortic valves: Comparison with echocardiography

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Purpose: To evaluate the diagnostic performance of cardiac computed tomography (CT) for the differentiation between tricuspid (TAV) and bicuspid aortic valves (BAV) in comparison with echocardiography.

Methods and Materials: 47 patients with TAV and 47 with BAV underwent transthoracic echocardiography (TTE) and retrospectively electrocardiography-gated dual-source CT. From the 47 patients with BAV, 7 (15%) had no raphe, whereas 40 (85%) had a raphe. Two independent and blinded observers assessed image quality (IQ) using a 4-point score, determined the cardiac phase providing the best IQ of the aortic valve, differentiated between TAV and BAV using CT, and assessed for the presence or absence of a raphe. Diagnostic performance of CT was determined using TTE as reference standard.

Results: Diagnostic IQ was found in all patients and was rated excellent in 82% (77/94), good in 17% (16/94), and moderate though diagnostic in 1% (1/94). In patients with TAV, the best IQ for the assessment of aortic valve morphology was found in all 47 patients during diastole. In patients with BAV, the best IQ was found in 70% (33/47) in diastole, in 4% (2/47) in systole, and in 26% (12/47) when combing both diastolic and systolic reconstructions. In 3 BAV patients with raphe, the valve was misclassified as TAV with CT. The sensitivity, specificity, positive and negative predictive values of CT for the diagnosis of BAV were 94, 100, 100, and 94%.

Conclusion: CT is highly accurate for the differentiation between TAV and BAV. For BAV without raphe, diastolic reconstructions are sufficient, whereas in BAV with raphe, additional reconstructions in systole are required.

B-722 10:57

ECG gated CT of the aorta predicts angiographic viewing angle for percutaneous aortic valve replacement

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Purpose: To test the hypothesis that appropriate angiographic viewing angles for percutaneous aortic valve replacement can be predicted from ECG-gated CTA of the aorta.

Methods and Materials: Ten consecutive patients with severe aortic stenosis underwent ECG gated CT of the thoracic aorta prior to percutaneous aortic valve replacement. Two independent readers, blinded to angiographic viewing angles, generated two dedicated thick-slab (20 mm) ray-sum views of the aortic root oriented orthogonal to the virtual valve plane by visually aligning the nadir of the three sinuses of Valsalva: The 'R-view' was chosen such that the right sinus projected between the left and the non-coronary sinuses, the 'NC-view' was chosen with the non-coronary sinus in the center. Images were generated twice by one reader. Viewing angles were recorded and compared with angiographic projection angles used at valve deployment.

Results: CT-based angles for R-views ranged at 13°LAO-6°RAO and 7 °CRA-11 °CAU, and ranged at 24°LAO-95°LAO and 30 °CRA-34 °CAU for NC-views. There was good intraobserver (≤5° difference for all views) and good interobserver agreement (≤7° differences). CT based viewing angles centered on the right sinus concurred best (≤9° RAO/LAO, ≤10 °CRA/CAU) with angiographic projections in 8/10 cases. Maximum differences were 15° CRA/CAU and 14° RAO/LAO, respectively.

Conclusion: Estimation of suitable angiographic projection angles for percutaneous aortic valve deployment from ECG gated CT is feasible and reproducible. This may reduce the number of injections currently required for appropriate angiographic viewing angle selection.

B-723 11:06

Eccentric mitral regurgitation: Assessment with 64-slice multi-detector row CT and real-time three-dimensional echocardiography

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Purpose: To prospectively evaluate 64-slice multi-detector row CT (64-MDCT) for assessing eccentric mitral regurgitation and compare the results with those on real-time three-dimensional echocardiography (RT3DE), with MRI as reference.

Methods and Materials: Thirty-two patients (23 men, 9 women; mean age, 41.8 years) with isolated eccentric mitral regurgitation underwent retrospectively ECG-gated 64-MDCT, RT3DE and MRI for assessing the severity of mitral regurgitation. Stroke volumes of left and right ventricle were measured for 64-MDCT and MRI. Using these measurements, regurgitation volumes (RV) and fractions (RF) were calculated and compared. Regurgitation parameters of all patients by RT3DE were measured offline by using the average rotation method. Linear regression analysis and paired Student t test were used to compare the RV and RF calculated by 64-MDCT and RT3DE. Agreement between imaging modalities was performed with Bland and Altman analysis.

Results: RV at 64-MDCT correlated well with that of MRI (r=0.93), and mean value of RV had no statistical difference between two methods (p> 0.05). RT3DE underestimated the RV compared with MRI, but the correlation coefficient was acceptable (r=0.88). RF measured by 64-MDCT had better correlation with that measured by MRI (r=0.92) than that obtained by RT3DE (r=0.83). Bland-Altman analysis showed no significant differences in RV (bias, -1.6 ml) and RF (bias, 0.4%) between the 64-MDCT and MRI.

Conclusion: ECG-gated 64-MDCT provides quantitative information with high accuracy for determining eccentric mitral regurgitation, and results with ECG-gated 64-MDCT are similar to those with RT3DE.

B-724 11:15

Mitral valved stent validation with cardiac-CT: Feasibility study

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Purpose: After endovascular aortic and pulmonary valve replacement, transapical mitral valved stent implantation is the latest development. The aim of the study was to evaluate the ability of cardiac-CT to depict, the accuracy of mitral stent valve placement, its relation to the native cusp and the left ventricular outflow tract (LVOT).

Methods and Materials: Twenty pigs underwent transapical off-pump mitral valved stent implantation. After the procedure, 15 pigs received a cardiac scan in a 64-slice cardiac-CT. Heart rates were above 100 bpm. Image and function analysis was performed by two cardiac-CT experienced radiologists and a cardiac surgeon. In

addition, all stents were evaluated by transesophageal echocardiography. After imaging, stent valve placement was controlled in situ. In all examinations, the accuracy of stent valve placement, and its relation to the native heart was determined.
Results: Cardiac-CT gained high quality in spite of the animal study design and increased heart rate. The position, atrial fixation and the cusps of the atrioventricular stent could be exactly shown. There was no migration, one wrong positioning, a relative LVOT-obstruction and one case of vegetation. Stent fractures were missed. These results were confirmed by in situ findings. Due to fewer artifacts, the relative stent position to the LVOT could be evaluated better in cardiac-CT than in TEE. Neither a valvularstent insufficiency nor a paravalvular regurgitation were seen in cardiac-CT or TEE.
Conclusion: Cardiac-CT is proper to evaluate the outcome of transapical mitral valved stent replacement. TEE and cardiac-CT complement one another in morphologic and functional stent valve analysis.

B-725   11:24

Morphological and dynamic features of normal mitral valve in cardiac cycle: Evaluated with dual-source CT coronary angiography
W. Deng, Z.G. Yang; *Chengdu/CN (dengwen0913@163.com)*

Purpose: To determine the morphological and dynamic features of normal mitral valve in cardiac cycle by using dual-source CT coronary angiography.
Methods and Materials: We performed a retrospective analysis of 62 subjects who meet our criteria and underwent dual-source CT coronary angiography. Ten reconstructed time phases in every 10% step of the R-R interval were made. Mitral annular area (MAA), mitral valve area (MVA), mitral annular diameter (MAD), mitral valve diameter (MVD) and mitral valve angles were measured on the standard planes. Differences of MAA and mitral valve angles between two consecutive reconstructed time phases were tested by using paired t test.
Results: Mitral annular showed a saddle like shape in most phases; it gradually turned to round in 90%-0% phases. Mitral valve closed in 0-40% phases and opened in 50-90% phases in majority. MAA was increased in 0-30% phases, then changeless from 30% phase to 60% phase, finally decreased in 60-0% phases. The amplitude of MAA from maximum to minimum during whole cardiac cycle was 269.90±70.62 mm². The maximum of MAA was 871.21±141.65 mm² in 80% phase, whereas minimum 668.84±126.68 mm² in 0% phase (p < 0.01). Mitral valve angles were increased in 30-60% phases, then gradually decreased until the second increase in 90% phase, finally decreased in 90-30% phases. The amplitude of anterior and posterior valve angle from maximum to minimum during whole cardiac cycle were 60.89±15.45° and 57.26±11.78°, respectively.
Conclusion: Dual-source CT coronary angiography is capable of quantitatively assessing the morphological and dynamic features of mitral valve.

B-726   11:33

also **EPOS**

Image quality of the aortic root in high-pitch dual source computed tomography using prospective ECG-synchronisation: Comparison to non ECG-synchronised high-pitch and standard pitch acquisition techniques
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Purpose: To prospectively evaluate the image quality of the aortic root in dual source computed tomography angiography (CTA) comparing prospectively ECG-gated high-pitch, non-ECG-gated high-pitch and non-ECG-gated standard pitch acquisition techniques.
Methods and Materials: 150 consecutive patients underwent clinically indicated CTA of the thorax on a 128-slice dual-source CT system. The patients were randomly assigned into three groups: Group A (n=50) was evaluated using prospective ECG-gated high-pitch (pitch:3.2); group B (n=50) using non-ECG-synchronised high-pitch (pitch:3.2); and group C using non-ECG-synchronised standard-pitch (pitch:0.8) acquisition. Image quality of the ascending aorta, aortic valve, and the coronary ostia was assessed by two readers using a 3-point scale (1=diagnostic, 2=motion artifacts but diagnostic, 3=non-diagnostic). Effective radiation doses were calculated.
Results: There was no significant difference in average heart rate among the three groups (group A: 68±16 bpm; group B: 69±17 bpm; group C: 70±13 bpm; p=0.78). Diagnostic image quality of the ascending aorta, aortic valve, and the coronary ostia was obtained in 94% (47/50) of patients in group A, 92% (46/50) in group B, and 12% (6/50) in group C. Overall image quality was significantly better in group A (1.1±0.3; p < 0.01) and group B (1.3±0.5; p < 0.01) compared to group C (2.6±0.6), while there was no significant difference between group A and B (p=0.37). Effective radiation dose was significantly higher in group C (7.3±2.4mSv) compared to group A (2.1±0.3 mSV; p < 0.01) and group B (2.1±0.5 mSV; p < 0.01).
Conclusion: High-pitch thoracic CT angiography provides excellent image quality of the aortic root even without ECG-gating at an average radiation dose of 2.1 mSv.

B-727   11:42

Combined assessment of aortic root anatomy and aortoiliac vasculature with dual-source CT in patients evaluated for percutaneous aortic valve implantation
P. Blanke, G. Pache, T. Baumann, W. Euringer, C. Lohrmann, M. Langer; *Freiburg/DE (philipp.blanke@uniklinik-freiburg.de)*

Purpose: To investigate feasibility and image quality of a combined dual-source computed tomography angiography (DSCTA) protocol to assess aortic root anatomy and aortoiliac vasculature in patients with severe aortic stenosis evaluated for percutaneous aortic valve implantation (PAVI).
Methods and Materials: Sixty consecutive patients (35 female, 25 male, mean age 80.3±8.6 years) with severe aortic stenosis evaluated for PAVI underwent a combined single-dose contrast-enhanced DSCTA protocol (< 70 kg/110 ml, ≥ 70 kg/130 ml contrast media) consisting of an electrocardiography-gated DSCTA of the chest with integrated cardiac computed tomography and an ungated computed tomography angiography of the abdomen. Two independent observers measured dimensions of the aortic root and the aortoiliac vasculature and rated image quality. Vessel attenuation was assessed. Amenability to transfemoral access was evaluated based on vessel diameter (> 7 mm), anatomy and the presence of vascular pathology.
Results: Image quality of the aortic root and aortoiliac vasculature was rated diagnostic in 60 (100%) and 59 (98%) patients, respectively. Vascular attenuation was > 200 HU at any vessel level. Mean diameter of the aortic annulus was 25.4±3.1 and 21.9±2.3 mm in the coronal and sagittal oblique view. Inter- and intraobserver correlation were high (r=0.89, r=0.92). Aortic root dimensions were suitable for PAVI in 85% of patients. 38 patients (64%) were deemed amenable to instant transfemoral access without further vasculature interventions.
Conclusion: The dimensions of the aortic root and the aortoiliac vasculature can be assessed with a combined single-dose contrast-enhanced DSCT protocol, thereby allowing for determination of patient eligibility to PAVI, prosthesis sizing and evaluation of the access route in one examination.

B-728   11:51

Measuring the aortic root in patients undergoing trans-catheter aortic valve replacement using dyna-CT and multislice computed tomography: Difference and variability
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Purpose: The aim of this study was to evaluate for the first time the agreement between conventional multislice computed tomography (CT) and the new method of rotational angiography (Dyna-CT) in measuring the aortic root, the coronary arteries and the thoracic aorta in patients undergoing trans-catheter aortic valve replacement (AVR).
Methods and Materials: A total of 21 patients (82±11 years, 15 f/6 m) with severe aortic valve stenosis and indication for AVR were included in this study. All patients underwent pre-interventional contrast enhanced ECG-gated CT (Brilliance 64-Philips) and intra-procedural Dyna-CT (Siemens) of the aortic root, the coronary arteries and the thoracic aorta acquired during rapid cardiac pacing. For agreement determination between the two methods statistical analysis in accordance with Bland-Altman was performed.
Results: All structures relevant for sizing of AVR were sufficiently visible in all patients with both imaging methods. Agreement was all within two standard deviations with highly corresponding values of correlation for anatomical normative values such as the distance of the coronary Ostia from the aortic valve plane (r=0.912, p=0.01). Measurement variability was lower for multislice CT than for Dyna-CT. Although proximal coronary artery stenoses were well displayed with Dyna-CT, lesser predictions could be made considering vessel wall constitution and distal coronary segments.
Conclusion: Intra-procedural Dyna-CT produces good image quality for AVR sizing and could probably be a reliable alternative method assessing anatomic relations as well as proximal coronary artery stenoses. Since image quality and resolution of CT is higher compared with Dyna-CT, vessel wall evaluations are more precise when using CT.

Monday

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

Interventional Radiology

SS 1609

Treatment of liver tumors

Moderators:
S. Shaikh; Miskolc/HU
C. Tziakouri-Shiakalli; Nicosia/CY

B-729   10:30

Comparison of diagnostic sensitivity of C-arm CT, digital subtraction angiography and 64-slice CT in detecting small hepatocellular carcinoma
J. Zheng, J. Li, X. Cui, X. Wang; *Beijing/CN (zhengjiasheng6@163.com)*

Purpose: To compare the diagnostic sensitivity of C-arm CT, 64-slice CT and DSA in detecting small hepatocellular carcinoma (HCC) with lesion size of 3 cm or less.
Methods and Materials: 48 patients with HCC who underwent 64-slice CT, DSA, and C-arm CT were followed up using lipiodol CT two weeks later. The number of detected lesions with size of 3 cm or less in each examination was compared with findings from lipiodol CT and counted separately used by McNemar test.
Results: A total of 133 lesions in 48 patients were confirmed by lipiodol CT. Among the 133 lesions, 55 (41.4%) were detected by 64-slice CT, 110 (82.7%) by DSA, and 130 (97.7%) by C-arm CT. McNemar test showed that the difference in diagnostic sensitivity is statistically significant between CT and DSA ($p < 0.0001$), CT and C-arm CT ($p < 0.0001$), DSA and C-arm CT ($p < 0.0001$). The 133 lesions were further classified into three groups according to the lesion size, including 98 lesions in group A (lesion size $\leq$ 1 cm), 27 lesions in group B (1 cm < lesion size $\leq$ 2 cm) and 8 lesions in group C (2 cm < lesion size $\leq$ 3 cm). 64-slice CT, DSA, and C-arm CT showed 29, 76, and 95 lesions in group A; 19, 26 and 27 lesions in group B; and 7, 8 and 8 lesions in group C, respectively.
Conclusion: Compared to 64-slice CT and DSA, C-arm CT showed higher sensitivity in diagnosing small HCC, especially for lesions with size 1 cm or less.

B-730   10:39

also **EPOS**

Interstitial laser therapy in focal liver lesions localized in "critical sites": Our experience
B. Caspani, A. Ierardi, F. Motta, P. Cecconi, L. Belli; *Milan/IT (amierardi@yahoo.it)*

Purpose: To demonstrate the effectiveness and the safety of interstitial laser therapy (ILP) in patients with unresectable focal liver lesions, deemed not accessible for other percutaneous procedures (radiofrequency, sclerotherapy).
Methods and Materials: From September 2006 to August 2009, 175 patients were treated. In 61 patients, the lesions were (diameter $\leq$ 3 cm) were localized in "critical sites": Perivascular and adjacent gallbladder regions, in the subglissonian area and at the hepatic dome. 68 nodules were treated in 79 sessions. Major and minor complications related to the treatment were compared with those observed in the nodules localized in "not critical sites". Effectiveness was defined as the percentage of HCCs completely ablated after percutaneous ILP. Follow-up was carried out with computed tomography (CT) at 1, 3, 6, 9 and 12 months.
Results: No major complications or deaths were registered. In 5 patients (8.19%), minor complications were observed. Comparing the percentage of minor and major complications in these patients to that of the remaining patients, no substantial differences were observed. Similarly, no differences in terms of effectiveness were registered in nodules located in critical and not critical sites.
Conclusion: ILP can be considered a safe and effective treatment in liver nodules not accessible with any other percutaneous procedure.

B-731   10:48

CT-perfusion technique in evaluation of viable residual tumor after radiofrequency ablation treatment in patients with hepatocellular carcinoma
D. Ippolito, M. Scorza, F. Invernizzi, L. Ratti, L. Antolini, S. Sironi; *Monza/IT (davide.atena@tiscalinet.it)*

Purpose: To assess the role of CT-perfusion (CT-p) technique in detection of blood flow changes related to therapeutic effects in HCC lesion, after treatment with RAFA.
Methods and Materials: A total of 27 patients with known cirrhotic liver disease and biopsy proven diagnosis of HCC lesion who underwent to RAFA treatment were prospectively enrolled in our study. Perfusion study of hepatic parenchyma and of treated lesion was performed about 1 month after treatment on a multidetector 16-slice CT (Philips Brilliance, 16p, NL). Contrast medium enhanced dynamic-CT was performed with static table position with acquisition of 8 dynamic slice/scan

for a total of 40 scans after injection of 50 ml of contrast medium. Treated lesion and surrounding parenchyma were evaluated using a dedicated perfusion software (CT Perfusion Philips 2.0) which generated a quantitative colour map of arterial and portal perfusion. The following parameters were considered: Hepatic perfusion (HP); Arterial Perfusion (AP); Blood volume (BV) and Hepatic Perfusion Index (HPI). Univariate paired Wilcoxon signed ranked test was used for statistycal analysis.
Results: Perfusion parameters of treated lesions could be quantitative assessed using CTp analysis. Seven out of 27 patients had a residual disease and values of perfusion parameters measured within tumor tissue were: HP: 42.1±14.8 ml/sec/100 gr; AP: 45.9±9.1 ml/min; TTP: 19.06±3.7 sec; BV: 19.08±4.9 ml/100 mg; HPI: 52.1 ±31.8%. The corresponding perfusion values calculated in patients without residual tumor were: HP: 10.3±6.1 ml/sec/100 gr; AP: 10.7±7.8 ml/min; TTP: 34.5±12.6 sec; BV 8.7 ± 12.9 ml/100 mg; HPI 12.6 ±7.5%. A significant difference ($p < 0.001$) was observed in mean value of all parameters calculated between treated lesions with residual tumor and those successfully treated.
Conclusion: Perfusion-CT in patients with HCC can enable assessment of tumor vascularity and monitoring of early treatment response after RAFA, by adding quantitative information about viable tumor tissue.

B-732   10:57

Pulmonary lipiodol embolism after TACE: CT findings and its clinicoradiologic outcome
G. Seo, S. Chong, I. Youn, J. Seo, Y. Kim, H. Lee; *Seoul/KR*

Purpose: To evaluate the CT findings and clinicoradiologic outcome of pulmonary lipiodol embolism (PLE) after transcatheter arterial chemoembolization (TACE).
Methods and Materials: 179 patients had underwent 500 examinations of TACE using DSA machine (Axiom Artis, Siemens) due to HCC (n=172) or cholangiocarcinoma (n = 1) or hepatic metastasis (n = 6) at our institute. They underwent CT scans (Lightspeed pro 16, GE) before and after TACE. We evaluated the pulmonary uptake of lipiodol and the associated findings (consolidation or pleural effusion) at CT. We calculated the recovery interval and assessed the overall incidence of PLE in patients who underwent TACE.
Results: Of 179 patients, 7 patients (M:F = 6:1; age range, 42 - 76 years; mean age, 61 years) revealed PLE after TACE. At CT, pulmonary uptake of lipiodol was located in the right lower lobe (n = 4), right middle lobe only (n = 2) or left lower lobe (n = 1). Five patients had consolidation with pleural effusion (n = 3) or only pleural effusion (n = 2). Three patients presented hemoptysis (n = 2) or dyspnea with fever (n = 1). In 5 patients, uptake of lipiodol was not detected at CT 23 - 150 days after (mean 55.8 days, median 29 days). In our study, the overall incidence of PLE was 1.4% (7/500).
Conclusion: Pulmonary lipiodol embolism after TACE shows the pulmonary uptake of lipiodol and the associated findings (consolidation or pleural effusion) at CT. Pulmonary uptake of lipiodol can improve during about 2-month follow-up period.

B-733   11:06

Periinterventional Flat Detector CT in patients with Transarterial Chemoembolisation (TACE) of liver tumors
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Purpose: To evaluate the usefulness of periinterventional C-arm CT (FD-CT) for TACE in patients with liver tumours.
Methods and Materials: In 25 patients (17 male) periinterventional C-arm CT before TACE was performed (2x after TACE with Lipiodol/Epirubicine, 3x after Lipiodol injection, 18x during contrast injection into hepatic artery before TACE with drug eluting Epirubicine beads, 1x for 3D visualisation of the celiac trunk, 1x after TACE). 20 patients suffered from HCC, 4 patients had metastatic disease (3x colon-, 1x breast ca, 1x CUP). Interventions were performed with a 30x40 cm flat detector C-arm DSA system. Images were acquired by C-arm rotation of 217° with 174, 226 or 457 projections in 8 seconds acquisition time with axial, coronal and 3D-reconstructions.
Results: FD-CT enabled good visualisation of Lipiodol retention after Epirubicine/Lipiodol embolisation. TACE was not performed in 3 patients due to poor Lipiodol retention. In 10 of 18 TACE with beads FD-CT demonstrated a better visualisation of feeding vessels compared to DSA. 8 embolisations were not performed as FD-CT demonstrated insufficient vessels, 1 case showed multifocal spread, in 1 catheterizing was possible in a second attempt after 3D imaging of celiac trunk, and 1 tumour devascularisation after TACE with beads was well documented.
Conclusion: In comparison with DSA, FD-CT allows a better visualisation of tumour vessels, simplifies selective catheterisation, the decision whether an embolisation is possible and enables a good visualisation of Lipiodol retention. Hence, FD-CT is a helpful periinterventional imaging tool but does not substitute CT and MRI in follow-up.

B-734 11:15
Radiofrequency ablation combined with a direct electrical current: Evaluation of optimal setting using in ex-vivo bovine liver

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Purpose: To investigate the optimal setting for radiofrequency (RF) ablation combined with direct electrical current (DC) ablation in ex-vivo bovine liver.
Methods and Materials: An electrical circuit combining a commercially available RF ablation system with DC was developed. The negative electrode of a rectifier which provides DC was connected to a 3 cm RF probe (LeVeen, Boston Scientific, Natick, MA, USA). A 100 mH inductor was used to prevent electrical leakage from the RF generator. DC was followed by RF ablation in freshly excised bovine livers. Electric current was measured by an ammeter. Coagulation volume, ablation duration and mean electric current were compared for various DC voltages (no DC, 2.2, 4.5, 9.0 V) and different RF ablation protocols (stepwise increase from 40 to 80 W, 40 W fixed, 80 W fixed).
Results: Applying DC with 4.5 or 9.0 V in combination with 40 W fixed or a stepwise increase of the RF energy resulted in significantly increased lesions when compared with 2.2 V or no DC ($p < 0.05$). At 4.5 V DC, the stepwise increase of the RF energy resulted in the same size of necrosis as a 40 W fixed protocol (26.6 ± 3.9 vs. 26.5 ± 4.0 ml), but significantly reduced ablation duration (296 ± 89 vs. 423 ± 104 s; $p < 0.05$). The mean electric current was lower at 4.5 V when compared with 9.0 V DC.
Conclusion: The combination of DC and RF ablation improves efficacy of liver ablation. Combining a stepwise increase of RF energy with a DC voltage of 4.5 V is most appropriate to increase coagulation volume and to minimize procedure time.

B-735 11:24
Neoadjuvant transarterial chemoembolization (TACE) for liver metastases of breast cancer followed by thermal ablation via MR-guided laser-induced thermotherapy (LITT)

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Purpose: To evaluate survival data and local tumor control of neoadjuvant repeated transarterial chemoembolization (TACE) using different chemotherapeutic combinations followed by laser-induced interstitial thermotherapy (LITT) in patients with liver metastases of breast cancer.
Methods and Materials: 161 patients (mean 57 years, range 31-83 years, SD: 1.3) with liver metastases of breast cancer were prospectively treated with a mean of 3.5 TACE sessions (range 1-9, SD: 1.3) to achieve a size and number of metastases meeting the requirements for LITT (diameter < 5 cm, number < 5), which was performed in 1 to 5 sessions per patient (mean: 1.8 times, SD: 0.96). The TACE protocol was performed with different drug combinations. Patients were either treated with mitomycin C alone (53 patients) or in combination with gemcitabine (108 patients).
Results: Overall, the mean reduction in size in response to TACE was 27%. In the mitomycin C group, the size was reduced by 26.9%, in the mitomycin C/gemcitabine group, the size was reduced by 27.4% (p=0.65). Mean survival of all patients was 32.5 months (range 5-101, SD: 21.6). The mean local tumor control rate was 13 months (maximum 90 months, SD: 15.9). Mean time to progression (TTP) was 8 months (maximum 69 months, SD: 12.3): in the mitomycin/gemcitabine group, it was 10.7 months; in the mitomycin group, 6.9 months (p=0.5).
Conclusion: Neoadjuvant TACE reduces size and quantity of hepatic breast cancer metastases to permit subsequent thermal ablation. A combination of mitomycin C and gemcitabine seems to improve the reduction achieved by TACE.

B-736 11:33
CT hepatic tumour burden measurement: Assessment of interobserver variation of hepatic tumour burden-volumetric technique vs estimation

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Purpose: To compare CT volumetric technique against percentage estimation by experienced radiologists for evaluation of tumor burden in patients with liver metastases from colorectal cancer in a phase III clinical trial of microbrachytherapy using selective internal radiation therapy (SIRT).
Methods and Materials: Helical CT studies in 27 patients with liver metastases from colorectal cancer enrolled in a phase III clinical trial were evaluated. All studies acquired on enrolment were reconstructed to section thickness of 2.5 mm. Volumetric measurements were made by tracing individual lesions on each axial image with a mouse-operated cursor on an imaging workstation (GE Advantage Windows); areas obtained were multiplied by reconstruction interval to obtain volumetric measurement. Three attending radiologists were asked to estimate percentage (%age) burden of lesions on axial CT scans independently to the nearest 5%. Interobserver agreement and comparison to reference standard were assessed using Cohen kappa statistic.
Results: The mean %age tumor volume was 12% (1 to 70%). The mean %age error in estimation for the three readers was 125, 83 and 111%, respectively, but there was no significant difference between the observers (p = 0.365, one-way ANOVA). For delivery of SIRT spheres to the liver, the total dose is calculated on the basis of thresholds of < 25%, 25-50% and > 50% tumor replacement. At these thresholds there was substantial agreement (Kappa = 0.639, 0.642 and 0.719) for all observers.
Conclusion: SIRT requires estimation of the tumor burden in the liver; this can be achieved at a 25% threshold by visual estimation.

B-737 11:42
Effects of perfusion abnormalities and localization of liver tumors on suspected hemorrhagic complications after laser-induced thermotherapy

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Purpose: Treatment of liver tumors by thermoablative techniques such as laser-induced thermotherapy is associated with the risk of postinterventional hemorrhage. The present study aimed at investigating a possible association between perfusion abnormalities such as hyperperfused foci or transient hepatic attenuation differences and the occurrence of hemorrhagic complications following laser-induced thermotherapy of focal liver lesions.
Methods and Materials: A total of 308 image datasets acquired by computed tomography or magnetic resonance imaging in 80 patients who underwent laser-induced thermotherapy of 80 hepatic target lesions were analyzed retrospectively. The datasets were evaluated for hyperfusion patterns and their morphology, serial changes, and hemorrhagic complications.
Results: Transient hepatic attenuation differences occurred more frequently after than before laser induced thermotherapy (25 patients - 31% vs. 49 patients - 61%). Patients with transient hepatic attenuation differences before therapy also had significantly more transient hepatic attenuation differences after the intervention (p < 0.001). Follow-up imaging revealed hemorrhage in 22 (28%) patients. No significant association was found between liver tumors with surrounding transient hepatic attenuation differences or hyperperfused lesions and postinterventional bleeding (p = 0.271 and 1.0, respectively). Postinterventional hemorrhage was significantly more common in patients with central or subcapsular liver tumors (p < 0.01 and p = 0.01, respectively) compared with lesions surrounded by a zone of normal parenchyma.
Conclusion: Hyperperfusion of lesions or presence of transient hepatic attenuation differences does not increase the risk of hemorrhage after laser induced thermotherapy. Hemorrhagic complications are more common in focal liver lesions in central or subcapsular location.

B-738 11:51
Induction of left liver hypertrophy by right portal vein occlusion: Embolization vs ligation

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Purpose: To investigate the volume increase of the left liver lobe after right portal vein occlusion before scheduled right hemihepatectomy.
Methods and Materials: 48 consecutive patients with metastases of the right liver lobe were indicated for right hemihepatectomy. Right portal vein occlusion was performed to induce volume increase of the small left liver remnant. 13 patients had explorative laparotomy and intraoperative ligation of the right portal vein (group I). The other 35 patients were treated percutaneously via the left portal vein (group II). The right portal vein was embolized using fluid embolics (histoacryl and Lipiodol, 1:3) for permanent occlusion of all segmental veins including the main right portal vein. Liver volumes were calculated from contrast enhanced MDCT data sets before embolization or ligation and prior to hemihepatectomy (total liver volume (TLV), left liver volume (LLV) and volume of segment 2+3. Interval between portal vein occlusion and hemihepatectomy was 46±19 days.
Results: The baseline total liver volume (TLV) and left liver volume (LLV) was different in both groups: 1766±262 vs 2200±670 ml (TLV, p < 0.05) and 600±189 vs 808±323 ml (LLV, p < 0.01), respectively. At 46±19 days follow-up, patients with portal vein ligation presented with a 31.1±26.1% increase of the LLV and 43.2±24.6% of segment 2+3. Percutaneous portal vein embolization (group II) resulted in an 38.5±38.5% (p> 0.05) increase of the left liver lobe (LLV) and 39.1±32% (p> 0.05) of segment 2+3. There was no statistical difference between both techniques.
Conclusion: Both embolization and intraoperative ligation resulted in significant contralateral volume increase without significant difference between both methods.

Monday

14:00 - 15:30   Room A

Musculoskeletal

SS 1710a

Spine

Moderators:
C. Schüller-Weidekamm; Vienna/AT
A. Vieira; Porto/PT

B-739   14:00

Conventional cervical spine imaging in the ER, still useful?

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Purpose: In evaluating traumatic injuries of the cervical spine, conventional radiography (CR) has a low sensitivity compared to Multi-Detector CT (MDCT). We evaluated if CR could be used to select patients in whom MDCT could be safely omitted.
Methods and Materials: Between May 2005 and July 2008, an observational, prospective cohort study was conducted on all high-energy trauma patients aged 16 years and older. All patients underwent routine CR and MDCT of the cervical spine. Several diagnostic algorithms were defined to identify patients without an indication for MDCT. MDCT was the standard of reference and unexpected abnormalities on MDCT the primary outcome measure. The sensitivity, specificity, post-test probability, costs and radiation dose for these different algorithms were calculated.
Results: 1047 patients were included, mean age 40 years (16-95), 731 (70%) male. 125 patients had a cervical spine fracture, 59 with clinical consequences. Utilizing the most sensitive algorithm, fractures would have been missed in 6 patients, one of whom needed clinical intervention; sensitivity 95%, specificity 29%. The post-test probability in this algorithm was 2% (95%CI 1-5%) and for injuries with clinical consequences almost 0% (95%CI 0-2%). Using this algorithm in 74%, an MDCT was indicated. Compared to a diagnostic algorithm in which all patients would receive a MDCT without preceding CR, a cost saving of 0.38 and 0.35 mSv per patient would be achieved.
Conclusion: CR results are limited in deciding to omit MDCT in ER patients with cervical spine injury, as is the resulting reduction in cost and radiation.

B-740   14:09

Biochemical MRI of facet joints and intervertebral discs: Axial T2 mapping at 3.0 Tesla

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Purpose: Degenerative changes of the facet joints represent a possible source of pain. Our objective was to assess lumbar facet joint cartilage in comparison to the intervertebral discs by means of quantitative T2-mapping.
Methods and Materials: Seventeen lumbar spine segments from 13 patients (mean age 38) suffering from low back pain were examined by axial T2-mapping at 3 T MR. Sagittal T1-FSE, sagittal and axial T2-FSE sequences were used for morphological imaging. A multi echo-SE-sequence was used for T2-mapping. Regions of interest were drawn on a single slice across the facet joints, the nucleus pulposus (60% of sagittal intervertebral disc diameter) and in both anterior and posterior annulus fibrosus (20% each). Discs with marked height reduction (more than 50%) were excluded from evaluation. A Pearson correlation analysis was performed.
Results: Mean T2 relaxation time values (in ms) were: facet joints: 59±18 (SD), nucleus: 90±28, anterior annulus: 53±14, posterior annulus 61±13. Correlation analysis showed neither an association between nucleus and facet joint nor between anterior annulus and facet joint T2 values, but a high correlation between facet joint and posterior annulus T2 values was observed (r=0.79, p < 0.001).
Conclusion: Our report represents the first attempt of a quantitative analysis of lumbar facet joint cartilage via T2 mapping in patients with low back pain. Our evaluation may suggest that the biochemical structure of the posterior part of annulus fibrosus seems to affect biochemical properties of facet joint cartilage and may help to detect early degeneration of facet joints.

B-741   14:18

Lumbar intervertebral disc pathology: Comparison of quantitative T2 mapping with conventional MR at 3.0 Tesla

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Purpose: To assess the relationship of morphologically defined lumbar disc pathology with quantitative T2 relaxation time measurements as a sensitive marker for disc hydration and collagen content.
Methods and Materials: Fifty-three patients aged 15-55 y (mean: 38 y) with single or recurrent episodes of low back pain were examined at a 3 T MR using sagittal T1-FSE, sagittal and axial T2-FSE for morphological MRI and multi echo-spin echo sequence for T2 mapping. ROIs for the annulus (AF) were drawn anteriorly and posteriorly in the outermost 20% of the disc. The space in between was defined as the nucleus (NP). The ratio between annulus and nucleus was referred as the T2 A-N-index and was calculated as follows: A-N-index = T2 (AF)/T2 (NP). To evaluate differences between classified groups, T-Tests were performed.
Results: In 265 analyzed discs, we found 39 (15%) focal herniations, 10 (4%) with annular tears, 123 (46%) bulging discs and 103 (39%) "normal discs" without the previous pathologies. The respective mean T2 values for the AF, NP and the A-N-index were as follows: herniation 51/96/0.64, annular tear 47/58/0.89, bulging 51/105/0.56, normal 56/111/0.52. T-testing showed significant differences in T2 A-N-index between normal discs and herniated discs (p < 0.01) but no difference between normal and bulging discs (p=0.17). Annular tears showed most significant decrease in NP T2 values (p < 0.01).
Conclusion: Quantitative T2 mapping in the lumbar spine at 3 Tesla yields additional information about the disc matrix and is a promising noninvasive tool to assess water content and collagen fiber integrity in different disc pathologies.

B-742   14:27

Schmorl's nodes in the lumbar spine: Evaluation by quantitative T2 mapping at 3.0 Tesla

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Purpose: The significance of Schmorl's nodes for low back pain and disc degeneration is still a matter of discussion. The objective of our study was to assess lumbar IVDs by means of T2 mapping at high field strength and compare discs with Schmorl's nodes to those without nodes.
Methods and Materials: Fifty-three patients aged 15-64 y (mean: 39 y) with low back pain were examined at a 3 T MR, using sagittal T1-FSE, sagittal and axial T2-FSE for morphological MRI and multi echo-SE sequence for T2 mapping. All discs were graded morphologically for the presence of Schmorl's nodes. Regions of interest (ROIs) for the annulus fibrosus (AF) were drawn 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). Additionally, one ROI was drawn for the node tissue itself. T-Tests were performed.
Results: In 265 analyzed discs we found 25 discs with Schmorl's nodes. The T2 values (in ms) for the AF and NP were 52±15/110±49 in discs without and 46±11/91±59 in discs with Schmorl's nodes, respectively. The differences in T2 relaxation time were significant for the nucleus (p=0.02) and the annulus (p=0.01). The node tissue itself had markedly lower T2 values (44±14) than the corresponding nucleus (p < 0.01).
Conclusion: Our findings suggest that discs with Schmorl's nodes have lower nucleus water content and lesser organization of collagen fibers than those without. This supports the hypothesis that Schmorl's nodes represent a sign of IVD degeneration.

B-743   14:36

Tractography of lumbar nerve roots: Initial results

V. Balbi, J.-F. Budzik, V. Lethuc, A. Bera-Louville, A. Cotten; *Lille/FR (vinz.balbi@yahoo.fr)*

Purpose: The aims of this preliminary study were to: (1) demonstrate the feasibility of in vivo DTI and fiber tracking of the lumbar nerve roots, (2) assess potential differences in DTI parameters of the lumbar nerves between healthy volunteers and patients suffering from disc herniation and (3) compare DTI parameters with the clinical assessment of the patients.
Methods and Materials: Nineteen patients with unilateral sciatica related to a posterolateral or foraminal disc herniation and 19 healthy volunteers entered this study. DTI with tractography of the L5 or S1 nerves were performed. Mean fractional anisotropy (FA) and mean diffusivity (MD) values were calculated from tractography

images. Patients were clinically evaluated using the Visual Analog Scale and the Roland Morris disability questionnaire.

Results: FA and MD values could be obtained from DTI-FT images in all controls and patients. The mean FA values of compressed lumbar nerve root was significantly lower than the FA of the controlateral nerve root (p=0.0001) and of the nerve roots of volunteers (p=0.0001). MD was significantly higher in compressed nerve roots than in the controlateral nerve root (p=0.0002) and in the nerve roots of volunteers (p=0.04). A positive correlation between the MD and the VAS score was found.

Conclusion: DTI with tractography of the lumbar nerves is possible. Significant changes of diffusion parameters were found in the compressed lumbar nerves and some of these changes were correlated with the clinical assessment of the patients.

B-744 14:45
Tractography in cervical spondylotic myelopathy: Diffusion abnormalities and clinical correlation

V. Balbi, J.-F. Budzik, V. Lethuc, A. Bera-Louville, R. Assaker, A. Cotten; *Lille/FR (vinz.balbi@yahoo.fr)*

Purpose: The aims of this study were to: (1) demonstrate a reliable way of obtaining microstructural parameters [Fractional Anisotropy: FA, Mean Diffusivity: MD] of the spinal cord in patients suffering from cervical spondylotic myelopathy (CSM) using tractography, (2) to compare DTI parameters with the clinical assessment of these patients and (3) with the assessment of the spinal cord using conventional MRI sequences.

Methods and Materials: 20 symptomatic patients with CSM and 15 volunteers entered this prospective study. FA and MD were calculated from tractography images by two independent radiologists at different levels: C2-C3 in both patients and controls, pathological level in patients and C4-C7 in controls. Conventional T2-weighted sequences were also performed. Patients were clinically evaluated using a self-administered questionnaire.

Results: FA values of patients were significantly lower at the pathological level than at C2-C3 (p < 0, 0001) and than at the C4-C7 level of the volunteers (p=0.0003). MD was significantly higher (p < 0. 0001) at the narrowed level than at C2-C3, but no difference was found between patients and volunteers. A positive correlation between FA at the pathological level and lower (p=0.0002) and upper (p=0.0009) limb function was demonstrated. MD was not correlated with any of the clinical scores. Increased signal intensity on T2-weighted sequences did not correlate either with FA, MD or with the clinical scores. Inter and intra-observer agreement was excellent for both FA and MD.

Conclusion: FA values were significantly correlated with some of the patients' clinical scores suggesting DTI could become a reliable technique for the assessment of CSM.

B-745 14:54
Clinical leakage rates and leak volumes for a new cement directing kyphoplasty system

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Purpose: A percutaneous device was developed to partially contain and control cement flow during kyphoplasty, reducing risk of posterior cement leakage. In a multi-center prospective randomized controlled study, cement leakage rates, locations and volumes for cement-directing-kyphoplasty-system (CDKS) and percutaneous vertebroplasty (PV) were compared in the treatment of osteoporotic vertebral compression fractures.

Methods and Materials: In CDKS, a curved reamer created a cavity to receive the cement-directing implant. Cement (Spineplex) was injected in a unilateral transpedicular or extrapedicular approach and the implant directed cement flow away from the posterior aspect of the vertebral body. Bilateral PV was performed on control-patients. A total of 62 levels were treated with CDKS and 39 levels with PV. Cement-leaks were identified and classified by location from radiography (by investigators) and CT (independent reviewer). Leak-volumes were determined from 3D-CT reconstructions.

Results: Radiographic leakage-rate was 12.9% for CDKS and 25.6% for PV, while CT leakage-rate was 64.5% for CDKS and 138.5% for PV. Eight CDKS-levels and 14 PV-levels exhibited multiple leaks. Basivertebral-vein-leaks occurred in 9.7% (CDKS) and 30.8% (PV), segmental-vein-leaks in 25.8% (CDKS) and 51.3% (PV), cortical-leaks (including endplates) in 29% (CDKS) and 56.4% (PV). Cement-leak-volume was < 0.01 cm³ for 16% of CDKS and 11% of PV, 0.01-0.10 cm³ for 19% of CDKS and 40% of PV, and 0.10-1.0 cm³ for 16% of CDKS and 23% of PV.

Conclusion: CDKS reduces the cement leakage rate by 50.4% (radiographs) and 46.6% (CT) versus vertebroplasty. Leakage rates for all locations and number of larger volume leaks were decreased for CDKS. Thus, the risk of complications associated with the procedure can be reduced.

B-746 15:03
Interobserver agreement using 64-slice MDCT to estimate degree of fusion after instrumental desis of the lower lumbar spine

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Purpose: To investigate interobserver agreement using 64 MDCT to estimate fusion after instrumental desis of lower lumbal spine including importance of different observer experience.

Methods and Materials: Thirty-six patients; 16 men and 20 women (median age 54.5) with postoperative low back pain after instrumental desis/spinal fusion of one or more levels: L3 to S1 underwent CT examination in 2007. Imaging was performed on 60 operated vertebral levels using 64-slice MDCT with coronal and sagittal reconstructions. Four blinded observers, two residents and two musculoskeletal radiologists, scored all scanned vertebral levels from 1 to 5 according to Glassmans score: 1: solid bilateral fusion, 2: solid unilateral fusion, 3: partial bilateral fusion, 4: partial unilateral fusion, 5: no fusion. Values 1 and 2 were placed in one group representing solid fusion and values 3-5 were placed in another representing partial or non-fusion. Specific changes affecting the hardware and discs were also noted.

Results: Four observers agreed on solid versus partial/non-fusion in 43 out of 60 cases (72%), 3 observers agreed in 53 cases (88%). The residents disagreed regarding fusion grading in 9 cases: kappa 0.58, moderate agreement. The musculoskeletal radiologists disagreed in 8 cases kappa 0.70, substantial agreement. On average, breakage/fracture of the hardware was reported by 3 observers, disc vacuum was reported by 2 observers and displacement/lucencies around the hardware were reported by 1 observer.

Conclusion: Inter-observer variation was found to be substantial in the present study. Difference in observer experience seems to have only minor impact.

B-747 15:12
Conversion and utility of QCT of the spine derived from sagittal reformations of contrast-enhanced MDCT

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Purpose: To develop a conversion equation for bone mineral density (BMD) of the lumbar vertebral bodies using QCT with sagittal reformations in routine abdominal contrast-enhanced MDCT and to apply this equation to MDCT datasets differentiating patients with and without osteoporotic vertebral fractures.

Methods and Materials: Fourteen patients with a mean ± SD age of 61 ± 11 years underwent standard QCT to assess BMD values of L1-L3. Afterwards, routine abdominal contrast-enhanced MDCT images of these patients were obtained and QCT of L1-L3 were performed using the sagittal reformations. The MDCT-to-QCT conversion equation for BMD was calculated with linear regression analysis. The conversion equation was applied to vertebral BMD datasets (L1-L3) of further 58 patients (19 females, 39 males) with a mean ± SD age of 68 ± 12 years. 22 of 58 patients had osteoporotic vertebral fractures.

Results: BMD values of contrast-enhanced MDCT were on average 36.9% higher than those of standard QCT. A correlation coefficient of r=0.92 was calculated for the BMD values of MDCT and standard QCT with the conversion equation $BMD_{QCT}=0.747 \times BMD_{MDCT}-17.19$ mg/ml. Patients with vertebral fractures showed significantly lower mean BMD_{QCT} values than patients without vertebral fractures (78.10 mg/ml vs. 107.33 mg/ml; p < 0.05). Using ROC analysis to differentiate patients with and without vertebral fractures, $A_{ROC}=0.778$ was obtained for BMD_{QCT} (p < 0.05).

Conclusion: With low technical effort, BMD measurements of the spine could be computed in sagittal reformations of routine abdominal contrast-enhanced MDCT. Using the conversion equation, the acquired BMD data could differentiate patients with and without osteoporotic vertebral fractures.

B-748 15:21
Biochemical MR of the intervertebral disc at 3.0 T: Comparison of T2 mapping with morphological scoring in patients with low back pain

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Purpose: The objective of our study was to assess the relationship between T2 relaxation times to standard morphological scoring of disc degeneration in patients with low back pain.

Methods and Materials: Fifty-three patients aged 15-64 y (mean: 39 y) with low back pain were examined at a 3 T MR using: sagittal T1-FSE, sagittal and axial T2-FSE for morphological MRI and multi echo-SE-sequence for T2 mapping. All

discs were classified as described by Pfirrmann et al. Regions of interest (ROIs) for the annulus fibrosus were drawn anteriorly and posteriorly in the outermost 20% of the disc on two adjacent slices. The space in-between was defined as the nucleus pulposus. The ratio between annulus and nucleus is referred as the T2 A-N-index and was calculated as follows: A-N-index = T2 (annulus)/T2 (nucleus).

Results: Morphological classification of 265 IVDs showed the following distribution: I: 6 discs (2.3%), II: 153 (57.7%), III: 81 (30.6%) and IV: 25 (9.4%). The mean T2 values for the annulus and the nucleus were 53 ±16 and 108 (±46) ms, respectively. ROI analysis yielded the following T2 A-N-index values for the respective Pfirrmann group: I: 0.19±0.07, II: 0.47±0.14, III: 0.61±0.16 and IV: 0.81±0.19. The differences between the groups were highly significant (p < 0.001).

Conclusion: Biochemical MR of the IVD based on T2 mapping shows a good differentiation between annulus and nucleus in morphological intact IVDs which decreases with increasing degeneration of IVD expressed by an increase of the T2 A-N-index, which may be explained by lower water content in the nucleus.

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

Musculoskeletal

SS 1710b
Elbow and wrist

Moderators:
S.G. Davies; Llantrisant/UK
S.P. Morozov; Moscow/RU

B-749   14:00
3 Tesla ulnar nerve tractography in cubital tunnel syndrome
G. Kasprian, A. Paul, A. Hold, T. Sycha, O. Aszmann, H. Engel, F. Kainberger, D. Prayer; *Vienna/AT (gregor.kasprian@meduniwien.ac.at)*

Purpose: This is the first study to investigate the 3D ulnar nerve morphology in clinically unequivocal cubital tunnel syndrome (CTS) using 3 Tesla diffusion tensor imaging (DTI) and tractography.
Methods and Materials: 16 patients with clinically and electrophysiologically proven CTS underwent 3 T MR imaging of the left (n=15) or right (n=2) elbow. After acquisition, a high resolutional T2-weighted sequence (reconstructed voxel size (mm): 0.16x0.16x2.5) and a DTI sequence (b-value=0/700, voxel size (mm)=1.16x1.16x3.5, 16 diffusion gradient encoding directions) were coregistered and aligned. After anatomical definition of multiple regions of interest (ROI) along the ulnar nerve on each axial slice position, tractography was performed and the regional FA values were determined.
Results: The ulnar nerve showed no structural abnormality (n=1), swelling (n=7) and/or an abnormal fascicular structure (n=8) on T2-weighted sequences. Tractography revealed a complete (n=6, 37.5%) or partial (n=7, 43.8%) discontinuity, or a continuous but structurally altered fiber architecture (n=3, 18.8%) of the ulnar nerve. The mean regional FA values dropped along the nerve from 0.468±0.024 to 0.337±0.122 (at ROI positions 4 cm vs. 8 mm proximally to the medial epicondyle).
Conclusion: 3 T ulnar nerve DTI and tractography shows a high specificity in the diagnosis of CTS and has the potential to identify and 3D localize the site of maximum nerve damage.

B-750   14:09
Comparison of ulnar collateral ligament injury in baseball players with MR imaging between rehabilitation and reconstruction surgery groups
N. Kim, S. Moon, H. Lee, J.-Y. Park, S.-H. Lhee; *Seoul/KR*

Purpose: To compare the MR imaging findings of ulnar collateral ligament (UCL) injury in baseball players between rehabilitation and reconstruction surgery groups.
Methods and Materials: Thirty-three baseball players with clinical evidence of UCL injury based on medial joint pain and valgus instability were included. All patients received the rehabilitation treatment more than 6 weeks. We reviewed the elbow MR images of 25 patients not responding to rehabilitation, consequently undergoing surgery, and 8 patients improved by rehabilitation treatment. The following MR imaging features were compared between 2 groups: the degree, site of UCL tear, signal intensity (SI), morphology of UCL, avulsed loose bodies, bone marrow edema of medial epicondyle, traction spurs of sublime tubercle, and T sign.
Results: The high grade partial tear (8 [32%]) and complete tear (11 [44%]) were more common in the operation group, and low grade partial tear (3 [38%]), chronic tear (3 [38%]), in the rehabilitation group (P=0.002). UCL tears at origin site were most common in 2 groups (21 [84%] vs 5 [63%]) (P=.380). The SI in 2 groups was bright high SI (16 [64%] vs 0 [0%]), intermediate SI (7 [28%] vs 3 [38%]) and dark SI

(2 [8%] vs 5 [63%]) (P=0.001). The wavy appearance of UCL was seen in 11 (44%) patients with operation, but never seen in patients with rehabilitation (P=0.031). The thickened UCL was seen in 5 (63%) patients with rehabilitation, and 5 (20%) with operation (P=0.036). MR images of operation group revealed avulsed loose bodies (7 [28%]), bone marrow edema (2 [8%]) of medial epicondyle, traction spurs (1 [4%]) and T sign (2 [8%]), but they were statistically insignificant.
Conclusion: The preoperative MR imaging may provide predicting rehabilitation outcome of UCL injury in baseball players.

B-751   14:18
High resolution ultrasound of the distal ulnar, median and radial nerve branches in the forearm and hand: A sonoanatomic correlation
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Purpose: Distal nerve branches in the forearm and hand may be affected by blunt or sharp injury. The diagnosis of such lesions is mainly clinical but high resolution ultrasound (HRUS) shows a potential for direct visualisation of these nerves. The purpose of this study was to show that under the precise knowledge of anatomic landmarks, state-of-the-art HRUS represents an effective modality for the assessment of the distal branches of the ulnar, median and radial nerve.
Methods and Materials: Distal nerve branches, their topographic relationships and relevant landmarks were illustrated in cadaveric dissections. HRUS-images of specimens were acquired and sonograms were correlated with cadaveric cross-sections along the corresponding sonographic scan-planes. Anatomical landmarks were defined for the detection of nerve branches/segments. The value of these landmarks for sonography was assessed in 20 healthy volunteers and 20 patients.
Results: The defined landmarks proved helpful for sonography of even the most distal and tiny nerve branches especially in regions with complex anatomy. Nevertheless, limitations were found in some regions in very skinny volunteers with a low amount of fat along the course of the nerves and in patients with a higher body mass index and soft tissue oedema.
Conclusion: With a precise knowledge of their anatomic course and topographic relationship, HRUS can clearly detect and demonstrate the distal branches of the three nerves of the upper extremity. Therefore, HRUS stands for a quick, cost effective and dynamic first line modality for assessment of this region in patients with suspected nerve pathology.

B-752   14:27
Tomosynthesis of the hand and wrist in rheumatoid arthritis patients
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Purpose: The aim of this study was to assess the usefulness of tomosynthesis in the detection of bone erosions in patients with rheumatoid arthritis (RA). To the best of our knowledge, such an assessment has not been performed yet.
Methods and Materials: From December 2008 to March 2009, 25 consecutive RA patients were included in this prospective study. They underwent radiographs, tomosynthesis and CT scan of the most symptomatic hand and wrist the same day. Two radiologists and one rheumatologist independently read the three imaging modalities.
Results: The total number of erosions for radiographs, tomosynthesis and CT was 119, 167 and 197, respectively. With CT as the reference method for erosions, the overall sensitivity and specificity of radiographs and tomosynthesis were 54/91.5% and 77/90%, respectively. The sensitivity of each reader increased of roughly 20% when using tomosynthesis.
Conclusion: Tomosynthesis represents a useful tool for the assessment of bone erosions in RA patients.

B-753   14:36
Bone marrow oedema predicts erosive progression on wrist MRI in JIA
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Purpose: MRI detectable bone marrow oedema (BME) has been associated with erosive progression and poor functional outcome in rheumatoid arthritis (RA). The aim is to explore the value of BME in predicting erosive progression in JIA.
Methods and Materials: 26 patients with JIA (disease duration 6.1±3.06) and wrist involvement, seen at the study centre between 2006 and 2007, underwent wrist MRI, coupled with clinical assessment and biochemical analysis at baseline and after 1 year. Bone erosions, BME and synovitis were semi-quantitatively scored by two independent readers according to a paediatric-targeted MRI scoring system.

The baseline MRI BME and synovitis scores and the results of clinical assessment were related with the change in the MRI erosion score from baseline to 1 year (Spearman's correlation).

Results: 31/111 (27.9%) carpal bones with BME at MRI baseline developed a progression of bone damage at 1 yr MRI follow-up versus 21/ 253 carpal bones negative for BME at MRI baseline (p < 0.0001). The predictive value of BME was strongest in the III metacarpal base (p=0.004), semilunate (p=0.02), and distal radius (p=0.003). Erosive progression was correlated with the baseline MRI BME score (rs 0.59; p < 0.001); no correlation were found with baseline MRI synovitis score or baseline clinical and laboratory parameters. The inter-observer reliability of scoring MRI scans was excellent.

Conclusion: Carpal bones with BME at baseline MRI are at a significantly higher risk of developing MRI erosion at the same site at 1 year follow-up. Wrist MRI may help to determine which patients are at high risk of erosive progression.

B-754   14:45

also
EPOS

Synovitis maps for the assessment of inflammatory disorders of the hand
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Purpose: To evaluate the diagnostic accuracy of synovitis maps derived from 3D-fast low angle shot (FLASH) sequences, usually used for MR angiography, to assess synovitis and tenosynovitis of the hand.

Methods and Materials: Institutional review board approval was granted based on a general waiver. 80 hands in 40 patients (mean age, 48 years; range, 15-72 years; 14 male) were assessed upon conventional MR images (axial T1w, coronal PD, axial and coronal T1w with fat saturation after i.v. Gadolinium) and synovitis maps derived from a FLASH sequence for the presence or absence of synovitis and tenosynovitis by two readers independently. Reader 1 (R1) was a fellowship trained musculoskeletal radiologist, reader 2 (R2) a staff rheumatologist. Reporting times and diagnostic confidence (scale: 1=least confident, 5=most confident) for the assessment of synovitis and tenosynovitis were measured. Results from an assessment of a panel of senior staff musculoskeletal radiologists using all imaging and clinical data served as the standard of reference for data analysis.

Results: Synovitis: upon conventional MR (sensitivity/specificity): 0.91/1.00 (R1), 1.00/0.67 (R2), upon synovitis maps: 0.87/0.75 (R1), 0.91/0.45 (R2). Tenosynovitis: upon conventional MR: 0.95/0.63 (R1), 0.67/0.79 (R2), upon synovitis maps: 0.67/0.89 (R1), 0.38/1.00 (R2). Mean reporting times (conventional MR/synovitis maps, sec): 142/37 (R1), 167/25 (R2). Mean diagnostic confidence (conventional MR/synovitis maps): 3.7/3.4 (R1), 3.2/3.5 (R2) for synovitis; 4.0/4.0 (R1), 3.3/3.7 (R2) for tenosynovitis.

Conclusion: We conclude from this study that synovitis maps are a reliable tool for a fast overview of all locations with synovitis and tenosynovitis of the hand.

B-755   14:54

Sonographic demonstration of trigger finger in acromegaly
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Purpose: To compare the prevalence of trigger finger in patients with acromegaly versus normal controls.

Methods and Materials: Diagnosis was made by a combination of clinical symptoms and sonographically measured thickening of the A1 pulley. A1 pulley thickness was measured in 40 patients and 40 controls by means of a 17-5 MHz high-resolution transducer. Thickening of the A1 pulley and abnormalities of the underlying flexor tendons associated with the clinical sign were diagnostic for trigger finger. Acromegalic patients were divided in groups according to disease activity and therapy. The study was performed at baseline and after one year follow-up.

Results: At baseline, clinical and US findings were consistent with trigger finger in 25% of patients (6 at presentation and 4 with uncontrolled disease). After one year, trigger finger recovered in the patients who were not receiving any treatment at the beginning of the study. In patients with uncontrolled disease, it remained unchanged. Measurement of the thickness of the A1 pulley was greater in acromegalic patients than in controls (0.44 ± 0.19 vs 0.24 ± 0.05 mm; p < 0.05). In the patients treated for acromegaly, trigger finger disappeared and a reduction in A1 pulley thickness was noted (p < 0.05) after one year of follow-up.

Conclusion: Trigger finger was observed in 25% of patients with acromegaly and none of the normal controls. The A1 pulley was significantly thicker in the patients with acromegaly, and normalized after one year in some who were treated for the disease.

B-756   15:03

Accessory tendinous slips arising from the extensor carpi ulnaris (ECU) tendon: Prevalence, MRI appearance and association with ECU tenosynovitis and tendinopathy
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Purpose: Our purpose was to report the prevalence of accessory tendinous slips arising from the ECU tendon, describe their MRI appearance, and assess the association between this anatomical variant and ECU tenosynovitis and/or tendinopathy.

Methods and Materials: Wrist MRI studies performed between March 2008 and February 2009 on a 1.5 T unit were reviewed by two radiologists, in consensus. Patients with prior ulnar-side surgery and studies without axial T1 and T2/STIR sequences were excluded. Presence of ECU accessory tendinous slips was assessed and their origin, diameter and distal insertion were noted. The presence of ECU tenosynovitis and/or tendinopathy was evaluated.

Results: One hundred and sixty wrists from 158 patients were included. The prevalence of accessory slips arising from ECU was 21.9% (35/160). The proximal origin was always visible: 8 times at the level of, and in 27 cases distal to ECU subsheath. Slip mean diameter was 0.66 mm. The distal insertion site was seen in 48.6% (17/35) of the cases: 13 were on the extensor digiti minimi tendon, 4 on the fifth metacarpal bone. ECU tenosynovitis and tendinopathy were, respectively, seen in 45.7 and 31.4% of the patients with an accessory slip, and in 10.4 and 12.8% of the patients without the anatomical variant. Tenosynovitis and tendinopathy were both statistically more frequent when accessory slips were present (p < 0.001).

Conclusion: Accessory tendinous slips arising from the ECU are frequent and visible on 1.5 T MRI studies. ECU tenosynovitis and tendinopathy are more frequently encountered in patients with this anatomical variant.

B-757   15:12

also
EPOS

MDCT arthrography for detecting traumatic scapholunate dissociation associated with intra-articular radius fractures
R. Schmitt, S. Fodor, S. Froehner, K.-J. Prommersberger, K.-H. Kalb, G. Christopoulos; Bad Neustadt an der Saale/DE (schmitt@radiodiagnostics.de)

Purpose: In intra-articular fractures of the distal radius, the scapholunate interosseous ligament (SLIL) is frequently ruptured when force transmission passes the scapholunate compartment. The aim of this study was to assess the incidence of scapholunate dissociation in the presence of intra-articular radius fractures and to determine the accuracy of MDCT arthrography.

Methods and Materials: A total of 182 patients (111 women, 71 men) suffering from acute intra-articular fractures of the distal radius underwent MDCT arthrography. A three compartiment arthrography technique was applied before transaxial CT scanning (16-row scanner, slice thickness 0.6 mm, increment 0.4 mm, coronal and sagittal MPR). All patients were treated with open reduction. Additionally, the SLIL was evaluated in 45 patients using arthroscopic or surgical approaches.

Results: In 117 wrists (64%), the SLIL was seen unaltered in MDCT arthrography. In 65 wrists (36%), SLIL lesions were found: Complete SLIL tears in 21 cases (12%) and partial tears in 44 cases (24%), with the stabilizing dorsal ligament portion (dSLIL) being involved in 27 cases. In summary, the dSLIL was injured in 48 of the 182 fractures (26%). 45 of these 48 patients underwent arthroscopic or surgical inspection. In 2 cases, the dSLL was found intact, while in 43 cases the dSLIL tears were confirmed, resulting in a positive predictive value of 96%.

Conclusion: Intra-articular fractures of the distal radius are frequently associated with traumatic scapholunate dissociation. MDCT arthrography is highly accurate in detecting SLIL injuries.

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

Abdominal Viscera (Solid Organs)

SS 1701a

Liver MR: High field and contrast media advantages

Moderators:
M.S. Erturk; Istanbul/TR
S. Jackson; Plymouth/UK

B-759   14:00

Apparent diffusion coefficient measured in the liver is region dependent
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Purpose: ADCs of the liver are generally measured in a large central region of the right lobe. The purpose was to compare ADCs of four different regions to the ADC in the center of the right lobe.
Methods and Materials: Diffusion-weighted imaging was performed with seven b-values (0, 50, 100, 250, 500, 750, 1000 s/mm²) on a 1.5 T MRI scanner using a SE-EPI sequence with SPAIR fat suppression and respiratory triggering (TR/TE 1700 ms/75 ms; slice-thickness 6 mm; FOV 380 mm; averages 2; PAT-mode GRAPPA). ADCs were determined in the central right lobe (780 pixels) and in four smaller regions (100 pixels) of the liver in a group of 20 fasting healthy volunteers (20-62 years). The four small regions were positioned cranial and medial in the right-dorsal lobe, right-medial near the gall-bladder and medial in the left-ventral lobe. The ADCs of the four smaller regions were statistically compared to the large central right lobe using paired t-tests.
Results: Mean with standard deviation of the ADC in the large central lobe was $1.040\pm0.171*10^{-3}$ mm²/s and ADCs in the respective four regions were 1.126 ± 0.151, 1.176 ± 0.138, 1.128 ± 0.136 and $1.285\pm0.261*10^{-3}$ mm²/s. The paired t-tests showed significantly different ADCs between all four regions and the central right lobe ($p < 0.013$).
Conclusion: ADCs measured in all alternative liver regions differ from the ADC of the central right lobe. Our findings contrast with previous studies reporting lack of significant differences between the ADCs obtained in different liver segments.

B-760   14:09

Liver MR imaging at 7 Tesla: A feasibility study
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Purpose: The purpose of this study was to evaluate the feasibility of 7 T MRI of the liver utilizing a custom-built 8-channel body coil.
Methods and Materials: In vivo MR examinations of the upper abdomen were performed in 12 healthy volunteers in supine position on a 7T whole-body MR system (Magnetom 7T, Siemens Healthcare). For image acquisition, a custom-built eight-channel phased array transmit/receive coil suitable for RF shimming was used. After sequence optimization the following data were obtained: 1) 2D and 3D T1w FLASH, 2) 2D T1w in and opposed phase, 3) T2w TSE and 4) True-FISP imaging. Based on a three-point scale we evaluated: 1) overall image quality; 2) delineation of liver vasculature; 3) presence of artifacts including chemical shift, B1 inhomogeneity, susceptibility and motion artifacts.
Results: Overall image quality was best for 2D T1w FLASH imaging (mean score: 2.63) and worst for T2w TSE (mean score 1.05). 2D T1w FLASH imaging demonstrated its superiority in the delineation of liver vasculature (mean score: 2.81), while T2w TSE MRI showed poorest results (mean score: 1.06). With B1 shimming, artifacts and B1 inhomogeneities could be effectively reduced. 3D FLASH MRI was least prone to artifacts (score: 1.17) in overall impairment. T2 weighted TSE imaging remained challenging and strongly impaired (mean artifact score: 1.97).
Conclusion: The results demonstrate the feasibility and diagnostic potential of dedicated 7 Tesla liver imaging. Especially, the inherently high signal vasculature carries the potential of a non contrast-enhanced angiographic application.

B-761   14:18

3 Tesla respiratory triggered diffusion-weighted MR imaging of malignant hepatic lesions: Comparative study between hepatocellular carcinoma and metastases of breast and colorectal cancer origin
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Purpose: To compare the apparent diffusion coefficient (ADC) values between hepatocellular carcinoma (HCC) and metastatic lesions of breast cancer (BC) and colorectal cancer (CRC) origin using 3 Tesla MRI.
Methods and Materials: The prospective study was approved by the institutional review board. Informed consent was obtained from all patients. Included were 29 patients (Mean age: 59 years) having 94 hepatic lesions, HCC (n=11), CRC metastases (n=66) and BC metastases (n=17). Diffusion weighted MRI was performed using respiratory triggered diffusion weight echo-planar MR imaging (b50, b400 and b1000) on a 3 Tesla MRI. Evaluations were performed on lesions larger than 1 cm in diameter and regions of interest were manually drawn around detectable lesions in the b50 images and transferred to the ADC map. The difference in ADC values was tested for statistical significance using Kruskal-Wallis-Test.
Results: CRC metastatic lesions showed a mean area of 7.76 cm² ±6.17 (Range: 1.63-34.94 cm²) and a mean ADC value of 0.95x10⁻³ mm²/sec (Standard Deviation (SD): 0.23x10⁻³, Range: 0.55x10⁻³ - 1.54x10⁻³ mm²/sec). BC metastatic lesions showed a mean area of 7.33 cm² ±5.34 (Range: 2.36-21.48 cm²) and a mean ADC value of 0.79x10⁻³ mm²/sec (SD: 0.35x10⁻³, Range: 0.22x10⁻³ - 1.43x10⁻³ mm²/sec). HCC lesions showed a mean area of 8.15 cm² ±6.01 (Range: 1-22.95 cm²) and a mean ADC value of 0.91x10⁻³ mm²/sec (SD: 0.196x10⁻³, Range: 0.56x10⁻³ - 1.31x10⁻³ mm²/sec). Statistical analysis showed no statistically significant difference in the reported ADC values between the three different lesions (p=0.21).
Conclusion: No statistically significant difference was noted regarding the ADC values reported for HCC, BC liver metastases and CRC liver metastases.

B-762   14:27

Liver lesion detection and image quality with T2-weighted imaging using parallel RF transmission at 3 T: Intraindividual comparative study with conventional RF transmission
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Purpose: To prospectively compare T2-weighted liver MRI at 3 T with and without parallel radiofrequency (RF) transmission regarding image quality, lesion conspicuity and lesion detection rate.
Methods and Materials: Institutional review board approval and informed consent were given. 22 patients with liver disease underwent a standardized MR sequence protocol including T2w-TSE, T1w-GRE and a contrast-enhanced dynamic study. A clinical 3.0 T MR scanner (Philips 32-channel Achieva 3.0 T TX) equipped with a parallel RF transmission system was used for imaging. T2-weighted images were acquired with conventional (cTX) and parallel (pTX) RF transmission and analyzed by two readers independently in a random order in separate reading sessions. As standard of reference (number of index lesions) consensus reading was performed 8 weeks after the initial reading and included all pre-/postcontrast images, clinical history, histopathologic findings and follow-up results. Image quality was scored on a 5-point scale (5-excellent;1-non-diagnostic), lesion conspicuity on a 3-point scale (3-good;1-poor).
Results: Image quality of T2w-TSE at pTX was scored significantly higher as compared with that at cTX by both readers (R1, 3.09±0.61 vs.4.23±0.43; R2, 3.09±0.53 vs.4.18±0.39; both p < 0.0001). Lesion conspicuity was scored significantly higher at pTX as compared to cTX (R1, 2.18±0.59 vs.2.95±0.21; R2, 2.27±0.63 vs.2.95±0.21; both p < 0.0001) with very good interobserver agreement (κ> 0.8). Of 57 index lesions, 50/50 were prospectively identified at cTX and 55/54 were detected at pTX.
Conclusion: T2-weighted liver MRI at 3 T using parallel RF transmission compared to that with conventional RF transmission provides significantly improved image quality and lesion conspicuity and yields a higher detection rate of focal liver lesions.

B-763   14:36

Easily adopted abdominal DWI quality control phantom
S. Gourtsoyianni, T.G. Maris; *Iraklion/GR (sgty76@gmail.com)*

Purpose: To develop and test diffusion weighted imaging quality control protocol based on easily constructed phantom and weighted regression algorithms for calculation of ADC's.
Methods and Materials: A soft plastic tank was filled with 3 ltrs of isotonic normal saline solution. Twelve glass vials were filled with different concentrations of sucrose solution ranging from 2 to 57% w/w, (known nominal ADC values), which at 21 °C

simulated range of ADC values obtained from different abdominal organs and lesions. Phantom was repeatedly scanned using head and pelvis phased array body coils. Region of interest (ROI-CV%), short term time reproducibility (STT-CV%) and long term time reproducibility (LTT-CV%) measurements were performed. A multislice single shot SE-EPI DWI sequence with fat suppression and 14 b- values (0 to 1500) was utilized. Calculated ADC maps were reconstructed using a vendor specific, a standard linear and a weighted linear (WL) regression fitting model using three sets of b values, 2, 4 and 14 points. The three models were compared in terms of ROI-CV, STT-CV and LTT-CV precision in ADC calculations.
Results: ADC measurements performed with 14-point method showed better precision (mean ROI-CV =2%) and STT-CV and LTT-CV (4.2%) as compared to 2- and 4-point methods. Post-hoc pairwise comparisons showed better discrimination when algorithm WL was used (p < 0.01). ADC measurements performed with WL algorithm showed a better precision (mean ROI-CV=3.6).
Conclusion: 4-point method enforced with WL algorithm seems to be a valuable and precise tool for measurement of majority of ADC values encountered in the abdomen.

B-764   14:45

Arterial spin labeling imaging of hepatic tissue perfusion using a FAIR-TrueFISP sequence

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Purpose: To develop a magnetic resonance technique of arterial spin labeling (ASL) for hepatic perfusion imaging without application of contrast-media.
Methods and Materials: Six healthy volunteers were included in the study. Imaging was performed before and after food uptake. A FAIR-TrueFISP (TR/TE 5.1/2.5, bandwidth 651 Hz/px) sequence was applied in a 1.5 T whole body imager (Siemens Sonata). Different inversion times TI between 800 and 2800 ms have been tested. Quantitative perfusion maps were calculated using a simplified solution of the extended Bloch equations. Perfusion maps were correlated to flow measurements in the portal vein using phase contrast imaging.
Results: Quantitative perfusion maps could be acquired in good image quality in all volunteers. The most homogeneous hepatic tissue perfusion was found for a TI=2000 ms. Distinctly higher ASL tissue perfusion and blood flow in the portal vein was found after food uptake. Typical perfusion values before food uptake ranged between 250 and 400 ml/100 g tissue/min, after food uptake between 500 and 650 ml/100 g tissue/min.
Conclusion: ASL imaging of hepatic perfusion is feasible using a FAIR-TrueFISP approach at 1.5 Tesla. The proposed technique may be useful in patients with hepatic diseases (e.g. liver cirrhosis or hepatitis) for disease monitoring.

B-765   14:54

^{68}Ga-DOTA-TATE PET/CT versus Gd-EOB-enhanced MR imaging of the liver for the detection and quantification of liver metastases in patients with neuroendocrine tumors: A preliminary comparative study

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Purpose: To evaluate the diagnostic capacity of Gd-EOB MRI and somatostatine-receptor-based PET/CT using ^{68}Ga-DOTA-TATE in the detection of liver metastases and determination of tumor load.
Methods and Materials: Forty-four patients suffering from liver metastases of neuroendocrine tumors (NET) (m:32; f:12) underwent both contrast enhanced (ce) MRI of the liver with Gd-EOB (Primovist®, Bayer Health Care) and cePET/CT using the somatostatine receptor affine agent ^{68}Ga-DOTA-TATE within a mean of 10 (+12) days. Standard of reference (SOR) was established by an independent study coordinator including all clinical data, prior and follow-up imaging (CT, MRI, PET/CT, surgery). 50% of all patients had both prior and follow-up imaging. Native, dynamic and hepato-specific MRI were acquired. Two independent board certified radiologists (2 and 8 years of experience with liver MRI) and 1 nuclear medical physician blinded to the SOR analyzed the data regarding number and location of liver metastases in 3 categories: I:< 5; II:6< 15; III:> 16 lesions. Image quality and diagnostic certainty were recorded (4-point scale). Differences were given in %.
Results: Gd-EOB-MRI was superior to PET/CT in 70.5% and, inferior in 22.7% and equal in 13.6% of all cases. MRI was superior to CT alone in 72.7%, inferior in 13.6% and equal in 20.5% of the cases. Image quality and lesion contrast was excellent in 87% of all MRI in liver specific phase.
Conclusion: Gd-EOB MRI in liver metastases of NET has the potential to quantify metastases more reliably than PET/CT and CT alone and should be performed when determination of exact tumor load is required.

B-766   15:03

Frequency and relevance of the "prolonged portal vein enhancement sign" in the hepatobiliary phase MR imaging obtained with gadoxetic acid

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Purpose: The purpose of this study is to determine the frequency and relevance of the prolonged portal vein enhancement (PVE) sign in the gadoxetic acid-enhanced hepatobiliary MR.
Methods and Materials: We evaluated 1289 patients who underwent gadoxetic acid-enhanced hepatobiliary MR. The prolonged PVE sign was defined as the presence of PVE greater than that of the liver parenchyma on the 30-minute delayed hepatobiliary phase. Two readers retrospectively reviewed MR scans in consensus regarding to the presence of the prolonged PVE sign and visualization of contrast filling in the bile duct. The frequency of the sign, and the association between the sign and various parameters including serum biochemical tests and visualization of contrast filling in the bile duct were assessed. We also performed a stepwise logistic regression to identify which variables significantly associated with the sign. Optimal cutoff values of biochemical tests for prediction of the sign were obtained with ROC analysis.
Results: 236 of 1289 patients were excluded because of various reasons. The prolonged PVE sign was seen in 158 (15%) patients. In multivariate analysis, serum direct bilirubin level and lack of contrast filling in the bile duct are significant associated with the prolonged PVE sign. Optimum cutoff values for prediction of the prolonged PVE sign were 2.18 mg/dL (sensitivity, 81%; specificity, 97%) for direct bilirubin levels.
Conclusion: The prolonged PVE sign in the gadoxetic acid-enhanced hepatobiliary phase MR is significantly correlated with serum direct bilirubin level, but was not specific for differentiation between extra- and intrahepatic causes of jaundice.

B-767   15:12

also EPOS

Differentiation of hypervascular benign tumors: Focal nodular hyperplasia, hepatic adenoma, and nodular regenerative hyperplasia with gadoxetic acid-DTPA enhanced MR imaging

H. Haradome, L. Grazioli, M. Tsunoo, M. Bondioni; *Brescia/IT*

Purpose: To evaluate the diagnostic performance with gadoxetic acid (Gd-EOB-DTPA)-enhanced MRI in the differential diagnosis of focal nodular hyperplasia (FNH), hepatic adenoma (HA) and nodular regenerative hyperplasia (NRH).
Methods and Materials: Seventy-nine patients (68 women, 11 men; age range, 19-58 years) with pathologically proven 118 nodules were enrolled in this study. Respiratory triggered T2-weighted image, breath-hold dual echo T1-weighted GRE image, and T1-weighted 3D-GRE (VIBE) image were obtained as pre-contrast images. After bolus injection with Gd-EOB-DTPA, 3D VIBE sequences were acquired at 20~35 sec (arterial phase), 80 sec (portal phase), 180 sec (equilibrium phase), and hepatobiliary phase images at 10 and 20 min, respectively. Two readers qualitatively and independently reviewed each tumor concerning the signal intensity on pre-contrast images, dynamic enhancement characteristics, and lesion-liver contrast on hepatobiliary phase images.
Results: 98.4% of FNH lesions demonstrated moderate to strong arterial enhancement while, 98.8% of HA lesions, and 81.2% of NRH lesions presented mild to moderate arterial enhancement. All but two FNH lesions and all NRH lesions appeared iso or slightly hyperintense to surrounding liver on portal or equilibrium and hepatobiliary phase images; however, all HA lesions appeared hypointense on the same images. The highly diagnostic confidence in the differentiation of FNH and NRH from HA on dynamic and hepatobiliary images was achievable. The results on hepatobiliary phase at 10 min were comparable to that at 20 min.
Conclusion: Gd-EOB-DTPA-enhanced-MRI provides both morphologic and functional characteristics of each tumor and facilitates accurate differentiation of FNH and NRH from HA with examination-time saving.

B-768   15:21

Diagnostic time window for liver MRI after administration of an oral manganese-based contrast agent (CMC-001)

M. Rief, A. Huppertz, B. Hamm, M. Taupitz, W. Moritz; *Berlin/DE (matthias.rief@charite.de)*

Purpose: To evaluate time response of the manganese-based oral contrast agent CMC-001 for liver magnetic resonance imaging (MRI).
Methods and Materials: 20 patients with liver metastases diagnosed by computed tomography were included in a phase II trial. Patients were randomly assigned to receive either half (n=11) or full dose (n=9) CMC-001. The full dose corresponds to 1.6 g manganese chloride tetrahydrate, 1.0 g L-alanine, and 1600 IU vitamin

D3. Unenhanced MRI was performed directly before oral intake of CMC-001. Postcontrast MRI was performed at 1, 2, 3, and 6 h after contrast agent application. The 1.5 Tesla MRI protocol included a breath-hold T1-weighted fast low-angle shot sequence (FLASH) and a T2-weighted half-Fourier acquisition single-shot turbo spin-echo sequence (HASTE) at each time point. For quantitative analysis signal intensities were measured in regions of interest in normal liver tissue and a representative liver metastasis.

Results: Already 1 h after oral application of CMC-001 signal intensity of liver parenchyma was increased on T1-FLASH. Increase of liver signal intensity was observed until 3 h and sustained up to 6 h. No significant difference in maximum T1 enhancement was observed between both groups (full dose: 56.6 ± 22.1%; half-dose: 56.4 ± 22.7%). Liver-lesion contrast on T1-FLASH also increased until 3 h after oral intake of CMC-001 and remained stable up to 6 h after contrast media application. On T2-HASTE signal intensity of liver parenchyma was not significantly altered at any time point.

Conclusion: Oral CMC-001 offers a prolonged diagnostic time window of at least 3 h for T1-weighted liver MRI.

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

Chest

SS 1704

Imaging of the airways and pleura

Moderators:
B. Feragalli; Chieti/IT
N. Screaton; Cambridge/UK

B-769   14:00

Longitudinal reproducibility of forced expiratory tracheal collapse in healthy volunteers: Assessment with MDCT

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Purpose: To assess longitudinal reproducibility of forced expiratory tracheal collapse in healthy volunteers using MDCT.

Methods and Materials: Fourteen healthy, non-smoking volunteers (6 M, 8 F, mean age = 48.7 + 13.8 yrs) were randomized to undergo repeat imaging 1 year after baseline imaging of tracheal dynamics using 64-MDCT and employing the same scanner and technique (40 mAs, 120 kVp, and 0.625 mm detector collimation) with spirometric monitoring of total lung capacity and forced exhalation. Cross-sectional area (CSA) of the trachea was measured 1 cm above the aortic arch at end-inspiration and dynamic expiration, and % expiratory reduction in tracheal lumen was calculated. Measurements were compared between baseline (Y1) and repeat imaging (Y2).

Results: Mean end-inspiratory CSA was 255.3 ± 55.8 mm^2 at Y1 and 255.1 ± 52.1 mm^2 at Y2; mean dynamic expiratory CSA was 125.6 ± 60.1 mm^2 at Y1 and 132.1 ± 58.4 mm^2 at Y2; and mean % expiratory reduction was 51.7 ± 18.2% at Y1 and 48.7 ± 18.7% at Y2. Mean differences between Y1 and Y2 values were 0.2 + 10.0 mm^2 for end-inspiratory CSA, 6.5 + 20.3 mm^2 for dynamic expiratory CSA, and 3.0 + 6.9% for % expiratory reduction. There was excellent correlation between the Y1 and Y2 measures of end-inspiratory CSA (R^2 = 0.97, p <.001), dynamic expiratory CSA (R^2 = 0.89, p <.001) and % expiratory reduction CSA (R^2 = 0.86, p <.001).

Conclusion: MDCT measurements of forced expiratory tracheal collapse in healthy volunteers are highly reproducible over time.

B-770   14:09

Rejection after lung transplantation: Airway morphometry in high resolution computed tomography (HRCT)

T. Achenbach, F. Döllinger, O. Weinheimer, I. Zwiener, E. Mayer, R. Buhl, C. Düber; *Mainz/DE (achenbac@uni-mainz.de)*

Purpose: Acute or chronic rejections are the most life threatening yet frequent complications after lung transplantation (LTX). Although HRCT is the imaging modality of choice, it just has contributory value amongst clinical tests. Bronchial dilatation and wall thickening have been described as a subjective marker for rejection. This study quantifies and compares objective bronchial parameters in LTX patients.

Methods and Materials: Mean diameter and wall-percentage (WP, marker of wall-thickness) of 10 different localizations were assessed with a dedicated software in follow-up HRCTs of 35 LTX-patients (15 m/20 f). HRCTs were selected with regard to forced expiratory volume in one second (FEV1) and WP. Temporal changes were analyzed. Comparisons of patients with (R, n=27) and without episodes of rejection (NR, n=8) were done.

Results: 1020 bronchial sections were analyzed. Median of highest WP was 22.2% (32.6%) for NR (R). The difference was significant (p=0.006). Variability of FEV1 was nearly twice as high for R-patients compared to NR-patients (14 vs. 27.6%). Variability of airway diameter was higher in NR-patients.

Conclusion: Variability of airway wall-percentage is an indicator of graft-rejection while diameter-changes lack a significant difference in this setting.

B-771   14:18

Pulmonary sarcoidosis: Re-evaluation and correlation of air trapping (AT), inspiratory HRCT findings and pulmonary function tests (PFT) in a one-year follow-up study

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Purpose: To re-evaluate AT extent, inspiratory lesion extent and PFT in pulmonary sarcoidosis patients, examine these parameters independently and correlate differences of inspiratory lesion extent and PFT with AT extent changes.

Methods and Materials: Thirty consecutive patients (3 men, 27 women) with proven sarcoidosis were re-evaluated prospectively with inspiratory/expiratory HRCT and PFT one year after initial examination. HRCT images were examined for presence and extent of AT and inspiratory lesions. HRCT findings and PFT were studied independently and the differences of AT extent between two controls were correlated with inspiratory lesion extent and PFT changes. Statistical evaluation was performed using paired-sample t-test, Mann-Whitney test and Spearman's correlation (SPSS 16.0). P < 0.005 was considered as statistically significant.

Results: AT was depicted in 25/30 (83.3%) at first control and in 27/30 (90%) at re-evaluation (p=NS). Between two controls, AT extent (8.9±7.0 vs.10.6±7.5%, p=0.084), inspiratory lesion extent (8.6±10.3 vs.6.9±7.6%, p=0.257) and PFT did not differ significantly. There was significant correlation between AT extent and residual volume/total lung capacity (RV/TLC), both in first (rho=0.512, p=0.015) and second control (rho=0.540, p=0.009). No correlation was found between AT extent changes and PFT changes. Significant correlation (rho=0.374, p=0.042) was recorded between AT extent and inspiratory lesion extent differences.

Conclusion: Although no clear changes in AT and inspiratory lesion extent were recorded in one year, patients who improved/worsened their inspiratory lesion extent seemed to improve/worsen their AT extent, respectively. Since PFT change failed to be correlated to AT extent change, we may assume that minor AT extent changes may not be detected by PFT.

B-772   14:27

also EPOS

In vivo micro-CT in a mouse asthma model: Does it assess bronchial inflammation, remodelling, or both?

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Purpose: Micro-CT has been shown to be able to demonstrate early peribronchial changes in a mouse asthma model. In this study, our goal was to determine whether these changes are related to inflammation, remodelling, or both.

Methods and Materials: Thirty BALB/C mice were challenged intranasally with ovalbumin according to three specific protocols in order to obtain 3 groups: 10 mice with bronchial inflammation (group A), 10 mice with both inflammation and remodelling (group B), and 10 mice with only remodelling (group C). Thirty other mice were challenged with saline to constitute 3 control groups. All mice underwent plethysmography and micro-CT. Peribronchial attenuation (PBA) values were measured using a semi-automatic method. The mice were then sacrificed and lungs examined histologically.

Results: PBA values were not different between asthmatic mice and control mice in group A (p=0.92), whereas there was a significant difference in group B (p=0.009) and in group C (p=0.02). Moreover, PBA was significantly correlated with basement membrane thickness (p < 0.001) and bronchial muscle area (p=0.01), the major histological components of bronchial remodelling.

Conclusion: PBA appears to reflect specifically bronchial remodeling in BALB/C mice. This should be considered in the use of micro-CT for monitoring new drugs targeting bronchial remodeling.

B-773   14:36

High resolution CT chest findings in the assessment of N influenza A (N1H1): Correlation with clinical outcome

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Purpose: To assess high resolution CT chest findings in cases of N influenza (N1H1) and to correlate with the clinical outcome.

Methods and Materials: 30 cases with the clinical manifestations and PCR proved N influenza A (N1H1) were evaluated by HRCT chest. Findings were analyzed in terms of frequency, location and distribution. Follow-up was done for 18 patients. Clinical outcome was evaluated for all cases

Results: Alveolar consolidation was detected in 89% of cases, it was bilateral in 76% with left-sided predominance in 69%. peribronchial and septal thickening were detected in 23% of cases. Scattered atelectatic bands were detected in 5% of cases. Pleural effusion was detected in 11% of cases. 27 patients showed complete recovery, and 3 passed away; they were cardiac patients (2 tight mitral stenosis and one ischaemic cardiomyopathy).

Conclusion: Bilateral alveolar consolidation was the most frequently detected high resolution CT finding in N influenza (N1H1) Cases. The prognosis is not related to the severity of HRCT findings but to the associated comorbidity.

B-774 14:45

Improvement in the reproducibility of MDCT quantification of lobar pulmonary volumes using an automatic segmentation technique

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Purpose: Density-based MDCT quantification (q-MDCT) of lung volumes is relevant in patients with emphysema or lung cancer. The inter- and intra-operator variabilities of q-MDCT obtained by two segmentation techniques were compared.

Methods and Materials: Forty-seven chest MDCT examinations of patients with emphysema (men/women = 34/13, age range: 48-85) were selected from our database. All patients had been studied with lung function tests and a standardized imaging protocol on a 16-MDCT scanner (thickness/interval=1.25 mm; pitch=1.5). The MDCT datasets were analyzed independently by two operators using a manual procedure for delimitation of pulmonary lobes (A), and a full-automatic approach that allowed for manual refinement of lobar separation (B). Lung (V) and emphysema volumes (VE) were obtained from both lungs and each lobe. The inter- and intra-operator differences were expressed as percentages over means. Mean differences (Δ-tot) and standard deviations (SD-tot) calculated from the two approaches were compared.

Results: The analysis conducted for both lungs showed minimal variability using A and no variability using B. From the lobar analysis, inter- and intra-operator variability ranges (min/max) obtained from B were lower than those from A: for V (B vs. A: Δinter-tot ± SDΔinter-tot = -3.7/1.6 ± 4/17% vs. -3.9/3.5 ± 4.5/22.6%; Δintra-tot ± SDΔintra-tot = 0.6/0.4 ± 1.3/8.1% vs. -1.5/0.9 ± 2.5/10.6%); for VE (B vs. A: Δinter-tot ± SDΔinter-tot = -3/2.9 ± 5/18.9% vs. -3/2.9 ± 8.5/23.3%; Δintra-tot ± SDΔintra-tot = -0.5/0.5 ± 3.2/9.8% vs. -1.1/1 ± 5.6/13.7%).

Conclusion: The reproducibility of q-MDCT lobar volumetry is improved by using an automatic segmentation technique.

B-775 14:54

also EPOS

Non-contrast-enhanced lung perfusion MRI in comparison to contrast-enhanced MRI perfusion in young cystic fibrosis patients

G. Bauman[1], M. Eichinger[1], M. Deimling[2], A. Niemann[1], M. Mall[1], L.R. Schad[3], M.U. Puderbach[1]; [1]Heidelberg/DE, [2]Erlangen/DE, [3]Mannheim/DE (g.bauman@dkfz.de)

Purpose: To validate a novel non-contrast-enhanced lung perfusion imaging technique based on Fourier decomposition MRI (non-CE-P) with dynamic contrast-enhanced MRI-perfusion (CE-P) of the lung in patients with cystic fibrosis (CF).

Methods and Materials: Eight CF-patients (mean age 7.3 years, range: 1 - 23 years) were examined on a 1.5 T whole-body MR-scanner. For non-CE-P, time-resolved sets of 198 lung images in three coronal slices were acquired using a 2D+t TrueFISP sequence (TR/TE/TA=1.9/0.8/112 ms, 4 images/s, FA=75°, ST=10 mm, matrix=128x128). Neither respiratory nor ECG-triggering was used. Breathing motion was compensated using a non-rigid image registration. Rapid data acquisition allowed observing intensity changes in corresponding lung areas with respect to the cardiac and respiratory frequencies. Spectral line representing cardiac frequency was integrated to calculate the perfusion-weighted images. For CE-P, a 3D+t FLASH-sequence (TR/TE=1.8/0.8 ms, FA=20°, ST=5 mm) was performed afterwards and subtraction images were used for assessment. Non-CE-P and CE-P images were visually and independently assessed for perfusion defects using a field based dedicated scoring system. The correlation between both methods was assessed.

Results: Mean scores per slice for non-CE-P and CE-P were 5.22±2.23, 5.30±2.58 (range 0-12). Spearman rank test correlation between methods (non-CE-P vs. CE-P) was 0.82 (P < 0.05).

Conclusion: Non-CE-P is feasible in CF-patients using Fourier decomposition MRI. Non-CE perfusion images showed good correlation with CE perfusion images. The Fourier decomposition MRI can be clinically relevant to obtain functional information in CF-patients without the use of iv-contrast media.

B-776 15:03

Presentation and reproducibility of a new morphological and functional scoring system for magnetic resonance imaging in cystic fibrosis

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Purpose: Since MRI gains importance in the assessment of the Cystic Fibrosis (CF) lung, quantification of the extent of disease is warranted. The aim of this study was to evaluate intra- and interobserver-reproducibility of a suggested morphological and functional scoring system.

Methods and Materials: 35 patients, mean age 15.3 years (range 0.5-42) with stable CF lung disease were examined by morphological and functional MRI. Lobe based analysis of the parameters: bronchiectasis/wall thickening, mucus plugging, abscesses/sacculations, consolidations, special findings and perfusion defects was performed. A maximum score of 12 was achievable for each lobe; the global possible maximum score was 72. Three radiologists with 7 (R1), 6 (R2) and 3 (R3) years of experience scored the images at two time points (interval 6-12 weeks). A deviation of maximum ±10% was allowed for good, ±20 % for acceptable inter- and intra-reader-agreement.

Results: Inter-reader-agreement of the global score for R1 and R2 was -0.3, (range -5, 4; good), for R1 and R3 was 4.9 (-5, 15, acceptable) and for R2 and R3 was -5, (-16, 5, acceptable). Intra reader agreement of the global score for R1 was -0.48 (range -4, 3, good), for R2 -1.7 (range -7, 4, good) and for R3 1.4 (-9, 11, acceptable).

Conclusion: The scoring system is applicable for all age groups. Intra- and inter observer agreement is good for experienced readers and acceptable for the inexperienced reader resulting in a good reproducibility of the scoring system. This scoring system can be applied for the assessment of morpho-functional MRI in CF patients.

B-777 15:12

Longitudinal volumetric computed tomography in a mouse model of cystic fibrosis

M.O. Wielpütz, M. Eichinger, S.H. Bartling, K. Leotta, S. Hirtz, H.-U. Kauczor, M. Mall, M.U. Puderbach; Heidelberg/DE (mark.wielpuetz@med.uni-heidelberg.de)

Purpose: The onset and spontaneous progression of cystic fibrosis (CF) lung disease is poorly understood. The aim of our study was to longitudinally characterize beta-ENaC-transgenetic (TG) mice, an established model of CF lung disease, by flat-panel volumetric computed tomography (VCT) and to describe differences between TG and wild-type (WT) mice in VCT.

Methods and Materials: Using a VCT-scanner prototype (80 kV, 50 mA, scan time 30 s, spatial resolution 150 µm) 20 WT and 23 TG mice were longitudinally examined at 10 time-points from the age of three up to 42 days. Examinations were performed in inhalative sedation (isoflurane) and free breathing. Blinded for the genotype, VCT images (reconstruction in transversal plane) were evaluated with respect to quantitative (lung density in Houndsfield units [HU]) and qualitative parameters (parenchyma homogeneity, diffuse infiltrates, atelectasis, air-trapping, airway-obstruction [trachea, bronchi]).

Results: Lung parenchyma showed significantly lower HU as well as inhomogeneous texture in TG compared to WT mice at all time-points (p < 0.001). The presence of diffuse infiltrates, atelectasis, air-trapping and airway-obstruction were significant signs for TG mice (p-values from < 0.05 to < 0.001). Obstruction of the trachea occurred exclusively in TG mice and proved to be a predictive factor for the early death of TG mice.

Conclusion: At all time-points, TG mice were identified by quantitative and qualitative parameters. Radiological findings are in good agreement with previously reported histological data. In contrast to histology, non-invasive VCT easily provides longitudinal in vivo intraindividual data. VCT should, therefore, be considered for therapy monitoring studies, providing intraindividual data and reducing the amount of animals required.

B-778 15:21

Utility of intrapleural contrast in diagnosis of occult diaphragmatic injury in thoracoabdominal stab wounds: Preliminary results

S. Sefidbakht[1], H. Abbasi[1], M. Akrami[1], R. Salahi[2], K. Asaadi[1], F. Panahi[2]; [1]Shiraz/IR, [2]Tehran/IR (sefidbas@uci.edu)

Purpose: To evaluate safety and effectivity of intrapleural contrast administration for diagnosing diaphragmatic injury (DI) in thoracoabdominal stab injuries (TASI).

Methods and Materials: Our institutional ethics committee approved this prospective study and written informed consent was obtained. 27 patients with thoracostomy tubes inserted for routine indications with TASI were included. 500 cc diluted contrast was administered via patients' thoracostomy tube. MDC was done with multiplanar

Monday

reconstructions. Images were evaluated by two radiologists in consensus. CT scans were considered positive if either intraperitoneal contrast or focal accumulation of contrast along the surface of the diaphragm. Classic CT signs of DI (dependent viscera, diaphragmatic discontinuity, collar sign and herniating viscera) and also the wound trajectory were also specifically sought for. All patients underwent thoracoscopic evaluation of the diaphragm. Cross tabulations of CT interpretations with thoracoscopic findings were performed and sensitivity, specificity and diagnostic accuracy for the preliminary data set were calculated.

Results: CT scan correctly predicted 21 out of 24 patients with intact diaphragm. 4 patients showed some form of DI, only one needing repair, which CT scan correctly predicted. The other three were in form of a) abrasion, b) 1.5 cm flap with intact peritoneum and c) 1.0 cm tear in right diaphragmatic dome. Wound trajectory was seen in two patients, other signs were not encountered. Negative predictive value in detecting defects needing surgical repair was 100%. Two false positive cases were present. No adverse effects were seen.

Conclusion: Intrapleural contrast administration might be a safe and reliable way to rule out diaphragmatic injuries needing surgical repair.

14:00 - 15:30	Room E1

Contrast Media

SS 1706

Contrast agents: Experimental and clinical

Moderators:
P. Aspelin; Stockholm/SE
M. Rief; Berlin/DE

B-779   14:00

also EPOS

MRI with SPIO-carbon dye mixture for detection of metastatic lymph nodes in VX2 tumor rabbits: Experimental study

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Purpose: To assess the value of SPIO-carbon dye mixture (SPIO-C) in diagnosing malignant and benign lymph nodes of VX2 tumor rabbits.

Methods and Materials: 36 New Zealand rabbits were included to establish reactively hyperplastic, tumor-bearing and normal lymph node (LN) model. MRI of bilateral popliteal areas were obtained before and 12 hours after subcutaneous injection of SPIO-C (SPIO: Resovist; Carbon dye: Chinese ink) into the dorsal footpads of all rabbits. Axial size, enhancement patterns, 6-point scale, and Enhancing rate (E %) were compared among three groups. Results were evaluated by using receiver operating characteristic (ROC) analysis, and greater area under the ROC curve (Az value) were compared by a Z test.

Results: 79 LNs were observed on MRI, divided into three groups: normal (n=35), reactive (n=25), and metastatic LNs (n=19), according to the pathology. The efficacy of T2WI-E% for diagnosis of metastatic LNs showed a significantly greater Az value than did others (0.956 vs 0.776, 0.883, 0.814). According to T2WI-E%, 79 LNs then divided into two new groups: certain diagnosis group (including metastatic (n=14, T2WI-E% $\geq$-46%) and benign (n=48, T2WI-E% $\leq$-65%) LNs), uncertain diagnosis group (n=17). Black carbon dye depositing in the LNs' surface were observed in all postmortem LNs.

Conclusion: The efficacy of T2WI-E% for diagnosis of metastatic LNs showed significantly greater than that of others, and according to T2WI-E%, LNs could divide into certain diagnosis group (biopsy non-required) and uncertain diagnosis group (biopsy required). LNs in uncertain diagnosis group could be biopsed under the guidance of MRI and carbon dye marker.

B-780   14:09

Optimizing flip angle and injection rate for combined first pass and steady state imaging of the supraaortic vasculature using gadofosveset trisodium at 1.5 T MRI: A volunteer study

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Purpose: The aim of this study was to determine the optimal injection-rate for first-pass imaging and optimal flip-angle using high-resolution steady-state-spoiled-gradient-echo-MRA-pulse-sequence for the supra-aortic vessels using prolonged intravascular contrast gadofosveset-trisodium.

Methods and Materials: Nine volunteers underwent four MR-sessions at weekly intervals with 0.03 mmol/kg BW of gadofosveset-trisodium at four different injection-rates (0.25, 0.5, 1, 2 cc/s). First pass time-resolved-MRA acquisition was performed: 3D FLASH with view sharing (TWIST), FOV 320x290, Matrix 320x290,

TR=2.69 ms, TE=0.97. For steady-state imaging, 3D-MRA-FLASH pulse-sequence was used (FOV 270 × 320 mm, spatial resolution: 0.7 mm, TR=12 ms, TE=4.62 ms; TA=4:11 min) using different flip-angles (10 -- 50° in steps of 10°). Signal intensities were analyzed in selected ROIs, contrast-to-noise ratios the carotid and jugular vein were calculated.

Results: The highest injection rate of 2 cc/sec provided the highest SNR during first pass. In the steady-state phase, no significant difference was observed among the four injection-rates (p> 0.05). The ROI-analysis for the median carotid artery and jugular vein presented the highest signal (CNR = 25 at 30°flip angle) with nearly three-fold CNR improvement over 10 and 50°.

Conclusion: Results show that during first pass, in given range of injection rates, nearly linear increase in SNR with injection rate. Injection rate has no influence on the steady state signal, as would be expected. However, steady-state MRI particularly of narrow vasculature or high-grade-stenosis are still challenging, and this problem can be overcome by optimized imaging protocols in combination with intravascular blood pool contrast agents.

B-781   14:18

Assessment of enhancement in gadoxetic acid- and Gd-DTPA-enhanced whole-body MRI in patients with rectal carcinoma

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Purpose: To compare intraindividually the qualification and quantification of enhancement in liver parenchyma, abdominal, pulmonary, and pelvic vessels between gadoxetic acid and Gd-DTPA in the setting of whole-body MRI.

Methods and Materials: Sixteen patients with histologically proven rectal carcinoma (mean age 62.9 years) were imaged twice by MRI. For pretherapeutic staging 10 mL gadoxetic acid (mean dose 0.032 mmol Gd/kg body weight) and for restaging after neoadjuvant therapy Gd-DTPA (0.1 mmol Gd/kg body weight) were administered. Three-dimensional T1-weighted GRE sequences of the liver in arterial-dominant and portal venous phases, of the thorax and pelvis in venous phases were acquired. The contrast enhancement was rated by two independent readers and was compared by means of multinomial regression analysis using generalized estimating equations. Signal-to-noise ratios (SNR) were compared by two-sided paired t-tests.

Results: Overall, contrast enhancement was rated sufficient for diagnosis in all examinations and both contrast media. Vascular enhancement was rated comparable with exception of the aorta, the peripheral intrahepatic veins, and the central lung vessels (p=0.0182, 0.0053, 0.0083, in favor of Gd-DTPA). A good interreader correlation was found (kappa range 0.25-0.86 for gadoxetic acid, 0.35-0.84 for Gd-DTPA). The quantitative evaluation revealed comparable parenchymal and vascular SNR with exception of the aorta, and the central pulmonary artery (67.4 vs. 89.3; p=0.0421, 44.5 vs. 59.5; p=0.0446, respectively, in favor of Gd-DTPA).

Conclusion: In the setting of whole-body MRI, the contrast enhancement after gadoxetic acid and Gd-DTPA is diagnostically efficient. The absolute intensity of vascular enhancement after administration of Gd-DTPA is higher.

B-782   14:27

Monitoring early Bevacizumab effect on human melanoma xenografts using dynamic contrast-enhanced (DCE) MRI with a novel Gd-based polymer contrast agent

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Purpose: To evaluate a novel macromolecular polyethyleneglycol (PEG)-based cascade-polymer gadolinium contrast agent in DCE-MRI assays of endothelial permeability and blood volume for its suitability to monitor early anti-angiogenic effect of bevacizumab in an experimental human melanoma model.

Methods and Materials: A total of 13 athymic rats were implanted with subcutaneous melanoma xenografts (MDA-MB-435) and imaged by DCE-MRI at 2.0T. A candidate PEG-cascade polymer, PEG12,000Generation4-(Gd-DOTA)$_{16}$, with an effective molecular weight of 194 kDa and a T1-relaxivity (mM^{-1}s^{-1}) of 9.9 (at 10 MHz and 37 °C) was applied for signal enhancement. In the treatment group (n=8), rats were imaged at baseline and 24 h after a single dose of bevacizumab (1 mg) to generate quantitative estimates of the endothelial transfer coefficient K^{PS} (µl/min·100 cm^3), as a measure of endothelial permeability, and the fractional plasma volume (fPV, %), as a measure of tumor vascularity, using a 2-compartment kinetic model.

Results: In the treatment group, the endothelial transfer coefficient K^{PS} was significantly (p < 0.03) reduced from 29±10 µl/min·100 cm^3 to 10±8 µl/min·100 cm^3 over the course of 24 h. The fractional plasma volume did not change significantly (3.1±1.6 vs. 3.6±1.4%, p> 0.05) over the course of the experiment.

Conclusion: The novel PEG-based cascade-polymer gadolinium contrast agent PEG12,000Generation4-(Gd-DOTA)$_{16}$ was successfully applied in dynamic MR assays of tumor endothelial permeability to detect and quantify the early anti-angiogenic effect of bevacizumab in a human melanoma model. This novel macromolecular contrast agent may be clinically applicable to non-invasively monitor early response to anti-angiogenic therapy on an individual tumor basis, pending approval for human use.

B-783   14:36

Magnetic platelet labelling for magnetic resonance imaging
S. Ungerer, M.C. Spoerl, K. Aurich, W. Weitschies, N. Hosten; *Greifswald/DE*

Purpose: There are many platelet affecting diseases where magnetic resonance imaging (MRI) tracking could provide information about homing and fate of these cells. Here, we evaluate whether human platelets could be labelled with iron oxide nanoparticles by phagocytosis alone for prospective diagnostic use in MRI.
Methods and Materials: A 7 Tesla small animal device MRI was used for signal measurements of particle suspensions and labelled cells in different media. Initially, a suitable particle size of the labelling agent Resovist® (Bayer Schering Pharma AG, Germany) was ascertained and MRI settings were optimized. After labelling human platelets by phagocytosis, the particle location within cells was determined by flow cytometry, transmission electron microscopy and fluorescence microscopy. Iron content per cell was determined by atomic absorption spectroscopy.
Results: MRI settings in different media as well as labeled platelet suspensions yielded best times-to-echo and times-to-repeat of 200 and 1500 ms, respectively. Contrast-to-noise was best with the largest particles. Flow cytometry and microscopy images show that particles were located both inside and outside platelets. Iron content detection showed a value of about 50 pg iron per cell in labelled platelets. MRI measurements of labelled cells resulted in images clearly depicting labelled cells.
Conclusion: Labelled platelets offered sufficient iron concentration for detection in MRI. In vitro labelling of platelets by endocytosis of superparamagnetic nanoparticles appears to be a promising tool for non-invasive monitoring of in vivo platelet homing and localization in MRI after retransfusion of autologous platelets.

B-784   14:45

Comparison of gadoterate, an ionic macrocyclic contrast agent with gadodiamide, a non-linear chelate in rats with reduced renal function
J.L. Haylor[1], F. Nutter[1], G. Jestin[2], A. Decausse[2], J.-M. Idee[2], D. Slater[1], S. Morcos[1]; [1]*Sheffield/UK*, [2]*Roissy/FR (j.l.haylor@sheffield.ac.uk)*

Purpose: To compare the effects of the gadolinium based contrast agents (GBCAs), gadoterate and gadodiamide, on tissue gadolinium retention and skin cellularity in rats with marked renal impairment.
Methods and Materials: Wistar rats were subjected to 5/6 subtotal nephrectomy (SNx) under isoflurane anaesthesia. Gadoterate (Dotarem™) or gadodiamide (Omniscan™) were injected intravenously, 2.5 mmol/kg/day for 5 consecutive days. Animals were sacrificed 4 weeks later. Tissue gadolinium was determined by inductively couple mass spectrometry. Total skin cellularity was quantified by a blinded observer.
Results: Reduced renal mass was associated with a 4-fold increase in serum creatinine (30±0.8 vs. 117±11 µmol/L) and large fall in creatinine clearance (2.46±0.39 vs. 0.61±0.1 ml/min, p < 0.01), a measure of the glomerular filtration rate. Gadoterate had no effect on total skin cellularity (796±214 vs. 869±152 cells/mm², NS). In marked contrast, gadodiamide produced a 4-fold increase in total skin cellularity (735±214 vs. 3092±976 cells/mm², p < 0.02) together with increased immunostain for CD34, FSP-1, prolyl-4-hydroxylase and α-smooth muscle actin. Gadoterate was associated with lower tissue gadolinium retention than gadodiamide particularly in the skin (43±6 vs. 842±236 nmol/g, p < 0.01), but also in bone (60±9 vs. 380±66 nmol/g, p < 0.002) and liver (442±112 vs. 969±128 nmol/g, p < 0.02). No significant difference was observed in the Gd content of the kidney (2501±41 vs. 3561±724 nmol/g, NS).
Conclusion: Gadoterate, in marked contrast to gadodiamide, had no effect on skin cellularity in rats with renal impairment and was associated with a lower retention of gadolinium in tissues, especially in the skin.

B-785   14:54

Characterization of normal, inflammatory and tumor-invaded lymph nodes in a rabbit model: Comparison of a new USPIO contrast medium (P904) with Sinerem®
S. Kinner[1], S. Maderwald[1], N. Parohl[1], J. Albert[1], P. Robert[2], C. Corot[2], J. Barkhausen[3]; [1]*Essen/DE*, [2]*Roissy/FR*, [3]*Lübeck/DE (Sonja.Kinner@uni-due.de)*

Purpose: The aim of this study was to define if P904, a new contrast medium consisting of ultra small superparamagnetic particles of iron oxide (USPIO), is able to discriminate metastastic lymph nodes from inflammatory and normal ones and to compare it to Sinerem®, another USPIO.
Methods and Materials: Ten New Zealand white rabbits underwent MRI after induction of either inflammatory (complete Freund adjuvant; n=6) or metastatic (VX2-tumour; n=4) lymph nodes either with Sinerem (n=3 with inflammatory, n=2 with metastastatic nodes) or P904 (n=3 with inflammatory, n=2 with metastastic nodes). T1 SE and MEDIC sequences were obtained 15 to 60 minutes and 24 hours after injection of the compounds. Thereafter, rabbits were euthanized; lymph nodes were removed and histopathologically processed. A comparison concerning nodal signal intensities over time, depiction of regional nodes and nodal size was performed.
Results: In rabbits with inflammatory lymphadenopathy, 24 nodes were detected with MRI and removed for histological analysis. In rabbits with lymph node enlargement due to questionable metastases, 21 nodes were detected of which all but one could be removed at autopsy. Size of the nodes which differed significantly in favour for metastatic nodes as well as iron content detectable by darkening of the nodes on T1w and MEDIC imaging correlated well with histopathology. No significant difference between Sinerem and P904 could be detected.
Conclusion: Our preliminary results show that both agents are able to depict and classify lymph node enlargement in metastasic and inflammatory diseases. This is of special interest in staging cancer patients.

B-786   15:03

Serum creatinine measurements: Evaluation of a questionnaire according to the ESUR guidelines
J. Hohmann, S. Potthast, G.M. Bongartz; *Basle/CH (jhohmann@uhbs.ch)*

Purpose: Serum creatinine measurements (SCM) are proposed by the ESUR to select patients with reduced renal function and therefore with a higher risk of CMIN and/or NSF. The objective was to find out the portion of patients with an elevated creatinine level (ECL) according to a questionnaire before contrast media injection.
Methods and Materials: Between April and July 2009, a questionnaire was completed in 623 patients (f=332, m=291, mean age: 63 y) before contrast administration (CT/MRI=167/456). SCM were performed when one or more questions concerning previous renal diseases (including surgery), renal diseases in relatives, diabetes, proteinuria, hypertension, gout and analgetic medication were positive.
Results: 232 patients (37%) gave one more positive answers to the questionnaire. Of these, 23 (10%) had an ECL, five (2%) of above 150 µmol/l. In one patient (0.4%, 292 µmol/l), we waived the contrast agent administration. Only the question concerning a previous renal disease showed a significant relation to an ECL (p=0.0026, OR=4.3). Comparing the groups with completely negative responses/at least one positive response/elevated serum creatinine levels, we found a significant age difference (51±16, 60±13, 72±10 y, p < 0.0001). In the study of Choyke et al., the portion of patients with an ECL who gave complete negative responses to a similar questionnaire did not differ significantly from the portion of patients who gave positive answers in our study (8/10%, p=0.4983).
Conclusion: Taking all results into account, we propose to limit the questions to previous renal diseases (including surgery) and considering the patient age prior to contrast media injection.

B-788   15:12

Contrast-enhanced hepatic perfusion index: A novel ultrasound imaging biomarker to monitor therapy
T. Gauthier[1], M. Averkiou[2], D.R. Owen[1], K. Kyriakopoulou[3], H. Wasan[1], E. Leen[1]; [1]*London/UK*, [2]*Nicosia/CY*, [3]*Athens/GR (t.gauthier08@csc.mrc.ac.uk)*

Purpose: To assess a novel contrast-enhanced ultrasound (CEUS) technique in predicting response following combined systemic chemotherapy and anti-angiogenic therapy for colorectal cancer liver metastases patients.
Methods and Materials: Dynamic CEUS examination was performed at the porta hepatis in 57 patients (25 with untreated liver malignancy, 20 healthy volunteers, 6 with post treatment of liver malignancy and 6 before and after treatment of liver malignancy). Contrast-enhanced hepatic perfusion index (CEHPI) defined as the product of main hepatic artery peak intensity times wash-in slope normalized by

Monday

the same measurement for the main portal vein, was measured from time-intensity curves following bolus iv injection of 2 ml of SonoVue. CEHPI was also measured before and after the first treatment in 5 patients undergoing combined systemic chemotherapy and anti-angiogenic therapy and one case pre and post RFA for colorectal cancer liver metastases.

Results: CEHPI was significantly increased in the untreated malignancy group compared with the healthy group (mean ± sd: 34.85 ± 19.54 vs. 3.59 ± 3.3; p < 0.0001). Both sensitivity and specificity were 100% for a CEHPI cut-off of 13.12 on ROC analysis. CEHPI was significantly reduced in the post treatment group compared with untreated liver cancer group (mean ± sd: 6.34 ± 3.82 vs. 34.85 ± 19.54; p < 0.0001). CEHPI also predicted response in all 6 cases in the pre and post therapy groups.

Conclusion: CEHPI is a novel biomarker, which may predict treatment outcome in colorectal cancer liver metastases patients undergoing therapy.

14:00 - 15:30   **Room F1**

Genitourinary

SS 1707

New imaging techniques in GU

Moderators:
S.K. Morcos; Sheffield/UK
I. Vivas; Pamplona/ES

B-789   14:00

Evaluation of relative wash-in enhancement curves of adrenal incidental lesions at early biphasic computed tomography
G. Foti, N. Faccioli, R. Manfredi, W. Mantovani, R. Pozzi Mucelli; *Verona/IT*

Purpose: To retrospectively evaluate the accuracy of pre-contrast attenuation and relative percentage wash-in (RPW-in) curves of enhancement at the time of early biphasic computed tomography (CT) in distinguishing adrenal adenomas from metastases.

Methods and Materials: One hundred and seven adrenal masses were evaluated in 86 consecutive patients (45 males, 41 females, mean age 56 years). Diagnosis was achieved with percutaneous biopsy (n=6), surgery (n=13), 1 year imaging follow-up (n=88). Unenhanced, arterial and portal enhanced scan were obtained. Diameter and absolute attenuation values in each phase of the study by means of a ROI covering 1/2 to 2/3 of the lesions were measured by two readers. RPW-in curves of enhancement were calculated. Sensitivity, specificity, PPV, NPV and accuracy in distinguishing adenomas from metastases were calculated for unenhanced scan and for wash-in curves. A value of p < 0.05 was considered significant.

Results: The final diagnosis was metastases in 51 cases and adenomas in 56 cases. There was a significant difference between benign and malignant lesions as regards diameter (p=0.001), unenhanced CT attenuation (p=0.001) and RPW-in curves from arterial enhanced (AE) to portal enhanced (PE) scan (p=0.014). Sensitivity, specificity, PPV, NPV and accuracy of unenhanced CT attenuation (at 11 HU threshold) and RPW-in curves from AE to PE scans in distinguishing benign from malignant lesions were 98, 86, 86, 98, 92, 94, 77, 79, 93, and 85%, respectively.

Conclusion: RPW-in curves may help in distinguishing adenomas from metastases and to guide the decision to perform a delayed scan when unenhanced scan is not available.

B-790   14:09

also EPOS

Scrotal acute diseases: The role of contrast-enhanced ultrasound
M. Valentino[1], M. Bertolotto[2], L.E. Derchi[3], F. Ciccarese[1], P. Pavlica[1], L. Barozzi[1]; [1]*Bologna/IT*, [2]*Trieste/IT*, [3]*Genoa/IT (massimo.valentino@aosp.bo.it)*

Purpose: Ultrasonography (US) is the mainstay for the scrotal pathology, but sometimes diagnosis may be indeterminate requiring further investigations. Contrast-enhanced ultrasound (CEUS) can improve the depiction of parenchymal disorders on the base of vascularity, which helps in the differential diagnosis of focal lesions or traumatic changes. The aim of this report is to analyze the effectiveness of CEUS findings in the evaluation of scrotal disease compared to baseline US.

Methods and Materials: A second-generation contrast medium (SonoVue, Bracco, Italy) with a low-mechanical index linear probe (4-7 MHz) was used in 46 patients (18-84 yrs) with acute scrotal pain or scrotal trauma.

Results: Final diagnosis included 23 germinal tumours, 4 focal orchitis, 6 focal ischemic lesions, 6 trauma, 2 testicular torsion and 5 negative. CEUS showed complete lack of enhancement in focal ischemia and torsion; absent or reduced enhancement with peripheral ring in abscess and focal orchitis; increased or in-homogeneous enhancement in tumours. In trauma, CEUS demonstrated the fracture with or without tunica albuginea interruption.

Conclusion: The results of this investigation indicate that CEUS images may provide useful information regarding differential testicular perfusion in the setting of acute testicular pain. CEUS correctly determined the less-perfused testis more often than US. The use of contrast agent after inconclusive US evaluation may improve management, address the correct procedure, and allow more confidence in diagnosis. CEUS appears to be both an accurate and cost-effective diagnostic adjunct in those rare patients with scrotal lesions for whom clinical and US evaluations are inconclusive.

B-792   14:18

Contrast enhanced ultrasound in the investigation of indeterminate testicular lesions: Patterns of enhancement in benign and malignant disease help improve diagnostic confidence
P.F.C. Lung, M.E.K. Sellars, P.S. Sidhu; *London/UK (Lung@doctors.org.uk)*

Purpose: Vascular testicular lesions suggest malignancy whilst avascular lesions indicate benign disease. B-mode and Doppler ultrasound may not definitively characterize these abnormalities. Uncertainty include technical limitation, lesion size and operator experience. We present our experience of contrast-enhanced ultrasound (CEUS) in evaluating the indeterminate focal testicular lesion.

Methods and Materials: Patients with a focal abnormality, indeterminate on B-mode and Doppler ultrasound were examined by two experienced operators examined patients using a 15L8w transducer on an Acuson Sequoia (Siemens, CA) using 4.8 mls of SonoVue (Bracco, Milan). Presenting symptoms, site of lesion, characteristic of lesion (size, reflectivity), and presence of vascularity were recorded, along with confidence of operator both pre- and post contrast administration. The pattern of enhancement of the lesion was noted.

Results: Over 1-year 27 patients (median age 37 yrs, range18-56 years) were recruited. Presenting symptoms were pain (n=17) and palpable lump (n=6). Following CEUS, diagnosis were made; venous infarction (n=3), segmental infarction (n=4), focal orchitis (n=1), tumour (n=19). Non-palpable testicular lesions were identified in 11 patients, with CEUS allowing demonstration of increased vascularity, confirmed in those lesions subject to histology demonstrating a vascular tumour. The absence of vascularity confirmed an area of non-perfusion demonstrated on subsequent ultrasound follow-up or histology to be benign. Operator confidence increased with the CEUS examination.

Conclusion: CEUS of the testis is feasible and provides increased operator confidence with making the correct diagnosis. A CEUS examination has the potential for identifying and classifying small indeterminate focal testicular lesions into benign or malignant with some certainty.

B-793   14:27

also EPOS

Dual energy computed tomography: Improving the differentiation of uric acid stones using dual-source flash technology
P. Stolzmann, H. Scheffel, S. Leschka, L.M. Desbiolles, K. Rentsch, B. Marincek, H. Alkadhi; *Zurich/CH (paul.stolzmann@usz.ch)*

Purpose: To investigate the in-vitro performance of the latest dual energy (DE) computed tomography (CT) system (Definition Flash, Siemens) for the differentiation of UA-containing and non-UA-containing uroliths.

Methods and Materials: 110 urinary stones (4.2 ± 3.0 mm, 15 different compositions) were examined in-vitro using the Flash dual-source CT scanner. The scanner was operated in two different DE modes at two tube voltages (3 groups; 80/140 kV with and w/o the Selective Photon Shield (SPS) and 100/140 kV with the SPS). Tube current time products were adapted to yield constancy in CT dose indices. Urinary stone CT numbers and image noise (IN) were manually measured. Dual energy indices (DEI) were compared using paired and un-paired t-tests; IN using the Friedman test. The stones were classified as UA-containing or non-UA-containing. Diagnostic performance was calculated using crystallographic analysis as the standard of reference.

Results: 65/110 stones (60%) were non-UA-containing; 45 stones (40%) were UA-containing. DEI was greatest at 80/140 kV when using the SPS ($DEI_{80 kV/140SNkV}$ = 0.038 vs. $DEI_{80 kV/140 kV}$ = 0.028, $DEI_{100 kV/140SNkV}$ = 0.025; p < 0.005). DEI of UA-containing urinary stones were significantly (p < 0.001) lower as compared to non-UA-containing stones. IN of high kV acquisitions were similar (p = 0.15), whereas IN of low kV acquisitions were significantly (p < 0.001) different being lowest using 100 kV. The software correctly classified all stones at all settings with a diagnostic performance of 100% (95%CI: 97-100%).

Conclusion: DECT with SPS and 80/140 kV significantly improves the discrimination between UA-containing and non-UA-containing urinary stones as compared with DECT without using the SPS. The 100/140 kV setting with SPS is associated with lower IN but demonstrates similar discrimination abilities as compared to 80/140 kVp setting without the use of the SPS.

B-794 14:36

In vitro analysis of urinary stones with unenhanced dual energy single-source 256-slice-MDCT

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Purpose: Knowledge of chemical composition of renal stones is essential for treatment and prevention. Recent advances in speed of single-source MDCT offer the capability for a rapid double scan with two energies within one breath-hold. Our purpose was to perform an in-vitro analysis of the composition of renal stones based on photon absorption patterns in high- and low-energy CT-scans of a single-source 256-slice-MDCT.
Methods and Materials: 75 urinary-tract stones from 20 patients were inserted into different tubes which were positioned in a water-filled box. CT protocol parameters included 1 mm slice thickness, 0.5 mm increment, 80 and 140 kVp. ROIs were drawn in low- and high-energy photon images to determine the HU. The difference between the two energies (dHU) and the Dual Energy-Index (DEI=dHU/2220) was calculated for each stone. CT results were compared with the reference-method Infra-Red-Transmission-Spectroscopy (IRTS).
Results: IRTS identified 8 uric-acid, 50 calcium, 15 mixed and 2 cystine stone. The CT derived DEI was 0.0214±0.0218 for uric-acid, 0.1671±0.0486 for calcium, 0.0539±0.0329 for mixed and 0.0836±0.0341 for cystine stones. Statistical analysis revealed a highly significant difference (p < 0.0001) between DEI for uric-acid vs. calcium and calcium vs. mixed stones. In addition, DEI for cystine vs. uric-acid and cystine vs. calcium stones showed a significant difference (p=0.0105 and 0.0204, respectively) with some overlap.
Conclusion: Our in-vitro analysis shows that dual energy single-source MDCT has the potential to differentiate between uric-acid and calcium stones. Thus, in-vivo examination of stones within one breath-hold may potentially add ancillary information for the urologist before potential stone-extraction and may allow earlier start of metaphylaxis.

B-795 14:45

Dual energy computed tomography for characterization of adrenal gland lesions in patients with bronchial carcinoma

S. Bulla, G. Pache, P. Blanke, T. Baumann, E. Kotter, M. Langer; *Freiburg im Breisgau/DE (stefan.bulla@uniklinik-freiburg.de)*

Purpose: To intra-individually compare density measurements of a Dual Energy (DE) CT virtual native scan (VNC) with a true nonenhanced scan (TNE) for characterizing adrenal gland lesions in patients with bronchial carcinoma (BC).
Methods and Materials: In this prospective study, 189 patients (113 male, 76 female, age 60.1±10.4) referred for initial staging of bronchial carcinoma underwent a thoracoabdominal scan (Dual-source, Siemens Definition, Germany) including a native scan of the abdomen. In case of an adrenal gland lesion, attenuation was measured in the medial, lateral and ventral part of both adrenal glands in TNE and VNC. Based on their attenuation values lesion were regarded as adenomas (less than 10 HU), or metastasis (> 20 HU) or as indifferent lesions (HU=10-20), which would require additional work-up.
Results: 49 lesions were identified in 35 patients (25 male, 10 female, age 64.7±9.5). As compared to TNE VNC regarded 17 of 18 lesions as metastasis (HU: TNE 29.9±4.4; VNC 28.1±4.4), whereas one lesion was regarded as indifferent. Both methods classified 26 lesions as adenoma (HU: TNE -1.1±9.3; VNC -0.4±7.1) and 5 as indifferent (HU: TNE 15.6±1.7; VNC 15.9±1.6). Two sided paired t-test (p = 0.99) showed no significant differences between TNE and VNC and Pearson correlation coefficient (r = 0.91; p < 0.01) was significant.
Conclusion: DE CT seems to have the potential to allow characterization of adrenal gland lesions according to their unenhanced attenuation values as in conventional CT.

B-796 14:54

Single-acquisition dual energy CT for renal mass characterization

A. Graser, N. Arndt, K. Nikolaou, M.F. Reiser, H.-C. Becker, T.R.C. Johnson; *Munich/DE (anno.graser@med.uni-muenchen.de)*

Purpose: To evaluate the diagnostic accuracy of dual energy CT (DECT) in renal mass characterization.
Methods and Materials: 165 patients with suspicious renal masses underwent preoperative unenhanced single energy and nephrographic phase dual energy CT (DECT) on a dual source scanner (Somatom Definition, Siemens). Tube potential was 80 and 140 kVp; exposure, 404 and 96 mAs; collimation, 14x1.2 mm. DECT image quality and noise were rated on a 5-point scale (1=excellent, 5=not interpretable). Using solely the DE acquisition including virtual non-contrast and color coded iodine images, masses were characterized as malignant or benign. Subsequently, the same assessment was performed based on both true unenhanced

and nephrographic phase scans. Interpretation times and diagnostic accuracies were recorded. Dose reduction of a single phase over a dual phase protocol was calculated. Paired t test and Mann-Whitney U test were used to test for significance.
Results: Mean DECT image quality was 1.46±0.33, noise was 1.55±0.38. Histopathology showed malignancy in 123 patients; benign masses were detected in 27. Based on single phase DECT, 119/123 (96.7%) malignant and 24/27 (88.9%) benign lesions were correctly characterized. The dual-phase approach identified 121/123 (98.4%) malignant and 25/27 (92.6%) benign lesions, p> 0.05 for both. Mean interpretation time was 2.2±0.8 minutes for DECT, and 3.5±1.0 minutes for conventional CT, p < 0.001. Omission of the true unenhanced phase led to a 48±16% dose reduction.
Conclusion: DECT allows for characterization of renal masses in a single acquisition. Omission of a true unenhanced acquisition will reduce reading time and cut radiation exposure by 48%.

B-797 15:03

Optimizing CT-urography: Split-bolus technique and coughing prior to acquisition

A.S.D. Hauser, G.M. Bongartz, S. Potthast; *Basle/CH (ahauser@uhbs.ch)*

Purpose: To systematically evaluate the impact of coughing, compression and coughing and compression combined on ureteral opacification and distension in split-bolus CT-urography with nephrographic and late phase imaging.
Methods and Materials: 60 consecutive patients were prospectively enrolled and split up into 3 groups (coughing prior to scan, external compression, coughing + external compression). 7 patients had to be excluded. 4.5 and 10 min post contrast media injection a multislice CT was performed in all patients. Two experienced radiologists reviewed excretory images and performed quantitative measurements of urinary tract distension and qualitative measurements of urinary tract opacification.
Results: Coughing during nephrographic phase provided significantly better opacification of the proximal and distal ureter compared to combined coughing/compression and compression alone (each p < 0.01); furthermore, coughing during nephrographic phase yielded slightly higher values than all techniques in late phase but not statistically significant. On the other hand, combined coughing and compression showed slightly higher distension values in both phases though these results were not significant (p> 0.05) either. Interobserver agreement was generally high with 0.96 for opacification and 0.90 for distension.
Conclusion: Coughing combined with split-bolus CT-urography provides improved ureteral opacification already during the nephrographic phase with the additional benefit of reduced radiation exposure as late phase imaging is not necessary.

B-798 15:12

Urinary bladder neck dysfunction in male patients: Evaluation with MRI and with voiding MR-cystourethrography

M. Di Girolamo, A. Trucchi, S. Mariani, P. Fina, C. De Cecco, V. David; *Rome/IT (digirolamomarco@hotmail.com)*

Purpose: To evaluate with MRI male patients with urinary bladder neck dysfunction, studying the anatomical aspect of bladder neck and performing voiding MR-cystourethrography.
Methods and Materials: We have evaluated with MRI 21 male patients with urinary bladder neck dysfunction diagnosed with pressure-flow study. All the patients had undergone US in the month proceeding MRI and patients with BPH were excluded. The MR examinations were performed with the patient placed in supine position and using a phased-array body coil. The patients had urine-filled bladders and sagittal and oblique coronal TSE T2-weighted scans were performed. 15 patients underwent also voiding MR-cystourethrography performed with T1-weighted spoiled 3D gradient-echo acquisitions on sagittal plane performed after the filling of bladder lumen with contrast-material-enhanced urine.
Results: We detected 18 patients with abnormality of smooth muscular structures of the bladder neck and 3 patients with bladder neck cyst. MRI allowed a perfect evaluation of the different smooth detrusor muscles of the bladder neck. In patients with the typical urinary bladder neck dysfunction, we detected the hypertrophy of posterior smooth muscular structures of bladder neck and the kyphosis of prostatic urethra. Only 6 patients were able to perform voiding MR-cystourethrography that showed the characteristic radiological features.
Conclusion: MRI with voiding MR-cystourethrography could be performed in male patients with bladder outlet obstruction in order to visualize anatomical information useful to determine the causes of voiding obstruction, to diagnose urinary bladder dysfunction and to establish the best therapeutic approach.

14:00 - 15:30   Room F2

Breast

SS 1702

Staging of breast cancer

Moderators:
J. Danes; Prague/CZ
A. Linda; Udine/IT

B-799   14:00

The accuracy of breast cancer size measurement: Digital breast tomosynthesis (DBT) vs 2D digital mammography (DM)

L.M. Meacock, S. Mombelloni, A. Iqbal, N. Akbar, Y. Wang, M.J. Michell; *London/UK*
(lisameacock76@hotmail.com)

Purpose: DBT may provide more accurate assessment of tumour size than DM because DBT allows better visualization of the margins of masses due to lack of superimposition of normal breast structures. The aim of this project is to compare the accuracy of tumour size measurement of DBT and DM.
Methods and Materials: 84 patients with invasive malignancy or DCIS recalled to the screening assessment clinic underwent DBT. Tumour size was recorded on DM and DBT. Two measurements were obtained for each spiculated lesion in each projection, the first incorporating the spicules, the second only the diameter of the soft tissue mass. The maximum diameter was measured in the CC and MLO projections for circumscribed lesions and microcalcifications. Comparison was made with surgical histopathological size. Pearson correlation analysis was performed on the data.
Results: 78 patients were included. Patients undergoing neo-adjuvant chemotherapy were excluded. DBT had higher size correlation with histopathology for all lesions DBT correlation coefficient (0.830), DM (0.781). DBT measurement of the mass for spiculated lesions had a higher correlation with histopathology DBT (0.932), DM (0.861), DBT measurement including the spicules had the highest correlation with the histopathology DBT (0.984), DM (0.861). DBT correlation with histopathology was higher than DM for circumscribed lesions DBT (0.765), DM (0.557). No difference between DM and DBT was found in measuring microcalcification extent DM (0.776), DBT (0.783).
Conclusion: DBT is more accurate than DM in measurement of tumour size for soft tissue lesions. The spicules of spiculated masses should be included.

B-800   14:09

Combined staging at one stop in MR-mammography: Evaluation of an extended protocol to screen for distant metastasis in breast cancer - initial results and diagnostic accuracy in a prospective study of 64 consecutive patients

M. Dietzel, P.A.T. Baltzer, T. Vag, M. Gajda, O. Camara, W.A. Kaiser; *Jena/DE*

Purpose: MR-mammography (MRM) is frequently used for preoperative local tumor staging (T-Staging). Current whole-body scanners allow combination of multiple coils enabling T-Staging and distant-metastasis staging (M-Staging) within one examination. This prospective study was conducted to: (1) Design an extended MRM-protocol for combined T- and M-staging. (2) Identify diagnostic accuracy of this protocol to identify metastatic disease.
Methods and Materials: 65 consecutive breast-cancer patients underwent MRM preoperatively (B:1.5 T). A standard MRM-protocol (axial: T1w/GRE dynamic contrast-enhanced, T2w/TSE; FOV: whole breast; TA: 10 min) was extended to screen for distant metastasis (coronal: T2w/HASTE, T1w/VIBE; FOV: thorax, abdomen and thoracic/lumbar spine; TA: 90 sec). Standard-of-Reference was routine examinations to screen for distant metastases according to current guidelines including dedicated CT in cases of pathologic findings. Two experienced radiologist (> 3000 MRI; blinded to Standard-of-Reference) independently rated the whole-body scans on a five-level confidence-score (I°: no lesion, II°: benign lesion, III°: probably benign lesion; IV°: probably metastatic lesion, V°: metastatic lesion). Size of metastatic vs. benign lesions was compared (Mann-Whitney-Test-U). Inter-rater agreement (weighted-kappa) and Scoring by the observers was analyzed (Contingence-tables).
Results: Metastatic lesions were present in 5 patients; in further 43 patients, benign lesions were identified. Size differences between benign vs. metastatic were not significant. Weighted-kappa demonstrated "almost perfect" Inter-rater agreement (Kappa: 0.92). Both observers reached high Sensitivity (100%), Specificity (98.3%) and Positive-Predictive-Value (83.3%), if IV°/V° were considered as a positive test-result.
Conclusion: Applying the extended protocol, accurate screening for distant metastasis was possible in combination with a conventional MR-mammography examination. This demonstrates the potential for combined breast-cancer staging at one stop using MRI.

B-801   14:18

Additional value of MR mammography in preoperative staging for breast-conserving surgery

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Purpose: To evaluate the additional value of MR mammography (MRM) in preoperative staging in patients with a proven malignancy who are eligible for breast-conserving surgery. Moreover, the additional value of MRM with respect to surgical management changes was analyzed.
Methods and Materials: We performed a retrospective search of our MRM database in 2008. 52 patients planned for breast-conserving surgery were detected. The following clinical data were analysed: age, multifocality, multicentricity, changes in surgical management and pathological correlation. Multifocality or multicentricity was defined as two or more tumor foci within a single quadrant or within different quadrants, respectively. The MRMs were analyzed by two experienced radiologists working in consensus.
Results: The average age of all patients was 57 years [range 35 - 75 years]. MR mammography detected multifocality in 29%, multicentricity in 13% and both multifocality and multicentricity in 4%. Surgical management was changed in 34% of all treated patients: in 15%, management was converted from breast-conserving surgery to more extensive breast-conserving surgery and in 19% from breast-conserving surgery to mastectomy. In 89%, the pathologic specimen supported the conversion in surgical management. Of all treated patients, 90% had a ductal type adenocarcinoma, 8% a lobular type adenocarcinoma and 2% a colloid carcinoma.
Conclusion: In our study, surgical management was changed preoperatively in 34% of all treated patients based on MR-mammography findings. In 89% of these patients, pathologic specimen confirmed this change in surgical strategy supporting the additional value of preoperative MRM in patients planned for conserving breast surgery.

B-802   14:27

MRI of the breast in women with newly diagnosis of breast cancer: Accuracy of DWI in the assessment of axillary lymphadenopathy

R. Eiada, A. Scaranelo, P. Crystal, S. Kulkarni; *Toronto, ON/CA*
(Riham.Eiada@uhn.on.ca)

Purpose: To evaluate the accuracy of diffusion-weighted MR imaging (DWI) of the axilla in staging breast MRI.
Methods and Materials: Results of preoperative staging breast MRI with additional DWI sequence in 63 patients with new diagnosis of invasive breast cancer (65 axillae, two patients with bilateral breast cancer) were retrospectively reviewed. Visual assessment of signal intensity of the most suspicious lymph node on DWI sequences and ADC reconstructed mapping were correlated with sentinel node biopsy (SNB) or axillary node dissection (ALND) histopathology. ADC computer based image analysis values of the lymph nodes were measured and comparison was made between benign and malignant groups.
Results: Of 65 axillae, histology revealed 28 malignant (28/65, 43%) and 37 benign (37/65, 57%) axillary lymph nodes. Of 33 cases found negative on DWI, 6 were diagnosed as metastatic with SNB or ALND (sensitivity 79%). Of 32 malignant axillary lymph nodes by DWI, 10 cases were found benign on histopathology (specificity 73%). Visual assessment was significantly correlated with histopathologic diagnosis (p < 0.000, Accuracy 75.3%). Mean ADC values of lymph nodes were 0.64 ± 0.18 and $0.80 \pm 0.53 \times 10$ ($^{-3}$) mm^2/sec in the benign and malignant groups, respectively. The ADC values were not significantly correlated with histopathologic diagnosis.
Conclusion: DWI is potentially accurate non-invasive method for staging of axillary lymph nodes in breast cancer. An overlap of ADC values exists in patients with metastatic vs. benign, with a tendency of lower ADC values in benign lymph nodes. Further research is required to validate our preliminary results.

B-803   14:36

Does edema differ between benign and malignant breast lesions? Role of T2-weighted STIR imaging

M. Telesca, F. Pediconi, V. Dominelli, F. Vasselli, C. Catalano, R. Passariello; *Rome/IT (mariannatelesca@yahoo.it)*

Purpose: To determine whether there is a real difference between the edema of benign and malignant breast lesions on breast MRI.
Methods and Materials: 839 consecutive women underwent bilateral contrast-enhanced breast MRI between January 2004 and December 2007. Patients were classified using the BI-RADS classification for level of suspicion for malignant lesions. Comparisons were made with findings from cytological or histological

analysis. Findings from prior X-ray mammography and/or ultrasound were available for all patients. The breast MRI protocol comprised a precontrast T2-weighted STIR sequence and a dynamic 3D T1-weighted FLASH sequence acquired before and at 2 minute intervals after administration of 0.1 mmol/kg bodyweight of c.a. Patients were separated into 3 groups according to the characteristics of the edema: patients with diffuse unilateral edema, patients with perifocal edema and patients without edema.

Results: Edema was observed in 739/839 patients and was characterized by high signal intensity on T2-weighted images. 600 patients had malignant lesions; in these patients edema was diffuse in 440 and perifocal in 160. 139 patients had benign lesions; in these patients, edema was diffuse in 40 and perifocal in 99 (phillodes, papillomas tumors, mastitis). There was a highly significant difference between edema in the patients with benign and malignant lesions. Edema was rarely present in benign lesions but was more highly associated with malignant lesions.

Conclusion: Surrounding edema detected on T2-weighted STIR imaging is a useful adjunct to findings from conventional T1-weighted dynamic imaging for accurate differentiation of benign from malignant disease.

B-804 14:45

Should routine breast cancer staging include magnetic resonance imaging?

F. Pediconi, V. Dominelli, M. Telesca, F. Vasselli, C. Catalano, R. Passariello; *Rome/IT (federica.pediconi@uniroma1.it)*

Purpose: To evaluate contrast-enhanced MR-mammography (CE-MRM) in surgical planning of patients with breast cancer.

Methods and Materials: 164 women with biopsy-proven breast cancer (BIRADS 6) underwent preoperative CE-MRM using an axial 3D dynamic T1-weighted gradient-echo sequence and 0.1 mmol/kg gadobenate dimeglumine. Histological evaluation of additional lesions detected by CE-MRM was performed. Sensitivity, accuracy and positive predictive value (PPV) of CE-MRM compared to X-ray mammography/ultrasound were calculated and evaluation of CE-MRM on surgical decision-making was based on the additional malignant lesions detected.

Results: X-ray mammography/ultrasound detected 175 suspicious lesions (BI-RADS 4 or 5). CE-MRM detected 51 additional suspicious lesions in 34/164 (21%) patients; 7/34 had multifocal and 4/34 multicentric disease, 21/34 had synchronous contralateral lesions and 2/34 showed infiltration of the pectoralis muscle. CE-MRM revealed a larger tumor size for 26 lesions. CE-MRM changed the therapeutic procedure previously proposed in 32/164 (20%) patients: 7 patients with multifocal disease at CE-MRM underwent quadrantectomy, 3 patients underwent mastectomy for multicentric disease, 12 patients underwent additional surgery on the contralateral breast, 2 patients underwent neoadjuvant chemotherapy because of the pectoralis muscle invasion identified only by CE-MRM and 4 patients underwent quadrantectomy because of a larger tumor size. No cases of over-treatment occurred since the 51 additional lesions detected by CE-MRM were histologically confirmed as malignant. Sensitivity, accuracy and PPV for malignant lesion detection and identification were 100, 93.4 and 93.4% for CE-MRM compared to 77.3, 72.1 and 91.4% for mammography/ultrasound.

Conclusion: CE-MRM positively impacts patient-management decisions in patients with newly diagnosed breast cancer.

B-805 14:54

Prediction of breast cancer tumor size by six different methods

M. Meier-Meitinger, L. Häberle, M. Uder, R. Schulz-Wendtland, P. Fasching, B. Adamietz; *Erlangen/DE*

Purpose: To assess breast cancer dimensions in mammography (MG), conventional ultrasound (US), compound imaging (CI) and elastography compared to final pathological tumor size (pT).

Methods and Materials: 106 malignant breast lesions were examined by MG, US, CI and elastography and measured in the largest diameter. In US and CI, two different measurements were made, US1 and CI1 (measuring only the hypoechoic nucleus), respectively, US2 and CI2 (measuring hypoechoic nucleus plus hyperechoic halo). Measurements were compared with pT by Bland-Altman-plots; statistical tests were performed considering tumor entities and breast densities.

Results: CI2 (mean=1.48 cm), US2 (1.45 cm) and elastography (1.65 cm) agreed best with pT (1.51 cm). The least reliable measurements resulted from US1 (1.19 cm) and CI1 (1.18 cm), followed by MG (1.76 cm). Correspondingly, Bland-Altman-plots revealed superior tumor size estimation by US2, CI2 and elastography with relatively low variation, whereas MG showed the greatest variance. Consistently, smaller tumors were better to assess than larger ones. CI2 and US2 made best tumor estimation for IDC-group and elastography for ILC-group, although not statistically significant. There was no significant correlation between accuracy of

tumor sizing and breast density, but the analysis showed that the verifiability and measurability of tumors in MG decrease with increasing breast densities.

Conclusion: Best tumor size prediction for IDC is reached by US2 and CI2, for ILC by elastography. Therefore, we propose to include the hyperechoic surroundings around the tumor in US and CI measurement and to enter elastography as an additional modality in the clinical tumor staging process.

B-806 15:03

Preoperative magnetic resonance imaging of the breast: Does it affect local recurrence rate?

V. Dominelli, F. Pediconi, M. Luciani, V. Casali, C. Catalano, R. Passariello; *Rome/IT (valeria.dominelli@yahoo.it)*

Purpose: To evaluate the benefit of preoperative MRI in local recurrence rates of breast cancer after surgical treatment of primary carcinoma.

Methods and Materials: We retrospectively evaluated 49 patients with histologically-proven local breast cancer recurrence detected between 7/47 months after initial surgical treatment. All patients underwent similar systemic treatment after surgery and follow-up breast-MRI to evaluate the extent of the relapse. Patients were differentiated in group A, comprising 10/49 patients with preoperative contrast-enhanced breast-MRI before surgery, and group B comprising 39/49 patients with no breast-MRI examination before surgery. The chi-square test was used for statistical evaluation.

Results: 14 patients underwent mastectomy (6 in group A, 8 in group B), 30 patients underwent quadrantectomy (3 in group A, 27 in group B), and 5 patients underwent lumpectomy (1 in group A, 4 in group B). There were 28 (57%) cases of recurrence in the same breast after breast-conserving surgery (4/10 [40%] in group A vs 24/39 [61%] in group B), 5 (10%) cases of local recurrence after mastectomy (4/10 [40%] in group A vs 1/39 [3%] in group B) and 16 (33%) cases of contralateral disease (2/10 [20%] in group A vs 14/39 [36%] in group B). Metachronous contralateral carcinoma and local recurrence in the ipsilateral breast were (p < 0.001) more frequent in patients without preoperative local MR-staging (88 and 85%) compared to those with breast carcinoma who underwent MRI before primary therapy (12 and 14%, respectively).

Conclusion: Preoperative local MR staging allows a significant reduction of ipsilateral recurrences and contralateral cancer at follow-up.

B-807 15:12

Initial clinical evaluation of dual energy contrast enhanced digital mammography (CEDM): A comparison with standard mammography and ultrasound

C. Dromain[1], C.S. Balleyguier[1], F. Thibault[2], A. Tardivon[2]; [1]*Villejuif/FR*, [2]*Paris/FR (clarisse.dromain@igr.fr)*

Purpose: Contrast Enhanced Digital Mammography (CEDM) aims at demonstrating tumor angiogenesis. Results of a clinical study on 109 patients with 136 suspicious findings are presented, which compares Dual Energy CEDM with standard of care: mammography (MX) and ultrasound (US).

Methods and Materials: Patients having received both MX and US examinations were imaged with Dual Energy CEDM (MLO and CC views). The acquisition parameters of the low energy image are similar to standard MX while the high energy image is acquired at 45 to 49 kVp with Mo/Cu track/filter. Low and high energy images are then combined by a specific software to deliver an iodine-equivalent image. MX+US, then MX+CEDM images including 77 malignant and 59 benign findings were evaluated. Findings were classified using probability of malignancy (7-point scale), BIRADS and confidence of presence (5-point scale). Lesion size was estimated for MX, US and CEDM. Histology was used to establish the truth.

Results: Area under ROC was superior for MX+CEDM compared to MX+US using BI-RADS (p=0.03). The specificity for MX+US versus MX+CEDM was 0.39 versus 0.56 (p=0.06), 0.47 versus 0.63 (p=0.08) and 0.15 versus 0.34 (p=0.02) considering, respectively, the probability of malignancy, BI-RADS and confidence of presence. No statistically significant difference was found for the sensitivity. The lesion size was closer to the histological size for CEDM.

Conclusion: In our experience, Dual Energy CEDM as an adjunct to MX presents a higher diagnostic accuracy than the standard of care (MX+US) and seems to provide a more accurate assessment of the lesion size.

B-808 15:21

Accuracy of preoperative staging of the axilla in breast cancer by axillary node needle core biopsy

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(lisa.hackney@uhns.nhs.uk)

Purpose: Histological confirmation of axillary nodal metastases preoperatively avoids a sentinel node biopsy and enables a one step surgical procedure. The aim was to establish the local positive predictive value of axillary ultrasound (AUS) and guided needle core biopsy (NCB) in axillary staging of breast cancer.
Methods and Materials: 179 consecutive patients (screening and symptomatic) presenting from 1st December 2008 - 3 1st May 2009 with breast lesions categorised R4-R5, or axillary lymphadenopathy underwent axillary ultrasound scans. Ultrasound guided NCB was undertaken on nodes radiologically classified R3-R5. Lymph node size, number, and morphological features were documented. Yield was correlated with tumour size, grade, type and lymphovascular invasion. AUS/NCB was correlated with surgical pathological findings or histology to determine sensitivity, specificity, negative predictive value and positive predictive value.
Results: 176 patients underwent preoperative AUS, 39.77% had abnormal ultrasound findings. 35.22% underwent axillary node NCB of which 61.29% were positive. 142 patients underwent surgery of whom 52 (36.6%) had lymph node metastases on histology. The smallest tumour size associated with positive nodes at surgery was 10 mm. The sensitivity of AUS with and without a NCB was 60%. Specificity was 96.59%, with a negative predictive value of 76.58% and a positive predictive value of 92.86%.
Conclusion: Preoperative AUS ± NCB accurately predicted the status of the axilla in 79.28%. The most significant factor producing discordance between preoperative AUS and NCB was tumour type. 42.86% of axillary metastases undetected preoperatively were lobular carcinomas, compared to 13.56% undetected with all other tumour types.

14:00 - 15:30   **Room G/H**

Head and Neck

SS 1708

Advances in temporal bone and face imaging

Moderators:
A.S.C.C. Germano; Amadora/PT
K.A. Stringaris; Athens/GR

B-809 14:00

Visualization and evaluation of endolymphatic hydrops in Menier's disease

W.H. Flatz, R. Guerkov, O. Dietrich, B. Ertl-Wagner, M.F. Reiser; *Munich/DE*
(radiologie.muenchen@gmail.com)

Purpose: The objective of our study was to detect and evaluate endolymphatic hydrops in Menier's disease in vivo using MRI.
Methods and Materials: 16 previously untreated patients suffering from clinical symptoms of Menier's Disease were examined in a prospective study. Gadolinium was administered intratimpanically 24 hours prior to the MR scan. MRI was performed using a 3 T scanner using a dedicated 8 channel surface coil acquiring a 3D-FLAIR sequence and a high resolution True-FISP Dual Excitation sequence (CISS). Correlation with clinical symptoms and audiovestibular function testing was performed using electrocochleography (ECochG) and vestibular evoked myogenic potentials (VEMP).
Results: Inner ear fluid spaces could be well delineated in high resolution using both employed MR-sequences. 3D-FLAIR clearly depicted gadolinium distribution in the perilymphatic space and thus allowed delineation between peri- and endolymphatic regions. Patients suffering from severe clinical signs and functional impairment of Menier's disease showed smaller perilymphatic spaces and larger endolymphatic spaces compared to patients with not so severe symptoms. Additionally, in patients showing severe clinical and functional impairment evaluated by ECochG and VEMP, lack of vestibular gadolinium distribution was found.
Conclusion: Endolymphatic hydrops can be detected and evaluated using 3D-FLAIR after intratimpanically administered gadolinium. Endo- and perilymphatic spaces correlate with severity of symptoms in Meniere's disease.

B-810 14:09

The value of non-echo planar diffusion-weighted MRI versus echo planar and conventional MR sequences in the detection of middle ear cholesteatoma

K. Firouznia, H. Sharifian, E. Taheri, A. Azizian, M. Shakiba, P. Borghei, R. Farjad, M. Roshan Fekr, M. Naghdi; *Tehran/IR (k_firouznia@yahoo.com)*

Purpose: The non-echo planar imaging diffusion-weighted (non-EPI DW) MRI sequence has recently emerged as new imaging technique in detecting cholesteatoma. We prospectively evaluated the usefulness of this sequence and compared its diagnostic efficacy with previous MR sequences including EPI and delayed post contrast MR scan.
Methods and Materials: A group of 23 patients, including second look patients (16 male, 7 female; mean age: 34±17.5 [9-76] years) were evaluated with MRI, consisting delayed post-contrast, EPI and non-EPI DW sequences, prior to surgery as gold standard. Two experienced radiologists reported images. For each sequence, mean sensitivity, specificity, and predictive values (positive [PPV] and negative [NPV]) of MRI were calculated and interobserver agreement between the two radiologists was assessed by kappa statistics.
Results: Surgery proved 16 cases of cholesteatoma (size: 1.5-60 mm). For delayed post-contrast, the mean sensitivity, specificity, PPV and NPV were as follows, respectively: 75.1, 85.7, 92.3, and 60.6%. They were 56.3, 85.7, 89.9, and 46.5% for EPI and 90.7, 100, 100, and 82.7% for non-EPI. Kappa agreement for delayed post-contrast, EPI and non-EPI DW MRI were 0.83, 0.58 and 0.91, respectively. Detection rate of non-EPI was significantly better than EPI DW MRI ($p_s < 0.05$). Mean detection rate (sensitivity) of non-EPI (90.7%) was statistically better than delayed post-contrast (75.1%) (P < 0.05). One patient had cholesteatoma sized 1.5 mm in surgery that was missed in all sequences.
Conclusion: Both delayed post-contrast and non-EPI DW MRI are valuable methods in detecting cholesteatoma. Non-EPI DW sequence is, however, much more accurate. EPI DW sequence does not show enough efficacies in detecting cholesteatoma.

B-811 14:18

Value of non-echo planar diffusion-weighted magnetic resonance imaging versus delayed post-gadolinium T1-weighted magnetic resonance imaging for the detection of middle ear cholesteatoma

B. De Foer[1], J.-P. Vercruysse[1], A. Bernaerts[1], J. Meersschaert[2], M. Pouillon[1], T. Somers[1], R. Hermans[2], E. Offeciers[1], J.W. Casselman[3]; [1]*Antwerp/BE*, [2]*Leuven/BE*, [3]*Bruges/BE*

Purpose: To retrospectively compare non-echo-planar (non-EP) diffusion-weighted imaging (DWI) versus delayed post-gadolinium (Gd) T1-weighted magnetic resonance imaging (MRI) and the combination of both techniques in 120 cholesteatoma patients.
Methods and Materials: This study was approved by our institutional review board. The patient group included 57 patients clinically suspected of having a middle ear cholesteatoma without prior history of surgery and 63 patients prior to second look surgery. Four radiologists evaluated three blinded sets of MR images of these patients: delayed post-Gd T1-weighted sequences, non-EP DWI sequence and the combination of both techniques. Overall sensitivity, specificity, negative (NPV) and positive (PPV) predictive value and intra- and interobserver agreement were assessed and compared between methods. Results were compared to first stage and second look surgery.
Results: Sensitivity for delayed post-Gd T1-weighted sequences was 56.65% with a specificity of 67.59%, while for the non-EP DWI sequence this was, respectively, 82.58 and 87.22%. Sensitivity for the combination of both techniques was 84.15% with a specificity of 88.16%. Significant differences in sensitivity and specificity were found between delayed post-Gd T1-weighted sequences and both the non-EP DWI sequences and the combination of both techniques. Similar results were found for NPV and PPV.
Conclusion: MR imaging for detection of middle ear cholesteatoma can be performed using non-EP DWI sequences alone. Non-EP DWI sequence combined with delayed post-Gd T1-weighted sequences provides no significantly higher sensitivity and specificity, NPV or PPV. The use of delayed post-Gd T1-weighted sequences alone has a significant lower sensitivity and specificity, NPV and PPV.

B-812 14:27

Diffusion-weighted MR imaging of patients with recurrent cholesteatoma

S.A. Khedr, A. Gaballa, A. Adly; *Jiddah/SA*

Purpose: The aim of this prospective study was to determine the role of diffusion weighted MR imaging combined with conventional MR imaging for the detection of residual or recurrent cholesteatoma in patients who have undergone middle ear surgery.

Methods and Materials: Twenty-one patients who had undergone resection of cholesteatoma were referred for MR imaging. MR imaging (1.5 T) was performed using a diffusion-weighted fast spin-echo sequence, a proton density and T2- weighted double-echo turbo spin-echo sequence, and T1-weighted spin-echo sequences before and after IV injection of gadopentetate dimeglumine (0.1 mmol/kg of body weight). Diffusion-weighted MR images were reviewed for the presence of a high signal- intensity cholesteatoma. Imaging findings were correlated with findings from second or third look surgery in all patients.

Results: Diffusion-weighted MR imaging combined with conventional MR imaging depicted 11 of 13 cholesteatomas patients (sensitivity, 84.6%). The two lesions that missed by diffusion-weighted MR imaging were smaller than 5 mm. All the MR images of patients without cholesteatoma were correctly interpreted as showing negative findings for cholesteatoma (specificity, 100%). The positive predictive value and negative predictive value were 100 and 80%, respectively. Diffusion-weighted fast SE images showed few artifacts at the air-bone interfaces.

Conclusion: Diffusion-weighted MR imaging combined with conventional MR imaging can confirm residual or recurrent cholesteatoma in patients who have undergone middle ear surgery by showing a high-signal-intensity lesion. Because tumors smaller than 5 mm may be missed, a diffusion-weighted MR imaging study with negative findings does not exclude small residual or recurrent cholesteatoma.

B-813 14:36

MR diagnosis of facial neuritis: Usefulness of 3D VISTA FLAIR sequence compared to 3D T1-FFE-FS sequence

H. Lim, J. Lee, S. Kim, J. Baek; *Seoul/KR (merhen98@gmail.com)*

Purpose: To retrospectively investigate the usefulness of 3D-VISTA FLAIR sequence when compared to 3D T1-FFE-FS sequence in peripheral facial palsy patient.

Methods and Materials: The study enrolled 36 patients (mean age ± SD, 50 years ± 17; range, 16 - 78 years) who underwent temporal bone MR imaging using 3-T MR unit for peripheral facial nerve palsy. The facial nerve was divided into 5 segments including canalicular, labyrinthine, anterior genu, tympanic and mastoid. Two readers independently reviewed 3D-T1-FFE-FS images and 3D-VISTA FLAIR images with regard to the degree of enhancement in each segment. We compared diagnostic performance of two MR sequences with McNemar test and evaluated interobserver agreement.

Results: Patients were diagnosed as unilateral peripheral facial palsy by physical examination and electrophysiologic study. The diagnostic sensitivities, specificities and accuracies were 97.2, 86.1 and 91.7% for of 3D-VISTA FLAIR, and 100, 56.9 and 78.5% for 3D-T1-FFE-FS, respectively. The specificity and the diagnostic accuracy of 3D-VISTA FLAIR were greater than those of 3D-T1-FFE-FS by two readers (p < 0.001). According to each segment of the facial nerve, enhancement of the canalicular segment and anterior genu were significantly correlated with the presence of the facial palsy (p < 0.001 for canalicular; p = 0.033 and 0.009 for anterior genu by reader 1 and reader 2, respectively). The interobserver agreements of 3D-VISTA FLAIR and 3D-T1-FFE-FS were excellent between two readers (kappa value: 0.831 vs. 0.694).

Conclusion: The 3D-VISTA FLAIR can improve the diagnostic performance of MRI in patients with peripheral facial palsy.

B-814 14:45

Proceedings in differential diagnosis and evaluation of the prognostic value in case of facial nerve palsy using high resolution 3 T MRI

H.P. Burmeister, A. Kraft, G.F. Volk, P.A.T. Baltzer, P. Schmidt, C. Klingner, O. Guntinas-Lichius, H.-J. Mentzel, W.A. Kaiser; *Jena/DE (hartmut.burmeister@med.uni-jena.de)*

Purpose: The aim of this study was to evaluate 3 T-MRI in case of facial nerve palsy with respect to differential diagnosis and prognostic value.

Methods and Materials: Thirty-three patients underwent T1-weighted 3 T-MRI before and after application of Gadolinium-DTPA (T1-flash3D, slice thickness 0.6 mm, TR 20 ms, TE 2.46 ms, 384x384 matrix) within four days after beginning of the facial nerve palsy. Signal intensities of the premeatal segment and the geniculate ganglion were measured. Comparative statistical evaluations concerning the enhancement within and between the segments were performed intraindividual and interindividual and for percentage increase respectively. To assess specificity and sensitivity of the enhancement, receiver operating characteristic (ROC) curves were calculated. Results were correlated with both the degree of the recovery after 3 months and etiopathologic factors.

Results: Wilcoxon Testing resulted in significant differences (p < 0.001) between both sides for the premeatal segment and the geniculate ganglion before and after contrast media application. Regarding the percentage increase of signal intensity

we found significant increases (p < 0.001) for both the healthy and the paralyzed side. The ROC analysis showed a high-grade sensitivity (97%) and specificity (94%) for the percentage increase of the premeatal segment. The quotient from signal intensity of the ill and healthy side correlated with the degree of recovery after 3 months. A differentiation between etiopathologic subgroups (borreliosis, Ramsey Hunt syndrome, idiopathic paresis) became possible.

Conclusion: 3 T-MRI enables both the detection of the relevant damaged nervous segments and initial statements about differential diagnosis and prognostic value in facial nerve palsy.

B-815 14:54

Temporal bone fractures: Classification using the new system; evaluation during emergency brain CT

R. Moschona[1], E. Koutsaftakis[1], S. Kopanakis[1], M. Kalomenopoulou[1], G. Zarifis[2], S. Giannou[1]; [1]*Rethymno/GR*, [2]*Chania/GR*

Purpose: Temporal fractures are usually associated with severe head trauma, which limits the clinical evaluation and distracts the clinician's attention away from the signs of the fracture. The radiologist plays a key role in demonstrating and describing the type of fracture, especially when the patient's condition forbids further clinical evaluation. The purpose of this study is to use the new classification system in describing temporal trauma and demonstrate the CT signs that an emergency brain scan offers.

Methods and Materials: We reviewed the CT findings of 20 patients of temporal bone trauma (age range 9-71 years) after a head injury.

Results: Nineteen patients had opacification of the ipsilateral mastoid cells, eighteen had hemotympanon. Eight patients had air in the ipsilateral temporomandibular joint fossa. Eight had pneumocephalus, one patient with pneumolabyrinth. Thirteen fractures were longitudinal, two mixed and one oblique, according to the older system. Three fractures violated the otic capsule, according to the new system, and one disarticulated the ossicular chain. Two patients were diagnosed with sensorineural hearing loss and one patient with conductive hearing loss. Four patients had signs of temporal trauma but CT didn't reveal the fracture line.

Conclusion: The new classification system (otic capsule sparing versus otic capsule violating) demonstrates predictive ability, according to bibliography, relatively to the traditional one, and combines the radiographic signs with their neurologic impacts. The radiologist should be familiar with the classification systems, as his/her task is to reveal clinically silent temporal fractures in a head trauma patient suffering from more severe pathology.

B-816 15:03

also EPOS

Prenatal imaging of facial clefts by two-dimensional and three-dimensional ultrasound and fetal magnetic resonance

V. Frisova, M. Kyncl, B. Prosova, L. Mrazkova, M. Rocek; *Prague/CZ (veronika.frisova@gmail.com)*

Purpose: Facial clefts are common congenital abnormalities affecting about 1 in 700 live births. The diagnostic accuracy of prenatal ultrasound is limited and only little data about MRI have been published yet. The purpose of our study was to compare the feasibility and accuracy of prenatal two-dimensional (2D) and three-dimensional (3D) ultrasound and magnetic resonance (MRI) in evaluation of the fetal lip and palate.

Methods and Materials: Seven patients referred for suspected fetal facial anomaly on the scan or family history of facial clefts underwent examination both by ultrasound and by MRI. Ultrasound examination included 2D imaging with consequent 3D volume acquisition (GE Voluson 730 Expert). Fetal MRI was performed on Philipps Gyroscan Intera 1.5 T with additional Sence Cardiac Coil on maternal abdomen. Imaging included sB-TFE and SS-T2/TSE sequences in three planes. Retrospective analysis of US and MRI data was performed. Outcomes were obtained from the mother or from the labor ward.

Results: Ultrasound and MRI were equally precise in evaluation of facial clefts. 2D and 3D ultrasound and MRI are comparable in evaluation of fetal lip; however, 3D ultrasound with MRI allowed higher confidence in decision about presence/ absence of cleft palate.

Conclusion: The feasibility and accuracy of 2D/3D MRI and ultrasound is highly influenced by experience of the operator. In expert hands, US is comparable with MRI; however, we believe that the combination of imaging methods increases the diagnostic accuracy thus allowing easier counseling of parents. Supported by the grant of MZO 00642036312

Monday

B-817 15:12

Computed tomography (CT) multislice dentascan: A new protocol to reduce the radiation dose

P. Caruso, E. Tagliafico, F. Adinolfi, M. Costa, B. Giardina, T. Luminati; *Genoa/IT (pietro.caruso@oeige.org)*

Purpose: The request of dental CT has significantly increased also in young patients for the development of new implantologic techniques. The purpose of our work is to set a CT protocol to reduce significantly the radiation dose, maintaining both panoramic and accuracy features that are intrinsic to such imaging technique. **Methods and Materials:** A multi-detector CT provided with a Dentascan software was used for our study. The first phase of our study was conducted on a phantom, in order to set a low-dose protocol. During this phase, we measured the dose absorbed by the phantom with a standard protocol and with our new low-dose protocol. In a second phase, we used the new protocol on 90 patients presented at our Institution to undergo a CT scan of the upper and lower dental arcade. CT images were reviewed by a radiologist and by a dentist in consensus. **Results:** Mean dose administered by the standard protocol was 48.4 mGy, while it was 8.1 mGy with the low dose protocol (p <.001). Both radiologist and dentist did not assess a relevant loss of quality with the low-dose protocol compared to standard protocol. **Conclusion:** Our new low-dose CT protocol seems to be effective in the evaluation of dental arcades. Even though the dose administered to the patient remains higher if compared to the dose administered by a dedicate cone-beam CT, the latter seems to be poorly effective in the evaluation of classes 2 and 3 according to Misch classification.

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

Physics in Radiology

SS 1713

Image quality and quality control

Moderators:
T. Lehnert; Frankfurt a. Main/DE
R. Padovani; Udine/IT

B-818 14:00

Volume cerebral blood flow (CBF) measurement using an interventional ceiling-mounted C-arm angiography system

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Purpose: Measuring CBF in the angiographic suite using a C-arm CT system may help optimize management of stroke patients during interventional therapy. **Methods and Materials:** Our new scanning protocol uses multi-sweep acquisitions with a C-arm angiography system to calculate 3-D images (Axiom Artis dTA, DynaCT, Siemens). Each acquisition (6 consecutive bi-directional sweeps, 5.5 s per sweep) has a different injection delay to increase temporal sampling (TS). Our new interpolation algorithm reconstructs 4-D data which are then processed using deconvolution to compute the whole-brain CBF map. We investigated different injection and acquisition protocols in 5 perfusion-normal pigs (injection location, injection rate 1.5-6 ml/s, contrast concentration 50-100%, injection duration 4-8 s) with CT as the gold standard. From a total number of 6 acquisitions, additional subsets of 3 and 2 acquisitions were taken to investigate different TS options. After registering the C-arm CT and CT data, the mean CBF was computed in six circular ROIs (radius 2 mm) per slice placed in corresponding areas in each hemisphere in three slices. **Results:** Injection rate of 6 ml/s, for 8 s, 50% dilution with catheter just proximal to the right carotid provides the most uniform contrast enhancement. All three TS options showed good qualitative agreement of the CBF values compared to CT measurements. There was good correlation (r > 0.79, p < 0.001) between the C-arm and CT CBF values. **Conclusion:** We have optimized acquisition parameters for perfusion measurement in the angio suite using a C-arm CT system, and demonstrated that two multi-sweep acquisitions can already provide adequate temporal sampling.

B-819 14:09

Application of a protocol for the assessment of digital radiography imaging systems

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Purpose: To trial a digital radiography quality assurance protocol from the forthcoming report from the Institute of Physics and Engineering in Medicine (IPEM). **Methods and Materials:** This protocol was applied to a group of six identical Caesium Iodide digital X-ray detectors to assess reproducibility, while three further detectors were assessed to examine the wider applicability. Ten images with minimal spatial frequency processing were acquired from which the detector response, lag, modulation transfer function (MTF), normalized noise power spectrum (NNPS) and threshold contrast-detail (c-d) detectability were calculated. The X-ray spectrum used was 70 kV and 1 mm added copper filtration, with a target detector air kerma (DAK) of 2.5 µGy for the NNPS and c-d results. **Results:** The images were typically acquired in 20 minutes, with a further 30 minutes required for analysis. Average spatial frequency for the 50% point of the MTF for six identical detectors was 1.29 mm^{-1} ± 0.05 (3.9% coefficient of variation (cov)). The DAK set for the six systems was 2.57 µGy ± 0.13 (5.0% cov) and the NNPS at this DAK was 1.42 x 10^{-5} mm^2 (6.5% cov). Average threshold contrast for the six detectors was 0.4% at 11.1 mm; cov for the c-d results ranged from 9 to 35% depending on disc diameter, indicating poorer reproducibility than the quantitative results. NNPS and MTF clearly differentiated between the four different detectors. **Conclusion:** The IPEM protocol was quick, reproducible and gave an in-depth assessment of performance for a range of digital X-ray detectors using quantitative measurements.

B-820 14:18

Initial experience with constancy checking of digital breast tomosynthesis systems

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Purpose: To report on our initial experience with constancy checking of digital breast tomosynthesis (DBT) systems. **Methods and Materials:** Based on our previously developed DICOM analysis software for 2D mammography quality control, we created a vendor independent analysis method to perform constancy checking of DBT systems. Where available, both the projective images and the reconstructed tomographic planes of a homogeneous phantom (4 cm of PMMA) are used for the analysis. The uniformity of each tomographic plane is represented in analysis volumes for different parameters (mean pixel value, signal-to-noise ratio (SNR), standard deviation, variance). Noise analysis is performed by calculating plane noise power spectra (NPS) and inter plane co-variance graphs. Relevant DICOM headers are stored for follow-up in time. This method was tested on two prototype systems (Siemens Mammomat NovationTOMO and InspirationTomo prototype) and one commercially available system (Hologic Selenia Dimensions) for 20 successive days. As a proof of concept, the proposed methods have also been utilized on the GE Healthcare Senographe DS modified for tomosynthesis investigation and the IMS Giotto prototype (Bologna, Italy). **Results:** Datasets of all tested systems could be analyzed successfully. The current method is sensitive for (simulated) changes in beam quality and the analysis volumes were useful for the detection of deviations in volume uniformity, potentially indicating detector artifacts or failing read-out electronics. Also, the projective data gave valuable information on detector artifacts, lag, angular deviations and temporal changes in detector temperature. **Conclusion:** The proposed approach is a promising method for performing constancy checks on DBT systems.

B-821 14:27

New phantom concept for double-energy contrast-enhanced digital mammography

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Purpose: Contrast-enhanced Digital Mammography (CEDM) is a recent development based on intra-venous injection of iodinated contrast medium. Two techniques were developed: temporal subtraction and dual energy (DE) where two images are acquired with different spectra and recombined into one image representing the iodine content in the breast. A specific phantom is designed to assess the quality of this image. **Methods and Materials:** Combinations of High-density Polyethylene (HDPE, C_2H_4, 0.95 g/cm³) and water were chosen to simulate breast tissues, for their chemical

compositions and densities close to those of adipose and glandular tissues as described by Hammerstein (1979). A polymethylmethacrylate (PMMA) plate derived from the linearity insert of AAPM report 15 contains two series of iodinated zones with surface densities determined from clinical images. The first series covers these densities. Two areas of different equivalent glandularities and constant thickness overlap each half of these iodinated zones. The second series of constant iodine density is partially overlapped with a glandularity stepwedge (0-100%).

Results: Determined iodine densities are between 0.25 and 4 mg/cm². 1 cm glandular tissue is simulated with 0.09 cm HDPE and 0.94 cm water (error < 1%) and 1 cm adipose tissue with 0.64 cm HDPE and 0.31 cm water (error < 0.6%). Measurements in narrow beam conditions of image signal on a digital mammography system gave an average error of 5.8% vs. usual breast equivalent slabs (CIRS).

Conclusion: This method allows designing a phantom of iodine-injected breast adequate for image quality assessment of DE-CEDM. It is low cost and provides good flexibility for multiple thickness and glandularity configurations.

B-822 14:36

also EPOS

Application of monochromatic images in artery stent assessment using CT spectral imaging: A phantom study

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Purpose: CT spectral imaging is capable of creating monochromic images so that high keV images with small beam hardening artifacts can be used for artery stent assessment. In this study, we compare the measured in-stent luminal diameter (ISLA) using monochromic images with the measured ISLA using 140 kVp image.

Methods and Materials: A coronary artery stent phantom (Cypher-2.5 mm) filled with contrast fluid and surrounded by water was scanned using a high definition CT in spectral imaging mode and the scan was repeated using 140 kVp in helical mode. Eleven monochromatic images (40 - 140 keV, 10 keV increment) and one 140 kVp image were reconstructed. The in-stent luminal diameter (ISLA) was measured as the full width half maximum (FWHM) of the attenuation profile across the stent at six different stent locations. The measured ISLA was then compared between the monochromic images and the 140 kVp image using Mann-Whitney test.

Results: The accuracy of measured ISLA increased with the increase of keV in the monochromic images. For monochromic energy below 90 keV, the measured ISLA (40 keV: 46+2%; 50 keV: 47+2%; 60 keV: 48+2%; 70 keV: 48+2%; 80 keV: 49+2%) was found comparable to the measured value in the 140 kVp image (47±2%). For those at higher energies, statistical significantly (p < 0.05) better results were obtained (90 keV: 49+2%; 100 keV: 50+3%; 110 keV: 50+3%; 120 keV: 50+3%; 130 keV: 52+4%; 140 keV: 53+3%).

Conclusion: The accuracy of the artery stent assessment can be improved using high keV monochromic images in CT spectral imaging.

B-823 14:45

Lesion detectability in digital mammography and digital breast tomosynthesis: A phantom study

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Purpose: The complexity of anatomical structure within the breast represents the ultimate limit to signal detection in a mammogram. To increase lesion conspicuity Digital Breast Tomosynthesis (DBT) has been recently proposed and several manufacturers are currently performing clinical trials. In this study, we have compared lesion detectability performance of digital mammography and DBT by making use of a phantom in which details of interest are within a heterogeneous background.

Methods and Materials: The breast phantom, CIRS (USA) model no. 020 BR3D, consists of various slabs made of heterogeneous tissue-equivalent material that exhibits characteristics of real breast tissue. Between these slabs, we have inserted thin layers of homogeneous material containing details of mammographic interest to simulate lesions. A commercial digital mammography unit and a DBT prototype, both manufactured by IMS (Italy), have been used for our study. The 3D reconstruction software is provided by Dexela (UK). 2D and 3D images of the breast phantom have been obtained at various dose levels to compare performance of the two modalities.

Results: Comparison between 2D and 3D images recorded at similar dose levels shows superior performance of DBT over digital mammography. Indeed, whilst certain details of interest are not detectable for any dose level with digital mammography, DBT can reveal their signal by reducing complexity of tissue structures.

Conclusion: This preliminary investigation demonstrates that in terms of physical image quality, the inherent limitations of 2D mammography due to structure noise can be overcome by the introduction of 3D reconstruction via breast tomosynthesis.

B-824 14:54

Physical characterization of a novel wireless detector for digital radiography

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Purpose: Digital radiography (DR) technology has been the subject of great development to make the DR more suitable for clinical practice. One of the limiting factors of a DR system with respect to a computed radiography (CR) system was the inability to perform certain specific examinations due to the form factor of the DR detector. To address this problem, a novel wireless DR clinical system for general radiography has recently been introduced. The detector is based on indirect conversion using a Gadolinium-oxysulphide phosphor (Gd_2O_2S (Tb)). This unit, named DRX-1 (manufactured by Carestream Health), is based on a-Si:H photodiode and TFT technology. The goal of this work is to characterize the imaging performance of the device.

Methods and Materials: The physical characterization was measured in terms of performance metrics such as Modulation Transfer Function (MTF), Noise Power Spectra (NPS), Detective Quantum Efficiency (DQE), and contrast-detail (CD) analysis. The psychophysical characterization of the CD data was performed using custom evaluation software. The detector was tested under exposure to five different IEC specified beams: RQA 3, 5, 7, and 9.

Results: The measured MTF values were consistent with those reported for other phosphor based imaging systems ($h_{50} \sim 1.2$ lp/mm). The DQE (0) values were respectively 25, 32, 33, and 25% for RQA 3, 5, 7, and 9. Contrast detail analysis results were comparable with results from a CsI DR under identical acquisition conditions.

Conclusion: The measured physical characteristics of DRX-1 are comparable with other digital imaging system widely used in clinical practice.

B-825 15:03

Image quality performance evaluation of digital breast tomosynthesis on a GE senographe essential system

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Purpose: New methodologies are needed to provide measurements for image quality evaluation in digital tomosynthesis. We applied classical and novel methods to the comparison between a Senographe DS, previously used in clinical trials for tomosynthesis, and a Senographe Essential used in tomosynthesis mode.

Methods and Materials: Image quality in digital breast tomosynthesis (DBT) depends on acquisition parameters, detector performance, and reconstruction algorithms. Image quality measurement is done in projection views for DQE and in reconstructed DBT slices for quantum-limited performance and image uniformity (brightness, signal-to-noise, and resolution uniformity). Radiation quality using rhodium anode and filter at 30 kVp, typical of clinical use, was preferred over the normative molybdenum anode and filter at 28 kVp. New methods for evaluation of quantum-limited performance and image resolution uniformity are presented, and results from the new system are compared to those of the Senographe DS DBT system.

Results: The DQE of Senographe Essential in clinical tomosynthesis mode approaches 70% at 0.5 lp/mm and 8.7 µGy/view, substantially exceeding that of the Senographe DS. Quantum-limited operation is evaluated in the reconstructed volume, and Senographe Essential exhibits quantum-limited performance down to 8.7 µGy/view. Image brightness uniformity, SNR uniformity and resolution uniformity are on a par with the Senographe DS. Resolution uniformity measurements reveal the importance of proper sampling of the volume along the vertical axis.

Conclusion: The performance of the Senographe Essential in tomosynthesis mode is in line with expectations, offering similar image quality at 30% lower dose than Senographe DS.

B-826 15:12

Performance assessment of dynamic spiral scan modes with variable pitch for quantitative perfusion computed tomography

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Purpose: Spatial coverage in dynamic contrast enhanced CT can be increased beyond the physical detector width using spiral scanning techniques with continuous periodic table movement and variable pitch (A4DS: adaptive 4D spiral). We compared perfusion values acquired with A4DS techniques with results from standard dynamic scans at different temporal sampling rates.

Methods and Materials: A biological perfusion phantom (preserved porcine kidney) was scanned with both techniques. In standard mode, three scans were performed at adjacent overlapping positions (detector width 38.4 mm) covering the whole phantom with temporal resolutions of 0.5, 1.0 and 1.5 s. The A4DS scans

were performed with a cycle time of 1.5 s and scan ranges of 100 and 148 mm, respectively. The phantom was not moved between scans to assure that identical image slices showed identical phantom slices. Tissue flow was calculated with a deconvolution type algorithm optimized for heterogeneous temporal sampling. Regions of interest were drawn in strongly and moderately enhancing areas and around the whole cortex in three slices in the upper, central and lower portion of the phantom.

Results: In the flow range of 40 to 100 ml/100 ml/min, values did not differ by more than 5 ml/100 ml/min between any of the scan modes. Correlation between continuous table movement modes and any of the standard modes was excellent (r> 0.98); regression slopes never differed from unity by more than 2%.

Conclusion: Dynamic spiral scan modes with variable pitch allow increasing the coverage for perfusion measurements by almost a factor of four without a significant reduction in accuracy.

B-827 15:21

also EPOS

Impact of clinical image processing algorithms on the detectability of microcalcification clusters in digital mammography

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Purpose: To evaluate the impact of two commercially available image processing algorithms on the detection of microcalcification clusters in digital mammography.
Methods and Materials: A database of 200 normal digital mammograms clinically acquired with the Siemens Mammomat Novation DR was collected retrospectively. Clusters of microcalcifications were simulated in half of the raw images (n=100), i.e. before image processing. The methodology to simulate microcalcifications was validated in an earlier study. Subsequently, all raw images were processed with two different image processing algorithms (Siemens OpView v1 and Siemens OpView v2). Radiologists interpreted all processed mammograms (n=400) using the multi-reader multi-case (MRMC) receiver operating characteristic (ROC) paradigm. The Dorfman-Berbaum-Metz (DBM) ROC analysis was performed on ROC data for assessing the significance of difference between the calculated Figures of Merit (FoMs), representing the radiologists' performance. The proper ROC (PROPROC) fitted area under the ROC curve (AUC) was chosen as FoM.
Results: Statistically significant difference was found between Siemens OpView v2 and OpView v1 (p-value = 0.02), with Siemens OpView v2 having the highest AUC for all radiologists (average AUC= 0.90, range from 0.88 to 0.92). Average AUC for OpView v1 was 0.87 (range from 0.84 to 0.90).
Conclusion: These results demonstrate that image processing has a significant impact on the detectability of microcalcification clusters. Therefore, objective and quantitative measurements should be used by manufacturers to select and further optimize image processing algorithms.

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

Computer Applications

SS 1705

Image interpretation and decision making

Moderators:
T. Baumann; Freiburg/DE
S. Wildermuth; St. Gallen/CH

B-828 14:00

also EPOS

CT colonography with color coding by means of open source software (OsiriX): A new approach to primary 2D reading

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Purpose: To assess the usefulness of color coding for primary 2D reading of CT colonography (CTC) images by means of open source software (OsiriX).
Methods and Materials: Thirty patients with fifty-two colonic lesions (10 flat lesions, 4 polyps sized < 6 mm, 20 polyps sized 6-10 mm, 13 polyps sized 10-30 mm, and 5 colonic masses) underwent CTC in the supine and prone position with a low radiation dose protocol. After DICOM export via PACS to a Macintosh computer running OsiriX 3.5.2, CTC datasets were read as 2D axial source images with standard bone visualization window (300 HU level, 1500 HU width) and no color look-up table (CLUT), and subsequently reviewed in blind with a customized window (-220 HU level, 1800 HU width) and a dedicated CLUT (GEcolor). Lesion conspicuity was expressed through a semiquantitative scale from 1 (poor) to 4 (excellent). Absolute maximum lesion size in millimeters was also recorded.

Results: Visualisation of all lesions was significantly better with than without color coding (mean ± standard deviation: 3.69 ± 0.51 vs 3.17 ± 0.96, p = 0.0003), and in particular that of flat lesions (3.60 ± 0.52 vs 2.30 ± 1.16, p = 0.0126). Lesion conspicuity with color coding was better in 20/52 lesions (38.5%), equal in 30/52 lesions (57.7%), and worse in 2/52 lesions (3.8%). Finally, a significant inverse correlation was found between image quality improvement with color coding and lesion size (r_s = -0.4219, p = 0.00184).
Conclusion: Usage of color coding for primary 2D reading of CTC images can improve visualisation of colonic lesions, especially of small polyps and flat lesions.

B-829 14:09

also EPOS

CT perfusion based characterisation of lung nodules using hepatic perfusion software: Bronchial artery vs pulmonary artery, which supplies the lesion?

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Purpose: To characterize lung nodules based on its arterial supply using hepatic perfusion software (HPS). To differentiate malignant lesions (ML) from benign lesions (BL) based on the arterial supply.
Methods and Materials: 62 histopathologically proven lung nodules which were examined with 64-slice-MDCT were included. Of the 64 lesions, 40 were ML and 24 BL served as controls. In all 64 lesions, CTP parameters were compared. HPS was used: hepatic artery ROI was taken at aorta as bronchial artery (BA) and portal vein at pulmonary artery (PA), splenic ROI at chest wall muscle. Bronchial Perfusion (BAP), Pulmonary perfusion (PAP), Total perfusion (TP) and Perfusion index (PI) were calculated. General perfusion software (GPS) was also used and compared with HPS: BF, PEI, TTP, BV and MTT were calculated. Statistical ratios were calculated.
Results: Using HPS, we deduced that ML were predominantly supplied by BA and had minimal PA perfusion. The ratio of BAP to PAP was 9.1:1 ± 2.4 which was statistically different from BL (p < 0.0001). BL showed low BAP and high PAP and ratio of BAP to PAP was 1:8.3 ± 1.7. ML showed higher PI which was statistically different from BL (p < 0.001). Routine GPS calculation showed: Except for MTT and TTP, which was statistically (p < 0.0001) lower in ML, all CTP parameter values were significantly (P < 0.0001) higher in ML when compared to the ML.
Conclusion: The preliminary results show that using HPS lesion vascularity (BA vs PA) can be shown and lesion characterization can be done which will significantly add relevant information to results based on the GPS and conventional contrast CT.

B-830 14:18

Automated segmentation of pleural effusions in MDCT

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Purpose: To develop and evaluate an algorithm for fully automatic segmentation of pleural effusions in MDCT.
Methods and Materials: A 7-step algorithm for automated segmentation of pleural effusions in MDCT datasets was developed in the C++ programming language, utilising routines from the ITK image processing library. Automated segmentation of pleural effusions was performed in 40 MDCT datasets of the chest that were randomly chosen from the hospital's digital PACS archive. Manual segmentation and volumetry of pleural effusions served as the gold standard. The accuracy of the automated segmentation was quantified based on the differences of the segmented volumes, the degree of over-/undersegmentation and the Hausdorff distance.
Results: The mean volume of the pleural effusions was 557.30 ml (±477.27 ml) for the automated and 553.19 (±473.49 ml) for the manual segmentation. The difference was not statistically significant (student's t-test, p=0.133). Regression analysis confirmed a strong relationship between the automated algorithm and the gold standard (r sq=0.998). Mean overlap of the segmented areas was 79% (± 9.3%) over all datasets with moderate oversegmentation (22 ± 9.3%) and undersegmentation (21 ± 9.7%), respectively. Mean Hausdorff distance was 5.66 mm (±8.35 mm). Mean duration of the automated segmentation process was 8.4 minutes (±2.6 minutes) as compared to 32.9 minutes (± 17.4 minutes) for manual segmentation, resulting in a mean reduction of 68.6% in segmentation time.
Conclusion: An automated algorithm for segmentation and volumetry of pleural effusions in MDCT datasets was successfully implemented. Initial results show a high diagnostic accuracy when compared with manual segmentation.

B-831 14:27

Feasibility of semi-automated tumor response assessment of liver metastases according to RECIST guidelines

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Purpose: To evaluate the feasibility of semi-automated compared to manual tumor response assessment (TRA) of liver metastases according to RECIST (Response Evaluation Criteria in Solid Tumors).

Methods and Materials: In total, 32 consecutive patients with colorectal-cancer and liver metastases (mean 3.2) were followed by in mean 2.8 contrast-enhanced CT examinations (70 s delay, 3 mm slice thickness, 2.5 mm increment). Two radiologists (R1, R2) measured the longest axial diameter (LD) of 269 liver metastases manually and semi-automatically using a post-procession software package installed as thin-client on a PACS workstation. Measurements of the LD and TRA ('progressive disease', 'stable disease', 'partial response') were performed according to RECIST and analyzed for between-method, interobserver and semi-automated intraobserver variability. Additionally, the time needed for evaluation was compared for both methods.

Results: Altogether, measurements showed an excellent concordance correlation coefficient (r>= 0.96). Intraobserver differences in semi-automated LD (mean, 1.4±2.6 mm), interobserver differences in manual LD (mean, 1.9±1.9 mm) and LD differences between methods performed by R1 (mean, 2.1±2.0 mm) did not vary significantly. Differences in LD between both methods performed by R2 (mean, 2.6±2.0 mm) and interobserver differences in semi-automated measurements (mean, 3.0±3.0 mm) varied significantly (p < 0.01). Interobserver agreement in manual and semi-automated TRA were 91.4% for each. Between both methods an agreement in TRA of 86.2% was obtained by each observer. Intraobserver agreement in semi-automated TRA was 84.5%. Semi-automated (2.7 min) compared to manual (2.3 min) evaluation took slightly more time (p < 0.01).

Conclusion: At present, semi-automated and manual evaluation of liver metastases yield comparable results in response assessments and require a comparable effort.

B-832 14:36

The impact of 3D-stereoscopy on the approximation of distances

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Purpose: To evaluate if the use of 3D-stereoscopic display enhances the approximation of distances concerning accuracy and confidence.

Methods and Materials: A model of different sized blocks was build and scanned. 31 readers (17 radiologists (group 1), 14 non-radiologists (group 2)) were asked to estimate without additives 9 defined distances on the virtual model with (3D-stereo) and without 3D-stereoscopy (3D-mono), with (moved) and without moving (static), and on native model (model). Gold-standard was the measured distances. The readers had to note the degree of confidence on a visual analogue scale. The mean total error (error) and mean confidence (confidence) for all modalities were compared among each other in both groups (t-test).

Results: Group 1 showed a higher mean error compared to group 2 for 3D-mono-static (p=0.009), 3D-mono-moved (p=0.045), 3D-stereo-static (p=0.087), and model (p=0.038). No significant error difference was found in both groups comparing 3D-stereo-moved to model (p=0.17 (group 1) and p=0.406 (group 2)). Group 1 showed a significant error difference between 3D-mono-moved and 3D-stereo-moved (p=0.044). Group 2 showed significant error differences between 3D-mono-static and all other modalities (p=0.001-0.042), and between 3D-mono-moved and 3D-stereo-static to model (p=0.008 and p= 0.014). Group 1 had an increase of confidence comparing 3D-mono and 3D-stereo to model (p=0.001 and 0.002). Group 2 had an increase of confidence comparing static to moved for both modalities (p=0.002-0.006).

Conclusion: 3D-stereoscopic display has a limited impact on accuracy of distance approximation although there is an increase of user confidence.

B-833 14:45

also EPOS

Segmentation of complex liver metastases in CT scans for reliable chemotherapy monitoring

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Purpose: In oncological therapy monitoring, an estimation of the change in size of a tumor is an important criterion for the assessment of treatment success. We present a semi-automatic segmentation algorithm that determines the 3D volume of a liver metastasis in addition to the established RECIST diameter.

Methods and Materials: We developed a hybrid two-step method that is initialized by a manual stroke across the tumor. First, a coarse segmentation is generated by adaptive thresholding based on a histogram analysis of the stroke and the region around the tumor. Second, structures of similar density adjacent to the tumor are removed by model-based morphological processing. Special handlings have been developed for tumors close to the organ boundary and rim-enhancing metastases. We evaluated the results of our method by calculating the volume overlap and RECIST agreement with reference segmentations provided by two radiologists on 136 complex liver metastases from 47 patients and 4 sites.

Results: The average volume overlap compared to the ground truths is 82% and the average relative difference to the reference RECIST diameter is 7.8%. For the reproducibility test, we generated random strokes through the lesion and calculated the mean coefficient of variation for the volumes which is 12.6%. The average runtime of the algorithm is 1.6 s.

Conclusion: Our algorithm is fast and provides volumetric measurements with a high accuracy and reproducibility. In combination with a manual correction method, it can be used to achieve reliable conclusions about the response of a liver metastasis under therapy.

B-834 14:54

Evaluation of global left ventricular function with DS-CT: Comparison of three workstations with magnetic resonance as gold standard

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Purpose: To compare the accuracy and reliability of left ventricular (LV) volumes assessment of three different workstations (WS) and to compare results to cine MRI as standard reference.

Methods and Materials: Two expert radiologists evaluated DS-CTCA 30 dataset on three different WS: Leonardo (Siemens), Aquarius (Terarecon) and Vitrea (Vital). LV end-diastolic (EDV) and end-systolic volumes (ESV) and ejection fraction (EF) were evaluated for each WS using an automatic and semiautomatic analysis. Mean time, inter-reader and intra-reader agreement were calculated. Results were compared with those obtained by cine MRI.

Results: A low correlation between the automatic method and MRI results was found for all workstations. Correlation and Bland and Altman plots between DS-CT and MRI, obtained with the semiautomatic analysis on all WS were good (r2 = 0.81, 0.86 and 0.83, respectively). A constant error was found for all WS (+5%, -3% and +4%) for the automatic evaluation of EF. Mean time was significantly shorter for Leonardo WS (8'35") compared to Vitrea WS (10'20") and not significantly longer than for Aquarius WS (7'32"). Intra-reader agreement was good for all WS (wK=0.83, 0.79 and 0.81). Inter-reader agreement was significantly better for Leonardo and Aquarius than for Vitrea (wK=0.85 and 0.91 Vs wK=0.75).

Conclusion: A good correlation with MRI was obtained for all workstations using a semiautomatic analysis. However, Vitrea WS is more time consuming when a semiautomatic evaluation is used.

B-835 15:03

Performance of an prototype computer aided diagnosis (CAD) tool for the volumetric assessment of lymph nodes at multidetector-row CT data

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Purpose: Accurate volumetric evaluation of lymph nodes at CT-scans is one of the most difficult tasks in radiology, for radiologist readers as well as a computer program.

Methods and Materials: 38 MDCT datasets of the neck, chest or abdomen were obtained anonymously from 21 patients selected randomly from routine clinical cancer staging. Axial images of 3 mm slice width and a slice increment of 2 mm were analyzed by an experienced radiologist reader who drew an outline accurately around a total number of 105 pathological lymph nodes on all slices involved by the lesions. Furthermore, all studies were submitted to a CAD tool (Definiens AG, Munich, Germany) for volumetric assessment using a context driven CAD algorithm.

Results: Comparing all lymph node volumes derived from CAD to the ones from gold standard a mean discrepancy of 1.1 ccm (12.4%) at a standard deviation of 3.4 ccm and a variability of 6.6 ccm was found. Excluding the 21 (20%) lymph nodes with the most complex environment based on the previously established four-point scale, a superior accuracy of a mean discrepancy of 0.3 ccm (10.5%) at a standard deviation of 0.8 ccm and a variability of 1.5 ccm could be achieved.

Conclusion: The prototype CAD tool investigated showed a surprisingly high accuracy in volume measurement in 80% of the lymph nodes assessed. The accuracy achieved on the tested data proved to be significantly higher than in manual diameter measurements between two human readers reported by literature and would be sufficient for immediate clinical utilization.

Monday

B-836 15:12
Evaluation of a method of computed-aided detection (CAD) of pulmonary nodules at computed tomography

G. Foti, N. Faccioli, A. Contro, T. Milazzo, M. D'Onofrio, R. Pozzi Mucelli; *Verona/IT*

Purpose: To compare sensitivity and reading time obtained using CAD software as second reader (SR) or concurrent reader (CR) in identifying pulmonary nodules at chest CT.

Methods and Materials: Non-enhanced CT scans of 100 consecutive oncologic patients were retrospectively reviewed by 4 readers in order to identify solid pulmonary nodules measuring 3 to 30 mm in diameter. Reference standard was achieved by a consensus reading of the 4 readers. McNemar test was used to compare sensitivities obtained, at 3 and 5 mm thresholds, by reading without CAD (readers 1 and 2), with CAD as SR (readers 1 and 2 with 2 month delay), and CAD as CR (readers 3 and 4). The paired student's t test was used to compare reading time. A value of $p < 0.05$ was considered significant.

Results: Two hundred-fifty-eight and 224 nodules at 3 and 5 mm thresholds were, respectively, identified. CAD standalone sensitivity was 62.79 and 67.41%, respectively, at 3 and 5 mm thresholds, with 4.15 and 2.96 FP findings per exam. CAD as SR allowed a significant increase of sensitivity in the identification of pulmonary nodules compared to reading without CAD both at 3 and 5 mm thresholds ($p < 0.001$). CAD as CR allowed a non-significant increase of sensitivity compared to reading without CAD ($p > 0.05$). Reading time using CAD as SR was longer than reading without CAD ($p < 0.001$) and with CAD as CR ($p < 0.025$).

Conclusion: CAD as SR, with longer reading time, increases sensitivity if compared to reading without CAD ($p < 0.001$) or with CAD as CR ($p < 0.025$).

B-837 15:21
Computer-aided detection and assessment of non-small-cell lung cancer (NSCLC) using a novel PET/CT software tool: Initial results

S. Hahn[1], T. Heusner[1], X. Zhou[2], A. Bockisch[1], M. Forsting[1], G. Antoch[1]; [1]*Essen/DE*, [2]*Malvern, PA/US (steffen.hahn@uk-essen.de)*

Purpose: To determine the feasibility of a prototype PET/CT software tool (PET-Computer-Aided-Detection / PET-CAD) for automated detection and assessment of lung lesions.

Methods and Materials: 20 patients with NSCLC were examined with FDG-PET/CT. A threshold was manually determined by examining the maximal standardized uptake value (SUV) of non-tumorous lung tissue. The manually determined threshold was then used for lung lesion detection and assessment on PET. The number of lesions detected, their maximal SUVs, and sizes in the x-, y-, and z-planes, as automatically provided by the software, were compared with visual lesion detection and with manual lesion measurements on CT.

Results: The sensitivity for automated detection of lung lesions was 90% (19 of 21 lesions detected), 2 lesions were false negative, 9 lesions were false positive. The mean of the max SUVs of all lesions was 9.3 ($\pm$ 6.5), while that of true-positive lesions was 10.4 ($\pm$ 6.8). The two false-negative lesions had SUVs of 17.2 (falsely assigned to the liver) and 1.6 (not detected). The mean lesion sizes in the x-, y-, and z-planes were 7.4 cm ($\pm$ 4.7 cm), 7.7 cm ($\pm$ 4.7 cm), and 8.4 cm ($\pm$ 5.7 cm), respectively, when assessed by PET-CAD. On manual measurements, lesion sizes were smaller in all planes with 5.8 cm ($\pm$ 2.7 cm), 6.1 cm ($\pm$ 2.6 cm), and 7.1 cm ($\pm$ 3.2 cm) for the x-, y- and z-planes, respectively.

Conclusion: Automated software-based organ segmentation and PET lesion assessment will be available for PET/CT image evaluation. These novel software tools are expected to substantially improve clinical PET/CT workflow in NSCLC patients.

Neuro

SS 1711
Advanced MRI: High field and new techniques
Moderators:
P. Barsi; Budapest/HU
J. Frühwald-Pallamar; Vienna/AT

B-838 14:00
Effects of 7 Tesla head MRI on postural stability

J.M. Theysohn[1], A.K. Bitz[1], M. Gerwig[1], D. Timmann[1], F. Schmitt[2], E.R. Gizewski[1], M. Forsting[1], M.E. Ladd[1], S.C. Ladd[1]; [1]*Essen/DE*, [2]*Erlangen/DE (jens.theysohn@uni-duisburg-essen.de)*

Purpose: Ultra high-field MRI (7 Tesla and above) generates more temporary side-effects compared to 1.5 T, e.g. dizziness. Moreover, some subjects report a subjective postural instability shortly after the examination, even outside the scanner room. The current study aims at quantitatively assessing this subjective effect by measuring postural instability before and after a 7T examination.

Methods and Materials: Twenty-five volunteers performed stability-of-stance tests (while standing on a foam cushion in Romberg's position, and with feet close together, duration: 30 s; variable: eyes open/closed) before (reference), 5 minutes after, and 15 minutes after a 7T head examination (45 minutes, Magnetom 7T, Siemens Healthcare, Germany), using an 8-channel transmit/receive head coil (Rapid Biomed, Germany). Additionally, fifteen of these performed a control study (separate day) resting on a gurney outside the scanner room (replacing MRI), to exclude physiological effects by orthostatic regulation. Analysis of the body motion was performed by an ultrasound real-time measuring system (Zebris Medical Systems, Germany). Sway path length of the lumbar spine was analyzed and compared for different time points and regarding different eye states using one-way ANOVA and post-hoc Bonferroni.

Results: Sway path length showed a significant ($p < 0.011$) increase for closed eyes 5 min after MRI examination, indicating a postural instability, which was normalized after 15 min, and which can be attributed to the vestibular system. The control group without MRI exposure showed no relevant changes over time.

Conclusion: 7T MR examination of the head seems to cause a dysfunction of the vestibular system, but only temporarily.

B-839 14:09
Magnetic resonance imaging of cranial nerves at 7 Tesla

A.E. Grams, O. Kraff, S. Orzada, S. Maderwald, J. Kalkmann, M.E. Ladd, M. Forsting, E.R. Gizewski; *Essen/DE (astrid.grams@uk-essen.de)*

Purpose: The aim of this study was to demonstrate the feasibility of cranial nerve (II - XII) imaging with 7 Tesla MRI. Due to an increased SNR and a higher spatial resolution with increasing magnetic field strengths, a high detection rate for small anatomical structures such as the CNs is expected. On the other hand, due to more pronounced susceptibility effects, a reduction in imaging quality is assumed.

Methods and Materials: Four consecutive volunteers were examined with a 7T whole-body scanner and a custom-built 8-channel transmit/receive head coil. Four sequences were evaluated: a 3D-MPRAGE, a 3D-CISS, a 3D-TrueFISP and a 2D-T2-TSE sequence. Due to vendor limitations, no parallel imaging could be performed in the CISS. Cranial nerve identification rate was evaluated with a previously established three-point scale, and the presence of artifacts or other imaging limitations was described.

Results: TrueFISP, although suffering from severe banding artifacts, provided the best identification rate, and 83% of the nerves could be identified with certainty in this sequence (62% in the CISS and the MPRAGE, and 42% in the T2-TSE). MPRAGE provided little contrast between CNs and CSF in some areas, and CISS suffered from susceptibility and pulsation artifacts. T2-TSE was especially not able to display small cranial nerves.

Conclusion: 7T MRI is feasible for cranial nerve visualization. As parallel imaging was not possible in the "gold standard" CISS, a higher resolution could be achieved in the TrueFISP sequence, which seems to be advantageous at the moment.

B-840 14:18

Cerebral magnetic resonance spectroscopy (MRS) at 7 Tesla: Standard values and regional differences

A.E. Grams, I. Brote, S. Maderwald, A.K. Seifert, K. Kollia, M. Forsting, M.E. Ladd, E.R. Gizewski; *Essen/DE (astrid.grams@uk-essen.de)*

Purpose: At lower field strengths, regional differences of cerebral metabolite distributions have been described, but these data are controversial. 7T-MRS is expected to provide higher spectral resolution in comparison to lower field strengths; on the other hand, problems which decrease spectral quality are expected in high-field-MRS.
Methods and Materials: 7T-MRS was performed in 10 healthy volunteers with a 1H single-voxel-PRESS-sequence (TE: 30 ms) in the frontal (FWM), and parietal white matter (PWM), in the insular (IGM), the occipital (OGM) and the thalamic gray matter (TGM). The metabolites N-acetyl-aspartate (NAA), choline (Cho) and creatine (Cr) were preprocessed and quantified with the software jMRUI; furthermore, Cho/Cr and NAA/Cr-ratios were measured.
Results: Significant differences between the different brain areas were found for all metabolites: NAA ($p = 0.0006$), Cho ($p = 0.005$) and Cr ($p = 0.0007$) and for Cho/Cr-ratio ($p = 0.003$) but not for NAA/Cr-ratio. Concentration of NAA varied with IGM < FWM < PWM < OGM < TGM, Cho with OGM < IGM < PWM < FWM < TGM and Cr with IGM < FWM < PWM < TGM / OGM. The lowest Cho/Cr-ratio was found in OGM (0.15), the highest in FWM (0.91). NAA/Cr-ratio was found to be in a similar range from 1.45 (IGM) to 1.79 (TGM) in all examined areas.
Conclusion: 7T-MRS confirmed regional metabolite differences in the brain. Cho/Cr-ratio seems to reflect these differences, whereas NAA/Cr-ratio displays a constant value throughout the brain. The present study could provide a basis for further clinical applications of 7T-MRS.

B-841 14:27

also EPOS

New generation biomarkers on MR spectroscopy for characterization of intracranial abscesses at 3 T

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Purpose: To evaluate the new generation biomarkers on MR spectroscopy for characterization of intracranial abscesses at 3 T.
Methods and Materials: A retrospective study of MR spectra of 54 patients in age range of 32-56, M:F ratio of 3:2 with surgically proved brain abscesses was done with IRB approval. All patients have earlier under gone a comprehensive brain infection protocol on a 3 T MR Achieva XR system with a 8 channel head Coil using DWI with ADC, T1, FLAIR, T2, post contrast 3D T1, DTI, MR spectroscopy with 2D PRESS: TR 2000 TE with short TE of 35 msec and long TE of 144 and 288 msec, NEX: 1. FOV: 100 mm, acquisition matrix: 10x10. All data were then evaluated for following 1. Presence of Acetate at 1.9 ppm, 2. Presence of aminoacids at 0.9 ppm, 3. Presence of succinate at 2.4 ppm, 4. Presence of lactate at 1.2 ppm, 5. Presence of trehalose at 3.6 ppm. Based on these ratios, spectral patterns were then created called MRS-B (AnAB, MRS-Aerab), MRS-T: tuberculous MRS-F (fungal), MRS-P (Parasitic).
Results: MRS-B (An Aero, Aero)-bacterial abscesses (n=24): acetate, succinate, lactate and lipids. The biomarker ratios are as follows: Acetate-succinate ratio > 2-aerobic (acetate dominance),< 2-anaerobic (succinate dominance). MRS-P parasitic abscesses: (n=14): succinate and lactate and lipids, with a succinate/lactate ratio of 0.5. MRS-T-tuberculous abscesses (n=7), Lipid dominance with lipid acetate ratio > 2, no succinate, lipid lactate ratio of 1.5 showing a lipid fominance, with elevated choline in 5 cases. MRS-F fungal abscesses (n=9): lactate, lipids, trihalose with a lactate trihalose ratio of 1.8 to 2.0.
Conclusion: Intracranial abscess imaging with MRS at 3 T adds characterization information of abscesses of varied pathologies.

B-842 14:36

Mapping brain ATP and brain pH using multivoxel ^{31}P MR spectroscopy: A preliminary study

R.H. Wu[1], W. Liu[1], K. terBrugge[2], D. Mikulis[2], X. Cheng[1]; [1]*Shantou/CN*, [2]*Toronto, ON/CA*

Purpose: Although brain ATP studies can be found in multi-voxel ^{31}P MR spectroscopy, previous studies of intracellular brain pH were conducted in single-voxel ^{31}P MR spectroscopy. The purpose of this study was to explore the feasibility of mapping brain ATP and brain pH by using multivoxel ^{31}P MR spectroscopy.
Methods and Materials: Phantom studies were carried out by using a GE 3 T scanner firstly. 2D PRESSCSI sequence was selected because of better signal to noise ratio. TR was 1000 msec and TE 144 msec with 128 scan averages. The acquisition matrix was 16 x 16 phase encodings over a 24-cm FOV. Then, two healthy volunteers were studied. Data were processed offline using the SAGE/IDL software. Multivoxel spectra and brain ATP map were analyzed. Brain pH values were calculated from the difference in chemical shifts between inorganic phosphate (Pi) and phosphocreatine (PCr) resonances. Color scaling map was generated using MatLab software.
Results: Multivoxel ^{31}P spectra were obtained for phantom and the healthy volunteers. PCr map was obtained in phantom. At this moment, peaks of PCr were not homogeneous in phantom studies. There was noise for multivoxel ^{31}P spectra in volunteer studies. PME peak, Pi peak, PDE peak, PCr peak, γATP peak, αATP peak, and βATP peak can be identified. Preliminary brain ATP map and brain pH map were generated in the volunteers.
Conclusion: It is feasible to map brain ATP and brain pH using multivoxel ^{31}P MR spectroscopy. However, endeavors should be made to improve quality of multivoxel ^{31}P MR spectroscopy.

B-843 14:45

also EPOS

Noninvasive estimation of cerebral-spinal fluid flow through the shunt system and intracranial pressure by 3.0 T MRI

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Purpose: High signal-noise ratio in 3.0 T MRI unit and new design of pulse sequences allow precise measuring linear and volume velocity through the shunt system. Intracranial pressure (ICP) can be calculated from flux-pressure curve (shunt characteristics) and flux, measured by MRI.
Methods and Materials: MR study was performed with 3.0 T MRI by Phase Contrast pulse sequence voxel: 0.35x0.35 mm, acquisitions 30, VENC 3.0 cm/sec, no cardiac synchronization, with movement compensation. Slice was placed across the ventricular catheter. We examined 10 children (4 - 10 yo). 6 patients had shunt systems MedSil (Russia) and 5 patients Medtronic (USA). All shunts had medium level pressure. Two patients had signs of shunt malfunctioning.
Results: During the phantom study, calibration was performed to convert MR data (mean velocity) to flux for 1.2 mm diameter catheter. The linear correlation was significant (R2=0.99). In children whose MedSil shunts functioned correctly, pressure was calculated from shunt characteristics (flux-pressure curve). In this, 4 children mean linear velocity changing from 0.27 to 1.04 cm/sec, flux from 4.0 to 26.3 ml/h and ICP pressure from 58 to 106 mmH$_2$O. Five patients with functioning Medtronic shunts had mean linear velocity 0.36 - 0.57 cm/sec, flux 6.6 - 12.7 ml/h. 2 patients with both types of shunt system had clinical and radiological signs of malfunctioning (linear velocity was too low to measure).
Conclusion: Correct estimation of CSF flux through the shunt system and CSF pressure by MRI is possible. It helps to diagnose the shunt system malfunctioning.

B-844 14:54

Measuring perfusion and permeability in high grade gliomas: Dynamic contrast enhanced MRI in 3D at 3 T

W.H. Flatz, M. Ingrisch, S. Sourbron, R. Goldbrunner, B. Ertl-Wagner, M.F. Reiser; *Munich/DE (radiologie.muenchen@gmail.com)*

Purpose: To investigate the feasibility of simultaneously measuring perfusion and permeability in high grade gliomas using Dynamic-Contrast-Enhanced MRI in 3D.
Methods and Materials: 14 previously untreated patients suffering from histologically proven high-grade glioma were examined. MRI was performed using a 3 T-scanner acquiring perfusion images with rapid Dynamic-Contrast-Enhanced Perfusion-MRI. The regions-of-interest were positioned in perfusion maps into tumor_center, tumor_periphery, peritumoral region depicted by abnormal T2-weighted images and in contralateral normal-appearing white and grey-matter. Lesion and white and grey-matter curves were analyzed with a 2-compartment uptake (2CU) model and a 2-compartment exchange (2CX) model, yielding cerebral blood-flow (CBF), cerebral blood-volume (CBV), permeability surface product (PS) and, in case of the 2CX model, extracellular, extravascular volume VEE. The best model was chosen according to the Akaike information criterion.
Results: All contrast-enhancing (CE) lesions visible on post-contrast T1w-images could be identified on PS-maps. All CE lesions were found and analyzed with the 2CU- and 2CX-models. The 2CX model was, according to the Akaike information criterion, the best model for all lesions. CBV and PS were significantly higher ($p < 0.01$ and $p < 0.001$) in lesions than in normal appearing white and grey matter. CBV and PS were significantly higher ($p < 0.01$ and $p < 0.001$) in lesions than in normal appearing white and grey matter.
Conclusion: Contrary to dynamic-susceptibility-studies, T1w-perfusion-imaging provides unambiguous interpretation, simultaneous quantitative assessment of perfusion/permeability, large spacial-coverage and detection of smalllesions. CBF and CBV values are in good agreement with literature. Contrast-enhancing lesions

Monday

show significantly increased CBV- and PS-values and a heterogeneous distribution. Assessment of permeability/perfusion might allow for lesion characterization and therapy monitoring.

B-845 15:03

Evidence for altered cerebral venous drainage in chronic mild traumatic brain injury by quantitative MR flow

N. Alperin[1], A. Pomschar[2], S.H. Lee[1], I. Koerte[2], F. Heinen[2], M.F. Reiser[2], B. Ertl-Wagner[2]; [1]Miami, FL/US, [2]Munich/DE (alperin@uic.edu)

Purpose: Large inter-individual variability has been reported in the distribution of cerebral venous drainage between primary and secondary channels (jugular veins vs. epidural, vertebral, and deep cervical veins) in the supine posture. We investigated whether a history of mild traumatic brain injury (mTBI) can partly accounts for this variability.
Methods and Materials: Fifteen subjects with documented history of mTBI and eleven age and gender-matched individuals without previous trauma were studied by MR (mean age 23.5 vs. 24.5 years). 2D-time-of-flight MRV of the upper neck was performed to visualize the venous vasculature, and 2 cine-phase contrast scans with high and low velocity encoding were performed to quantify total arterial inflow and venous drainage in primary and secondary veins. Relative drainage through the jugular and the secondary veins were calculated. Cranio-spinal CSF flow was also measured to derive an MR estimate of ICP (MRICP) using a previously published method.
Results: A fivefold larger mean venous drainage through secondary channels was found in the mild TBI group compared to the normal controls (13.4 vs. 2.5%; p < 0.003). In addition, mean MRICP was higher by 3 mmHg in the mTBI group (12.5 vs. 9.45 mmHg; p < 0.03).
Conclusion: The mTBI group had significantly higher cerebral venous drainage through the epidural, vertebral and deep cervical veins compared to the control group. The cause for this difference is yet unclear. However, increased venous drainage through secondary channels in supine has been previously documented in idiopathic intracranial hypertension patients, thereby linking altered venous drainage with elevated ICP.

B-846 15:12

Cerebellar proton spectroscopic abnormalities in pediatric attention deficit/hyperactivity disorder

J. Soliva Vila, A. Moreno, J. Fauquet; Barcelona/ES (24744jsv@comb.es)

Purpose: In a previous voxel-based morphometry study conducted in an independent ADHD (attention deficit/hyperactivity disorder) sample, we found a decreased gray matter volume in the right prefrontal region and the left cerebellar hemisphere. We tested the hypothesis that these regions may show neurometabolite abnormalities.
Methods and Materials: We designed a proton magnetic resonance spectroscopic study with a group of 17 ADHD medicated children and a group of 17 laterality, gender and age matched controls. In a 1.5 T magnet, spectral acquisition was performed with a single-voxel technique and a short TE PRESS sequence. Two volumes of interest were selected in the right dorsolateral prefrontal region and the left posterior cerebellar lobe. NAA (N-acetylaspartate), Cre (creatine), Cho (choline), MI (myo-inositol) and Glx (glutamate-glutamine) resonance intensities were absolutely quantified using a time-domain analysis procedure (AMARES). Statistical analyses employed a Mann-Withney U test for independent samples and a Bonferroni correction for multiple comparisons was applied (alfa-value = 0.005). Correlation analyses investigated possible relationships between deviant neurometabolites and dosage and time of methylphenidate intake.
Results: In the left cerebellar hemisphere, ADHD children showed significant decreased MI (p = 0.004) and NAA (p = 0.001) absolute concentrations. Correlation analyses yielded no significant results.
Conclusion: The diminished concentration of the NAA could be related to a gray matter volume decrease, while the reduced MI concentration could express a decreased glial density. This is the first proton MR spectroscopic study examining the cerebellum and it provides additional support for its role in the ADHD neurobiology.

B-847 15:21

MRI-based gating of PET data in a hybrid PET/MRI system to avoid motion artifacts

L. Stegger[1], A. Kolb[2], M. Hofmann[2], C. Pfannenberg[2], O. Schober[1], C.D. Claussen[2], M. Schäfers[1], B. Pichler[2], A. Boss[2]; [1]Münster/DE, [2]Tübingen/DE (stegger@uni-muenster.de)

Purpose: Head motion during PET image acquisition, e.g. in patients with movement disorders, can severely reduce image quality and quantification accuracy. In this study, we evaluated a PET gating method based on concurrent MRI measurement of head movement in a hybrid PET/MRI system (Siemens BrainPET).
Methods and Materials: Five patients who exhibited significant head motion during a PET/MRI examination were enrolled. PET data were collected for ten minutes in "list mode", i.e. all data of the decay events are stored individually on hard disk, for retrospective gating and reconstruction. MRI images of a single transaxial plane at the level of the basal ganglia were concurrently acquired every second. Head movement was derived from the MRI image series by means of a coregistration algorithm. Only PET data from head positions within 2 mm and 4° of the reference were used for image reconstruction. Image quality was assessed visually by judging the delineation of cortex, white matter and basal ganglia and quantitatively by comparing uptake ratios.
Results: Concurrent data acquisition and subsequent data processing were successful in all patients. Delineation of the brain structures, especially of the basal ganglia, was significantly improved. Accordingly, the contrast between high and low uptake structures was significantly higher.
Conclusion: MRI-based gating of PET emission data is a promising method to improve PET data quality for brain imaging. It utilizes the unique feature of hybrid PET/MRI systems, namely the simultaneous acquisition of both PET and MRI data. The method can be easily applied for routine imaging.

14:00 - 15:30	Room N/O

GI Tract

SS 1701b

Non-tumoral disease in and around the tube

Moderators:
J. Rimola; Barcelona/ES
P.J. Shorvon; London/UK

B-848 14:00

Stapled transanal rectal resection (STARR): Persisting functional deficits despite anatomical correction? correlation with dynamic MR-defecography-findings

S. Kirchhoff, R. Lang, C. Kirchhoff, M. Kreis, K. Jauch, M.F. Reiser; Munich/DE (sonja.kirchhoff@med.uni-muenchen.de)

Purpose: Functional disorders of the gastrointestinal tract including the pelvic floor in terms of obstructive defecatory disorders are a common problem with increasing incidence. Regarding therapy, stapled-transanal-rectal-resection (STARR) seems to be an innovative operation technique. The purpose of this study was to prospectively evaluate MR-defecography for morphological and functional results after STARR-surgery.
Methods and Materials: Patients with obstructive defecation-dysfunction were interviewed and rectal manometry, procto/rectoscopy and MR-defecography were performed pre- and postoperatively. All patients underwent a STARR-operation in general anaesthesia. The mean follow-up period was 20±6 months after surgery.
Results: 10 patients (10 f, 0 m; 62±12 years) were enrolled; the STARR-operation was performed successfully in all cases. Preoperatively, all patients reported a fractionated defecation, 6 (p=0.02) postoperatively. A subjective improvement during defecation was observed in 6 patients (p=0.02) for 9 patients pre- vs. 3 patients posteropatively (p=0.02). In MRI, 9/10 patients showed preoperatively an intussusception versus 1/10 patient postoperatively (p=0.002). The rectozele-size was assessed on MRI preoperatively with 2.6 ± 1.4 cm versus postoperatively of 1.4 ± 1.2 cm (p=0.05). Comparing pre- and postoperative additional findings such as cystoceles a significant extent-reduction was detected post-surgery. The rectal manometry-findings showed no significant difference for the active pinch-pressure and the pressure-at-rest pre- compared to postoperatively.
Conclusion: In 9/10 patients, MRI showed an anatomic correction of the intussusception by STARR, whereas only a few patients reported functional improvement, making the STARR-outcome-results comparable to standard operation-techniques. However, MR-defecography is necessary to identify those patients possibly benefiting the most from the STARR-operation.

B-849 14:09
MR imaging of perianal fistulas: Value of using an innovative self-adaptive ano-rectal water plug for the classification
S. Yang, Q. Zhu, Z. Gong, X. Zhao, W. Tan, F. Lu, S. Zhan; *Shanghai/CN (caddie_yang1980@yahoo.com.cn)*

Purpose: To investigate the value of using the innovative self-adaptive ano-rectal water plug for the classification of perianal fistula patients in conventional MRI studies.
Methods and Materials: 18 perianal fistula patients underwent MR scans on a Philips 1.5 T Achieva Dual scanner with a body coil and conventional T1WI and T2WI SPAIR sequences before and after using the water plug. The end locations of fistulas, extensions and abscesses were utilized to classify the fistulas with and without the water plug (referring MR classification of St Jame's University Hospital). MR findings were compared with the surgery results.
Results: A Chi-square test revealed significant differences in the end locations of fistulas on MR images before and after using water plugs (χ^2=5.56, P < 0.05). 1 grade 1 simple lincear intersphincteric low fistula, 3 grade 2 intersphincteric fistulas with abscess or secondary track (1 low and 2 high), 1 grade 3 trans-sphincteric high fistula, 6 grade 4 trans-sphincteric fistulas with abscess or secondary track (1 low and 5 high), and 2 grade 5 supralevator and translevator diseases were classified without water plugs. 5 patients were uncertain. With water plugs, 3 high grade 2 fistula patients were found. Further 1 grade 4 low and 2 grade 4 high fistula patients were observed, and only 1 was uncertain. Complete agreement between MRI and surgery for the classification occurred in 13 (72%) and 17 (94%) patients with and without water plugs.
Conclusion: The innovative self-adaptive ano-rectal water plug is useful for the conventional MRI to classify the perianal fistulas.

B-850 14:18
The role of CT and fistulography in the occurrence of pancreatic fistula following pancreaticoduodenectomy
N. Faccioli, G. Foti, F. Moore, R. Pozzi Mucelli; *Verona/IT (nfaccioli@sirm.org)*

Purpose: To compare fistulo-Computed Tomography (FCT) and conventional fistulography in the evaluation of pancreatic fistula (PF) after pancreaticoduodenectomy (PD).
Methods and Materials: In a 2-years period, 65 patients underwent FCT and conventional fistulography for clinical suspect of PF (ISGPF criteria) in a mean time of 4.1 days (range 2-7) after PD. In both examinations, contrast material was manually injected into a drainage catheter placed during PD beneath the pancreogastro (PG) or pancreojejunum (PJ) anastomosis. Two experienced radiologists retrospectively reviewed fistulo-CT and fistulography examinations, looking for fluid collection, fistulous tract, and filling of anastomosed loop by the contrast material. Imaging findings were analyzed using Fisher's exact probability test. Non-parametric tests (Kruskal-Wallis, Mann-Whitney U) were used to evaluate ordinal data. A p value < 0.05 was considered significant.
Results: PF was depicted in 48 patients at fistulo-CT (30 peri-anastomotic fluid collections, 8 fistulous tracts, 10 filling of anastomosed loop) and in 58 patients at fistulography (25 fluid collections, 16 fistulous tracts, 17 filling of anastomosed loop). Se, Sp, PPV, NPV and Acc of FCT and fistulography were, respectively, 73.8, 82.3, 94.1, 54.8, 75.6 and 89.2%, 85.7, 98.3, 46.1 and 88.9%. A statistically significant difference was found regarding the overall sensitivity in diagnosing PF (p < 0.005).
Conclusion: Although fistulo-CT allows evaluating whole abdominal content, fistulography has high accuracy for the diagnosis of PF because of its dynamic nature and the high capability to depict fistulous tracts and fillings of anastomosed loop.

B-851 14:27
Value of MDCT in the diagnosis and management of acute gastrointestinal haemorrhage: Correlation with digital substraction angiography
A. Md Ralib[1], R. Zakaria[2], Z. Mohamad[2], A. Muda[2]; [1]*Kuantan, Pahang/MY*, [2]*Kuala Lumpur/MY (drzalie@gmail.com)*

Purpose: To determine the accuracy of Multidetector CT (MDCT) in the detection and localisation of acute gastrointestinal haemorrhage with Digital Substraction Angiography (DSA) as the gold standard.
Methods and Materials: All patients with acute gastrointestinal haemorrhage who had both MDCT and DSA performed were included. MDCT was performed with a 64-slice MDCT in unenhanced, arterial and delayed phases. Positive MDCT findings include visualisation of contrast extravasations in the arterial phase or pooling of contrast in the delayed phase. Positive DSA include visualisation of contrast extravasation into the bowel lumen.

Results: From January 2008 to April 2009, there were twelve patients with sixteen examinations who had both MDCT and DSA. Ten patients had negative MDCT and also negative DSA. Five patients had positive MDCT and also positive DSA. One patient had positive MDCT, but a negative DSA (false positive of 6%). This gives a sensitivity of 100%, specificity of 91%, positive predictive value of 83% and negative predictive value of 100% for MDCT in detecting acute gastrointestinal haemorrhage. In all patients with positive DSA, the MDCT findings helped in the accurate localisation of the bleeding arteries in which embolisations were performed with good results.
Conclusion: MDCT is very sensitive in the detection and also exclusion of acute gastrointestinal haemorrhage. MDCT also gives an accurate localisation of the source of the haemorrhage, which helps in the management of the patient. A negative MDCT makes an urgent DSA unnecessary.

B-852 14:36
2-year follow-up study of 94 patients with mesenteric panniculitis
N. van Putte-Katier, O.E. Elgersma, T.R. Hendriksz; *Dordrecht/NL (nkatier@yahoo.com)*

Purpose: Mesenteric panniculitis is an uncommon idiopathic disorder characterised by chronic inflammation of the intestinal mesentery. A possible paraneoplastic origin has been suggested. There are however few data available on the natural history of mesenteric panniculitis. The purpose of this study was to assess clinical outcome of patient with mesenteric panniculitis after 2 years with specific attention to the development of malignancy.
Methods and Materials: As part of a large hospital based prevalence study, consecutive abdominal CT examinations of 3820 patients were retrospectively evaluated for mesenteric panniculitis. Clinical characteristics, therapy and outcome of all patients with mesenteric panniculitis were retrospectively evaluated during a 2 year follow-up period.
Results: CT findings of mesenteric panniculitis were found in 94 patients (2.5%) with a male predominance (70%). Mesenteric panniculitis coexisted with malignancy in 45 (47.4%) patients and with a benign disorder in 35 (37.9%) patients. In 14 patients (14.7%), mesenteric panniculitis was the only diagnosed abnormality; common presenting symptoms in these patients included abdominal pain, diarrhea and weight loss. In 12 patients, symptoms disappeared within a few months without treatment. One patient was treated with prednisone without clinical improvement. 5 patients with non-malignant disease developed a malignancy during the follow-up period.
Conclusion: Although a relatively benign condition, mesenteric panniculitis may be a first sign of malignancy. In view of the possible paraneoplastic origin, close follow-up studies in patients with mesenteric panniculitis are recommended to search for any hidden malignancy. Long-term follow-up is necessary to substantiate these results.

B-853 14:45
Visceral fat volume and its association with mesenteric panniculitis
N. van Putte-Katier, O.E. Elgersma, T.R. Hendriksz; *Dordrecht/NL (nkatier@yahoo.com)*

Purpose: Mesenteric panniculitis is a rare inflammatory disorder of unknown etiology affecting the mesentery. Recent studies have improved the understanding of adipose tissue and its active role in inflammatory mesenteric and intestinal disease. However, little is known on the role of adipose tissue in the pathophysiology of mesenteric panniculitis. The purpose of this study was to determine whether increased mesenteric adipose tissue plays an important role in mesenteric panniculitis.
Methods and Materials: As part of a large hospital based prevalence study on mesenteric panniculitis, a nested case-control study was conducted. 94 patients (70% male) with mesenteric panniculitis were identified and compared to 94 individuals matched by gender and age. Total, subcutaneous and visceral fat volumes were measured on 10 x 5 mm contiguous CT-slices around the level of the umbilicus. A fat-density mask was constructed to include pixels with attenuation values ranging from -190 to -30 Hounsfield units.
Results: Mean age of individuals in both groups was 66.6 + 11.2 years. Persons with mesenteric panniculitis had a significant larger total fat volume (mean volume 2,257 ml versus 2,121 ml, p=0.038), visceral fat volume (mean volume 1,037 ml versus 923 ml, p=0.024) and borderline significant higher BMI (26.9 kg/m^2 versus 26.2 kg/m^2, p=0.061). Subcutaneous fat volume was not significantly different between groups.
Conclusion: Significant higher levels of visceral fat exist in patient with mesenteric panniculitis compared to individuals without mesenteric panniculitis. Further research is necessary to correlate these findings to the endocrine and metabolic functions of visceral fat in mesenteric panniculitis.

B-854 14:54

Small bowel MRI for the depiction of inflammatory bowel disease: Value of different MR sequences

T.C. Lauenstein, K. Schirrmacher, S. Kinner, L. Umutlu, G. Gerken, S.C. Ladd, M. Forsting; *Essen/DE (thomas.lauenstein@uni-due.de)*

Purpose: Different MR sequences are used for the diagnosis of IBD including fast imaging with steady state precession (TrueFISP) and gadolinium enhanced T1w imaging. We aim to compare diagnostic accuracy and image quality of these sequences.
Methods and Materials: 84 patients with Crohn's disease were included. 1500 cc of a 2.5% mannitol solution was administered 45 minutes prior to the exam. T1w 3D GRE sequences (TR/TE 1.64/0.6 ms, flip angle 15°, slice thickness 1.6 mm, acquisition time 12-16 sec, contrast delay 75 sec) and TrueFISP sequences (TR/TE 4.45/2.23 ms, flip angle 70°, slice thickness 3 mm, acquisition time 14-18 sec) were collected on a 1.5 T MR system (Magnetom Avanto, Siemens). Image quality was assessed on a 3-point scale (1=poor, 2=moderate, 3=good quality). Localization of IBD lesions was noted. Clinical and endoscopic data served as standard of reference.
Results: Mean value of image quality amounted to 2.5 for gadolinium enhanced T1w MRI and 2.9 for TrueFISP. Image quality of TrueFISP was rated superior in 26 patients (T1w MRI: 4 patients). IBD lesions were found in 61/81 patients by the reference standard. Sensitivity of TrueFISP imaging for the depiction of IBD was 79% (T1w MRI: 85%). The evaluation of both sequences together resulted in an increasing sensitivity of 90%. Specificity for TrueFISP and T1w MRI amounted to 85%.
Conclusion: Image quality of small bowel MRI is more robust for TrueFISP. This is important when non-compliant patients are examined. However, gadolinium-enhanced T1w MRI is more sensitive regarding the depiction of IBD.

B-855 15:03

The use of diagnostic imaging in irritable bowel syndrome patients

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Purpose: The diagnosis of Irritable Bowel Syndrome (IBS) is made using symptom-based criteria but can require diagnostic imaging (DI) to exclude organic pathology. The purpose of this systematic review (SR) was to search and appraise the literature for current evidence regarding the role of DI in patients with IBS.
Methods and Materials: A systematic literature review of the primary and secondary literature was performed using Evidence-Based Medicine (EBM) methodology.
Results: The Pubmed search identified 1451 papers and following review of the abstracts a subgroup of 111 papers was identified, which at least partially addressed the aims of SR. 7 published manuscripts (six primary research articles and one SR) were deemed valid to this systematic review examined either colonic investigations (optical colonoscopy and barium enema) (n=6) or the use of ultrasound (n=3) or both (n=1). Review of the secondary literature found three additional relevant SRs. Review of all these papers suggested that the prevalence of organic GI disease in patients meeting symptom-based criteria for IBS is similar to the general population. Organic conditions found infrequently in patients with IBS-type symptoms include diverticulosis, colorectal cancer, organic small bowel pathology (celiac disease, Crohn's disease and tumors), inflammatory bowel disease and ovarian cancer. Although current best evidence suggests that presence of "alarm symptoms" is a disappointing predictor of organic disease, their presence may justify performance of diagnostic tests.
Conclusion: DI is not required in patients with IBS without "alarm symptoms". In patients with "alarm symptoms", DI studies should be carefully selected based on predominant symptoms and likely differential diagnosis, to exclude organic disease.

B-856 15:12

To investigate the utility of T2 relaxation time measurement as a potential biomarker of inflammation in acute colitis

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Purpose: To investigate the utility of T2 relaxation time measurement as a potential biomarker of inflammation in acute colitis.
Methods and Materials: Ten patients with acute colitis were recruited. CRP and stool frequency was measured and MRI performed on admission and again (within one week) following intensive medical therapy. For each MRI study, two sets of breath held coronal Half Fourier Acquisition Single Shot Turbo Spin Echo (HASTE) images of the abdomen and pelvis were acquired (TE 52 and 86 ms). Mural HASTE signal intensity was measured from all visible colonic segments via regions of interest (ROI) placed on pre-treatment images and matched on post-treatment images. Allowing calculation of pre and post-treatment T2 relaxation times. Total T2 score for each individual study was obtained by summation of segmental T2 values. Correlation of T2 score with CRP and stool frequency, and change in T2 score with change in CRP and change in stool frequency following treatment was assessed using Spearman statistics.
Results: Pre and post treatment mean T2 score, CRP and stool frequency were 628 (range 369 to 1187), 27.6 mg/l (range 5 to 71.6) and 10.5 stools/day (range 8 to 15); and 580 (range 171 to 1160), 13.8 mg/l (range 5 to 34.3) and 6.8 stools/day (range 3 to 10), respectively. There was no significant correlation between T2 score and CRP and stool frequency (p=0.389 to p=0.946).
Conclusion: Quantitative T2 measurements are unlikely by themselves to be of use as site-specific biomarkers of inflammation in patients with acute colitis.

B-857 15:21

Abdominal MRI of rabbits following for hernia repair implanted meshes for the evaluation of different fixation techniques and postoperative complications

S. Kirchhoff, R. Ladurner, M.F. Reiser, C. Kirchhoff, A. Lienemann; *Munich/DE (sonja.kirchhoff@med.uni-muenchen.de)*

Purpose: Laparoscopic-mesh-implantation is commonly performed for hernia-repair. Inflammatory reactions towards meshes or nerve-entrapment using regular fixation-devices are suspicious for the chronic unclear postoperative pain. The aim was to compare the technique of prosthetic-mesh-fixation in laparoscopic-intraperitoneal-incisional/ventral-hernia-repair using cyanoacrylat-glue (GlubranGE) to conventional fixation-spiral-tacks. MRI was performed as routinely performed in humans to identify implanted meshes, morphology and postoperative complications (adhesions).
Methods and Materials: 20 New Zealand White sedated rabbits were examined on 3.0 Tesla MR-scanner (Trio, Siemens Medical Solutions) laying in a plastic-tube with a cut-opening in the operated-abdomen in a prone-position using a body-array-coil. Axial/sagitall T1- and T2-wTSE-sequences were performed. ePTFEmesh (Gore-tex Dual Mesh) and polypropylene (PP) meshes (Dyna Mesh-IPOM) with 3 of each type implanted in each animal bilaterally the median-line using different fixation-techniques were compared. MR-images were analysed for mesh-detection, mesh-configuration, fixation and adhesions. The in-situ-situation was taken as gold standard since the animals were killed 12 weeks-after with a tensile-strength-analysis being performed.
Results: 3 animals showed directly the implanted meshes. In all animals, spiral-tacks were identified with dislocation-signs in 11 animals proven by gold standard whereas cyanoacrylat-glue was never detectable. MRI showed indirect adhesions-signs in 7 animals in the PP-meshes-area, in 1 animal in ePTFE-mesh-area confirmed by the gold standard. For the tensile-block-analysis, the fixation of PP-meshes with cyanoacrylat-glue showed an equivalent strength as ePTFE meshes fixed with spiral-tacks.
Conclusion: In this animal-study, tensile-strength-analysis revealed equal fixation-strength comparing cyanoacryla-glue fixed-ePTFE with the spiral-tackers fixed PP-mesh. Adhesions were detected more frequently after PP-mesh-implantation on MRI and in-situ. For future applications, ePTFE-meshes with glue-fixation should be used more frequently to possibly increase the patients' satisfaction postoperatively.

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

Cardiac

SS 1703

Advantages of high field and other new developments

Moderators:
R. Maksimovic; Belgrade/RS
B.J. Wintersperger; Munich/DE

B-858 14:00

7 Tesla cardiac MRI in humans

H.H. Quick, S. Maderwald, K. Nassenstein, S. Orzada, A.K. Bitz, O. Kraff, I. Brote, L.C. Schäfer, M.E. Ladd; *Essen/DE (Harald.Quick@uni-due.de)*

Purpose: To perform cardiac MRI at 7 Tesla in humans featuring a custom-built 2x4-channel transmit/receive radiofrequency (RF) body array coil.
Methods and Materials: Scanning was performed on a 7-Tesla whole-body MRI system (Magnetom 7T, Siemens). A custom-built flexible 2x4-channel transmit/receive body RF coil was used for signal transmission and reception. Ten healthy

volunteers (6 male, 4 female) were placed head-first supine with the chest at the isocenter. The imaging protocol encompassed cardiac function along all cardiac standard views using peripheral pulse-triggered cine FLASH and cine TrueFISP sequences. The image quality was visually assessed for signal homogeneity and myocardium-to-blood contrast.

Results: All ten subjects tolerated the examination well and could be successfully examined. The RF coil, qualitatively provided relatively homogeneous RF signal over the sensitive body volume. Some image regions, however, showed mild destructive interference with associated signal voids. Both cine-sequences, FLASH and True-FISP, provided good imaging quality and signal homogeneity over almost the entire cardiac volume and with good myocardium-to-blood contrast. The achieved spatial resolution was 1.4x1.4x4 mm, providing excellent detail of cardiac morphology. Due to the consistently elevated T-wave in the strong magnetic field, ECG triggering had to be substituted by peripheral pulse-wave triggering.

Conclusion: These initial results can be considered as a first step towards human in vivo cardiac imaging at 7T highfield MRI. The FLASH and TrueFISP sequence provided excellent image quality, contrast, and spatial resolution for evaluation of cardiac function. Subsequent 7T highfield cardiac MRI studies on patients featuring a 16-channel RF coil with further improved signal are currently under investigation.

B-859   14:09

Contrast-enhanced whole-heart MR coronary angiography at 3.0 T using the intravascular contrast agent gadofosveset

M. Prompona, C.C. Cyran, K. Nikolaou, K. Bauner, M.F. Reiser, A. Huber; *Munich/DE (mariadoctor@hotmail.com)*

Purpose: To compare contrast-enhanced (CE) whole-heart coronary magnetic resonance angiography (MRA) at 3.0 T using gadofosveset to non-contrast-enhanced steady-state free precession (SSFP) technique at 1.5 T.

Methods and Materials: This prospective randomized study was conducted among 20 healthy male volunteers. All subjects underwent CE whole-heart MRA at 3.0 T employing a 3D FLASH sequence after gadofosveset injection as well as non-contrast-enhanced coronary MRA at 1.5 T using a 3D SSFP sequence with T2-preparation. Prospective ECG-triggering and adaptive respiratory gating was used. Acquisition time, signal-to-noise ratio (SNR) of coronary blood, contrast-to-noise ratio (CNR) between coronaries and adjacent myocardium or epicardial fat and image quality were evaluated using a 2-tailed paired sample student´s t-test.

Results: Significant increase of overall CNR between coronary blood and adjacent myocardium was assessed in 3.0 T images in comparison to 1.5 T (38.9 ± 19.6 and 26.3 ± 15.4, respectively; $p < 0.005$). No significant difference in CNR between coronary blood and epicardial fat was measured. Whereas the mean image quality for proximal and mid coronary segments was not statistically different between the two methods ($p > 0.05$), distal coronary segments presented significantly higher image quality at 3.0 T ($p = 0.02$). Overall image quality (2.15 ± 0.49 at 1.5 T vs. 2.35 ± 0.39 at 3 T) proved similar for both methods.

Conclusion: CE coronary MRA at 3.0 T demonstrated higher overall CNR between coronary blood and myocardium and an improved image quality of the distal coronary segments compared to non-contrast-enhanced SSFP technique at 1.5 T.

B-860   14:18

Contrast enhanced coronary MRA at 3.0 T using a 32 channel coil to detect coronary artery stenosis: How does it measure up against 64-slice coronary CTA and X-ray angiography?

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Purpose: To evaluate the diagnostic accuracy of 3.0 T contrast enhanced whole-heart coronary MRA using 32 channel coils in patients suspected of CAD compared to 64-slice CTA and X-ray coronary angiography (CAG).

Methods and Materials: 32 patients who were scheduled for CAG underwent both coronary MRA and coronary CTA. 3.0 T (MAGNETOM Trio, A Tim System, Siemens AG) ce-CMRA was acquired by using inversion-recovery prepared FLASH sequence and a 32 channel coil with an acceleration factor of 3 (GRAPPA). The diagnostic accuracy of MRA and 64-Slice CTA in detecting significant stenoses ($\geq 50\%$) was compared on per-segment basis using CAG as reference.

Results: MRA and CTA examinations were successfully completed in all 32 patients. The averaged imaging time of MRA was 6.1 ± 1.2 min. In a total of 419 coronary segments with a reference luminal diameter ≥ 1.5 mm on QCA, forty-nine segments (12%) were evaluated as non-assessable on MRA and twenty-eight segments (6.7%) on CTA were non-diagnostic. On assessable segment based analysis, 3.0 T whole-heart CMRA correctly identified 45 significant stenoses, and CTA correctly identified 52 significant stenoses. The sensitivity, specificity, PPV and NPV of MRA

and CTA for detecting significant stenoses were 92, 95, 73, 99, 96, 92, 67, and 99%, respectively on assessable segment basis.

Conclusion: Combined with dedicated 32-channel coils, parallel imaging with higher acceleration factors allows significant reduction in imaging time when compared to our previous results. These improvements resulted in substantially improved overall accuracy of MRA in detecting CAD if only assessable segments were considered.

B-861   14:27

Magnetic resonance imaging with MR-compatible cardiac pacemaker EnRhythm SureScan with MR compatible leads CapSureFix

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Purpose: This is our first experience with the use of a MR-compatible cardiac pacemaker EnRhythm MRI SureScan with MR compatible leads CapSureFix.

Methods and Materials: A MR-compatible cardiac pacemaker EnRhythm Sur-eScan with MR compatible leads CapSureFix was implanted in 52 patients in a clinical study at Na Homolce Hospital, Prague. Twenty-five of these patients were randomized for MRI and underwent MR scanning at 1.5 Tesla scanner.

Results: This type of cardiac pacemaker is MR compatible only when the defined criteria are met: Closed-bore 1.5 Tesla scanners are required; the pacemaker has to be implanted for at least six weeks before scheduling MRI. Before the patient is placed into a MR system, the pacemaker has to be switched into a MR compatible mode by a cardiologist or specialized technician. Without this step, the pacemaker is not MR safe. After the scan, the pacemaker is switched back. The patient is monitored during the scan. Specific absorption rate for the whole body must not exceed 2.0 W/kg, 3.2 W/kg for the cranial region (of the head 3.2 W/kg), with a slew rate this should not exceed 200 T/m/s. The scanning isocenter cannot be focused between C1 and T12. Checking the type of the pacemaker and leads with a chest X-ray before scanning is highly recommended. This pacemaker is characteristic with unique X-ray contrast marks.

Conclusion: We present the first MR-compatible cardiac pacemaker on the market. We expect a significant increase in the number of these devices in a short time.

B-862   14:36
also EPOS

In vivo detection of bone marrow mesenchymal stem cells (MSCs) after intracoronary infusion using magnetic resonance imaging: An experimental study of a novel method to trace the transplanted cells

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Purpose: This study was designed to use MRI to analyze the cell distribution after intracoronary infusion (ICI) in variations of heart status in a swine myocardial infarction model.

Methods and Materials: After inducing a myocardial infarction, iron oxide labeled male cells (1×10^8) were infused through the coronary artery of the beating swine heart in Group 1. In Group 2, cardiopulmonary bypass (CPB) was set up and then the same volume of cells was infused after cardioplegic arrest. In Groups 3 and 4, the animals underwent either beating or arrested ICI with the same volume of saline. Three days later, cell distribution was assessed by T2* change with magnetic resonance imaging.

Results: T2* change of the heart in the cell infusion groups was significantly higher than that of saline infusion groups. However, in the MRI visualization of myocardium with a short axis slice of mid-left ventricular, signal void corresponding to the ventricular septum between Groups 1 and 2 were not visible. Group 1 had less T2* change than Group 2 in the spleen (16.72 ± 2.83 versus 22.18 ± 3.98, $P < 0.05$) and liver (2.4 ± 0.44 versus 5.32 ± 3.40, $P < 0.05$). However, there was no statistical difference of T2* change between two groups in the kidney.

Conclusion: The majority of BMSCs transplanted by ICI would be entrapped by the extracardial organs. The arrested heart with CPB during ICI does not favor more cell retention in the injured myocardium. The optimal approach of delivery of BMSCs still needs further investigation.

B-863   14:45

Screening athletes for proximal coronary artery anomalies with 3-dimensional coronary MR angiography

N.H.J. Prakken, M.J. Cramer, M.A. Olimulder, B. Velthuis; *Utrecht/NL (NHJPrakken@Gmail.com)*

Purpose: Under 35 years of age, 14% of sudden cardiac death (SCD) in athletes is caused by a coronary artery anomaly of wrong sinus origin (CAA). Although rare, an inter-arterial course of the coronary artery can lead to syncope and SCD during exercise. Can free-breathing 3-dimensional magnetic resonance coronary angiography (3D-MRCA) be used to screen for CAA in competitive athletes and non-athletes as an addition to the clinical cardiac MRI protocol?

Monday

Methods and Materials: 360 healthy men and women aged 18-60 years (mean age 31±11 years, 37% women) underwent standard cardiac MRI and a free-breathing 3D-MRCA balanced turbo field echo protocol taking 10 minutes extra scan time at maximum. There were 207 athletes (≥ 9 hours/week), and 153 age and gender matched non-athletes (exercising ≤ 3 hours/week). The 3D dataset was screened for CAA.

Results: 335 (93%) subjects had a technically satisfactory 3D-MRCA of which 4 (1%) showed a malignant variant of the right coronary artery (RCA) origin coursing between the aorta and pulmonary trunk. Additional findings included 3 subjects with a proximal stenosis of the right and 1 of the left coronary artery and 6 persons with proximal myocardial bridging of the left coronary artery. Overall, 3D MRCA quality was better with faster scan sequences in athletes than non-athletes due to lower heart rates with longer end-diastolic resting periods.

Conclusion: 3D MRCA can be used as part of the standard Cardiac MRI protocol to screen young competitive athletes and non-athletes for anomalous proximal coronary arteries in approximately 10 minutes time.

B-864   14:54

Peripheral arterial involvement in marfan syndrome: A new clinical sign identified by whole-body vascular imaging

L.M. Palena, M. Rosati, K. Buttazzi, V. Russo, L. Lovato, R. Fattori; *Bologna/IT (marianopalena@gmail.com)*

Purpose: Aorta is the only recognised site of vascular involvement in Marfan Syndrome (MFS), which is usually evaluated by echocardiography. MR Angiography (MRA) was used in a population of MFS patients, in order to obtain a complete vascular assessment.

Methods and Materials: From March 2006 to August 2009, 243 patients (146 males and 97 females, mean age 32 ± 14 years) with clinical features of MFS underwent a multidisciplinary assessment in our Marfan Center. Diagnosis was determined according to Ghent Nosology criterions. Imaging screening was performed with echocardiography, while all patients in whom MFS was confirmed (54 patients, 24%) underwent MRA. Ascending, descending thoracic and abdominal aorta (indexed to body size area), supra-aortic, visceral, iliac and femoral vessels were measured.

Results: Aortic dilation and/or dissection occurred in 48/54 MFS patients. Aortic measurements were underestimated by echocardiography in 8/48 cases and overestimated in 18/48 cases. In 13 (24%) patients, aortic dilation was associated to involvement of other vessels: iliac artery dilation in 12 patients, in 1 patient associated with dilatation of the celiac artery, 2 patients showed a dilation of the iliac and ovarian veins, in one case associated with dilation of subclavian and vertebral artery. Analysis of fibrillin-1 gene is ongoing in 7 of these 13 patients.

Conclusion: Peripheral arterial involvement is a new marker of MFS, probably reflecting a more aggressive disease, identified by the systematic use of MRA. With respect to echocardiography, MRA is able to provide a more accurate and comprehensive evaluation of arterial system.

B-865   15:03

Non-invasive vortex-based estimation of pulmonary arterial pressure and pulmonary vascular resistance in patients with manifest pulmonary hypertension

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Purpose: Manifest pulmonary hypertension is accompanied by the appearance of a vortex of blood flow in the main pulmonary artery, which can be visualized by magnetic resonance (MR) imaging. The applicability of its period of existence to non-invasively estimate mean, systolic and diastolic pulmonary arterial pressure (mPAP, sPAP and dPAP) as well as pulmonary vascular resistance (PVR) were investigated.

Methods and Materials: 50 patients with manifest pulmonary hypertension underwent right heart catheterization for mPAP-, sPAP-, dPAP- and PVR-determination as well as time-resolved, three-dimensional MR phase contrast imaging of the main pulmonary artery with mean delay of 5 days. Velocity fields resulting from phase contrast measurements were calculated and visualized with dedicated software. Relative periods of existence of a vortex of blood flow in the pulmonary artery with respect to the cardiac interval were determined visually.

Results: In all 50 patients, a vortex of blood flow in the main pulmonary artery was detected. The Pearson correlation coefficients between the relative period of vortex existence and mPAP, sPAP, dPAP and PVR, respectively, were 0.94, 0.88, 0.90 and 0.78. Corresponding standard deviations from the linear regression lines were 4 mmHg, 9 mmHg, 4 mmHg and 210 dyn.s. cm^{-5}.

Conclusion: Elevated mPAP, the quantity defining pulmonary hypertension, can be calculated from the period of existence of the vortex in the main pulmonary artery very precisely. The weaker correlations to sPAP, dPAP and PVR allow a non-invasive estimation of these parameters but also indicate, that mPAP truly determines vortex existence.

B-866   15:12

Chronic sildenafil treatment in men with type 2 diabetes: Cardiovascular effects evaluated by cardiac MRI

N. Galea, I. Carbone, D. Cannata, G. Cannavale, E. Giannetta, A. Isidori, C. Catalano, R. Passariello; *Rome/IT (nicogale2000@yahoo.it)*

Purpose: More than 7% of people have diabetes and cardiovascular disease remains the most important complication. Diabetic cardiomiopathy is a not-well known cardiac complication and represents a good model of endothelial dysfunction. It is characterized by an impairment of diastolic performance resulting in ventricular remodelling and reduction of ejection fraction. The purpose of our study was to evaluate by Cardiac MRI (CMR) the impact on cardiovascular performance of a three-month treatment with sildenafil, a selective phosphodiesterase-5-inhibitors (PDE5i).

Methods and Materials: We designed a randomized, placebo-controlled, double blind (subject/outcome assessor) study on chronic treatment with high dose of sildenafil (100 mg/in 3 daily doses). We have enrolled 50 men with type 2 diabetes (T2DM), metabolically controlled; 2 patients drop out the study (1 for dyspepsia,1 non-compliant). All patients performed a CMR exam (cineMR and CE-IR) before and after 3 months of therapy. All data were analysed by using Argus software (Siemens) to assess end-diastolic volume (EDV), end-systolic volume (ESV), stroke volume (SV), cardiac output (CO), ejection fraction (EF) and myocardial mass (MyoM). Segmental kinesis of whole left ventricle was also evaluated.

Results: CMR results showed a significant improvement of heart remodelling parameters, by increasing EDV, EF, SV and CO after treatment. Clinical monitoring reveals a significant better control of cardiovascular risk parameters (glycemia, cholesterol, systolic and diastolic blood pressure).

Conclusion: Sildenafil, for its cardiovascular effects, improves cardiac performance in subjects with T2DM. CMR is the ideal tool in follow-up after therapy with sildenafil, thanks to its high accuracy and reproducibility.

B-867   15:21   also EPOS

Time-resolved contrast-enhanced magnetic resonance angiography (CEMRA) of the left atrium-pulmonary veins complex with half dose of intravenous gadolinium-based contrast agent: Comparison of image quality with a conventional CEMRA protocol

V. Zampa, L. Faggioni, F. Odoguardi, E. Picano, C. Bartolozzi; *Pisa/IT (lorenzofaggioni@inwind.it)*

Purpose: To evaluate image quality of time-resolved contrast-enhanced magnetic resonance angiography (CEMRA) of the left atrium-pulmonary veins (LA-PV) complex with half dose of intravenous gadolinium-based contrast agent (GBCA) in patients candidate to percutaneous radiofrequency ablation of atrial fibrillation.

Methods and Materials: Sixty-five patients underwent CEMRA of the LA-PV complex on a 1.5 T MRI scanner. On 34/65 patients, a time-resolved multiphase CEMRA sequence (Time-Resolved Imaging of Contrast KineticS, TRICKS) with 3.5-sec frame resolution was performed beginning 8 seconds after start of intravenous injection of 0.1 mL/kg of 0.5M GBCA at 3 mL/sec flow rate. On the remaining 31/65 patients, a conventional fast-spoiled gradient-echo (FSPGR) CEMRA acquisition with centric k-space filling was run using 0.2 mL/kg GBCA at the same flow rate and a bolus triggering technique. Signal intensity in the LA-PV complex (SI_{LA-PV}) with FSPGR and TRICKS was measured. Diagnostic quality of Maximum Intensity Projection (MIP), Volume Rendering (VR), and Virtual Endoscopy (VE) reconstructions was also assessed through a semiquantitative score (0=poor, 1=fair, 2=good, 3=excellent).

Results: SI_{LA-PV} (expressed in arbitrary units) was not statistically different between TRICKS and FSPGR (673.6±137.9 vs 721.9±239.1 [mean±standard deviation]; p> 0.05, two-tailed Mann-Whitney test). Image quality of MIP, VR and VE reconstructions was significantly higher with TRICKS than with CEMRA (2.67±0.62 vs 1.15±0.90, 2.60±0.63 vs 1.46±0.78, and 2.47±0.74 vs 1.69±0.95; p=0.0022, p=0.0002, and p=0.0340, respectively).

Conclusion: CEMRA of the LA-PV complex is feasible with TRICKS and half-dose GBCA and yields better image quality of MIP, VR, and VE reconstructions than a conventional FSPGR sequence performed with full GBCA dose.

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

Interventional Radiology

SS 1709
Carotid and intracranial interventions

Moderators:
J.-P. Pruvo; Lille/FR
C. Senturk; Madrid/ES

B-868   14:00

CT perfusion before and after carotid stenting as work-up for CABG in patients with asymptomatic carotid artery stenosis

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Purpose: To explain why patients with asymptomatic carotid artery stenosis may benefit from carotid artery stenting, based on CT brain perfusion parameters.
Methods and Materials: Fifteen patients with asymptomatic carotid artery stenosis who were treated in the work-up before coronary artery bypass grafting (CABG), underwent CT perfusion (CTP) on a multidetector-row CT scanner before and after carotid artery stenting. Degree of treated stenosis was ≥ 75%. Degree of contralateral stenosis was ≤ 55%. After drawing regions of interest (ROIs) values of mean transit time (MTT), cerebral blood volume (CBV) and cerebral blood flow (CBF) were computed. We calculated relative values that compared the treated hemisphere to the contralateral side: ratios of CBV (rCBV), CBF (rCBF) and difference in MTT (dMTT). These relative perfusion parameters were assessed and compared before and after treatment using the Wilcoxon signed-ranks test for two related samples.
Results: After treatment only dMTT improved significantly from 0.73 to -0.09 (p < 0.05), indicating normalization of MTT. Both rCBV and rCBF improved, though not significantly, from 1.03 to 0.99 (p 0.427) and from 0.92 to 0.99 (p 0.112), respectively.
Conclusion: In asymptomatic patients with carotid artery stenosis, dMTT significantly improved after stenting. This shows that cerebral perfusion is compromised in asymptomatic patients, which may increase ischemic risk when cerebral perfusion pressure is reduced during CABG.

B-869   14:09

In vitro comparison of different carotid artery stents: A pixel-by-pixel analysis using CT angiography and contrast-enhanced MR angiography at 1.5 T and 3 T

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Purpose: CT angiography (CTA) and MR angiography (MRA) are increasingly used methods for evaluation of stented vessel segments. The purpose of this study was to compare CTA, contrast-enhanced MRA (CE-MRA) at 1.5 T, and CE-MRA at 3 T for the visualization of carotid artery stents and to define the best noninvasive imaging technique alternatively to intra-arterial conventional angiography for each stent.
Methods and Materials: CTA and CE-MRA appearances of 18 carotid artery stents of different designs and sizes (4.0 to 10.0 mm) were investigated in vitro. The profile of the contrast-to-noise ratio (CNR) of the lumen of each stent was calculated semiautomatically by a pixel-by-pixel analysis using the medical imaging software OSIRIS®. For each stent, artificial lumen narrowing (ALN) was calculated.
Results: In all but one stents, ALN was lower on CE-MRA at 3 T than at 1.5 T. With CE-MRA at 3 T and at 1.5 T, ALN in most nitinol stents was lower than in the groups of stainless steel and cobalt alloy stents. In most nitinol stents, ALN on CE-MRA at 3 T was lower than on CTA. In all stainless steel stents and cobalt alloy stents, ALN was lower on CTA than on CE-MRA. With CTA and CE-MRA, in most stents, ALN decreased with increasing stent diameter.
Conclusion: CTA and CE-MRA evaluation of vessel patency after stent placement is possible, but considerably impaired by ALN. Investigators should be informed about the method of choice for every stent.

B-870   14:18

Stent fractures in the innominate artery

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Purpose: Innominate artery (IA) stenting is a minimally invasive treatment for IA stenosis and obstruction. Only a few case studies of stent fracture of the IA have been published. In this retrospective study, we examined the frequency and the risk factors of balloon expandable stent fractures in the IA.

Methods and Materials: In 31 patients, 32 stents were investigated. The mean patient age was 58.4 ± 10.5 years. All patients underwent fluoroscopy, duplex Doppler ulrasound and clinical examinations in the follow-up. We analyzed the data of fractures, the length and type of the lesions and these affects on the clinical outcome.
Results: We recognized stent fractures in 11 (34.4%) stents. Type I fracture was identified in 1 stent (3.1%), type II in 4 (12.5%), type III in 3 (9.4%) and type IV in 4 cases (12.5%). Cox propotional hazards regression analysis indicated stenting for long lesions as a risk factor associated with IA stent fracture (hazard ratio = 1.21 95% confidence interval 1.05-2.10, Wald test p=0.016). The Kaplan-Meyer plots and the result of the Log-Rank test demonstrated the cumulative fracture rate was significantly higher with longer stents (P=0.008). However, no significant difference could be detected in the primary patency rate of the fractured and non-fractured stents.
Conclusion: In summary, IA stenting is a safe and effective procedure. There was no significant correlation between stent fracture and clinical outcome. Selective stenting and implantation of stents not longer than 2 cm are preferable.

B-871   14:27

Endovascular treatment of extra- and intracranial dissections using self-expanding microstents

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Purpose: To determine the feasibility, safety and efficacy of the treatment of neurovascular dissections based on the deployment of self-expanding microstents.
Methods and Materials: 48 patients 28 male, 20 female, median age 51 years. Manifestations of dissections: 8 aneurysms, 32 stenoses and/or ischemic lesions, 4 SAH and 2 iatrogenic. Locations of dissections: 18 ICA, 2 MCA, 1 ACA, 25 VA, 2 BA (multiple entries). In every patient, complete vessel reconstruction was the aim of treatment. A total of 76 stents was used (34 Enterprise, 9 Leo, 12 Solitaire, 3 Neuroform, 6 Protégé, 9 Coroflex please, 1 coroflex blue, 1 Wallstent, 1 Graft Master).
Results: Vessel reconstruction and full patency was achieved in every patient with ischemic dissection. Telescoping stent deployment allowed hemodynamic exclusion of all dissecting aneurysms. In 22 patients, more than one stent was required to achieve the goal of treatment. No adverse events were encountered.
Conclusion: Microstents are safe and highly effective devices for the endovascular reconstruction of extra- and intracranial dissections.

B-872   14:36

Intracranial angioplasty and stent implantation in atherosclerotic lesions and symptomatic stenoses: 123 experiences

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Purpose: Atherosclerotic disease of the major intracranial arteries is a frequent cause of stroke. In addition, many patients with symptomatic intracranial stenosis are at very high risk for recurrent stroke. We report peri-procedural and short term results of intracranial atherosclerotic lesions and symptomatic stenoses treatment using angioplasty and stenting.
Methods and Materials: From 8/2002 to 5/2009 (81 months), 123 procedures of stent implantation were performed in 113 patients with intracranial atherosclerotic stenoses. There were 50 women and 63 men. Age was in range from 23 to 78 years (mean age 61.2 years). 106 lesions were symptomatic, the others were asymptomatic. 87 stenoses (71%) were located in anterior circulation; 34 of them (28%) in MCA and 53 (43%) in ICA. 36 stenoses were in posterior circulation (29%); 4 of them in basilar artery (3%), 32 (26%) in vertebral artery. Balloon expandable stents were used in 101 lesions (82%), self expandable stents were used in 22 lesions (18%).
Results: Primary technical success was achieved in 117 lesions (95%) and 6 stents implantations were unsuccessful in the first session; three of them were successfully treated during the second session (secondary technical success 98%). There were 18 periprocedural complications (14%), 4 minor without sequelae, and 13 major leading to change of treatment and prolonged hospital stay. One procedure-related death occurred.
Conclusion: Intracranial angioplasty and stent implantation in symptomatic atherosclerotic lesions documents a high rate of technical success and a low rate of subsequent stroke. This procedure is technically feasible, but in very tortuous vessels it can still be challenging to reach the target segment.

B-873 14:45

Symptomatic atherosclerotic middle cerebral artery stenosis treatment with self-expandable intracranial stents: Single center experience

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Purpose: Endovascular treatment of intracranial stenosis with self-expandable stents (SES) is a new challenging for prevention and treatment of acute stroke.
Methods and Materials: In this prospective, multicenter, single-arm study, medically refractory patients with symptoms evaluated with Rankin score attributable to angiographically demonstrated intracranial stenosis > 50% in vessels of 2.5 to 4.5 mm in diameter were enrolled. Intracranial lesions were predilated with an undersized balloon catheter to 80% of the native vessel diameter, followed by deployment of the self-expanding Wingspan stent to facilitate further remodeling of the atherosclerotic plaque and to maintain vessel patency. All patients underwent post-procedural neurologic examinations and angio-MR was performed 3 and 6 months after the procedure.
Results: Eleven patients were enrolled in our study. 8 patients had an acute ischemic stroke (AIS), the remaining had transient ischemic attacks (TIA). There was successful deployment of the Wingspan stents in all patients. The M1 (n. 8) and M2 (n. 3) middle cerebral artery segments were treated. Successful recanalization occurred in 100% of patients with reduction of the stenosis from $84 \pm 4\%$ down to $18 \pm 2\%$. No immediate post procedural complications occurred. 24 hours post-procedural MR diffusion analysis showed absence of acute ischemic lesions. No restenosis were showed at 6 months angio-MR follow-up.
Conclusion: Our experience with SES in treatment of middle cerebral stenosis demonstrated the technical feasibility and high rate of recanalization with acute stenting. A good planning associated with the choice of adequate devices in dedicated centers with high experience operators permit to obtain excellent results.

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also EPOS

Balloon-assisted endovascular occlusion of intracranial aneurysms

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Purpose: Evaluation of additional balloon support during endovascular occlusion of intracranial aneurysms: indications, procedural complications and follow-up.
Methods and Materials: From January 2006 until August 2009, 52 intracranial aneurysms in 50 patients (36 female, 14 male; mean/median age 56 years (range 23-86)) were treated in our hospital by endovascular occlusion with balloon support. Twenty-six patients presented with SAH, two patients had neurological deficit; 16 aneurysms were incidentally detected; eight aneurysms needed additional coiling. Aneurysms ranged in maximal size between 2 and 20 mm (mean/median 6 mm). Aneurysms were located in the supraclinoid internal carotid artery (n=23, including 10 P Com aneurysms), anterior communicating artery (n=8), middle cerebral artery (n=6), pericallosal artery (n=2) and 13 posterior circulation aneurysms (including 10 basilar tip aneurysms). Clinical and angiographic follow-up were at 1-3, 6, 12, 18 and 36 months after treatment.
Results: All aneurysms were occluded without technical failure. Indication for balloon-support: broad neck aneurysm (n=23), microcatheter stability problem (n=10), small aneurysm size (2-3 mm) to control possible perforation (n=8), poor neck visibility in media bifurcation aneurysm (n=5), combined broad neck aneurysm and microcatheter stability (n=5), thrombo-embolic prevention in partial thrombosed aneurysm (n=1). Six procedural complications occurred (12%): 4 thrombo-embolic and two haemorrhages (aneurysm perforation). One patient died (2%) and one patient had permanent neurological deficit (2%). Eight aneurysms (15%) had neck remnants of 10-25%. Three aneurysms showed partial re-opening during follow-up (6%). Mean follow-up 12 months (range 0-36 months).
Conclusion: Endovascular balloon support helps to occlude complicated intracranial aneurysms with a low mortality and morbidity rate.

B-875 15:03

also EPOS

Endovascular management, a successful efficient method in the treatment of catoticocavernous fistulae: Our experience in 46 patients

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Purpose: To discuss the efficacy of endovascular management by various methods as the treatment option for caroticocavernous fistulae.
Methods and Materials: In our study, 46 patients were included during the period from 02/02/2004 to 02/05/2009. 32 were male patients and 14 were female patients with mean age of 37 years. 25 patients presented with Type A carotid fistulae and 21 patients with dural fistulae. The majority of the patients (37) presented with proptosis, the other patients had red eye (32), diplopia (9), headache (13) and diminished vision (23). Pre procedural workup with CT, CTA, MR and MRA was done in all the patients. High resolution DSA was done using Advantax LCN + (GE Biplane system). Embolisation materials in the form of balloons were used in 15 patients and coils in 7 patients. Both balloons and coils were used in four patients. Glue was used in 3 patients and PVA in 14 patients. Onyx was used in three patients in our series.
Results: Complete cure in the form of total reversion of the disease was achieved in 34 patients. Improvement with residual pathology was achieved in eight patients in whom there was complete clinical cure but angiogram demonstrated small residual fistula with or pseudoaneurysm. The procedure was abandoned because of technical reasons in one patient. Spontaneous closure of fistula occurred in one patient. Inadvertent balloon detachment occurred in two patients. Thus, complete clinical cure was seen in 91% of patients which is on par with worldwide literature of 85 - 87% success rate.
Conclusion: Endovascular treatment of CCF has become the accepted form of therapy. Early diagnosis by high index of suspicion is needed.

B-876 15:12

CT-guided epidural blood patch in the treatment of spontaneus liquoral hypotension

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Purpose: We describe our diagnostic and therapeutic approach in patients with spontaneous liquoral hypotension (LH).
Methods and Materials: In 6 patients with clinical signs spontaneous LH, confirmed by typical brain MRI findings, we performed MRI-myelography and myelo-CT to detect the fistula site. In 2 cases, epidural hematomas were present. If a site was observed or strongly suspected, we performed in a different session epidural autologous blood patch under CT guidance.
Results: All patients had liquoral fistula at cervical or dorsal levels. In all cases but one, we observed complete headache improvement. Cerebral epidural hematomas underwent complete or partial regression. No complication occurred.
Conclusion: Myelo-MR is an useful screening tool to diagnose liquoral fistulae in patients with LH. Myelo-CT is useful to detect the fistula site in selected patients. CT-guided epidural blood patch is a simple and safe procedure that allows a more targeted treatment than blind patch.

B-877 15:21

Can you embolize the rabbit renal artery by microwire? Yes or No

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Purpose: PVA is a commonly used embolic material for perforated intracranial arteries. We tried microwire and RF generator for embolization of rabbit right renal artery which is similar in size with human middle cerebral artery, M2. We compared radiofrequency wire electrode with PVA embolization in terms of the embolic effects and absorption of embolic materials.
Methods and Materials: This experiment was performed in accordance with the regulations on the animal care and experiments. 12 New Zealand white rabbits were divided into two groups according to the materials; 4 rabbits with PVA 150-250 um in and 8 rabbits with RF ablation by RF generator (RF 3000, Boston Scientific Corporation, Boston, USA) and 0.018 inch Tefron coated platinum Mandril guide wire (Cook, Bjaeverskov, Denmark). Rabbits were sacrificed 3 days, 1 week, 2 weeks, and 4 weeks after the embolization.
Results: In gross pathology, swelling of embolized kidney was observed 3 days after the embolization, whereas shrinkage of the kidney was consistently seen after 2 weeks with hard consistency and nodular spaces. In the histologic analysis, the PVA particles made incomplete obstruction and no vascularity was noted after 3 days. The RF ablation showed full layer necrosis with thrombus formation after three days. 4 weeks later, PVA and RF group showed no remarkable change. The RF group showed generalized destruction of the architecture of artery with thrombolysis.
Conclusion: Embolization of radiofrequency wire electrode is a good candidate for embolic method, showing more cell destruction in rabbits in comparison with PVA particles. A long-term follow-up and safety study are necessary.