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Insights into Imaging

Education and strategies in European radiology

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23rd Annual Meeting and Postgraduate Course

European Society of Radiology

ESGAR 2012

EUROPEAN SOCIETY OF GASTROINTESTINAL AND ABDOMINAL RADIOLOGY

EDINBURGH / UK

BOOK OF ABSTRACTS

INCLUDES ABSTRACTS OF SCIENTIFIC PRESENTATIONS

JUNE 12 – 15

23RD ANNUAL MEETING AND POSTGRADUATE COURSE

CENTRAL ESGAR OFFICE
Neutorgasse 9
AT – 1010 Vienna, Austria
Phone: +43 1 535 89 27
Fax: +43 1 535 70 37
E-Mail: office@esgar.org
www.esgar.org

MEETING PRESIDENT
Prof. Steve Halligan
University College London
University College Hospital
Level 2 Podium
235 Euston Road
UK – NW1 2BU London, United Kingdom

IMPORTANT ADDRESSES

ORGANISING SECRETARIAT

Central ESGAR Office
Neutorgasse 9
AT – 1010 Vienna, Austria
Phone: +43 1 535 89 27
Fax: +43 1 535 70 37
E-Mail: office@esgar.org

EXECUTIVE DIRECTOR

Ms. Brigitte Lindlbauer
E-Mail: blindlbauer@esgar.org

WEBSITE

www.esgar.org

EXHIBITION MANAGEMENT

MAW – Medizinische Ausstellungsgesellschaft
Freyung 6
AT – 1010 Vienna, Austria
Phone: +43 1 536 63 35 or -34
Fax: +43 1 535 60 16
E-Mail: maw@media.co.at

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11:00 - 12:30 **Pentland**

Scientific Session 1

CT Colonography 1 - Implementation

SS 1.01

CTC: a comparative analysis of the actual costs with current reimbursement rates provided by the National Health Service

R. Scandiffio, A. Mantarro, L. Faggioni, P. Bemi, P. Vagli, I. Cavallini, E. Neri, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to evaluate the economical impact of CTC on the National Healthcare System (NHS) by comparison of the CTC actual costs with the allocated reimbursement rates.

Material and Methods: We estimated the actual costs of human resources, equipments and consumables (medical devices and drugs) employed to perform one CTC examination in our Unit. The costs of human resources were calculated assuming an average CTC execution and reporting time of 30 and 15 minutes, respectively. Radiological equipments encompass: PROTOCO~2~L Colon Insufflator; 64-row CT scanner LightSpeed-VCT; Advantage Workstation GE-Healthcare. Medical staff included: one radiologist, one radiographer and one nurse. Medical devices comprised: enema bag, administration set with small catheter and retention cuff CO~2~ delivery system for colonic insufflation, 2 pairs of gloves, 2.5-mL syringe, needle cannula, push-fistula bandage, patient's gown, shorts and sheets. Drugs included: 50 mL diatrizoate meglumine+diatrizoate sodium solution (Gastrografin®); 250 mL water for injection; lidocaine hydrochloride (Nefluan®); 20 mg hyoscine butylbromide (Buscopan®); 4 L carbon dioxide.

Results: The actual costs for each category are as follows (Euros): medical staff, 74.19; radiological equipments, 72.20; medical devices, 38.88; drugs, 12.09. The sum of these items yields an overall cost of 197.40 Euros/examination. By comparison, current NHS reimbursement amounts to 184.00 Euros, resulting in a hospital debt of 13.40 Euros/examination.

Conclusion: Current NHS reimbursement is unable to fully support the actual cost of CTC examinations, with consequent excessive expenditure of hospital resources.

SS 1.02

CT colonography versus colonoscopy or barium enema for diagnosis of symptomatic colorectal cancer: economic analysis from a multicentre randomised controlled trial

S. Halligan[1], G.L. Yao[2], K. Wooldrage[1], S. Zhu[2], W. Atkin[1], R. Lilford[2], T. Siggar Investigators[1]; [1]London/UK, [2]Birmingham/UK

Purpose: The purpose of this study was to determine the cost-effectiveness of CT colonography (CTC) for diagnosis of symptomatic colorectal cancer using real-world data obtained from 5384 patients participating in a multicentre pragmatic randomised controlled trial (RCT).

Material and Methods: Cancer detection rates were determined via two RCTs: barium enema (2527 patients) versus CTC (1047) and colonoscopy (1277) versus CTC (533). Resource costs for diagnostic procedures, the proportion of patients referred for subsequent investigations/treatment, and all associated downstream costs (further diagnostic procedures, surgery, outpatient visits, treatment costs, hospital stay, etc.) were calculated on an individual-patient basis. Cost per additional cancer detected was calculated via intention-to-treat with bootstrapping for incremental cost-effectiveness.

Results: Total mean and procedure costs were as follows: enema 444GBP (procedure cost 169GBP) versus CTC 512 (215); colonoscopy 651 (270) versus CTC 512 (215). The additional cost per colorectal cancer detected was 21,333GBP for CTC versus enema (3 additional cancers per 1000 patients). Cancer detection was similar for CTC versus colonoscopy, so cost per additional cancer for colonoscopy was >100,000GBP. For CTC, the mean cost per additional primary extracolonic cancer was 1965GBP.

Conclusion: CTC is more cost-effective than barium enema. CTC is marginally cheaper than colonoscopy but with similar cancer detection rates; choice of procedure will depend on other factors, including safety, acceptability and detection of extracolonic tumors. Notably, CTC becomes cost-effective at the threshold of 1 life saved per 26 extracolonic tumours detected.

SS 1.03

Potential complications at CT colonography in asymptomatic and symptomatic patients: national survey of Italy

M. Ciolina[1], F. Iafrate[1], G. Iussich[2], D. Regge[2], M. Iannitti[1], P. Baldassari[1], A. Pichi[1], A. Laghi[3]; [1]Rome/IT, [2]Candiolo/IT, [3]Latina/IT

Purpose: The purpose of this study was to retrospectively evaluate the incidence of complication related to CTC performed in both symptomatic and asymptomatic patients undergoing CTC during the period ranging from 2000 and 2010.

Material and Methods: With a national survey, an e-mail questionnaire about serious adverse events of CT colonography was sent to all Italian Public Health Centers performing a daily CTC service. Technical parameters related to complications and kind of treatment needed for adverse events were also investigated. Collected data were analyzed and raw frequencies were determined.

Results: All centers (13/13) interviewed, answered positively to the survey. Among 13 centers, 40.121 CTC were performed. No deaths were reported. 39 (0.097%) patients experienced a complication during the procedure: 32 vasovagal self-limiting attack episodes (0.079%) and 7 bowel perforations (0.017%). In 4 (57%) cases, the site of perforation was within the rectum, in 3 (43%) cases within the sigmoid colon. No case of perforation within transverse, ascending colon and caecum. Three of perforated patients had to undergo surgery, while four patients had a conservative treatment. 4/7 cases of perforation had a conventional colonoscopy in the past seven days prior to CTC or on the same day of the exam.

Conclusion: In summary, we found a low rate of colonic perforations (0.017) that were associated with CT colonography. The rate of occurrence of luminal perforation, however, was more than four times lower than equivalent rates published for colonoscopy.

SS 1.04

National survey of colonic imaging in the UK

A. Lowe, A.D. Culverwell, S. Punekar, D. Prasad, S. Stephenson, C. Jackson, C. Kay; Bradford/UK

Purpose: The purpose of this study was to evaluate current provision of colonic imaging in the UK NHS, to quantify radiologist and radiographer experience and training, and to document current CTC technique and future plans for delivering colonic imaging services.

Material and Methods: Postal questionnaires were sent to GI lead radiologists and radiology managers at UK hospitals between April 2011 and November 2011. Comparison is made to a previous national survey in 2004.

Results: Responses were obtained from 86 UK hospitals. There has been a significant increase in the percentage of centres and volume of CTC being performed since 2004. Most reporters are GI sub-specialists, trained on formal courses, but 40% are non-specialist and 18% have not been formally trained. 60% of centres double read at least some of the examinations. 94% use automated insufflation, 96% buscopan, 72% oral tagging. 54% use full purgation for all cases. 46% use iv contrast for all cases. 16% of centres have radiographers performing first read. Increasing demand is being managed by creating more CT capacity by extended working into evenings and weekends and training more radiologists and radiographers to read CTC.

Conclusion: Role out of CTC into UK radiology departments since 2004 has been extensive and responsible. Technique is good with experienced, specialist radiologists providing the majority of final reports. In less experienced centres, double reading is frequently utilised. Issues remain around low volume in centres and individuals and lack of formal training in a minority.

SS 1.05

How do patients and doctors weight the relative importance of false-positive and false-negative diagnoses of cancer by CT colonography: discrete choice experiment

D. Boone[1], S. Halligan[1], N. Bell[1], S. Zhu[2], S. Mallett[3], C. von Wagner[1], S.A. Taylor[1], D. Altman[3], R. Lilford[2]; [1]London/UK, [2]Birmingham/UK, [3]Oxford/UK

Purpose: Receiver operator curve (ROC) analysis of radiological tests applies equal penalties for false-negative and false-positive diagnosis. We determined whether patients and doctors also weight these errors equally.

Material and Methods: 72 patients and 50 doctors completed a discrete choice experiment of 20 individual questions, presented graphically on a laptop. Each question posed 2 alternative radiological tests; CT colonography versus a "new" hypothetical scan that correctly diagnosed one additional

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colorectal cancer or polyp (i.e. a lesser false-negative rate), raising sensitivity by 10% (from 85% to 95%) but at the expense of additional false-positive diagnoses. The number of false-positives per additional cancer diagnosis was varied for each question. The clinical consequences of false-positive diagnoses were explained prior to the test. Participants indicated their preferred test for each question. Responses were collated and the "tipping-point" calculated for each group overall.

Results: For 10% increase in cancer sensitivity, patients tolerated a mean 47% (95%CI 39%-56%) increase in false-positives, equating to 2350 per additional cancer detected. Doctors tolerated an additional 14% (95%CI 9%-21%), which equated to 700 per cancer. For an 10% additional polyp detections, patients tolerated an additional 33% rise in false-positives compared to 17% for doctors.

Conclusion: Patients (especially) and doctors regard false-negative diagnosis of colorectal cancer (and polyps) as overwhelmingly more important than false-positive diagnoses. Statistical analysis of radiological tests must take this discrepancy into account if they are to truly reflect diagnostic benefit.

SS 1.06

Use of computed tomographic colonography (CTC) in patients older than 75 years

D.A. Tiferes, A. Habr-Gama, J.G. Rodrigues, R.O. Perez, I. Proscurshim, R. Blasbalg, R.P. Caldana; São Paulo/BR

Purpose: The purpose of this study was to demonstrate the use of CTC in patients older than 75 years.

Material and Methods: Retrospective analysis of 116 consecutive CTC examinations performed in patients older than 75 years was undertaken. Performance and outcome measures including colonoscopy referral, prevalence of lesions ≥ 10mm, significant extracolonic findings and complication rates were obtained by using a CTC database and review of medical records.

Results: 35 males and 81 females, with ages ranging from 75 to 95 years (mean 81.2 years), underwent CTC for colorectal cancer screening (27.6%), due to incomplete colonoscopies (33.6%) and for evaluation of gastrointestinal symptoms (38.8%). Adequate technique (insufflation and bowel preparation) was obtained in 93.2% (645 of 696) of the colonic segments evaluated. There were no complications. Colonoscopy was indicated in 19% (22 of 116) of patients, using a 10 mm lesion size as threshold for referral. Sixteen of these patients underwent colonoscopy and/or surgery, with 15 patients harboring lesions ≥ 10 mm (11 invasive cancers and 4 advanced adenomas). The overall per-patient CTC positive predictive value was 93.8% (15 of 16). Significant extracolonic findings were seen in 12.9% (15 of 116) of patients, mostly consisting of aortoiliac aneurysms (n=6).

Conclusion: CTC is a safe and effective modality for colorectal evaluation in patients older than 75 years. Based on CTC results, optical colonoscopy may be ultimately avoided in over 80% of those patients.

SS 1.07

CTC in symptomatic patients: are we keeping negative colonoscopies to a minimum?

S.F. Kerr, D.J.M. Tolan, M. Sheridan; Leeds/UK

Purpose: In many institutions, CTC has supplanted colonoscopy as first-line investigation for colonic neoplasia in symptomatic patients with comorbidity. However, published outcomes of CTC performance outside research trials are lacking. We reviewed our CTC experience in symptomatic patients with the primary objective of establishing positive predictive value (PPV) for benchmarking clinical practice during early service development.

Material and Methods: All CTC examinations performed over a two-year period from May 2007 (i.e. 2-year minimum clinical follow up) were reviewed. For those reporting a significant colonic abnormality (i.e. polyp ≥6mm; cancer; or indeterminate thickening), endoscopy and pathology reports were reviewed. CTC was performed with standard technique including intravenous contrast.

Results: Of 1852 consecutive CTC examinations (median age 78), 337 reported a significant colonic abnormality. 70 had undergone previous incomplete colonoscopy and were excluded from further analysis. 215 had subsequent colonoscopy and/or surgery; corresponding lesions were confirmed in 167 and excluded in 32. Excluding 16 patients with inadequate subsequent visualisation of the appropriate colonic segment, per-patient PPV of CTC was 83.9%. Seven patients were ultimately diagnosed with inflammatory (rather than neoplastic) lesions; categorising these as "false positive" reduces PPV to 80.4%. In total, 251 polyps ≥6mm and cancers were reported on CTC in 194 patients proceeding to colonoscopy and/or surgery; per-lesion PPV was 85.7%.

Conclusion: PPV of CTC for significant colonic abnormalities is high and the number of subsequent negative colonoscopies is low.

SS 1.08

Perforation rate in CT colonography: a systematic review from literature

D. Bellini, M. Rengo, D. Caruso, F. Vecchietti, M. Osimani, A. Laghi; Latina/IT

Purpose: The purpose of this study was to assess the perforation rate in CT colonography and to evaluate methodological aspects and patients' characteristics related to colonic perforation.

Material and Methods: Methods for analysis and inclusion criteria were based on PRISMA recomandations for systematic reviews and meta-analyses. MEDLINE, Cochrane, Sumsearch2 and Web of Science databases, from inception to September 2011, were searched for studies that reported perforation rate in Virtual Colonography. The evaluation of eligibility and the selection of articles were performed independently by two radiologists. From each primary study, reviewers abstracted the year of publication, the country where the study was performed, whether it was a single or multicenter study, number of patients, number of patients underwent CTC for screening and because symptomatic, whether manual or Automatic colon distention was performed, number of patients perforated, center experience. Moreover, for each one of perforated patients, clinical data were extracted.

Results: 188 articles were identified through database searching and after screening process, 15 articles fulfilled eligibility criteria and were selected for qualitative synthesis. The number of patients enrolled per study ranged from 262 to 21923, with a median of 9617. In 57700 CTC performed (44% for screening, 50% because symptomatic), 21 patients (mean age 75) have been perforated with a perforation rate of 0.0298. Only 3 patients perforated underwent CTC for screening.

Conclusion: While considered safer than optical colonoscopy, CT colonography is not without risk, especially in symptomatic patients.

SS 1.09

Withdrawn by the authors

SS 1.10

Role of CT colonography in preoperative evaluation prior to laparoscopic surgery for complicated diverticular disease

R. Rizzati[1], S. Tartari[1], G. Anania[2], M. Bassi[1], M. Princivalle[1], R. Righi[1], G. Benea[1]; [1]Lagosanto/IT, [2]Ferrara/IT

Purpose: The purpose of this study was to investigate the clinical value of CT colonography (CTC) in the diagnosis of complicated diverticular disease in order to properly plan the laparoscopic surgery.

Material and Methods: From January 2009 until November 2010, 49 patients scheduled for surgery for complicated diverticulitis, known or suspected, underwent CTC. All patients were previously evaluated with optical colonoscopy (OC). Sensitivity in lesion location and detection was compared between OC and CTC and discrepancies analyzed. Accuracy of CTC in complicated diverticulitis evaluation was determined.

Results: A total of 49 patients with complicated diverticulitis were classified by CTC. OC was incomplete in 37/49 (26%) cases. Based on CTC assessment, 10 cases of complicated diverticulitis were managed medically; 30 patients underwent laparoscopic surgery for complicated diverticular disease. In 14 patients, CTC findings suggested an open surgery treatment due to adhesions, abscesses or fistulas. In diagnosis of complicated diverticular disease, CTC showed 100% agreement regarding location and extent of the lesion and 90% sensitivity for complications. Furthermore, CTC detected 34 extracolonic findings, 12 of whom had major clinical relevance.

Conclusion: CTC provides more detailed and precise depiction of complicated diverticular disease compared to OC, allowing an appropriate and accurate management of patient.

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11:00 - 12:30 **Fintry**

Scientific Session 2
Interventional Radiology

SS 2.01
CT-perfusion technique, with evaluation of quantitative perfusion map, as an early predictor for tumour response to transarterial chemoembolization in patients with HCC lesions
P.A. Bonaffini, D. Ippolito, C. Talei Franzesi, C. Capraro, R. Corso, S. Sironi; Monza/IT

Purpose: The purpose of this study was to prospectively investigate the role of CT-perfusion (CT-p) technique in evaluation of perfusion changes in HCCs before and after transarterial chemoembolization (TACE) therapy.
Material and Methods: Twenty-seven patients with cirrhotic liver disease and histologically proved HCC were prospectively enrolled in our study. CT-p study was performed on 16 multidetector CT (Brilliance 16, Philips, NL), dose exposure was 120 Kv, 80 mAs. In all cases, bolus injection of 50 ml of non-ionic contrast agent (350 mgI/ml) at a flow rate of 6 ml/sec was performed and forty dynamic scans were acquired at a fixed table position. A dedicated perfusion software which generated a quantitative map of arterial and portal perfusion by means of colour scale was employed. The following perfusion parameters were assessed before and after TACE: hepatic perfusion (HP), arterial perfusion (AP), blood volume (BV), hepatic perfusion index (HPI).
Results: A complete HCC filling by lipiodol was found in 18 cases with following perfusion parameters: HP 32.7±15.1 ml/sec/100gr; AP 38.4±8.8 ml/min; BV 17.6±9.5 ml/100mg; HPI 96.2 ±7.5%. Corresponding value calculated in patients without residual tumor were: HP 13.6±6.3; AP 13.1±7; BV 6.8±4.8; HPI 13.6±9.2. A significant difference ($p<0.001$) was found for all parameters between residual viable tumor tissue ($p<0.001$) compared to successfully treated lesion, due to the presence of residual arterial vascular structure in viable portion of treated HCC.
Conclusion: On the basis of the small patient population, this feasibility study shows that quantitative analysis of perfusion could provide an in vivo early biomarker for predicting treatment response in patients with HCC lesions.

SS 2.02
Survival after radiofrequency ablation and salvage transplantation in patients with hepatocellular carcinoma and Child-Pugh A cirrhosis
O. Seror, G. N'Kontchou, M. Beaugrand, J.C. Trinchet, Y. Ajavon, N. Sellier; Bondy/FR

Purpose: In patients with hepatocellular carcinoma (HCC) in Milan criteria, liver transplantation (LT) may be the best therapeutic option. However, the shortage of grafts, leads to attempt liver resection (LR) or radiofrequency ablation (RFA) as a first-line treatment for patients with Child-Pugh A cirrhosis.
Material and Methods: We report results, obtained between 2000 and 2007 from a single center, involving 67 patients (mean age: 58 years) eligible for LT, who were treated with RFA, followed by LT if there was recurrence or liver failure.
Results: RFA achieved complete ablation in 96% of nodules. No mortality occurred. During a post-RFA median follow-up of 48 months, 38 patients experienced recurrence, corresponding to a 5-year recurrence rate of 58%. Of these, 14 patients did not receive a transplant, because they fell outside the Milan criteria, 21 were transplanted, and 3 were treated by RFA after refusing LT. Binodularity (95% CI HR=2, 1.0–4.0; p=0.049) was the unique risk factor for recurrence. By the study's end-point, 24 patients had undergone LT. No HCC recurrence occurred after LT. Among the 43 non-transplant patients, 12 died due to HCC progression, and 27 were alive without detectable viable tumor. The probability rates for 5-year overall and tumor-free survival were 74% and 69%, respectively.
Conclusion: First-line RFA followed by salvage LT allows comparable survival figures with a first-line LT, whist limiting the number of grafts.

SS 2.03
Microwave ablation of liver tumours at 2.45 GHz with a 1.8 mm applicator: radiological outcomes
P.A. Patel, I.D.C. Wilson, C.N. Hacking, B. Stedman, D.J. Breen; Southampton/UK

Purpose: Little published data exist on outcomes following microwave ablation (MWA) at 2.45 GHz in human liver tumours. We have analysed our performance of percutaneous MWA assessing technical success and short-term outcomes.
Material and Methods: 46 liver tumours [hepatocellular carcinoma (22), metastases (24)], with a mean tumour size of 30mm, in 37 patients with an average age of 67 years were treated by multi-station percutaneous MWA over 14 months. Post-ablation dual-phase CT was performed on average at 23 days post-treatment and technical success assessed. Subsequent follow-up CTs have been performed. Data were collected prospectively.
Results: 40 of 46 tumours (87%) were successfully treated by MWA. Sub-total treatment occurred initially in eight tumours in seven patients. Sub-total treatments were anticipated in one patient with two tumours in whom the procedure was abandoned due to general anaesthesia difficulties. Of six unexpected sub-total treatments, three tumours underwent completion MWA, and one completion trans-arterial chemoembolization. Average length of imaging follow-up was 116 days (maximum 449 days). From tumours with complete ablations, there has been only one late local recurrence, detected at 132 days post-ablation. Five patients died of progressive disease, at an average of 245 days post-ablation.
Conclusion: Complete MWA was achieved in 40 of 46 (87%) tumours with an average size of 30 mm. Early experience has led to a modified, multi-stationed approach with a trend to primary complete treatments later in this cohort.

SS 2.04
Biodegradable oesophageal stents: indications and complications in the management of malignant oesophageal tumours
D. Mullan, P. Kellati, H. Sheikh, H. Laasch; Manchester/UK

Purpose: Oesophageal stents are well established in the management of malignant oesophageal tumours and traditionally require covered, retrievable, metal stents to avoid complicated mucosal embedment. Radiotherapy should not be given with a metal stent in situ, requiring stent retrieval and nasogastric/gastrostomy insertion. Biodegradable oesophageal stents are a recent product indicated primarily for benign strictures. We report the novel use of non-covered biodegradable stents in the management of malignant strictures, allowing concurrent radiotherapy with stent in situ. We discuss indications, implications and complications.
Material and Methods: Patients with oesophageal malignancy suitable for radical radiotherapy were referred for biodegradable stent insertion at a regional oncology centre. Prospective auditing allowed retrospective statistical review of clinical data including symptoms, demographics, outcomes, complications and survival. All cases were performed under fluoroscopic guidance by a consultant radiologist.
Results: 18 stents were inserted in 17 patients between 17/4/2009 and 9/8/2011. All were placed immediately prior to radiotherapy. Two stents blocked with food/mucosal hyperplasia, one requiring gastrostomy and one preferring NG insertion due to stent associated pain. 1 patient complained of pain alone, endoscopy showing mucosal hyperplasia. 1 stent slipped requiring reinsertion.
Conclusion: Biodegradable stents inserted for potentially curable malignancy confer the significant advantage of permitting concurrent radiotherapy whilst obtaining luminal expansion. This permits a psychologically significant oral diet and avoids the need for gastrostomy/nasogastric tube insertion. They do, however, seem prone to specific complications, such as pain and mucosal hyperplasia.

SS 2.05
Right-sided Wallflex stenting in patients with malignant colonic obstruction: a single-centre prospective study
I. Walton, B. Fox, P. Williams; Plymouth/UK

Purpose: Self-expanding metallic stents (SEMS) have been used to relieve malignant colonic obstruction as palliation or as an interim procedure to surgical resection. There is a paucity of data related to colonic stent insertion in the proximal colon. We present the world's largest single-centre 10-year prospective data to assess the outcomes in stented patients with right-sided lesions.
Material and Methods: A total of 40 consecutive patients (45% women; mean age 76) were treated for right-side obstruction due to primary or recurrent colon cancer with SEMS: 2 as an interim to surgery and 38 for palliation. A Wallflex stent was used in all patients and inserted under combined endoscopic and fluoroscopic guidance.
Results: Right-sided colonic stent deployment was attempted in all 40 patients with 41 stents. SEMS was successfully deployed in 34 cases (85%) with two complete obstructions, one failure deployment, and an inaccessible obstructing lesion in three cases. There were no procedural complications (perforation, migration). Clinical success was achieved in 30 of 34 cases (88%). Long-term complications included: a migration of a successfully deployed stent, and three re-obstructions due to faecal blockage or tumour ingrowth. The remaining patients had normal bowel movements for the period of follow-up or until expiration.

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Conclusion: Management of proximal malignant colonic obstruction with the Wallflex device is safe and effective. Technical and clinical success is encouraging, with outcomes comparable to distal colonic stenting.

SS 2.06

Selective radioembolization with 90y microspheres for liver secondary lesions: our experience

R. D'Angelo, F. Fiore, L. Aloj, C. Arrichiello, S. Lastoria, V. Albino, F. Izzo; Naples/IT

Purpose: The purpose of this study was to assess the safety and effectiveness of intra-arterial Y90 SIR sphere treatment in patients with liver metastasis.
Material and Methods: Between 2005 and 2011, radioembolization was performed in 83 patients with non-surgical liver metastases in progression after chemiotherapy: 52 with colorectal tumor; 19 with breast cancer; 4 with melanoma; 2 with NET; 2 with pancreas tumor; 2 with gastric tumor; 2 with ovarian tumor. The administered dose was calculated with Body Surface Area Method (BSA). All patients underwent PET/TC before and after treatment. PET-Y90 was performed to check the microspheres distribution. Work up included also embolization of gastroduodenal artery and other arteries using micro-coils. Shunting study was performed with TC 99MAA after positioning of 3French microcatheter.
Results: The mean administered dose was 1.55 GBq. The partial/complete response was achieved in 27 patients; in 42 was obtained stability and progressive disease in 24 patients. No significant side-effects of treatment were observed; 37 patients developed fever and can last up to a week. 43 patients also experienced abdominal pain controlled by oral analgesia. Prophylaxis treatment was used for 1 month after with PPI.
Conclusion: Our experience suggests that radioembolization is effective and safe for local treatment of non-surgical hepatic metastasis in progression after systemic chemotherapy.

SS 2.07

Role of transarterial chemoembolization as bridging strategy in T2 HCC patients on the waiting list

I. Bargellini, E. Bozzi, G. Lorenzoni, P. De Simone, R. Cioni, F. Filipponi, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to retrospectively evaluate long-term outcomes of T2 stage HCC patients who underwent orthotopic liver transplantation (OLT) after transarterial chemoembolization (TACE), compared to patients transplanted without bridging therapy.
Material and Methods: The study included 168 cirrhotic patients (147 male, mean age 55.8 years) with T2 HCC, who underwent OLT from 1996 to 2010. In patients treated by TACE, latest CT examination prior to OLT was reviewed to assess tumor response according to mRECIST. Patients were divided into three groups: (A) no bridging therapy; (B) complete response (CR) after TACE; (C) partial response, stable or progressive disease after TACE. Overall (OS), recurrence-free (RFS) and disease-free (DFS) survivals were calculated by Kaplan-Meier analysis and compared by log-rank test.
Results: Fifty-six patients were in group A, 60 patients in group B and 52 patients in group C; preprocedural data were comparable among groups. Five-year OS, RFS and DFS were 75.2%, 92.7% and 73.2%, respectively. Survivals were significantly higher in group B compared to group C and comparable between group A and B. Of interest, in tumors > 3cm, RFS and DFS censored for periprocedural deaths (n=7) were higher in group B compared to group A (p=0.05).
Conclusion: In T2 transplanted patients, CR after pre-operative TACE represents a favorable prognostic indicator. TACE may be beneficial for T2 patients with overall tumor size >3cm.

SS 2.08

Comparison of percutaneous portal vein embolization, portal vein ligation and portal vein occlusion combined with ipsilateral hepatic artery cannula implantation prior to major liver resection

P. Pajor, O. Hahn, I. Dudas, A. Zsirka, T. Winternitz, P.K. Kupcsulik; Budapest/HU

Purpose: The purpose of this study was to evaluate the results of percutaneous portal vein embolisation (PVE), portal vein ligation (PVL) and portal vein ligation combined with hepatic artery cannula implantation into the ipsilateral hepatic artery (PVL+can) prior to extended hepatectomy.
Material and Methods: Between 2004 and 2012, hundred and twenty patients presenting with multiple or large liver metastases or large hepatocellular carcinoma were included. The estimated residual liver volume (FLR) of these patients after the planned extended hepatectomy was less than 30% (normal liver), or 40% (cirrhotic liver). To increase the FLR, portal vein occlusion techniques (39 PVE, 81 PVL alone, or PVL+can) were performed. They were evaluated with MDCT including volume assessment, before and 8 weeks after these procedures.
Results: 96/120 patients became resectable (PVE, PVL, PVL+can, 74.3%, 80%, 88.5%). FLR increase 8 weeks after PVE, PVL or PVL+can was 17.6%, 16.5%, 19%, the complication rate of the various portal occlusion techniques were 4.5%, 3.6%, 11,5%, respectively. At least 4 segments were resected during hepatectomy. Overall, postoperative morbidity and mortality rates were 13% and 2.5%, respectively. Complication and mortality rates did not differ significantly in the 3 groups.
Conclusion: Patients with previously unresectable liver tumors can benefit from resection after all kinds of portal occlusion techniques. Although complication rate of portal occlusion combined with hepatic artery canulla implantation is higher, more patients become resectable due to higher increase rate of FLR in this group.

SS 2.09

Dynamic evaluation and quantification of microvascularization during degradable starch microspheres transarterial chemoembolisation (DSM-TACE) of HCC lesions: a feasibility study

P. Wiggermann, W.A. Wohlgemuth, A.G. Schreyer, M. Loss, C. Stroszczynski, E. Jung; Regensburg/DE

Purpose: The purpose of this study was to evaluate the time-dependent changes of microvascularization in HCC lesions during DSM-TACE using contrast enhanced ultrasound (CEUS).
Material and Methods: A total of 64 CEUS examinations were performed (1-5 MHz, convex probe) in 8 selected patients who underwent DSM-TACE of HCC lesions. I.v. application of ultrasound contrast media was performed before and 24 h post-embolization. In addition, i.a. contrast application was performed via the angiographic catheter right before and after the embolization and during a follow-up time of 2 h every 30 min. The capillary perfusion was analyzed using a dedicated perfusion software.
Results: A reduced microvascularization was seen right after DSM-TACE in all cases. The reduction of PEAK, RBV (regional blood volume) and RBF (regional blood flow) compared to pre-embolization values was highly significant ($p<0.001$). During follow up, a stepwise revascularization of the lesions was documented: 90 min post embolization perfusion parameters were not significantly different from pre-embolization values.
Conclusion: In this feasibility study, capillary perfusion quantification of HCC lesions after DSM-TACE could be demonstrated using CEUS. It was possible to quantify for the first time the transient embolizing effect of DSM-TACE.

SS 2.10

Multi-centre survey of radiologically inserted gastrostomy feeding tube in the UK

A. Lowe[1], H.U. Laasch[2], S. Stephenson[1], C. Butterfield[1], M. Goodwin[2], C. Kay[1]; [1]Bradford/UK, [2]Manchester/UK

Purpose: The purpose of this study was to evaluate variance in current UK practice and clinical outcomes for direct percutaneous radiologically inserted gastrostomy (RIG).
Material and Methods: A prospective UK multi-centre survey of RIG was performed between October 2008 and August 2010.
Results: Data from 684 patients were provided by 45 radiologists working at 17 UK centres. 263 cases (40%) were performed with loop-retained catheter, and 346 (53%) with balloon-retained devises. 60% of all patients experienced pain in the first 24 hours but settled in the majority thereafter. Early complications, defined as occurring in the first 24 hours, included: minor

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bleeding (1%), wound infection (3%), peritonism (2%) and tube misplacement (1%). Late complications, occurring between day 2 and day 30, included: mild pain (30%), persisting peritonism (2%) and 30-day mortality of 1% (5/665). 93% of cases were performed using gastropexy. Gastropexy decreased post-procedural pain ($p<0.001$), but gastropexy-related complications occurred in 5%. Post-procedure pain increased significantly as tube size increased ($p<0.001$). The use of balloon retention feeding tubes was associated with more pain than the use of loop retention devices ($p<0.001$).

Conclusion: RIG is a relatively safe procedure with a mortality of 1%, with or without gastropexy. Pain is the commonest complication. The use of gastropexy, smaller tube sizes and loop retention catheters significantly reduced the incidence of pain. There was a gastropexy-related complication rate in 5% of patients. Neither pre-procedural antibiotics nor anti-MRSA prophylaxis affected the rate of wound infection.

11:00 - 12:30 **Sidlaw**

Scientific Session 3
Luminal GI tract

SS 3.01
Software-assisted evaluation of gastric motility in MRI improves the assessment of functional parameters

S. Bickelhaupt[1], J.M. Froehlich[1], R. Cattin[2], S. Raible[2], H. Bouquet[3], U. Bill[3], M.A. Patak[1]; [1]Zurich/CH, [2]Biel/CH, [3]Bern/CH

Purpose: Functional MRI of gastric motility is of high clinical relevance, e.g. for gastric-emptying disorders, but time-consuming due to the manual measurement. A newly developed software (Motasso) has proven valid for semi-automatic measurement of small-bowel motility. The aim of this study was to evaluate the feasibility of Motasso for the assessment of gastric motility by comparing it to manual measurements.

Material and Methods: 10 patients (5 male/5 female; mean 41 years) were included in this study. MRI (1.5-T, Siemens-Sonata) was performed after standardized preparation (3% Mannitol over 1 h). 2D (dynamic-T2-2D-FIESTA;TR253.8/TE1.89/FOV400/10mm slice) motility acquisitions covering the entire abdomen were performed in apnea. Image analysis for assessment of gastric motility was performed both manually and with the software in the proximal/distal corpus. The main characteristics (amplitude/frequency/diameter) describing gastric motility were compared using (paired) Student's t-test.

Results: 10 single regions-of-interest (5 in the proximal/5 in the distal corpus) were measured by hand and with Motasso. All motility curves qualitatively matched each other (10/10; 100%). No significant difference ($p>0.05$) was found for amplitudes (mean: 18.17 mm, manual: 17.78 mm, Motasso), contraction frequency (5.1/min, 4.7/min) and mean lumen diameters (34.12 mm, 33.13 mm). Mean duration for single measurement was significantly ($p<0.001$) lower with Motasso (6.40 min, manual: 1.40 min, Motasso). Mean manual wave propagation was 0.68 mm/sec.

Conclusion: Motasso proves to be feasible for fast and accurate measurement of gastric motility in both the proximal and distal corpus. No significant differences between manual measurements and the software could be observed. Motasso can help to reduce the time needed for assessment of relevant characteristics in gastric motility and thus ease the clinical practice of gastric motility analyses.

SS 3.02
Accuracy of MDCT in preoperative definition of maximum tumor diameter in patients with gastric cancer

S. Guerrini, M.A. Mazzei, N. Salvini, P. Mercuri, N. Cioffi Squitieri, C. Vindigni, D. Marrelli, L. Volterrani; Siena/IT

Purpose: The maximum tumor diameter (Dmax) is a prognostic factor in patients with gastric cancer, considering its dependance on the depth of invasion. The aim of our work has been to evaluate the accuracy of MDCT in the preoperative definition of Dmax in patients with gastric cancer, assuming surgical specimen measurements as gold standard, in order to obtain a pre-surgery prognostic evaluation.

Material and Methods: Pre-surgery CT examinations of 47 patients (mean age 53.5, range 48-71) with diagnosis of gastric cancer were evaluated retrospectively and in a blind fashion by a radiologist with expertise in the oncologic field. The Dmax measured was obtained through 2D multiplanar curved reconstruction (ADW 4.6 GE Healthcare). The results were compared with macroscopic data after surgery.

Results: The mean value of Dmax obtained by surgical specimen was 50 mm (range 30-60) versus 63 mm (range 46-92) of Dmax measured through MDCT. If the Dmax values were stratified in three groups (group 1 smaller than 40 mm, group 2 between 40 and 80 mm, group 3 bigger than 80 mm), a correlation with MDCT results of 25%, 62% and 71%, respectively, was found.

Conclusion: MDCT is an accurate technique to obtain an appropriate preoperative definition of Dmax, within the limits of tumor bigger than 40 mm. The revaluation of each case with Dmax smaller than 40 mm will supply additional information about the discrepancy (retraction of the stomach following immersion into formalin, diffusion in the submucosal layer).

SS 3.03
Evaluation of nine CT-signs in surgically proven internal hernia after gastric bypass, initially missed on CT

J. De Cock, D. Vanbeckevoort, L. Van Muylder, M. Lannoo, D. Bielen; Leuven/BE

Purpose: Retrospective evaluation of nine CT-signs of internal herniation after laparoscopic gastric bypass in 13 patients with surgically proven internal hernia where the diagnosis initially was missed.

Material and Methods: We retrospectively evaluated the CT-scans of 13 patients who had complaints of long-lasting vague abdominal pain after undergoing a laparoscopic gastric bypass procedure. None of the patients were initially diagnosed with internal herniation. Surgical exploration revealed internal herniation in all 13 patients. We reevaluated the images using nine CT-signs: swirled appearance of mesenteric fat or vessels, mushroom shape of the hernia, mesenteric infiltration, the presence of reactive lymph nodes, tubular distal mesenteric fat surrounded by bowel loops, small-bowel dilatation, clustered loops of small bowel, small bowel other than duodenum posterior to the mesenteric artery and right-sided location of the enterostomy.

Results: Presence of the signs: Mesenteric swirl and mesenteric infiltration were 100%. Mushroom shaped hernia and reactive lymph nodes were 77%. Clustered loops of small bowel were 46%. Small-bowel dilatation was 38%. Displaced enterostomy was 31%. Tubular distal mesenteric fat surrounded by bowel loops was 23%. Small bowel other than duodenum posterior to the mesenteric artery was 15%.

Conclusion: When a patient suffers from vague long-lasting abdominal complaints after gastric bypass, thorough investigation of the nine CT-signs presented above is mandatory in diagnosing internal herniation on an abdominal CT-scan.

SS 3.04
Post-operative ileus, abnormal bowel and overall radiologist impression are independent predictors for clinical anastomotic leak on CT

K. Adams, D. Bosanac, A. Hansman, P. Peddu, S. Ryan, S. Papagrigoriadis; London/UK

Purpose: The purpose of this study was to investigate individual radiological features as predictive factors for anastomotic leak detection in CT scans following colorectal resections.

Material and Methods: Patients were identified from a prospective database from 2005 to 2011 with surgically confirmed post-operative anastomotic leaks. The control group (matched in 2:1 ratio) was selected from patients who were scanned with a suspicion of leak, but improved without operation. Four gastrointestinal radiologists reviewed anonymised CT scans, blinded to clinical outcome. Radiologists assessed for the overall impression of anastomotic leak, presence of leak features, and confidence level in their results.

Results: 17 patients with confirmed anastomotic leaks and 36 control patients were enrolled. No significant difference was observed in the sensitivity/specificity between the radiologists in correct leak detection, with overall correct diagnosis in 81.4%. A leak prediction model was constructed with multivariate binomial logistic regression with outcome classified as clinical leak. Leak, abnormal bowel wall and ileus were significant predictors (all $p<0.05$). The prediction model produced an overall sensitivity 85.2%, specificity 80.2% and ROC curve area of 87.3% (see graph). A correct leak prediction was associated with a significantly higher confidence level: 7.09/10 when incorrect versus 8.50/10 when correct ($p=0.02$).

Conclusion: Diagnostic accuracy was significantly higher when radiologists had a higher level of confidence in their diagnosis. Individual CT features have been used to create a risk prediction model for leak detection that improves diagnostic accuracy above overall radiological impression alone.

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SS 3.05

A diagnostic accuracy meta-analysis of endoanal ultrasound (EAUS) and magnetic resonance imaging (MRI) for Perianal Fistula Assessment

M.R.S. Siddiqui[1], H. Ashrafian[2], P. Tozer[1], N. Daulatzai[1], D. Burling[1], A. Hart[1], T. Athanasiou[2], R.K. Phillips[1]; [1]Harrow/UK, [2]London/UK

Purpose: We present a systematic review of published literature comparing endoanal ultrasound with magnetic resonance imaging for the assessment of idiopathic and Crohn's perianal fistulas.

Material and Methods: Electronic databases were searched from January 1970 to October 2010 for published studies in any language.

Results: Six studies comparing endoanal ultrasound and magnetic resonance imaging for perianal fistulas were analysed. There were 293 fistulas in the ultrasound group and 291 in the magnetic resonance group. The combined sensitivity and specificity of magnetic resonance for overall fistulas detected were 0.90 (95% CI: 0.75-0.96) and 0.66 (95% CI: 0.48-0.80). There was significant heterogeneity between studies reporting on MRI (Q=52.39, df=5, p=0.000, I2=90%). This compares to a sensitivity and specificity for endoanal ultrasound of 0.88 (95% CI: 0.77-0.95) and 0.45 (95% CI: 0.24-0.67), respectively. There was significant heterogeneity between studies (Q=49.28, df=5, p=0.000, I2=90%).

Conclusion: From the available literature, the summarised performance characteristics for MRI may be interpreted as better than those for EAUS, but the significant between-study heterogeneity precludes any firm conclusions being made for clinical practice. Future trials with improved study design (including prospective data collection and consideration of verification bias) may help to further clarify the role of MRI in the assessment and treatment response monitoring of perianal fistulas (particularly in patients with Crohn's disease).

SS 3.06

Clinical impact of defecographic images in patients with rectoanal intussusception as a disorder of obstructed defecation

H.J. Jeon[1], U.C. Park[2], H.S. Park[1], Y.J. Kim[1], S.I. Jung[1], S.W. Park[1]; [1]Seoul/KR, [2]ChungJu/KR

Purpose: Rectoanal intussusception (RAI) is a telescoping of the rectal wall during defecation. This study was designed to characterize a defecographic images and to evaluate clinical usefulness in a group of patients with RAI.

Material and Methods: Anorectal physiologic studies were performed in 555 patients with chronic constipation. Studies included defecography (n=315), anal manometry (n=237), anal EMG/PNTML (n=133) and colonic transit time study with KUB film (n=85). With the use of pre-treatment proctographic images, circumferential RAI was defined as first degree when detectable below the anorectal ring on straining, as second degree when it reached the dentate line and as third degree when it reached the anal verge. We analysed a correlation between the symptoms as obstructed defecation and the degree of RAI.

Results: 138 patients (43.8 percent) were found to have RAI. The defecographic images revealed 96 cases of RAI (70%) having associated anorectal pathology. RAI was of first degree in 101 (73%), of second degree in 21 (15%) and of third degree in 16 patients (12%). The mean size of the intussusception was 2.5 cm (range 1.0-5.5 cm). RAI patients with mechanically obstructing intussusceptum evacuated slower and less completely than those with non-obstructing intussusceptum on evacuation proctography ($P < 0.001$). Patients with second and third degree RAI showed a significantly higher frequency of obstructed defecation than in patients with first degree RAI ($P < 0.01$).

Conclusion: Present series with sub-classifying intussusception morphology provided the important diagnostic ramification and clinical therapeutic profiles in RAI patients with functionally obstructed defecation.

SS 3.07

Novel method for improving digitation characterisation during evacuating protography

H.S. Sidhu, G. Bhatnagar, S.A. Jackson, B. Fox; Plymouth/UK

Purpose: Some pelvic floor dysfunction patients digitate to facilitate evacuation; their ability to see digitation effects may improve their understanding/consultation. This study compares the use of newer lead-impregnated gloves (LIG) to traditionally used normal/latex gloves (NG) during evacuating proctography in detecting digitation and perceived certainty of its effects.

Material and Methods: Qualitative questionnaire to referrers was performed assessing the importance of digitation visualisation. Prospective randomised study was performed: digitating patients receiving either LIG (n=30) or NG (n=25), then combined with 45 non-digitating examinations (total=100), anonymised, and reviewed by two experienced GI radiologists (blinded). Certainty of digitation, LIG presence/absence, and perceived effects of digitation were recorded. A statistician was involved during methods/results.

Results: Qualitative data: 92% referrers visualised LIG in representative studies, 69% and 62% felt study appreciation and patient consultation would improve. Prospective study results: Significant overall interobserver agreement (Kappa 0.84) in confidence whether digitation occurred or not (false positive 1%). LIG use: Both readers detected all digitation and that LIG were worn (sensitivity/specificity 100%); in 97% readers were confident about digitation effects. NG use: Digitation was detected with certainty in 66% and effects of digitation were felt apparent in 18% (poor interobserver; Kappa 0.11). Certainty of digitation and its effects significantly improved ($p<0.01$ and <0.001, paired t-tests) with LIG compared to NG.

Conclusion: Clinicians value improved digitation visualisation in study appreciation and patient consultation and LIG use significantly improves visualisation of digitation and its effects during evacuation proctography compared to NG.

SS 3.08

Incidental focal colonic FDG uptake: correlation with colonoscopic findings

R.R. Nensey[1], G. Bhatnagar[1], H.S. Sidhu[1], S.J. Higgins[2], T. Sulkin[3]; [1]Plymouth/UK, [2]Torquay/UK, [3]Treliske/UK

Purpose: The purpose of this study was to assess the incidence of focal FDG uptake in the colon in patients not known to have colorectal carcinoma and to determine the significance of these PET positive scans on follow-up endoscopy.

Material and Methods: A retrospective data collection of the PET CT scans performed on patients at Royal Cornwall hospital was reviewed. The study included data of 306 scans performed over 15 months between October 2008 and December 2009. Patients with known bowel pathology were excluded from the study.

Results: Incidental FDG uptake within the colon was seen in 15 of the 306 patients. Endoscopy was subsequently performed on 9 of these cases, demonstrating an anomaly in the form of polyp or tumour. A further 2 incidental polyps were identified on endoscopy which did not indicate corresponding increased FDG uptake on the PET scans. Malignant tumours were identified on 3 of these PET positive patients; the sites being the rectum, sigmoid colon and caecum. The positive predictive value of PET for colonic disease from our study is 100%.

Conclusion: The positive predictive value of PET is 100% in detecting colonic pathology. It is vital to systematically review the bowel on nuclear medicine scans and if positive, follow up of such cases must be performed with endoscopy and biopsy for early detection and appropriate management of colonic pathology.

SS 3.09

Small and large bowel MRI: can additional diffusion-weighted MR imaging improve diagnostic confidence?

S. Kinner, S. Blex, M. Forsting, T.C. Lauenstein; Essen/DE

Purpose: MR enterography and colonography are well accepted techniques for the depiction of inflammatory and tumor diseases. Diagnostic confidence in some cases can be limited, especially in the presence of motion/breathing artifacts or suboptimal bowel distension. Diffusion-weighted imaging (DWI) is an emerging technique for abdominal MRI. Therefore, we aimed to evaluate if additional DWI for bowel MRI can improve diagnostic confidence.

Material and Methods: 18 patients underwent bowel MR because of suspected or known IBD (n=9), tumor disease (n=6), unspecific abdominal pain (n=2) and suspected graft-versus-host disease (n=1). MRI was performed on a 1.5 T (Magnetom Avanto, Siemens). In addition to T2w and contrast-enhanced T1w data, DWI sequences in axial and coronal plane were collected (b = 50, 500, 1000). The diagnostic confidence for lesion detection with and without DWI was evaluated by two experienced radiologists using a 4-point Likert scale (1: certainly no lesion(s), 2: probably no lesion(s), 3: probably lesion(s), 4: certainly lesion(s)).

Results: In 3 of 18 patients (17%), the diagnostic accuracy was improved by DWI. In two patients, readers changed diagnosis from "probable present lesion(s)" to "certain present lesion(s)". In one patient, a cecal tumor was diagnosed only on the basis of DWI. This diagnosis was subsequently confirmed by endoscopy.

Conclusion: DWI of the bowel can provide additional information to the reader and should be performed routinely with every gastrointestinal MRI as it can improve diagnostic confidence.

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SS 3.10

Value of CT colonography as preliminary study prior to laparoscopic surgery in patients with colon malignancies

S. Tartari[1], R. Rizzati[1], G. Anania[1], M. Bassi[1], L. Scagliarini[2], G. Benea[1]; [1]Lagosanto/IT, [2]Ferrara/IT

Purpose: The purpose of this study was to assess the clinical value of CT colonography (CTC) in the diagnosis and staging of colorectal cancer (CRC) in preoperative evaluation for laparoscopic surgery.

Material and Methods: From January 2009 until November 2011, 113 patients scheduled for surgery for CRC underwent CTC. All patients were previously evaluated with optical colonoscopy (OC). Sensitivity in lesion location and detection was compared between OC and CTC and discrepancies analyzed. Accuracy of CTC in CRC staging was determined.

Results: A total of 113 CRC were found by CTC. OC was incomplete in 37/113 (26%) cases. There were 17 cases of discrepancy of lesion location correctly identified by CTC and 7 polypoid (6-9 mm) lesions detected by CTC and missed by OC. Based on CTC findings, 103 patients with CRC were managed laparoscopically and 10 patients underwent conventional open surgery. Sensitivity of CTC in TNM preoperative staging of patients with CRC resulted to be respectively 100%, 86% and 100%. Furthermore, CTC detected 34 extracolonic findings, 12 of whom had major clinical relevance.

Conclusion: CTC is a useful method for diagnosing CRC. It allows to determine local cancer progression and yields to detect synchronous lesions in the large bowel also in endoscopically inaccessible regions. Compared to OC, CTC is more accurate in lesion location, making the laparoscopic surgical planning more precise and safer.

11:00 - 12:30 **Tinto**

Scientific Session 4
Pancreatic MRI

SS 4.01

Diffusion-weighted MRI in the characterization of pancreatic fluid collections

H. Rodrigues Duarte[1], M. Arvanitakis[2], M. Delhaye[2], M.A. Bali[2], C. Matos[2]; [1]Porto/PT, [2]Brussels/BE

Purpose: The purpose of this study was to measure the accuracy of diffusion-weighted MRI (DW-MRI) in the diagnosis of infected pancreatic fluid collections (PFCs).

Material and Methods: Between January 2010 and November 2011, all patients with post-pancreatitis PFCs requiring transmural EUS-guided drainage were prospectively included. Exclusion criteria were previous drainage or surgery. Before the endoscopic procedure, patients underwent high b-value DW-MRI with ADC measurements. Infection was suspected in cases of high signal of PFC in DW-MRI and low ADC. After drainage, fluid was sent for bacteriological cultures and considered infected if these were positive (gold standard). Continuous values were expressed in median and range and comparisons were performed using non-parametric tests.

Results: 26 patients were included in the study. The underlying disease was acute (n=15, 58%) or chronic pancreatitis (n=11, 42%). Sensitivity, specificity, accuracy, negative and positive predictive values of DW-MRI for predicting PFC infection were, respectively, 55.5% (5/9), 94% (16/17), 80% (21/26), 80% (16/20) and 83% (5/6). Some of these values increased if we considered only patients without previous antibiotics (n=17) (respectively, 75%, 92%, 88%, 92% and 75%). Median ADC was significantly lower in infected PFCs (2.8 vs 1.1 x 10[-3]mm[2]/sec, p=0.045).

Conclusion: DW-MRI may provide additional information concerning PFC assessment before drainage. Results show high specificity and negative predictive values, which can help in excluding PFC infection and determining time of drainage.

SS 4.02

Does diffusion-weighted imaging help in the differentiation of mass-like chronic pancreatitis and pancreatic cancer?

K. Sandrasegaran, B. Tahir, M. Tann, T. Howard; Indianapolis, IN/US

Purpose: Many patients with mass-like chronic pancreatitis, particularly in the pancreatic head, undergo radical surgery, since it is not possible to preoperatively differentiate this entity from ductal adenocarcinoma. We wanted to investigate if DWI may help in this situation.

Material and Methods: Retrospective review of radiology database revealed 36 patients with Whipple procedure who also had preoperative MRI with DWI. Two reviewers blindly and independently assessed the DWI images. Four weeks later, they reviewed the remaining MRI sequences for size of mass, double duct sign (DD), pancreatic duct cut off (CO), and perivascular soft tissue cuffing (VC). Univariate and multivariate analyses were performed, using surgical pathology as gold standard.

Results: There was no difference in age or gender between the cancer (group A, n=13) and chronic pancreatitis (group B, n=23) groups. On univariate analysis, the only finding that differentiated the two groups was size of mass. On logistic regression, no conventional or DWI parameter was found to be differentiate the two groups. There was no significant lowering of ADC in both mass-like chronic pancreatitis and cancer, compared to rest of pancreas. Findings such as DD, CO and VC, which are typically associated with cancer, were not useful in differentiating the two groups.

Conclusion: Conventional MRI and DWI are not useful in separating cancer from chronic inflammation. Neither entity causes substantial lowering of ADC.

SS 4.03

Initial evaluation of a new high-resolution diffusion-weighted MR sequence (ZoomEPI) for dedicated imaging of the pancreas

N. Schramm[1], W. Horger[2], M.F. Reiser[1], C.J. Zech[1]; [1]Munich/DE, [2]Erlangen/DE

Purpose: The purpose of this study was to initially evaluate a new high-resolution DWI sequence (ZoomEPI) with a small field-of-view for dedicated pancreas imaging.

Material and Methods: In 30 patients who underwent an abdominal MR examination on a 1.5T MR-system due to a clinical indication, a ZoomEPI sequence (Siemens, Erlangen, Germany) was acquired. In this sequence, a modified excitation pulse based on bipolar planar gradient trajectories aims to reduce the echo train length. Two reviewers compared the ZoomEPI sequence to the standard single-shot EPI DWI sequence in consensus. Image quality and disturbance of aliasing artifacts were assessed utilizing a four-point scale (1: excellent, no artifacts; 2: good, few artifacts; 3: moderate, still diagnostic, 4: non-diagnostic, heavy artifacts). Apparent diffusion coefficient (ADC) maps were generated (b50, b800). For statistics, a t-test was applied.

Results: The image quality of ZoomEPI was significantly better than that of standard DWI with a mean score of 1.97 vs. 2.36 ($p<0.01$). The ZoomEPI was judged from excellent to non-diagnostic in 13/30 (43.3%), 12/30 (40%), 4/30 (13.3%) and 1/30 (3.3%) patients, respectively. Standard DWI was rated from excellent to non-diagnostic in 4/30 (13.3%), 16/30 (53.3%), 7/30 (23.3%) and 3/30 (10%) patients, respectively. Despite the small FOV, aliasing was not noted in the ZoomEPI.

Conclusion: ZoomEPI imaging of the pancreas is feasible without disturbing aliasing artifacts. Due to its higher image quality compared to the standard DWI sequence, it has the potential to further improve DWI of the pancreas.

SS 4.04

Comparison of diffusion-weighted MR imaging and [68] Ga-DOTATATE PET/CT in detecting neuroendocrine tumors of the pancreas

C. Schmid-Tannwald, C. Schmid-Tannwald, R. Neumann, A. Haug, N. Schramm, G.P. Schmidt, M.F. Reiser, C. Rist; Munich/DE

Purpose: The purpose of this study was to compare diffusion-weighted MRI and DOTATATE-PET/CT in detecting pancreatic neuroendocrine tumors (NET).

Material and Methods: 19 patients with pancreatic NET were retrospectively included who underwent MRI including DWI and DOTATATE-PET/CT within 6 weeks. Two blinded readers compared T2-weighted (T2w), T2w+DW-MRI, T2w+contrast-enhanced T1-weighted (CE-T1w) MR and PET/CT for NET detection and confidence level. Sensitivity and confidence level of each review session were compared. ADC of tumor and normal pancreatic tissue was compared.

Results: 9/25 (36%) and 15/25 (60%) NET were detected on T2w and T2w+DW-MRI by both observers, respectively. Observer 1 and 2 detected 15/25 (60%) and 16/25 (64%) NET on their review of T2w+CE-T1w, respectively, and all 25 NET (100%) were detected on PET/CT by both observers. Detection rate and confidence level improved significantly by combined interpretation of T2w and DW-MRI or CE-T1w ($p<0.05$). There was no significant difference between NET detection rate of T2w+DW-MRI and T2w+CE-T1w ($p>0.05$). Detection rate and confidence level of PET/CT were significantly higher than MRI ($p<0.04$). Mean ADC of NET (1.02+/-0.26 x 10-3 mm²/s) was significantly lower than mean ADC of normal pancreatic tissue (1.47 +/- 0.39 x 10-3 mm²/s).

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Conclusion: DW-MRI is a valuable adjunct to T2w and comparable to CE-T1w in detection of pancreatic NET and ADC measurements provide a quantitative differentiation between NET and normal pancreatic tissue. DOTATATE-PET/CT seems to improve significantly the detection of pancreatic NET compared to MRI.

SS 4.05

Cystic pancreatic lesions: evaluation by diffusion-weighted 3T MR imaging with b-multiple SE-EPI

F. Donati, P. Boraschi, R. Gigoni, F. Falaschi, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to evaluate the usefulness of diffusion-weighted 3T MR imaging with b-multiple SE-EPI in providing an objective value for the differentiation of cystic pancreatic lesions.

Material and Methods: Fifty-two patients with cystic pancreatic lesions and ten normal subjects underwent MR imaging at 3T (GE-DISCOVERY-MR750; GE-Healthcare). After the acquisition of axial T1w/T2w sequences and coronal MRCP, diffusion-weighted MR imaging was performed using an axial respiratory-triggered spin-echo echo-planar sequence with multiple b-values (150, 500, 1000, 1500 sec/mm^2) in all diffusion directions. ADC value was calculated using a dedicated software fitting the curve obtained from the corresponding ADC for each b value. Fitted ADC values were calculated by two observers in conference for each cystic pancreatic lesion and for normal pancreatic parenchyma. Imaging results were correlated with surgery, ERCP, and/or imaging follow-up.

Results: Final diagnoses included intraductal papillary mucinous tumor (IPMT, n=35), serous cystadenoma (n=10), and mucinous cystadenoma (n=7). Fitted ADC value was 1.33x10^{-3} mm^2/sec for normal pancreatic parenchyma, 3.11x10^{-3} mm^2/sec for IPMT, 2.50x10^{-3} mm^2/sec for serous cystadenoma, 2.97x10^{-3} mm^2/sec for mucinous cystadenoma. Fitted ADC values were significantly higher in mucinous neoplasms than in serous cystadenomas (p-less-than-0.05).

Conclusion: Our results suggest that diffusion-weighted 3T MR imaging with b-multiple SE-EPI may be helpful to differentiate mucinous from serous cystic pancreatic lesions. Further investigations in larger series of patients are necessary to confirm our preliminary data.

SS 4.06

The utility of secretin-enhanced MRCP in diagnosing chronic pancreatitis

K. Sandrasegaran, B. Tahir, M. Tann, T. Howard, F. Akisik; Indianapolis, IN/US

Purpose: The purpose of this study was to assess the additional value of secretin-enhanced MRCP over conventional MRCP in diagnosing ductal abnormalities in chronic pancreatitis.

Material and Methods: Retrospective review found 140 patients with SMRCP and ERCP correlation within 3 months of each other. All studies were anonymized and the secretin-enhanced MRCP (group A) was separated from conventional 2D and 3D MRCP and T2-weighted images (group B). Groups A and B for each patient were assigned different and randomized case numbers. An experienced MRI radiologist graded image sets for no chronic pancreatitis using the Cambridge classification, and for the certainty of diagnosis (1= definitely certain, 2 = moderately certain, 3 = unsure). ERCP findings were taken as gold standard.

Results: In diagnosing the presence of chronic pancreatitis, the sensitivity (95% CI) was significantly higher in group A [62.8% (46.7-77.0) compared to B [47.7% (32.5-63.3), p<0.01]. The specificity (95% CI) was also significantly higher in group A compared to B [94.7 (88.0-98.3) vs. 87.3% (78.8-93.2), p<0.01]. The percentage of definitely certain diagnosis was higher in group A compared to group B (14%, p=0.03). In differentiating mild chronic pancreatitis (side branch disease only) from normal, the area-under-ROC curve (95% CI) was higher for group A compared to group B [0.71 (0.61-0.79) vs. 0.54 (0.44-0.64), p<0.01].

Conclusion: The use of secretin significantly improves the accuracy and confidence of diagnosing chronic pancreatitis, especially mild chronic pancreatitis.

SS 4.07

Stenosis of the main pancreatic duct in focal form of autoimmune pancreatitis: imaging findings on MR-MRCP and dynamic secretin-enhanced MRCP

F. Castelli, R. Negrelli, V. Di Paola, R. Manfredi, R. Pozzi Mucelli; Verona/IT

Purpose: The purpose of this study was to evaluate the MR-MRCP imaging of focal forms of autoimmune pancreatitis (AIP) and to describe ductal system involvement.

Material and Methods: Among the 130 diagnosed with PAI were included 37 patients with focal forms. Image analysis included parenchymal enlargement, signal intensity abnormalities, enhancement, main pancreatic duct (MPD) diameter and MPD focal narrowing, length of narrow stricture of the PD, presence of upstream dilatation from the stricture, multiple stenosis and dilatation of side branches. After secretin administration, the presence of the "duct penetrating" sign was evaluated as a problem-solving tool in the differential diagnosis between focal AIP and ductal adenocarcinoma. Median follow-up was 23.9 (range 4.1-126.7) months.

Results: At diagnosis, involvement of main pancreatic duct in the focal form of AIP showed a single stenosis in 27 (72.9%) patients, multiple stenosis in 10 (27.1%). The mean diameter of the length of the narrow stricture of the MPD was 13.5 mm, whereas the mean value of the upstream dilatation from the stricture was 3.9 mm. The alteration in signal intensity of pancreatic parenchyma was localized in the head in 18/37 (48.6%) patients, 10/37 (27.02%) in the body and 9/37 (24.3%) in the tail. Dilatation of side branches was observed in 17/37 (45.9%) patients.

Conclusion: After steroid treatment, there was a reduction in the size of pancreatic parenchyma in 16/37 (43.2%) patients, normalization of signal intensity abnormalities in 12/37 (32.4%) and recurrence of disease in 5/37 (13.5%). 4 (10.8%) patients underwent resective surgery confirming the histopathological diagnosis of AIP.

SS 4.08

MRCP evaluation of focal and diffuse forms of autoimmune pancreatitis

F. Castelli, V. Di Paola, R. Negrelli, R. Manfredi, R. Pozzi Mucelli; Verona/IT

Purpose: The purpose of this study was to evaluate focal and diffuse forms of autoimmune pancreatitis (AIP) and description of the main characteristics at diagnosis and follow-up through MR and MRCP.

Material and Methods: We included in the study 130 patients with histological diagnosis of AIP who underwent MRCP before and after steroid therapy. The analysis considered: pancreatic volume, localization of the lesion, abnormal signal intensity, enhancement of the parenchyma in the post-contrastographic phase, presence of stenosis of the main pancreatic duct (MPD), dilatation of the secondary pancreatic ducts (SPD).

Results: MRI showed a diffuse volumetric increase of the pancreas in 50/92 (54%) patients and a focal volumetric increase in 42/92 (46%). We observed changes in signal intensity represented by hypointensity on T1 imaging in 65/92 (70.6%) patients and hyperintensity on T2 imaging in 32/92 (35%); 51/92 (55.5%) patients showed parenchymal hypo-vascularization and 34/92 (37%) retention of medium of contrast in the late phase. There was a stenosis of MPD in 64/92 (69.5%) cases and a dilation of SPD in 36/92 (39%) patients. After therapy, 39/92 patients (42.4%) showed restitutio ad integrum, 49/92 (53.3%) parenchymal atrophy, while 4/92 (4.3%) patients underwent surgery. After secretin administration, the presence of the "duct penetrating-sign" was observed in 33/92 (36%) patients.

Conclusion: MRCP is useful in the diagnosis, monitoring of the response to therapy and evaluation of the different forms of AIP and of degree of ductal involvement.

SS 4.09

Multifocal branch-duct intraductal papillary mucinous neoplasms of the pancreas: MR imaging pattern and evolution over time

F. Castelli, V. Di Paola, D. Bosetti, R. Manfredi, R. Pozzi Mucelli; Verona/IT

Purpose: The purpose of this study was to follow the evolution over time of multifocal intraductal papillary mucinous neoplasms (BD-IPMN) of the side branches by MRI.

Material and Methods: We evaluated 155 patients with multifocal BD-IPMN examined with MR/MRCP. Inclusion criteria: ≥2 BD-IPMN involving any site of the parenchyma; communication with the main pancreatic duct (MPD) and previous investigations by MRI/MRCP after at least six months. Median follow-up was 25.8 (range 12-217) months. Exclusion criteria: <12 months of follow-up (n=33) and patients without follow-up (n=14). The population is thus of 108 patients. Quantitative analyses were number of dilated side branches; maximum diameter of the largest branch duct in the head and body-tail; maximum diameter of MPD in the head and body-tail, annual change of the largest lesion. Qualitative analyses were the presence of malformations/anatomical variants of the pancreatic ductal system; site of the lesions (head-uncinate process, body-tail, ubiquitous, bridge morphology); intraluminal dependent defects; mural nodules.

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Results: At diagnosis, the mean value of cystic lesions of the side branches was 7.09. The mean diameter of the cystic lesions was 13.7 mm. The mean diameter of the MPD was 3.6. At follow-up, the mean number of cystic lesions of the branch-duct was 7.76 ($p<0.05$). The mean diameter of the cystic lesions was 13.9 ($p<0.05$). The mean diameter of the MPD was 3.7. Intraluminal filling defects in the side branches were seen in 18/108 (16.6%) patients; mural nodules in 3/108 (2.7%) patients.
Conclusion: Multifocal BD-IPMN shows a very slow growth and evolution over time.

SS 4.10

Determination of pancreatic cancer extent using CT and MRI: implications for neoadjuvant treatment planning

O. Zakharova, G.G. Karmazanovsky; Moscow/RU

Purpose: A R0 resection is dependent on accurate preoperative staging. There is still no consensus on the single best diagnostic modality. The inverse relationship of tumor size and prognosis has been noted in many studies; 80-85% of patients are treated palliatively or neoadjuvantly. The high rate of duodenal invasion suggests a risk of duodenal undercoverage with highly conformal radiotherapy.
Material and Methods: To analyze the accuracy of CT and MRI in determining PC extent, we performed a retrospective analysis of CT and MRI scans and pathohistological reports of 174 cases of PC after pancreatoduodenectomies (2006-2011). We compared tumor size measurements of PC evaluated on CT and MRI with those in the pathological reports.
Results: Our study demonstrated sensitivity, specificity, and accuracy of contrast enhanced MDCT of 86%, 75%, and 83.3%, respectively, with a PPV of 96% and NPV of 100%. The sensitivity, specificity, and accuracy of MRI reaches approximately 75%, 50%, and 74.3%, respectively, with a PPV of 98.1% and NPV of 94.4%. In 124 patients (71.3%), tumor size reported by pathologist surpassed one claimed by CT and MRI studies ($p<0.001$).
Conclusion: The values of sensitivity, specificity and accuracy in PC detection speak in favor of MDCT as the single best diagnostic modality. Surgeons and oncologists need to keep in mind that MDCT and MRI have a tendency to underestimate the size of PC. This has important implications for neoadjuvant treatment planning.

11:00 - 12:30 **Moorfoot**

Scientific Session 5

Liver 1: Diffuse disease

SS 5.01

Evaluation of spleen stiffness with acoustic radiation force impulse: a comparison with histology in the assessment of liver fibrosis

P. Cabassa, F. Sogaro, L. Sottocornola, M. Ravanelli, A. Rossini, R. Maroldi; Brescia/IT

Purpose: The purpose of this study was to evaluate the spleen stiffness in patients affected by chronic hepatopathy by means of acoustic radiation force impulse (ARFI) and to match the results with the fibrosis grade, assessed by liver biopsy.
Material and Methods: 51 consecutive patients affected by chronic hepatopathy (mainly HCV) underwent ARFI of the spleen and liver biopsy. According to Knodell's index, 25 patients were classified F1, 14 F3 and 12 F4. 33 healthy volunteers represented the control group. All the studies were performed by two radiologists. Every study included a median of 5 ARFI measurement. Mean ARFI velocities (in m/s) were statistically compared. Diagnostic performance of ARFI in assessing different grades of liver fibrosis was assessed by ROC analysis. Inter- and intra-observer variability was also calculated using Bland-Altman plot.
Results: Spleen ARFI values were significantly different among healthy volunteers and F1-F4 patients ($p<0.001$), F1 versus F3-F4 patients ($p<0.001$) and F1-F3 versus F4 patients ($p<0.001$). There was no significant difference among healthy volunteers and F1 patients. ROC analysis showed a good performance of ARFI in differentiating mild (F1) from severe (F3-F4) fibrosis (AUROC 0.8). The differentiation between F3 and F4 fibrosis resulted to be difficult. Inter- and intra-observer agreement was good.
Conclusion: The stiffness of the spleen is increased in case of fibrosis. ARFI can differentiate mild (F1) from severe (F3-F4) fibrosis. ARFI of the spleen can be another noninvasive technique in the discrimination of the severity of liver fibrosis.

SS 5.02

Histopathological influences on the efficacy of dynamic gadoxetate disodium-enhanced magnetic MRI in staging liver fibrosis

D.S. Feier[1], R. Nolz[2], J. Maresch[2], C. Balassy[2], R. Badea[1], A. Ba-Ssalamah[2]; [1]Cluj-Napoca/RO, [2]Vienna/AT

Purpose: The purpose of this study was to evaluate the influence of histological parameters on the efficacy of dynamic gadoxetate disodium-enhanced (Gd-EOB-EDTA) MRI in staging liver fibrosis (LF) in patients with diffuse chronic liver diseases (CLD).
Material and Methods: Between January 2009 and November 2011, we analyzed retrospectively 80 consecutive patients (mean age 54.86 years, 58.7% males) with histologically proven LF, who underwent dynamic contrast-enhanced 3 Tesla MRI (CE-MRI) with Gd-EOB-EDTA. The patients were divided according to Metavir scoring system: F0 (n=17), F1 (n=10), F2 (n=12), F3 (n=11), F4 (n=26). The CE-MRI images were obtained blinded to histology before contrast injection and in the arterial (25 s), portal (70 s) and hepatocyte phase (20 min). Signal intensity of the liver in all phases was defined using region-of-interest measurements and relative enhancement (RE) was calculated.
Results: RE correlated strongly with fibrosis ($r=-0.65$, $p<0.0001$), moderately with necro-inflammatory activity ($r=-0.41$, $p=0.002$) and iron load ($r=-0.21$, $p=0.05$) but not with steatosis ($r=-0.12$, $p=0.32$). In multivariate analysis, only fibrosis independently influenced the values of RE ($p<0.0001$). The predicted RE cut-off values were: 1.30 for $F\geq1$ (AUROC=0.97, Se=100%, Sp=91%, PPV=76.9%, NPV=100%), 1.27 for $F\geq2$ (AUROC=0.96, Se=81%, SP=98%, PPV=95.6%, NPV=91.2%), 1.12 for $F\geq3$ (AUROC=0.98, Se=92.3%, Sp=97.5%, PPV=97.2%, NPV=93%) and 0.93 for F=4 (AUROC=0.93, Se=91%, Sp=88%, PPV=100%, NPV=83%). Discordance between RE and fibrosis stage was observed in 22 (27.9%) patients.
Conclusion: CE-MRI is accurate in staging LF in CLD patients. Steatosis, inflammation and iron load have no influence on the RE.

SS 5.03

Qualitative evaluation of liver fibrosis using gadoxetate disodium-enhanced MRI in patients with diffuse liver diseases

D.S. Feier[1], R. Nolz[2], J. Maresch[2], C. Balassy[2], R. Badea[1], A. Ba-Ssalamah[2]; [1]Cluj-Napoca/RO, [2]Vienna/AT

Purpose: The purpose of this study was to assess if gadoxetate disodium-enhanced MRI (Gd-EOB-EDTA CE-MRI) using quality scores is able to predict advanced liver fibrosis (LF) in patients with chronic liver diseases (CLD).
Material and Methods: We analyzed retrospectively 95 consecutive patients (mean age 54.18 years, 62.1% males) with histologically proven LF, who underwent dynamic 3 T CE-MRI with Gd-EOB-EDTA. A single expert pathologist assessed LF according to Metavir system. F0-2 (n=45, 47.4%) was considered insignificant LF and F3-4 (n=50, 52.6%) as advanced LF. The CE-MRI images were obtained blinded to histology before contrast injection and in hepatocyte phase (20 min). We assessed three new scores: enhancement homogenity (EnH, 1=homogenous, 0=inhomogenous), enhancement quality score (EnQS) and excretion quality score (ExQS, 0=none, 1=poor, 2=sufficient, 3=good, 4=excellent).
Results: LF correlated strongly with EnQ score ($r=-70$, $p<0.0001$), moderately with ExQ score ($r=-0.41$, $p<0.0001$) and EnH ($r=0.35$, $p=0.0008$). Independently, advanced LF can be predicted by a EnQS <=3 with an AUROC=0.90 [Se=93.8% (83.1-98.7), Sp=73.3% (58.1-85.4), PPV=79.6%, NPV=91.5%], by ExQS<=2 with an AUROC=0.72 [Se=36.73% (23.4-51.7), Sp=97.78% (88.2-99.9), PPV=94.8%, NPV=58.2%] and by EnH with an AUROC=0.67 [Se=40.82% (27-55.8), Sp=93.33% (81.7-98.6), PPV=87.2%, NPV=58.7%]. Together, the three scores are able to predict advanced LF with an AUROC=0.92 [Se=79.59% (65.7-89.8), Sp=93.33% (81.7-98.6), +LR=11.33, -LR=0.26, PPV=92.6%, NPV=77.4%]. The interobserver agreement and reliability was very good for all three scores: EnQS (k=0.84, ICC=0.91), ExQS (k=0.91, ICC=0.91), EnH (k=0.80, ICC=0.87).
Conclusion: The degree of liver parenchymal enhancement and the extent of biliary excretion of Gd-EOB-EDTA CE-MRI imaging are reliable predictors of LF in CLD patients.

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SS 5.04

Performance of liver stiffness measurement by Acoustic Radiation Force Impulse (ARFI) for the diagnosis of liver fibrosis

V. Cartier, J. Boursier, J. Lebigot, O. Adib, I. Fouchard, S. Michalak, C. Aube; Angers/FR

Purpose: The purpose of this study was to evaluate the performance of ARFI for the diagnosis of liver fibrosis.

Material and Methods: 98 patients were prospectively included. For each patient, 10 shear wave velocity measurements (m/s) were performed with ARFI in the right lobe, 10 in the left lobe, using an Acusson S2000 ultrasound system. The fibrosis stage was assessed by liver biopsy according to the Metavir F scoring. Cut-offs and diagnostic accuracies were calculated for different diagnostic targets of fibrosis and for the different sites of measurement.

Results: The population was constituted of 58% of men and the mean age was 54±13 years. The etiology of the liver disease was: alcohol (n=14), virus (n=26), dysmetabolic (n=43), other (n=15). The Metavir score was: F0/1: n=46, F2: n=24, F3: n=19, and F4: n=9. 30 valid measurements were obtained for all the patients. The cut-off and the diagnosis accuracy for ≥F2 fibrosis were: 1.80m/s and 67.3% in the right lobe, 1.75m/s and 73.5% in the left lobe; for ≥F3 fibrosis: 1.94m/s and 77.6% in the right lobe, 2.08m/s and 80.6% in the left lobe; and for F4 fibrosis: 2.17m/s and 84.7% in the right lobe, 2.30m/s and 79.6% in the left lobe.

Conclusion: ARFI has a high feasibility and good performances for the non-invasive diagnosis of liver fibrosis. Systematic use of ARFI during any abdominal ultrasound examination could be useful to detect patients with undiagnosed fibrosis.

SS 5.05

Is measurement of liver elasticity and liver iron content of value to identify high-risk patients with Gaucher disease?

A.E. Bohte[1], L. Van Dussen[1], E.M. Akkerman[1], A.J. Nederveen[1], R. Sinkus[2], M. Maas[1], J.M. Aerts[1], C.E.M. Hollak[1], P.L.M. Jansen[1], J. Stoker[1]; [1]Amsterdam/NL, [2]Paris/FR

Purpose: Long-term liver-related complications of Gaucher disease (GD) include fibrosis and increased risk to develop hepatocellular carcinoma (HCC). Splenectomy is a known risk factor for the development of liver pathology in GD. Moreover, accumulation of iron in Gaucher cells in the liver has been described. No adequate diagnostic tools exist to identify at-risk GD patients. We evaluated the potential usefulness of iron measurement, MR elastography (MRE) and Fibroscan of the liver in patients with GD.

Material and Methods: Twenty participants were included (16 male; mean age 48, range 24-70): 6 splenectomized GD patients (high-risk) and 7 non-splenectomized GD patients (low-risk) who were matched for age and gender with 7 healthy controls. All underwent liver iron concentration (LIC) measurement at 1.5T (Gandon, T2*), MRE at 3T and Fibroscan. For MRE, an SE-EPI sequence (TR/TE=420/40 ms; acquisition time 70s) was used. Groups were compared with non-parametric tests.

Results: Mean MRE values were 2.5 kPa (range 2.37-2.64) for high-risk GD and 1.67 kPa (range 1.31-2.12) for low-risk GD (p=0.006). Mean Fibroscan stiffness values were 8.1 kPa (range 3.5-10.5) for high-risk GD and 5.2 kPa (range 3.4-7.2) for low-risk GD (p=0.045). Low-risk GD did not differ significantly from controls for MRE and Fibroscan. LIC did not differ significantly between the groups.

Conclusion: MRE and Fibroscan can be used to monitor liver elasticity in patients with GD. We found no apparent role for LIC measurements.

SS 5.06

Reproducibility of magnetic resonance elastography of the liver at 3T

A.E. Bohte[1], A.J. Nederveen[1], P.F.C. Groot[1], A. De Niet[1], R. Sinkus[2], P.L.M. Jansen[1], J. Stoker[1]; [1]Amsterdam/NL, [2]Paris/FR

Purpose: To measure the reproducibility of MR elastography of the liver.

Material and Methods: 15 healthy volunteers and 13 patients with viral hepatitis B/C and liver fibrosis (17 male; mean age 34±12 years) were scanned four times at 3T: twice while in the same position (intrascan reproducibility, ISR), once after repositioning (within-day reproducibility, WDR), and once 2-4 weeks later (between-weeks reproducibility, BWR). Mechanical waves were applied to the chest with a coil-driven vibrating (50 Hz) piston. An SE-EPI sequence was used from which axial elasticity and viscosity maps were generated (TR/TE=420/40 ms; 7 slices, voxel size 4x4x4mm; acquisition time 70s with breath holds). Elasticity (kPa) and viscosity (Pa.s) values were derived from manually drawn ROIs in the liver. ROIs were automatically coregistered onto the repeated scans. Reproducibility indices (RI) were calculated by Bland-Altman analysis (defined as 1.96.SD of paired differences/mean value).

Results: Mean elasticity was 2.33±0.76 kPa (patients) and 1.65±0.15 kPa (volunteers). Mean viscosity was 2.28±0.59 Pa.s (patients) and 1.76±0.22 (volunteers). RI did not differ significantly between patients and volunteers. Mean RI of elasticity for all participants was 8.2%, 18.5% and 24.0% for ISR, WDR and BWR, respectively. For viscosity, RIs were 17.7%, 28.6% and 27.9%.

Conclusion: Elasticity showed better reproducibility than viscosity. The between-weeks reproducibility analysis shows that a change in liver tissue elasticity of more than 20% indicates a significant change, implying disease progression or regression.

SS 5.07

Comparison of MR elastography and US elastography in assessment of hepatic fibrosis

J. Yoon, J.M. Lee, J.K. Han, B.I. Choi; Seoul/KR

Purpose: The purpose of this study was to compare liver stiffness values in patients who underwent liver fibrosis using MR and US elastography, and to evaluate diagnostic performance between two examinations.

Material and Methods: For 5 months from 2011 Aug, 39 patients underwent MRE/USE and liver operation (n=37) or percutaneous biopsy (n=2). Hepatic fibrosis was graded by using Metavir score [F0-1 (n=21), F3 (n=4) and F4 (n=14)]. 6 mean liver stiffness values were averaged at USE. Mean liver stiffness value at MRE was an averaged value on 4 consecutive MRE images. For the assessment of concordance between USE/MRE, regression model was used and Pearson correlation coefficient was obtained. ROC analysis was performed between groups to assess diagnostic performance.

Results: At MRE, mean liver stiffness values in F0-1, F3, F4 were 1.76, 4.16 and 5.99, respectively. At USE, mean liver stiffness values were 4.74, 13.0, 44.9, respectively. Two exams showed moderate correlation (p=0.69), R2 was 0.61 (p<0.001). Correlation coefficients between two exams and Metavir score were 0.83 (MRE) and 0.81 (USE). As for differentiation of group F0-1 and F2-4, both showed 100% sensitivity and 95.2% specificity (MRE: Az >2.17, USE: Az >6.84). According to F0-3 versus F4 differentiation, MRE showed 100% sensitivity and 80% specificity (Az>2.2) and USE showed 92.9% sensitivity and 92% specificity (Az>10.16).

Conclusion: MR/US elastography were concordant in hepatic fibrosis evaluation. Mean liver stiffness values at both exams showed good correlation with Metavir score.

SS 5.08

The role of abdominal MR susceptibility-weighted imaging in diagnosing advanced liver fibrosis in patients with chronic liver diseases: a feasibility study

C. Balassy[1], D.S. Feier[2], G. Reiter[1], B. Kiefer[3], Y. Dai[4], S. Witoszynskyj[1], A. Ba-Ssalamah[1]; [1]Vienna/AT, [2]Cluj-Napoca/RO, [3]Erlangen/DE, [4]Shanghai/CN

Purpose: The purpose of this study was to assess the diagnostic value of susceptibility-weighted imaging (SWI) in detecting advanced liver fibrosis (LF) in patients with chronic liver diseases (CLD).

Material and Methods: Thirty-seven consecutive patients (mean age 55 years, 58.7% males) with histologically proven LF, who underwent abdominal SWI on a 3 Tesla MR scanner between January and November 2011, were analyzed retrospectively. A single expert pathologist assessed LF according to the Metavir system. F0-2 (n=20, 54.1%) was considered no-to-moderate fibrosis and F3-4 (n=17, 45.9%) as advanced fibrosis. The SWI measurements were evaluated with readers blinded to histology and clinical data. Normalized liver-to-muscle signal intensity ratios (LMR) were defined using region-of-interest measurements on SWI images.

Results: Log-transformed LMR values correlated strongly with LF (r=-0.75, p<0.0001), and moderately with necro-inflammatory activity (r=-0.45, p=0.004) and iron load (r=-0.33, p=0.04), but not with steatosis (r=0.2, p=0.23). In multiple regression analysis, LF and iron load independently influenced LMR values (p<0.0001). Together, LF and iron load explained 62% of the variance in LMR values (R[2]=0.62, p<0.001). The two parameters explained 58% of the amount of R[2], with LF as the largest contributor. The area under ROC curve for the diagnosis of advanced LF (F3-4) was 0.86 [sensitivity=66.7% (38.4-88.2), specificity=90.0% (70.8-98.9), +LR=7.33, -LR=0.37, PPV=33.8%, NPV=80.0%].

Conclusion: SWI is a promising non-invasive tool to detect advanced LF in CLD patients. LF is the main predictor of LMR, but iron load has an influence on these values.

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SS 5.09

Value of 1H MRS and chemical shift MR imaging in quantitative analysis and follow-up of fatty liver

F. Yuan, B. Song; Chengdu/CN

Purpose: The purpose of this study was to investigate the value of [1]H magnetic resonance spectroscopy (MRS) and chemical shift MR imaging techniques in quantifying fat content and monitoring treatment effects for fatty liver at follow-up examinations on 3.0 T MR system.

Material and Methods: 26 patients with confirmed fatty liver disease were examined with proton MRS and chemical shift-based fat suppression MR sequences (Dixon and triple-echo Dixon) on 3.0 T MR at baseline and 3, 6 months after treatment, respectively. Fat index (FI) of Dixon and the fat index star (FI*) of triple-echo Dixon, the relative lipid content 1 (RLC1) and relative lipid content 2 (RLC2) of MRS were calculated. Fatty liver index (FLI) was referred to the standard which was calculated from triglycerides (TG), gamma-glutamyl-transferase (GGT), waist circumference and body mass index (BMI). Statistical analysis was performed for the correlation between MR measured values and FLI.

Results: Significant positive correlation was demonstrated between MR imaging techniques measured values (FI, FI*, RLC1,RLC2) and FLI. There was statistical difference between FI, RLC1, RLC2 and FLI at baseline and 3, 6 months after treatment, respectively ($p<0.05$), while the statistical difference was found between FI* and FLI only at baseline and 6 months after treatment ($p<0.05$).

Conclusion: [1]H MRS and chemical shift-based fat suppression MR techniques can not only quantitatively measure liver fat content, but also dynamically evaluate the therapeutic effects. Dixon technique is more stable, while proton MRS is more accurate.

SS 5.10

Early detection of liver steatosis by magnetic resonance imaging in rats infused with glucose and lipids and correlation to insulin levels

G. D'Assignies[1], C. Kauffmann[2], G. Soulez[2], B. Van Beers[1], V. Vilgrain[1], V. Poitou[2], A. Tang[2]; [1]Clichy/FR, [2]Montreal, QC/CA

Purpose: The purpose of this study was to investigate the accuracy of 1.5 T MR imaging, 1H-MR spectroscopy and histological techniques to detect liver steatosis in three rat phenotypes assigned to an experimental glucolipotoxic model or a control group, and to correlate fat fraction assessed by MR techniques with insulin plasma level.

Material and Methods: Thirty-two rats [thirteen 2-mo-old (young) Wistar (YW), six 6-mo-old (old) Wistar (OW) and thirteen Goto-Kakizaki (GK)] fed a standard diet were assigned to a 72-h intravenous infusion of glucose and Intralipid fat emulsion or a saline infusion. Plasma insulin levels were measured. Steatosis was quantified with multiecho MRI, 1H-MRS and histology as fat fractions (FF).

Results: A significant correlation was found between multipoint Dixon MRI-FF and 1H-MRS-FF ($r = 0.81$, $P < 0.01$) and a weaker correlation was found between histology and 1H-MRS fat fractions ($r = 0.60$, $P < 0.01$). MRS and MRI accurately distinguished YW and GK rats receiving the glucose + Intralipid infusion from those receiving the saline control, whereas histology did not. A significant correlation was found between MRI-FF or 1H-MRS-FF and insulin plasma level ($r = 0.63$, $p < 0.01$; $r = 0.57$, $P < 0.01$).

Conclusion: MRI and 1H-MRS may be more sensitive to measure early-onset liver steatosis than histopathology in an experimental glucolipotoxic rat model. Fat fraction assessed with MR was correlated to plasma insulin level.

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11:00 - 12:30 **Pentland**

Scientific Session 6

Small bowel MRI in Crohn's disease

SS 6.01

Quantification of small bowel motility in stricturing Crohn's disease using dynamic MRI

A. Menys, E. Helbren, J. Makanyanga, N. Bell, S. Halligan, D. Atkinson, S.A. Taylor; London/UK

Purpose: The purpose of this study was to quantify small bowel motility within and upstream of Crohn's disease-related strictures.

Material and Methods: A previously validated non-rigid registration-based software algorithm was used to quantify small bowel wall motion acquired during coronal FISP sequence (20 second breath hold, TR-4ms, TE-1.7ms, slice thickness 10 mm, 1 slice/0.8 sec) in 34 Crohn's patients with stricturing disease (14 female, mean age 36) undergoing MR enterography. Linear ROIs were placed within the stricture (S), immediately upstream (pre-stricture-PS) and in normal bowel (N). ROIs were automatically propagated through the time series by the software and motility quantified, expressed as a Jacobian derived motility metric. Motility between locations was compared by paired Wilcoxon-Rank test. The PS bowel was divided into dilated and non-dilated groups (dilated = >50% increase in luminal diameter compared to normal bowel) and motility compared using Wilcoxon's rank-sum test.

Results: Mean motility within PS, S and N segments was 0.32, 0.16 and 0.38, respectively. There were significant differences between PS and S (p=0.0003), S and N (p=3.6e[-7]), but not N and PS (p=0.06). However, dilated PS had significantly reduced motility (mean=0.28) compared to non-dilated PS bowel (mean=0.44, p=0.01).

Conclusion: Small bowel motility is reduced in Crohn's strictures as would be expected. However, dilated segments of pre-stricture bowel also show abnormal reduced motility possibly representing a failure of small bowel propulsion and contributing to patient symptoms.

SS 6.02

Correlation between global small-bowel motility in MRI and local disease activity in patients with Crohn's disease

S. Bickelhaupt[1], J.M. Froehlich[1], R. Cattin[2], S. Raible[2], U. Bill[3], H. Bouquet[3], M.A. Patak[1]; [1]Zurich/CH, [2]Biel/CH, [3]Bern/CH

Purpose: Crohn's disease (CD) is an inflammatory bowel disease (IBD) characterized by local severe inflammation. Previous studies revealed reduced small-bowel motility in affected tissue measured at the terminal ileum. The aim was to evaluate the influence of local disease activity on global small-bowel motility in patients with CD based on histopathology.

Material and Methods: 15 healthy individuals (11 male, 4 female; mean 44 years) and 15 patients with histopathologically proven active CD (10 female, 4 male; mean 37 years) were included in this IRB-approved retrospective study. MRI (1.5 T, Siemens Sonata) was performed after a 1 h preparation of 1000 cc mannitol solution (3%). Cine T2-2D-FIESTA (TR 283.3/TE 1.89/FOV400/10 mm slice) motility acquisitions were performed in apnea. Image analysis for assessment of gastric motility was performed using a dedicated MR motility assessment software (Motasso) in 3 randomly chosen areas of the small-bowel outside the known CD-affected hot spots. The main characteristics (frequency, amplitude, diameter) were compared using Student's t-test and one-way ANOVA.

Results: 3 randomly chosen regions of interest were analyzed with Motasso in each participant. Patients with active-46913 revealed both significantly (p<0.01) reduced contraction-frequency (active-CD: 2.86/min;healthy: 4.53) and contraction-amplitude (6.71mm;10.14mm) compared to healthy individuals. Mean bowel-lumen diameter was only slightly, but significantly (p=0.04) larger in patients with active-CD (16.91mm) compared to healthy participants (14.79mm).

Conclusion: Small-bowel motility in patients with active-CD seems to be globally influenced by the local activity of the disease. Both contraction-frequency and contraction-amplitude were significantly reduced compared to healthy individuals, while the mean lumen-diameter was slightly increased. This suggests an influence of humoral factors related to (chronic-) inflammation.

SS 6.03

Value of 3T MRI in evaluating the mucosal involvement in Crohn's disease

R. Scandiffio, E. Neri, L. Faggioni, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to determine the diagnostic accuracy of 3T MRI in detecting mucosal involvement in Crohn's disease.

Material and Methods: Twenty-seven patients with known or suspected Crohn's disease underwent 3T small bowel MRI. All patients were evaluated after oral assumption of water solution. Acquisition protocol included Fast Imaging Employing Steady State Acquisition (FIESTA), Single-Shot FSE and contrast-enhanced dynamic study with Liver Acquisition with Volume Acquisition (LAVA). Aphtoid ulcers, pseudopolyps, fold thickening and distortion were the target of mucosal evaluation. Endoscopic examination and histopathological examination in patients who undergone surgery were considered as gold standard. Statistical significance was calculated with the Fisher exact test; sensibility and specificity of the MRI examination have been also calculated.

Results: Mucosal abnormalities were identified in 11 patients (42%); 2 examinations (8%) resulted as false negative (p=0.00002). All patients with mucosal abnormalities detected by MRI examination had active/severe disease. Sensitivity and specificity of MRI were 100% and 85%, respectively.

Conclusion: This preliminary experience shows an high diagnostic accuracy of 3T MRI in detecting mucosal abnormalities in Crohn's diseases; this represents an added value of MRI in the clinical assessment of the severity of the disease.

SS 6.04

Software-supported evaluation of small-bowel motility in MRI for faster and more reliable diagnoses

S. Bickelhaupt[1], J.M. Froehlich[1], R. Cattin[2], S. Raible[2], H. Bouquet[3], U. Bill[3], F. Merz[3], M.A. Patak[1]; [1]Zurich/CH, [2]Biel/CH, [3]Bern/CH

Purpose: Functional analyses of small-bowel motility by MRI have been performed by hand, which is potentially subjective and time-consuming. A newly developed software (Motasso) permits semi-automatic measurement of small-bowel diameter over time, thus displaying motility. The aim was to validate the software prototype comparing it to manual measurements.

Material and Methods: 45 patients (18 male/27 female; mean 48 years) were included. MRI (1.5-T, Siemens-Sonata) was performed after standardized preparation. 2D (dynamic-T2-2D-FIESTA) motility acquisitions covering the entire small bowel were performed in apnea (27 s). Image analysis for assessment of small-bowel motility was performed both manually and with the software. The time consumption and main curve characteristics were compared using Student's t-test, the level of scattering of individual measurements using Bland-Altman.

Results: 91 single regions of interest were analysed three times by hand and three times with Motasso, each measurement done by another expert. Overall 92% of the motility curves qualitatively matched each other. No significant intraindividual difference (p>0.05) was found for peristaltic frequencies (mean: 4.14/min, manual: 4.22/min, Motasso). Amplitudes (5.14 mm, 5.57mm) and mean lumen diameters (17.39mm, 14.68mm) slightly but significantly differed due to systematic differences in the definition of the bowel wall. Mean duration for single analysis was significantly (p<0.01) lower with Motasso (6.25 min, manual 1.30min, Motasso). The scattering differed significantly (p<0.01) between the methods.

Conclusion: The use of Motasso proves highly reliable, fast and accurate measurement of small bowel motility. Curve characteristics and peristaltic motility frequencies of manual and software-supported analyses did not differ significantly, while the measurement precision and the time needed for measurement differed significantly in favor of Motasso.

SS 6.05

Does quantified small bowel motility supplement the ability of conventional anatomical MRI markers to predict Crohn's disease activity?

A. Menys, F. Odille, M. Rodriguez-Justo, I. Proctor, M. Novelli, S. Punwani, D. Atkinson, S. Halligan, S.A. Taylor; London/UK

Purpose: The purpose of this study was to investigate the benefit of adding quantified small bowel motility to a validated MRI model of Crohn's disease activity.

Material and Methods: 23 Crohn's patients (mean age 35, 15 female) underwent MR enterography (Axial and coronal TrueFISP, HASTE, post-gadolinium VIBE images and coronal TrueFISP cine motility) and endoscopic

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terminal ileal (TI) biopsy within 4 weeks (mean 5 days). TI motility (MotiI) was quantified using validated software which measures bowel wall displacement based on non-rigid registration, expressed as the mean jacobian standard deviation. Two observers in consensus applied a validated MRI score of activity to the TI based on grading (0-3) mural thickness, T2 signal, contrast enhancement, and perimural oedema (scores totalled, tMRI). TI biopsies were assigned an acute inflammatory score (eAIS, 0-6) based on the presence of ulceration and neutrophil infiltration. On statistical advice, univariate analysis assessed the association between eAIS and both tMRI and MotiI independently. A multivariate analysis with backward selection assessed the benefit of adding MotiI to the tMRI model's ability to predict eAIS.

Results: There was a significant association between tMRI and eAIS (Reg Coeff=0.28, p=0.002) and negative association between MotiI and eAIS (Reg Coeff=-0.49, p=0.02). However, there was no significant advantage in eAIS prediction by adding MotiI to the tMRI model (p=0.6).

Conclusion: Small bowel motility is negatively associated with Crohn's disease activity, but may not add to existing anatomical MRI biomarkers.

SS 6.06

Software-assisted MRI assessment of gastric motility in patients with active Crohn's disease

S. Bickelhaupt[1], J.M. Froehlich[1], R. Cattin[2], S. Raible[2], H. Bouquet[3], U. Bill[3], M.A. Patak[1]; [1]Zurich/CH, [2]Biel/CH, [3]Bern/CH

Purpose: Humoral mediators released during inflammation in Crohn's disease (CD) may influence gastrointestinal motility beyond the affected areas. This could affect the functionality of other gastrointestinal organs, e.g. the stomach. Thus, the aim was to evaluate the systemic influence of local disease activity on gastric motility in MRI in patients with histopathologically proven active-CD.

Material and Methods: 10 individuals (6 healthy and 4 with histologically proven active-CD, 6 female/4 male, mean age 40y) were included in this IRB-approved, retrospective study. MRI (1.5-T, Siemens Sonata) was performed after a 1-h preparation of 1000 cc Mannitol solution (3%). Cine T2-2D-FIESTA (TR 283.3/TE 1.89/FOV 400/10 mm) motility acquisitions were performed in apnea. Gastric motility analyzed in the corpus image analysis for gastric motility was performed using a dedicated MR motility assessment software (Motasso). The main characteristics (frequency, amplitude, diameter, propagation) were compared using Student's t-test.

Results: Overall contraction frequency was not significantly ($p>0.05$) reduced in patients with active-CD (1.7/min) compared to healthy individuals (1.9/min). Yet, further comparison revealed several significant ($p<0.05$) differences in the motility characteristics with a reduced wave propagation speed (healthy: 2.36 mm/sec; active-CD: 0.25 mm/sec), contraction amplitude (22.74 mm; 13.84 mm) and mean diameter (36.38 mm; 17.45 mm) in patients with histologically proven active-CD.

Conclusion: Gastric motility patterns were significantly altered in patients with active-CD. Contraction waves propagated significantly slower and with lower amplitudes in patients with active-CD compared to healthy individuals, though the gastric contraction frequency was not significantly reduced. This might reflect the influence of inflammatory mediators on gastric motility.

SS 6.07

Correlation of MRI with surgery regarding disease behavior (Vienna classification) in patients with Crohn's disease

G. Schill, L.M. Dendl, C. Stroszczynski, A.G. Schreyer; Regensburg/DE

Purpose: The purpose of this study was to correlate the radiological assessment of Crohn's disease (CD) based on magnetic resonance enterography (MRE) with the surgical and histological assessment using the Vienna and Montreal classification score.

Material and Methods: We retrospectively assessed the MRE in 76 consecutive patients with known CD who had a MRE and surgery with a 2 weeks time period. Based on MRE, the diagnosis of abscess, fistula, conglomerate tumor, and stenosis was documented. For surgery and histology, the surgeon who performed the procedure as well as a pathologist did the Vienna and Montreal scoring regarding the subgroups B1 (non-stricturating, non-penetrating), B2 (stricturating) and B3 (penetrating).

Results: We found an excellent correlation (k=0.937) regarding the correct scoring assessment for disease behavior (B score). We found the highest sensitivity (96 %) for stenosis assessment and the highest specificity (95%) for fistulas. We calculated the highest positive predictive value for conglomerate tumors (95%) and the highest negative predictive value (98%) for abscesses. All correlations and results were statistically highly significant.

Conclusion: MR enterography provides an excellent correlation regarding the disease behavior (Vienna and Montreal classification) for patients with Crohn's disease. This represents an extremely important prerequisite for therapeutical planning concerning surgery or pharmaceutical therapy.

SS 6.08

Magnetic resonance imaging is correlated to faecal calprotectin level in the evaluation of small bowel and colonic Crohn's disease

D. Pendse, J. Makanyanga, E. Atkins, A. Menys, S. Bloom, S. McCartney, S. Punwani, S. Halligan, S.A. Taylor; London/UK

Purpose: Crohn's disease management requires knowledge of overall disease burden. A new MRI score of Crohn's disease activity was tested against reference standards of global activity: Harvey Bradshaw index (HBI) and faecal calprotectin.

Material and Methods: 34 patients (15 male), median age 33 (range 17-78), with known or suspected Crohn's disease underwent MR enterography [axial/coronal HASTE, TrueFisp and post gadolinium coronal VIBE/THRIVE at 1.5 T (n=24) or 3 T (n=10)]. On the same day, HBI questionnaire and faecal calprotectin were measured. Two observers qualitatively graded bowel wall thickness, mural T2 signal, mesenteric oedema, T1 enhancement and colonic haustral loss from 0 (normal) to 3 (most abnormal) for the jejunum, proximal ileum, terminal ileum and colon (6 segments). Each individual small bowel and colonic segmental score was multiplied according to the length of disease in that segment (0-5 cm x1, 6-15 cm x1.5, and ≥16 cm x2). For each of lymphadenopathy, comb sign, abscesses and fistula, a score of 5 was added if present. The relationship between MRI score, calprotectin and HBI was evaluated using Kendall's rank correlation.

Results: The mean MRI activity score was 15 (range 0-61.5) and was significantly correlated with calprotectin, Kendall's tau b=0.42, p=0.0009, but not with HBI, Kendall's tau b=0.006, p=1.

Conclusion: Global Crohn's disease activity measured using a qualitative MRI score is correlated to the faecal calprotectin level. MRI is useful for the global assessment of Crohn's disease activity.

SS 6.09

Correlating faecal calprotectin with small bowel MRI: a retrospective analysis

G. Bhatnagar, H.S. Sidhu, K. Woolson, C. Edwards, M. Puckett; Torbay/UK

Purpose: There is no gold standard test for comprehensive assessment of Crohn's disease (CD). Small bowel MRI (SBMR) and faecal calprotectin (FC) are emerging tools. Understanding the relationship of these two tests will enhance our ability to stage disease activity in CD.

Material and Methods: Patients attending Torbay Hospital with SBMR and FC samples within 35 days of each other were retrospectively assessed. SBMR were analysed using several criteria that were individually compared to FC.

Results: The study included 16 patients (5 normal, 11 abnormal FC). All patients with elevated FC had abnormal SBMR (p=0.05). More than half the patients with normal FC had abnormal SBMR (p=0.05). Statistical analysis by Fischer's exact test for count data of specific SBMR findings such as number of abnormal segments, wall thickness of abnormal segments and enhancement of abnormal segments amongst others did not demonstrate any significant relationship.

Conclusion: SBMR in patients with abnormal FC is always abnormal. This may prove to be a cost-effective finding in restaging CD by obviating the need for repeat SBMR in cases of deranged FC. SBMR may be abnormal in cases of normal FC. This finding suggests that SBMR is a more sensitive test of disease activity in CD and may represent the new gold standard. Some limitations of this retrospective analysis such as inconsistent temporal correlation between FC and SBMR as well as small sample size are recognised.

SS 6.10

Assessment of small bowel inflammation, stenosis and complications in patients with Crohn's disease on anti-TNF treatment using serial MRI scans

J.A.W. Tielbeek, M. Löwenberg, C.Y. Ponsioen, G. D'Haens, J. Stoker; Amsterdam/NL

Purpose: The purpose of this study was to assess the evolution of small bowel disease activity and complications in Crohn's disease patients treated with anti-TNF agents using serial MRI scans.

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Material and Methods: We performed a retrospective study of patients with Crohn's disease who had undergone serial MRI scans (T1- and T2-weighted sequences) while receiving anti-TNF treatment. Patients were grouped as clinical responders or non-responders. Stricturing lesions were evaluated using simplified scoring systems of inflammation (Steward et al.) and stenosis (Fornasa et al.). Complications were scored evaluating penetrating lesions, abscesses and/or fistulas.
Results: Forty-two MRI scans were evaluated in 13 clinical non-responders and 8 responders. In all patients, median inflammation scores decrease from 10 (range 6–15) on initial MRI to 8 (range 1–13) on follow-up MRI (p=0.168). In the responder group, 86% had reduced inflammation on follow-up MRI (p=0.0571). In this group, the first MRI detected complicated disease in 25% of the patients which resolved at follow-up MRI. Severity of stenosis was significantly reduced between serial MRI scans (p=0.0148). In the non-responder group, only 23% showed decreased inflammatory scores (non-significant). Severity of stenosis, stricturing and penetrating lesions was unchanged as indicated by serial MRI scans.
Conclusion: A reduction in both small bowel inflammation and inflammatory stenosis on serial MRI scans correlates with clinical responses to anti-TNF treatment. MRI can be used as a complementary approach to measure transmural healing in order to improve the clinical management in Crohn's disease patients.

11:00 - 12:30 **Fintry**

Scientific Session 7
Tumour staging

SS 7.01
DCE-MRI correlates with tumor: free resection margins in recurrent rectal cancer
M. Gollub[1], K. Cao[2], D. Gultekin[1], D. Kuk[1], M. Gonen[1], M. Sohn[1], L. Schwartz[1], P. Paty[1]; [1]New York, NY/US, [2]Beijing/CN

Purpose: The purpose of this study was to explore whether pre-operative DCE-MRI correlates to clinical outcome variables in patients who undergo surgical treatment for recurrent rectal carcinoma.
Material and Methods: A retrospective study of DCE-MRI in patients with recurrent rectal cancer was performed after obtaining an IRB waiver. We queried PACS from 1998 until 2008, to allow 3-year follow up. Using patient medical records, we determined which exams were done for recurrent disease. We explored the correlation between K[trans], Kep, Ve and AUC 90 and 180 seconds with time to re-recurrence [TTR], overall survival [OS] and margin status. The surgeons were blinded to DCE findings. Univariate Cox PH models were used for TTR and OS, while univariate logistic regression was used for margin status.
Results: One-hundred sixty-eight patients underwent MRI for recurrence. Major exclusions included: treatment prior to MRI, n=38; second recurrence, n=30 and medical treatment only, n=28. Among the remaining 47 patients, 27 went directly to surgery. Fourteen of these had positive margins. K[trans] (OR 0.03: CI: 0.001, 0.826, p=0.0382) and Kep (OR 0.19: CI: 0.039, 0.938, p= 0.0415) were inversely correlated with positive margins. In 20 patients undergoing neoadjuvant treatment, a correlation between AUC 90 and TTR was noted (HR 1.191, CI: 1.003, 1.413, p=0.0456).
Conclusion: A direct correlation was found between K[trans], Kep and clear resection margins. Such information might be helpful for treatment individualization.

SS 7.02
Agreement between transrectal ultrasound and MRI in prediction of depth of extramural tumor spread in rectal tumours
S.R. Rafaelsen, C. Vagn-Hansen, T. Sørensen, J. Pløen, A. Jakobsen; Vejle/DK

Purpose: The purpose of this study was to evaluate the agreement between transrectal ultrasound (TRUS) and MRI in sub-classification of T3 tumours.
Material and Methods: From January 2010 to December 2011, 68 consecutive patients with T3 tumours were included in this study. The mean age of the patients was 67.5 years (range: 33-91 years). The tumours were all >T2 on TRUS. The sub-classification was defined as T3a with a penetration of the rectal wall from 0 to 1 mm, T3b 1-5 mm, T3c 6-15 mm, T3d >15 mm: early T3 as T3ab and advanced tumours as T3cd (>5 mm). The TRUS findings were blinded to two experienced radiologist who did the interpretation of the MRI images and measured the depth of extramural tumour spread.
Results: We found a kappa value on 0.73 (95% CI: 0.61-0.87) for the sub-classification between the two methods. The kappa value in classifying early versus advanced T3 rectal tumours was 0.91 (95% CI: 0.81-1.00). There were no differences in mean maximal tumour outgrowth measured on TRUS, 5.3 mm (95% CI: 4.1-6.7 mm) and on MRI, 6.4 mm (95% CI: 4.9-7.9 mm).
Conclusion: There is a good agreement between TRUS and MRI in the pretreatment sub-classification of T3 tumours and a very good agreement in classifying tumors as early and advanced. TRUS can be used to predict advanced rectal cancers and thus be helpful if chemoradiation is considered in patients with contraindications to MRI.

SS 7.03
Rectal tumour volume delineation using T2-weighted and diffusion-weighted MRI: implications of observer agreement for radiotherapy planning
F. Regini, R. Cardoso De Melo, N. Griffin, J. Parikh, G. Charles-Edwards, G. Rottenberg, M. Leslie, A. Gaya, V. Goh; London/UK

Purpose: The purpose of this study was to determine if observer agreement for tumor volume delineation is better for DW-MRI than T2W MRI.
Material and Methods: 27 consecutive patients (15 male, 12 female, mean age 66.9, range 27.1-88.8 years) underwent 1.5 T MRI (Siemens) prior to chemoradiation (45 Gy in 25 fractions; oral capecitabine 850 mg/m[2]), including T2W (TR=6600 ms, TE=90 ms, NEX=2, ST=6 mm) and DW-MRI (TR=3000 ms, TE=77 ms, NEX=4, ST=6 mm, b=0-100-800 s/mm[2]) axial sequences. 3D tumor volume (cm[3]) was measured by VOI analysis by two independent readers for the T2W and b800 DWI axial images (OsiriX 3.9). T2 and DW-MRI tumor volumes were compared using Mann-Whitney test. Observer agreement was assessed using Bland-Altman statistics. Significance was at 5%.
Results: Artefacts precluded DWI analysis in 1 patient. In the remaining 26 patients evaluated, median (range) in cm[3] for the T2W and DWI (b=800) volumes was 47.24 (7.57-267.68) and 47. 22 (3.68-251.00), respectively, for Reader One and 44.67 (11.63-249.36) and 43.79 (6.70-291.54) for Reader Two. T2 volumes were slightly larger but not significantly different from DWI volumes: median 43.77 versus 42.44, P=0.92 for Reader One; median 42.25 versus 40.09, P=0.68 for Reader Two. Mean difference (95% limits of agreement) for T2 and DWI was -0.89 (-29.95 to +28.16) and +2.57 (-23.04 to +28.19), respectively, indicating slightly better inter-observer agreement for DWI.
Conclusion: Slightly better inter-observer agreement for volume delineation was noted for high b-value DWI, related to better conspicuity.

SS 7.04
Wall deformity in preoperative distinction between T1-T2 and T3-T4 staging of colorectal cancer
N. Flor, M. Mezzanzanica, P. Rigamonti, M. Peri, F. Sardanelli, G. Cornalba; Milan/IT

Purpose: To predict colorectal cancer (CRC) T stage using preoperative contrast-enhanced computed tomography colonography (CE-CTC).
Material and Methods: Sixty-nine patients with 75 CRC underwent CE-CTC. Two readers evaluated on 3D views three different types of wall deformity (WD) due to the CRC: < 25% of the lumen; between 25% and 50% (apple core); and ≥50%. Each category was associated with a T stage: < 25%, T1; between 25% and 50%, T2; ≥50%, T3 or T4. Standard of reference: pathology. This study was approved by IRB.
Results: Pathology: T1 (n = 5), T2 (n = 12), T3 (n = 45),T4a (n = 8) and T4b (n = 5). The detection rate of CRC was 100% (75/75). Mean CRC's largest diameter was 49 ± 20 mm (range 10-110), 19 mm for T1, 40 mm for T2, 52 mm for T3 and 64 mm for T4. The bowel preparation and colon distension were adequate in 62/69 (90%) and 67/69 patients (97%), respectively. Intra- and interobserver reproducibility for WD was almost perfect (k = 1 and k = 0.88, respectively). Sensitivity of WD for T stage ≥3 was 0.96 (56/58, 95% CI 0.88-0.96), specificity 0.71 (12/17, 95% CI 0.44-0.90), PPV 0.92 (56/61, 95% CI 0.82-0.97), NPV 0.86 (12/14, 95% CI 0.57-0.98) and accuracy 0.91 (68/75, 95% CI 0.82-0-96). Twenty out of 69 patients had at least one synchronous polyp ≥6 mm.
Conclusion: The presence of WD ≥50% (apple core type) is highly predictive of stage T3 or higher.

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SS 7.05

MRI morphology after transanal endoscopic microsurgery for patients with rectal cancer

M.H. Martens[1], M. Maas[1], L. Heijnen[1], D.M. Lambregts[1], J.W.A. Leijtens[2], F.C.H. Bakers[1], V.C. Cappendijk[1], G.L. Beets[1], R.G.H. Beets-Tan[1]; [1]Maastricht/NL, [2]Roermond/NL

Purpose: Patients with early rectal cancer or a good response after chemoradiation (CRT) are sometimes treated with transanal endoscopic microsurgery (TEM). Follow-up of TEM-patients includes MRI. This study aims to describe the rectal wall MRI morphology during short-term and long-term follow-up after TEM.

Material and Methods: A total of 36 patients were included with at least one post-operative TEM. For 17 patients multiple consecutive MRIs were available; 29 patients had a primary TEM and 7 had TEM after CRT.

Results: Three morphological patterns on MRI after TEM could be identified: (1) rectal wall thickening with or without fibrosis, (2) a notch at the TEM location, and (3) irregular delineation of the rectal wall. In eight cases, edema was present during short-term follow-up and remained present during long-term follow-up in patients with TEM after CRT. Wall thickening with or without fibrosis was observed in 24 patients and remaind consistent during long-term follow-up. A notch was observed in 15 patients and persisted during long-term follow-up in 83%. Sixteen patients had irregular delineation of the rectal wall, only during short-term follow-up. Six luminal recurrences occured; three patients had wall thickening, two a notch, and five patients had an irregular rectal wall.

Conclusion: Three patterns on MRI were identified after TEM. Radiologists can monitor these patients more accurately, which is important at a time when minimal invasive techniques are emerging.

SS 7.06

High-resolution magnetic resonance imaging versus computed tomography for preoperative local staging of colon cancer

E. Rollvén, T. Holm, E. Lörinc, B. Glimelius, L. Blomqvist; Stockholm/SE

Purpose: To study high-resolution T2-weighted MRI versus CT for preoperative local staging of colon cancer with surgery and histopathology as reference standard.

Material and Methods: Twenty-eight patients with a total of 29 tumours were included. Patients were examined on a 1.5 T MR unit using a phased array body coil. T2 turbo spin-echo high-resolution sequences were performed in three planes at the site of the tumour. CT was performed using a protocol for metastasis staging. The examinations were independently evaluated by two gastrointestinal radiologists using criteria adapted to imaging for prediction of T- and N-stages and extramural venous invasion. Based on the T-stage, tumours were divided into locally advanced (T3cd-T4) and not locally advanced (T1-T3ab). Surgical and histopathological findings served as reference standard.

Results: With MRI, T-stage, N-stage and extramural venous invasion were correctly predicted for each observer in 90 and 93%, 72 and 69%, 82 and 78% of cases, respectively. With CT, the corresponding results were 79 and 76%, 72 and 72%, and 78 and 67%. For MRI, interobserver agreements were 0.79, 0.10 and 0.76. For CT, the corresponding results were 0.64, 0.66 and 0.22.

Conclusion: Locally advanced colon cancer can be distinguished from not locally advanced by both high-resolution MRI and CT. MRI may have an advantage in identifying certain prognostic factors such as T-stage and extramural venous invasion.

SS 7.07

Gadofosveset-enhanced MRI for nodal staging in rectal cancer: pitfalls and learning curve

M.H. Martens, D.M.J. Lambregts, L. Heijnen, M. Maas, V.C. Cappendijk, F.C. Bakers, G.L. Beets, R.G.H. Beets-Tan; Maastricht/NL

Purpose: Nodal staging in rectal cancer remains a diagnostic challenge. In a recent pilot study, we have shown good performance for MRI using gadofosveset contrast in expert hands (sensitivity 80%, specificity 97%). The aim of the present study is to investigate whether the high accuracy will be sustained in clinical setting with non-expert radiologists.

Material and Methods: A total of 53 patients underwent standard MRI (T2W-FSE) for treatment planning and gadofosveset-MRI. Sixteen underwent (5x5 Gy+) immediate surgery, 37 underwent chemoradiation, a restaging MRI and surgery. Patients were scored as cN0/N+ based on the presence/absence of nodal gadofosveset enhancement on the pre-surgical MRI. Histology was the gold standard. In case of FP/FN findings, the scan was re-evaluated by an expert reader and compared in detail with histology.

Results: A total of 34 patients were pN0, and 19 pN+. Gadofosveset-MRI correctly staged 42 patients (sensitivity 84%,specificity 76%, PPV 67%, NPV 90%); 3 pN+ patients were understaged, 8 pN0 were overstaged. FN findings were due to: N+ node obscured by adjacent vessel (n = 1); microscopic tumour cells too small to detect with MRI (n = 2). FP findings were due to: interpretation errors that could be corrected by the expert reader (n = 3), decreased gadofosveset uptake in presacral/peri-vascular nodes (n = 4) and absence of gadofosveset-uptake eci (n = 1).

Conclusion: The previously reported high accuracy was sustained in this second cohort and was reproducible by non-expert radiologists. Understanding the pitfalls is crucial for clinical implementation. Pitfalls mainly occur due to readers' inexperience and insufficient uptake of gadofosveset in nodes located between vessels (in the upper mesorectum).

SS 7.08

Are p53 and c-erb-B2 expression useful as adjuvant tools in staging gastric adenocarcinoma by MDCT and MRI?

R. Mateus Marques, J. Dias, L. Fernandes, P. Mendonça, P. Santos, J. Esteves, L. Costa, F. Pina, M. Oliveira, J. Guedes Da Silva, A. Caldeira Fradique; Lisbon/PT

Purpose: P53 and c-erb-B2 have been proposed as indicators of poor prognosis in gastric adenocarcinoma (GA), while MDCT and MRI may understage the disease. The purpose of this study is to evaluate a relationship between the expression of these cellular markers and differences between staging by imaging and according to pathological studies or clinical progression.

Material and Methods: Between January 2009 and December 2011, 64 patients with GA underwent p53 and c-erb-B2 measurements by biopsy or surgery. P53 expression was divided into three levels and c-erb-B2 values were divided between negative and positive. Results were compared by logistical regression and Chi-square statistics with differences between clinical (CIS) or nodal (NIS) staging by imaging and clinical or nodal staging (CS and CNS) obtained by surgery or clinical progression.

Results: The results of P53 levels were low in 38 patients, moderate in 10 patients and high in 15 patients. C-erb-B2 was negative in 49 patients and positive in 10 patients. Differences in staging were 50% (CIS/CS) and 56.2% (NIS/CNS). Chi-square statistics revealed a p value of .481 and 0.705, respectively, for differences between CIS/CS (lower level of p value, 153 obtained for high p53 expression) and NIS/CNS. Cellular markers measurements correctly increased CIS in 6.9% and NIS in 3.5%.

Conclusion: P53 and c-erb-B2 measurements increased CIS and NIS with MDCT or MRI, but such improvement was not statistically significant, so their use as adjuvant tools needs further evaluation.

SS 7.09

Withdrawn by the authors

SS 7.10

Value of 3D FSE-Cube sequence at 3T MRI in pre-operative local staging of rectal cancer

R. Scandiffio, E. Neri, L. Faggioni, A. Mantarro, R. Balestri, C. Bartolozzi; Pisa/IT

Purpose: To compare a standard T2w imaging based on 2D acquisitions with 3D FSE-Cube sequence in the local staging of rectal cancer at 3T MRI.

Material and Methods: Eleven patients with rectal cancer were prospectively evaluated at 3T MRI. Sagittal, coronal, axial and oblique 2D T2w FSE images were obtained. An additional 3D T2 FSE-Cube sequence was performed after the 2D sequences. Each 3D data set was processed with multiplanar and curved planar reconstructions. Two experienced radiologists, using respectively 2D or 3D sequences, evaluated T and N parameters, with specific attention to measurement of the distance between the lesion and puborectal muscle and mesorectal fascia, and lesion extension. Linear Cohen k values were calculated to quantify agreement between MRI and histopathological data. Image quality was evaluated using a linear qualitative scale.

Results: Global sensitivities for T parameters were 56% and 64% for 2D and 3D images, while N category lesion accuracy values were 53% and 56%, respectively. Accuracy in measuring the distance from pubo- rectal muscle to lesion border was 60% and 100% for 2D and 3D, respectively. Image quality was considered very good on 2D images, and good on 3D images.

Conclusion: No significant differences between 2D and 3D images were observed for T and N staging. However, T2w FSE-Cube demonstrated higher accuracy than 2D in determining the distance between the lesion and the pubo-rectal muscle, which represents a key factor in planning surgical resection.

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11:00 - 12:30 **Sidlaw**

Scientific Session 8
Pancreatic CT

SS 8.01
Intraductal papillary mucinous neoplasm with an associated invasive carcinoma: image findings and diagnostic performance of MDCT for important prognostic factors

J.H. Kim, H.W. Eun, J.Y. Lee, J.M. Lee, J.K. Han, B.I. Choi; Seoul/KR

Purpose: Approximately, 30% of Intraductal papillary mucinous neoplasm (IPMN) have an associated invasive carcinoma (IPMC). To investigate imaging findings and diagnostic accuracy of MDCT for important prognostic factors in surgically proven IPMC.
Material and Methods: During 10 years, 38 patients with surgically proven IPMC were included in the study. Two radiologists retrospectively accessed morphological types, tumor size, duct size and mural nodule. They also accessed T and N stage and graded perineural invasion focus on five routes: plexus pancreaticus capitalis-I,R1; PLX-II, R2; along gastroduodenal artery, R3; along splenic artery, R4; posterior of pancreatic body, R5. Statistical analyses were performed using ROC analysis, McNemar test and Fisher's exact test. The κ statistics was used for interobserver agreement.
Results: Morphological types included main duct (29%), combined (47%) and branch duct (24%). Tumor size (3.9 + 2 cm) on CT was not statistically different from pathologic size (3.8 + 2 cm, p = 0.582). The main duct was 11.5 + 6.2 mm. Mural nodule was detected in 74%. Accuracy for the T stage was 73.7% and 68.4% and N stage was 68.4% and 76.3% with moderate agreement (κ = 0.636, κ = 0.708). AUC (Az) for perineural invasion was 0.868 and 0.821. The sensitivity, specificity and positive predictive value were 100%, 71.4% and 55.5%, and 90%, 71.4% and 52.9%. Interobserver agreement was moderate (κ = 0.659). Cancer located in the head commonly invades route 1 to 3, whereas cancer in the body and tail commonly invades route 4 or 5 (p = 0.002).
Conclusion: Main duct dilatation and mural nodule are common findings for IPMC. CT plays major roles in IPMN, not only in differentiating IPMC but also predicting important prognostic factors.

SS 8.02
Diagnostic performance of MDCT for prediction of important prognostic factors in resectable pancreatic cancer

J.H. Kim, S.H. Kim, H.W. Eun, J.Y. Lee, J.M. Lee, J.K. Han, B.I. Choi; Seoul/KR

Purpose: T-stage, N-stage, tumor size, vascular invasion and perineural invasion are most important prognostic factors for resectable pancreatic cancer. The purpose was to investigate the diagnostic accuracy of MDCT for these prognostic factors.
Material and Methods: This study group consisted of 111 patients with surgically resected pancreatic cancer who underwent preoperative dynamic CT during 10 years. Two radiologists retrospectively and independently accessed T-, N-stage, size, vascular invasion and graded perineural invasion using three-point scale focus on 5-routes; plexus pancreaticus capitalis I, R1; PLX-II, R2; along the gastroduodenal artery, R3; along the splenic artery, R4; posterior region of pancreatic body, R5. Statistical analyses were performed using the ROC analysis, McNemar test, paired T-test and Fisher's exact test. p value < 0.05 was considered significant. The κ statistics was used to determine interobserver agreement.
Results: The accuracy for T-stage was 82.9% and 77.5% with moderate interobserver agreement (κ=0.732). The accuracy for node metastasis was 59.5% and 55.0% with fair agreement (κ=0.597). Diagnostic accuracy for vascular invasion was 94% and 92%. The Az for diagnostic performance regarding perineural invasion was 0.733 and 0.66 with moderate agreement (κ=0.770). The cancer located in head commonly invade routes 1-3, whereas cancer located in body and tail commonly invade route 4 or 5 (p<0.0001). Tumor size on surgical specimen (3.4cm+1.46) is statistically larger than tumor size on CT (3.2cm +1.41, p=0.001). The nodular growth pattern was statistically larger than tumor size on CT (p=0.013).
Conclusion: CT is very useful for preoperative evaluation of T-stage, perineural invasion, and vascular invasion in pancreatic cancer, but limited evaluation for N-stage. CT, which plays a major role in patient with pancreatic cancer, not only accesses preoperative respectability by means of T-stage and vascular invasion, but also predicts important prognostic factors.

SS 8.03
Single-energy low-voltage arterial phase scanning for the detection of adenocarcinoma of the pancreas.

M.C. Ambrosetti, G.A. Zamboni, E. Zivelonghi, C. Cavedon, R. Pozzi Mucelli; Verona/IT

Purpose: To test a single-energy low-voltage protocol for detecting pancreatic adenocarcinoma.
Material and Methods: A total of 26 patients with pathology-proven pancreatic adenocarcinoma underwent MDCT with arterial phase at 80 kV on a 64-row scanner and were compared to a similar group of 26 patients scanned with a 120 kV arterial phase protocol. Except for tube voltage, all other scan parameters were constant. Scans were compared for quantitative image parameters (attenuation and standard deviation in liver, pancreas, aorta and tumour), CTDI and DLP using an unpaired t test. Image noise values for each protocol (SD of the HU from 3 ROIs drawn outside the body) were compared using an unpaired t test. Effective dose for each protocol was estimated with TLD measurements on an anthropomorphic phantom.
Results: The mean attenuation was significantly higher at 80 kV in the aorta (525.6 ± 126.8 vs. 292.9 ± 87.4 HU), liver (94.4 ± 17.8 vs. 75.3 ± 14 HU) and normal pancreas (162.1 ± 42 vs. 89.9 ± 19.7 HU) (all p < 0.0001), while no significant difference was observed for adenocarcinoma (67.8 ± 39.2 vs. 50.5 ± 20.5 HU; p = n.s.). CTDI and DLP were significantly lower at 8 kV (6.0 ± 1 vs. 9.7 ± 2.8 mGy, and 184.6 ± 40.3 vs. 369.6 ± 133.4 mGy x cm, respectively; all p < 0.0001). Tumour conspicuity (HUpancreas-HUtumour) was significantly higher at 80 kV (94.2 ± 39.3 vs. 39.5 ± 22HU; p < 0.0001). Mean image noise was significantly higher at 80 kV (12.3 ± 3.6 vs. 9.5 ± 2.9 HU; p < 0.0001). Estimated effective dose was significantly lower at 80 kV (0.157 vs. 0.201 mSv; p = 0.0083).
Conclusion: The use of 80 kV arterial-phase for abdominal CT increases the conspicuity of adenocarcinoma, thus potentially improving its identification.

SS 8.04
Dual energy CT perfusion in pancreatic carcinoma

M. Klauß, W. Stiller, M. Kieser, J. Werner, H.U. Kauczor, L. Grenacher; Heidelberg/DE

Purpose: The purpose of this study was to evaluate the feasibility of dual-energy (DE)-CT perfusion in pancreatic carcinoma.
Material and Methods: A total of 21 patients with histologically proven pancreatic carcinoma were examined prospectively with a 64-slice dual-source CT using a dynamic sequence of 34 acquisitions (80/140 kV~p~; 270/49 mAs; collimation of 14×1.2 mm) every 1.5 s after i.v. injection of 80 ml of iodinated contrast material (370 mg/ml, flow rate 5 ml/s). Image data of 80 kV~p~ and linearly blended 120 kV~p~-equivalent (M0.3) DE-perfusion acquisitions were evaluated with a body-perfusion CT tool (Siemens Medical Solutions, Erlangen, Germany) for estimating perfusion, permeability, and blood volume and parameter maps. These parameters were calculated to ROIs in carcinoma and healthy tissue.
Results: In all 21 patients, DE-CT perfusion was feasible, and tumor as well as healthy tissue was covered. All carcinomas could clearly be identified in the color-coded perfusion maps. Calculated values of perfusion, permeability and blood volume were lower in pancreatic carcinomas compared to healthy pancreatic tissue - 120 kV~p~-equivalent (M0.3): 0.23 ± 0.03 vs. 0.88 ± 0.04 min[-1] (p < 0.0001); [0.49 ± 0.07] vs. [0.66 ± 0.06]*0.5 min[-1] (p = 0.06), and 0.44 ± 0.06 vs. 1.22 ± 0.12 min[-1] (p < 0.0001); 80 kV~p~: 0.22 ± 0.04 vs. 0.81 ± 0.05 min[-1] (p < 0.0001), [0.37 ± 0.04] vs. [0.70 ± 0.05]*0.5 min[-1] (p < 0.0001), and 0.51 ± 0.08 vs. 1.37 ± 0.18 min[-1] (p = 0.0001). There were no significant differences between 120 kV~p~-equivalent and 80kV~p~-DE-acquisition regarding the difference between healthy and carcinoma tissue (perfusion: 0.65 ± 0.05 vs. 0.59 ± 0.06 min[-1] (p = 0.47), permeability: [0.17 ± 0.09] vs. [0.33 ± 0.08]*0.5 min[-1] (p = 0.21), blood volume 0.79 ± 0.13 vs. 0.86 ± 0.17 (p = 0.72).
Conclusion: DECT perfusion of the pancreas is feasible. Use of 120 kV~p~-equivalent DECT perfusion image data combines the advantages of increased (iodine) contrast at low kV~p~ (80) with the low noise at high kV~p~ (140) and could improve the delineation of pancreatic carcinomas in clinical use.

SS 8.05
New CT findings in severe acute pancreatitis that correlate with clinical outcome

K. Sandrasegaran, B. Tahir, M. Tann, T. Howard; Indianapolis, IN/US

Purpose: Recently, new concepts of severe acute pancreatitis (SAP) have emerged, including disconnection of main pancreatic duct and peripancreatic fat necrosis. We wanted to determine which imaging criteria best predicted medium-term outcome (<6 months) in SAP.

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Material and Methods: A total of 61 patients with SAP were retrospectively evaluated for site, presence and % volume of pancreatic and peripancreatic fat necrosis and signs of infection. The imaging findings were correlated with the occurrence of mortality (n = 2), systemic morbidity (organ failure, DIC) (n = 36), local morbidity (persistent pancreatic fistula, colonic perforation) (n = 25), length of hospital stay and number of surgical operations required. Multivariate generalized linear model analysis was performed.
Results: The mean age was 48.1 years (range 18 to 81), and there were 37 males and 24 females. Local morbidity was correlated significantly with the presence of main duct disconnection (p = 0.04), peripancreatic fat necrosis (p = 0.02) and size of collection > 10 cm (p = 0.01). Initial length of stay correlated with necrosis of >30% of pancreas (p = 0.01), and presence of duct disconnection (p = 0.05). Number of operations required correlated with duct disconnection (p = 0.03). CT findings did not correlate with mortality or systemic morbidity.
Conclusion: The presence of peripancreatic fat necrosis >10 cm in the widest dimension and main duct disconnection significantly affect medium-term morbidity and need to be included in radiology reports, in addition to the extent of glandular necrosis.

SS 8.06

Correlation of CT scores and acute kidney injury in severe acute pancreatitis

Z. Li, B. Song; Chengdu/CN

Purpose: To investigate the correlation between MDCT severity scores and the presence of acute kidney injury (AKI) in patients with severe acute pancreatitis (SAP).
Material and Methods: 119 SAP patients with confirmed AKI in 42 were retrospectively included. Contrast-enhanced MDCT scan was performed for all patients and 75 had repeated CT scans. The imaging findings including pancreatic size, necrosis, retroperitoneal inflammatory exudation, and other organ involvements were observed, based on which Balthazar's CT score, CT severity index (CTSI) and extrapancreatic inflammation on CT (EPIC) score were calculated. The correlation between CT Severity indexes, clinical scores (APACHE II and Ranson Score) and final clinical outcomes were statistically analyzed.
Results: SAP patients with AKI were associated with markedly increased incidence of multiple organ dysfunction (88.1%) and high mortality (47.6%). Unclear delineation between renal cortex and medulla, and pancreatic/peripancreatic hemorrhage suggested AKI. In SAP patients with AKI, the CT severity indexes showed significantly closer correlation with APACHE II and Ranson scores than in patients without AKI. EPIC score showed the largest area under the ROC curve (AUC = 0.903) than CTSI (AUC = 0.721) and Balthazar scores (AUC = 0.571). CT findings of exudates reduction and encapsulation were predictive for AKI recovery.
Conclusion: EPIC score is better correlated with clinical scores in predicting the presence of AKI in SAP patients; however, it is significantly less sensitive than APACHE II Score in reflecting the dynamic changes of AKI.

SS 8.07

Cystic dystrophy in heterotopic pancreas: MDCT findings in a large series and possible association with minor papilla abnormalities

M. Wagner, M. Vullierme, V. Rebours, P. Ruszniewski, V. Vilgrain; Clichy/FR

Purpose: Cystic dystrophy in the heterotopic pancreas (CDHP) is a complication of pancreatic heterotopia mostly associated with alcoholism. The purpose was to describe MDCT features of CHDP and to analyze its association with minor papilla abnormalities as described by Klöppel in 2007.
Material and Methods: A total of 82 patients, with a CDHP confirmed on endoscopic ultrasonography and a triple-phase MDCT on the upper abdomen, were retrospectively included. The following imaging findings were recorded: size and location of cysts, duodenal wall thickness, pancreatic abnormalities and inflammatory changes.
Results: Typical findings of CDHP were observed in 95% (78/82). Among them, CDHP was mostly located in the second part of the duodenum (72/78, 92%). Mean thickness of the duodenal wall was 22.6 mm. Cysts were multiple in 90%, (mean number 2.9) and measured between 2 and 60 mm. Pancreas abnormalities were depicted in 74.5% (58/78) (calcifications: 10% (8/78), dilatation of main pancreatic duct in 15.5% (12/78) or both in 49% (38/78)). Santorini duct dilatation and/or calcification in minor papilla was present in 35% (27/78). Calcifications in the minor papilla without calcification in the major papilla were only observed in three patients (4%). Inflammatory changes were found in 88.5% (69/78).
Conclusion: Our study confirms in a large series of patients that the previously described MDCT criteria are seen in most cases. Yet, conversely to pathological hypothesis, we have not shown a strong association between CDHP and minor papilla abnormalities.

SS 8.08

Can MDCT predict the resection status after pancreaticoduodenectomy for pancreatic adenocarcinoma?

O. Zakharova, G.G. Karmazanovsky; Moscow/RU

Purpose: The completeness of resection for pancreatic cancer (PC) has a powerful prognostic significance for recurrence and survival. 3D-CT is an accurate predictor of resectability for PC. The aim is to figure out whether it can prevent an R+ resection.
Material and Methods: Retrospective analysis of CT scans and pathohistological reports of 89 cases of PC after Whipple procedures was performed. We conducted a comparative analysis of demographic, clinical, intraoperative and pathologic characteristics of the two groups of patients: with R0 and R1 resections. The tested specifications included: sex, age, size of tumor (CT and morphology), TNM stage, evaluation of vessel involvement (using 3D reconstructions) and tumor grade.
Results: R0 resections were found in 76 (85.4%) patients (group A). R1 surgical margins were detected in 13 (14.6%) cases (group B). There were no R2 resections in our study. The accuracy of 3D-CT in determining an R0 resection was 85%. Patients who underwent vascular resections were more likely to have had an R1 resection. In group B, the average size of tumor was 30.4 ± 3,7 mm ($p < 0.05$); four (30.8%) patients had circumferential involvement of a major vessel of more than 180 degrees ($p < 0.05$).
Conclusion: MDCT is the most reliable method used for PC staging. In up to 15%, irresectability is only seen during surgery. 3D-CT imaging increases the diagnostic accuracy of vascular invasion. To avoid unnecessary laparotomies, it is important to properly interpret CT data.

SS 8.09

Acute pancreatitis: evaluation by using diffusion-weighted MR imaging with parallel imaging technique and multiple b gradient factor values

P. Boraschi, F. Donati, R. Gigoni, G. Gherarducci, F. Pacciardi, F. Falaschi, C. Bartolozzi; Pisa/IT

Purpose: To determine the usefulness of diffusion-weighted MR imaging (DW-MRI) with parallel imaging technique and multiple b-gradient-factor values in patients with acute pancreatitis (AP).
Material and Methods: A series of 25 patients with clinical diagnosis of AP underwent MR imaging with 1.5 T device (Signa HDxt,GE Healthcare). After the acquisition of axial T1/T2w sequences and coronal MRCP, DW-MRI was performed using an axial breath-hold single-shot spin-echo echo-planar sequence (parallel imaging factor,3); the values of b-factor were set at 0, 300, 500, 700 and 1000s/mm[2]. All DW images were blindly interpreted. Qualitative evaluation was performed by consensus reading of two reviewers who evaluated the presence or absence of AP and complications. Quantitative evaluation was performed by two other radiologists in conference who calculated mean ADC values for each patient using a b-value of 500s/mm[2].
Results: DWI could detect acute pancreatitis as persistent bright signal intensity at different b-gradient-factor values. The reviewers were able to differentiate inflammation from necrotic and hemorrhagic tissue and identified possible causes of AP (choledocholithiasis and pancreas divisum) on MR images in 11/25 cases. Furthermore, the mean pancreatic ADC value in the AP group was significantly lower than in the normal control group (p less than 0.05).
Conclusion: DW-MRI with parallel imaging technique and multiple b-gradient-factor values can assess the manifestations of acute pancreatitis using no contrast material and has the potential of becoming a powerful tool for the evaluation and follow-up of these patients.

SS 8.10

Does image registration influence tumour perfusion values?

S. Kandel[1], H. Meyer[2], P. Rogalla[1]; [1]Toronto, ON/CA, [2]Berlin/DE

Purpose: To evaluate whether image registration in CT perfusion influences perfusion values in pancreatic cancer.
Material and Methods: A total of 23 patients with pancreatic cancer underwent perfusion CT imaging of the pancreas on a 320-slice dynamic volume CT scanner (Toshiba) using 16 cm detector coverage with 0.5 mm primary slice thickness. The dynamic CT protocol consisted of 17 low-dose volumetric scans,

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acquired over 66 seconds during 3 breath-hold periods. Rigid image registration was performed by using the volume with the highest aortic attenuation as reference. All other volumes were visually matched with the pancreatic lesion serving as the volumetric region of interest. Following registration to correct for motion, maximum-slope and Patlak analysis technique were applied. Values for tumour perfusion and blood volume before and after volume registration were statistically compared using the paired T test.
Results: The average ROI used for analysis was 79 mm[2]. Tumour perfusion and blood volume were 0.37 ml x 100 ml[–1] x min[–1] (SD: 0.05) and 36.7 ml/100 mg (SD: 22.9) without, and 0.33 ml x 100 ml[–1] x min[–1] (SD: 0.02) and 18.8 ml/100 mg (SD: 7.17) with image registration, the difference was statistically not significant for maximum slope perfusion (10.8%), but significant for blood volume (48.9%, $p < 0.001$).
Conclusion: Image registration influences perfusion results in pancreatic cancer dependent on the analysis technique and degree of volumetric misregistration from breathing motion, and thus may be recommended in upper abdominal perfusion imaging.

11:00 - 12:30 **Tinto**

Scientific Session 9
GI MRI & CT

SS 9.01
Preliminary study on the optimal acquisition time for hepatobiliary phase MR imaging enhanced with Gd-BOPTA
F. Yuan, B. Song; Chengdu/CN

Purpose: The purpose of this study was to investigate the optimal acquisition time for Gd-BOPTA-enhanced hepatobiliary phase MR imaging in healthy volunteers with normal liver function.
Material and Methods: A total of 48 healthy volunteers (29 males, 19 females) were recruited. They were scanned using a 3.0 T MR system with gradient-echo 3D fast acquisition sequence prior to and at 40 min, 60 min and 90 min, respectively, after injection of Gd-BOPTA. The SNR, CR, %Enhancement~SNR~ and %Enhancement~CR~ of liver, left/right hepatic duct, gallbladder and common bile duct were measured in each phase and statistically analyzed using repeated measures ANOVA.
Results: (1) The SNR and CR of liver and left hepatic duct showed the highest value at 60 min after Gd-BOPTA injection, while at 90 min for gallbladder and common bile duct ($p < 0.05$). There were no significant differences for SNR and CR of right hepatic duct among the three delay times ($p = 0.61$ and $p = 0.69$), but the highest mean value still appeared at 60 min. (2) The %Enhancement~SNR~ and %Enhancement~CR~ of liver and left/right hepatic duct showed the highest value at 60 min after injection, while at 90 min for gallbladder and common bile duct. However, only %Enhancement~SNR~ and %Enhancement~CR~ of gallbladder and %Enhancement~SNR~ of common bile duct showed statistical significance.
Conclusion: For individuals with normal liver function, the optimal acquisition time to obtain hepatobiliary phase images of liver and hepatic duct after injecting Gd-BOPTA is at 60 min, while that for gallbladder and common bile duct is at 90 min.

SS 9.02
Potential benefits from a novel automated MR scanner software interface in liver MR imaging in terms of examination efficiency and image quality
C. Kloeters[1], L. Umutlu[1], C. Mönninghoff[1], A. Sombetzki[2], G. Antoch[2], M. Schlamann[1], M. Forsting[1], T.C. Lauenstein[1]; [1]Essen/DE, [2]Düsseldorf/DE

Purpose: To analyze an automated MRI algorithm in patients with contrast-enhanced liver examinations in terms of examination efficiency and image quality.
Material and Methods: Seventy-eight patients (34-75 years, mean: 53.2 years) were prospectively included in the study and randomized to one of the following scanners: 1.5 T MAGNETOM Aera including a completely automated user interface or a 1.5 T MAGNETOM Avanto with manually operated scanner software. Two blinded readers rated the image quality of the contrast-enhanced MR liver examination in terms of angulations/FOV, image contrast, image noise, artifacts and presentation of the target organ from “excellent” (5) to “insufficient” (1). The degree of diagnostic confidence to depict liver lesions was rated from “certain” (5) to “uncertain” (1). Additionally, total examination time was recorded. A Chi-square and U test were used for analysis.
Results: All examinations were technically feasible and well tolerated. The mean image quality for the automated processed examinations was rated higher for all categories and showed statistically significant difference in assessment of image contrast (mean~automated~ 4.6 vs. mean~manual~ 4.1) and presentation of target organ (mean~automated~ 4.4 vs. mean~manual~ 4.0) ($p < 0.05$). The diagnostic confidence was 4.6/3.9 ($p < 0.05$), respectively. Mean examination time was 25.24 min in the automatically and 21.05 min in the manually processed examinations.
Conclusion: Despite higher examination time, the automated MR scanner user interface shows an increase in image quality and diagnostic confidence. The innovation of new optimized MR sequences should carry the potential for time-saving strategies.

SS 9.03
Differentiating small (I 1 cm) focal liver lesions as metastases or cysts by means of computed tomography: a case study to illustrate a fuzzy logic-based method to quantify uncertainty in radiological diagnosis
R. Girometti[1], F. Fabris[2], A. Sgarro[2], S. Pullini[1], G. Zanella[3], G. Como[1], L. Cereser[1], C. Zuiani[1], M. Bazzocchi[1]; [1]Udine/IT, [2]Trieste/IT, [3]Palmanova/IT

Purpose: To illustrate a fuzzy logic-based method to quantify uncertainty in radiological diagnosis.
Material and Methods: We enrolled 22 oncologic patients with 50 focal liver lesions ≤1 cm detected at 64-row computed tomography (CT), proven to be cysts (n = 20) or metastases (n = 30). Two readers with 15 (R1) and 5 (R2) years of experience independently reviewed CT images. For each lesion, they expressed the diagnosis of metastasis as a certainty level (C) within the interval [0,1] (certainty in the alternative diagnosis of cyst was assumed to be 1-C). After cross-tabulating data according to the gold standard, table cells were considered as fuzzy subsets and complementary certainty values as their degrees of memberships. Accordingly, we estimated per-lesion diagnostic performance of readers both on usual crisp ($C \geq 0.51$) and fuzzy basis.
Results: Uncertainty mainly increased the crisp subset of false-positive cases: from 0 to 0.8 (R1) and from 1 to 2.4 (R2). The difference between crisp and fuzzy diagnostic performance was larger for the less experienced reader: sensitivity, specificity, PPV, NPV and accuracy were 90.0, 100, 100, 87.0 and 94.0% versus 90.0, 96.0, 97.1, 86.5 and 92.4% for R1 and 93.3, 95.0, 96.6, 90.5 and 94% versus 94.0, 88.0, 92.1, 90.7 and 91.6% for R2, respectively.
Conclusion: Radiological diagnosis can be expressed as a fuzzy degree membership to weight the impact of readers’ uncertainty on crisp diagnostic performance. One potential application is to test the readers’ competency.

SS 9.04
In vivo and ex vivo intravoxel incoherent motion and dynamic contrast-enhanced MRI in pancreatic ductal adenocarcinoma: correlation with histologic parameters
P. Lucchesi, M.A. Bali, T. Metens, P. Demetter, L. Verset, C. Matos; Brussels/BE

Purpose: To quantify changes in dynamic contrast-enhanced (DCE)-MR perfusion and intravoxel incoherent motion-diffusion coefficients obtained in pancreatic ductal adenocarcinoma (PDA) in vivo and IVIM-diffusion coefficients ex vivo. To determine whether these quantitative parameters correlate to each other and if there is a correlation between IVIM-diffusion coefficients and fibrosis or microvascular density (MVD).
Material and Methods: DCE-MR perfusion and IVIM (9 b value) were performed at 1.5 T in ten patients with PDA. IVIM was repeated on specimens after surgery. The ADC, the perfusion fraction f and the pure diffusion D were calculated in vivo and ex vivo. The obtained values were tested for significant differences between in vivo and ex vivo and were correlated with fibrosis content and MVD counts. DCE-MR quantitative parameters derived from one-compartment (OC) and two-compartment (TC) models were correlated with IVIM parameters.
Results: The in vivo signal decay was biexponential, whereas the ex vivo signal decay was monoexponential. In comparison to in vivo measurements, a significant reduction of f, D and ADC was found in ex vivo PDA ($p = 0,05$). No correlation between DCE-MR perfusion and IVIM parameters was found. IVIM parameters were not significantly correlated with fibrosis and MVD.
Conclusion: In PAD, in vivo ADC values are strongly influenced by perfusion. Quantitative DCE-MR perfusion parameters and IVIM parameters most probably represent different physiological processes and in our series no significant correlation with MVD or fibrosis could be demonstrated.

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SS 9.05

Parenchymal enhancement in MDCT of the abdomen: iso-osmolar versus low-osmolar contrast media

M. Rengo, D. Caruso, D. Bellini, M. Maceroni, C.N. De Cecco, M. Osimani, A. Laghi; Latina/IT

Purpose: To evaluate if a noninferior liver and pancreas parenchymal enhancement can be obtained injecting an iso-osmolar contrast at a lower iodine dose than a low-osmolarity contrast medium.

Material and Methods: A total of 120 patients were prospectively randomized into two groups. Group A received 650 mgI/kg of (lean body weight) LBW of iodixanol [320]. Group B received 750 mgI/kg of LBW of iomeprol [400]. Attenuation values were measured at the level of the aorta, portal vein, liver and pancreas parenchyma on unenhanced, portal and equilibrium enhanced phases. A noninferiority analysis and analysis of variance (ANOVA) were performed to compare the two groups.

Results: A total of 56 patients were included in group A and 57 in group B. No significant differences were found between the two groups for liver and pancreas parenchymal enhancement. Mean liver CEI values for group A and B were respectively 51.8 (± 7.8) and 50.4 (± 10.9), during portal phase, and 28.4 (± 6.7) and 32.8 (± 7.5), during equilibrium phase. Mean pancreas CEIs were 44.4 (± 7.3) / 42.7 (± 11.6) and 29.1 (± 3.2) / 31.2 (± 8.9), respectively, for portal and equilibrium phases. No inferiority, in terms of contrast enhancement, resulted for the iso-osmolar CM compared to the low-osmolar one.

Conclusion: According to these results, we assume that a lower amount of iso-osmolar CM may be injected to obtain an equal parenchymal enhancement of a low-osmolar CM.

SS 9.06

Visceral fat volume and its association with mesenteric panniculitis

T. Meulman, N. Van Putte-Katier, O. Elgersma, T.R. Hendriksz; Dordrecht/NL

Purpose: Recent studies have improved the understanding of adipose tissue and its active role in inflammatory mesenteric and intestinal disease. 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 a role in mesenteric panniculitis.

Material and Methods: As part of a large hospital-based prevalence study on mesenteric panniculitis, a nested case-control study was conducted. A total of 94 patients (70% male) with mesenteric panniculitis were 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: The mean age of individuals in both groups was 66,6 + 11,2 years. Persons with mesenteric panniculitis had a larger total fat volume (mean 2257 ml vs. 2121 ml, p = 0.038), visceral fat volume (mean volume 1037 ml vs. 923 ml, p = 0.024) and borderline significant higher BMI (26,9 kg/m[2] vs. 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.

SS 9.07

Apparent diffusion coefficient and tumor wall thickness in short-term treatment evaluation of gastrointestinal cancers: value of early changes on MR imaging

K. Cao, L. Tang, N. Wang, X. Li, Y. Sun, Y. Li, X. Zhang; Beijing/CN

Purpose: To assess the early changes of apparent diffusion coefficient (ADC) and tumor wall thickness on MRI during treatment of gastrointestinal (GI) tumors, and investigate their abilities in short-term treatment evaluation.

Material and Methods: A total of 30 newly diagnosed GI cancer patients who subsequently received chemotherapy or chemoradiation therapy were enrolled. MR scans were performed before, 1st week and 4-6th week after therapy started. Tumor wall thickness and ADC value were measured. Those with ≥30% regression in tumor wall thickness post-treatment were regarded as good responders. ROC were used to evaluate the abilities of ADC and thickness in differentiating good/poor responders.

Results: ADC values increased significantly at both early and post-treatment points (P < 0.05). Tumor wall thickness showed significant decrease at the later period. On early MRI, greater increase in ADC value was found in good responders (n = 12) compared with poor responders (n = 18) (25.90% ± 25.58% vs. 9.99% ± 15.83%, P < 0.05), yielding AUC = 0.752 when ROC curve was drawn. The best cutoff value was 10% increase for early ADC change, and the sensitivity and specificity to find good responders were 75% and 72.2%. 8/9(88.9%) patients with decreased ADC value at the 1st week were poor responders. All four (100%) patients with early tumor wall thickness decreasing ≥10% were good responders.

Conclusion: Change of ADC value as early as 1st week was found following treatment related with tumor regression at the end of short-term treatment in GI cancer patients. Early changes of ADC value and tumor wall thickness can help to pick up some good/poor responders. This project is supported by the National Natural Science Foundation of China, No. 81071129.

SS 9.08

Non-occlusive mesenteric ischemia: CT features and their prognostic values

M.A. Mazzei, F.G. Mazzei, G. Imbriaco, S. Guerrini, E. Foderà, M. Centra, D. Marrelli, L. Volterrani; Siena/IT

Purpose: Non-occlusive mesenteric ischemia (NOMI) is the most lethal form of acute mesenteric ischemia (58-70%) because of the poor understanding of its pathophysiology, its mild and nonspecific symptoms and signs at imaging, which often delay the diagnosis. The purpose of our work has been to evaluate CT appearances in 16 patients with NOMI, to recognize their CT characteristic features and their prognostic values.

Material and Methods: Twenty-two abdominal CT examinations of 16 patients (14 males and 2 females, mean age of 73 years, range 49-88) with a confirmed diagnosis of NOMI were retrospectively reviewed , randomly and individually by two radiologists (with 9 and 3 years' experience in abdominal imaging, respectively) to evaluate mesenteric findings (mesenteric vessel caliber: normal, increased, reduced; fat stranding; fluid; pneumatosis), vessel features (diameter of superior mesenteric artery, superior mesenteric vein and inferior vena cava), loop findings (thickness and degree of attenuation of bowel wall; content: gasless or dilated; pneumatosis of bowel wall) and findings of peritoneal cavity (fluid and air).

Results: Global mortality was 50% (8/16 patients). The reduction of caliber of mesenteric vessels and the paper thin appearance of bowel walls were significantly associated with higher mortality (p = 0.05 and p = 0.084, respectively).

Conclusion: Considering its characteristic features, the CT evaluation of patients with a clinical suspicion of NOMI could be useful to provide possible prognostic information.

SS 9.09

MRI in the evaluation of acute abdominal pain

S. Byott[1], I. Harris[2]; [1]Manchester/UK, [2]Preston/UK

Purpose: To analyse the diagnostic accuracy and efficacy of MRI in the diagnosis of patients under the age of 60 years presenting with an acute abdomen.

Material and Methods: A 3-year prospective analysis from January 2009 to December 2011 was performed. Patients presenting with acute abdominal pain were imaged using MRI when ultrasound was inappropriate or non-diagnostic. Non-contrast HASTE coronal and axial sequences were performed. Patients presenting with renal colic were excluded. A minimum of 6-week follow up was made, with correlation between MR findings and surgical data to ascertain diagnostic accuracy.

Results: A total of 92 cases were included in the study. MRI was positive for acute surgical pathology in 19 patients and negative in 65, while 8 scans demonstrated acute pathology not requiring surgery. In the MR-negative group, 59 were discharged without surgery, 6 had negative laparoscopy and 2 had subsequent readmissions without requiring surgical intervention. In the MR-positive group, 17 patients had surgery confirming MR findings, while 2 patients were treated conservatively. Nine different types of pathology were diagnosed by MRI including appendicitis, abdominal collections, caecal volvulus, small bowel obstruction, large bowel obstruction, Crohn's stricture, splenic injury, colitis and pancreatitis. MRI demonstrated a 100% efficacy in terms of diagnosis of pathology requiring surgical intervention.

Conclusion: MRI is a safe, readily available and effective way to diagnose acute abdomen and should be the investigation of choice for patients of an age prone to radiation.

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SS 9.10

Abdominal and soft tissue abscess: diagnostic ultility of diffusion-weighted MRI in children and young adults

H. Neubauer, I. Platzer, V. Mueller, T. Meyer, J. Liese, H. Koestler, D. Hahn, M. Beer; Wuerzburg/DE

Purpose: To evaluate detectability and imaging characteristics of abscess formations on diffusion-weighted MRI (DWI) in children and young adults.

Material and Methods: Seventeen patients (11 females, age 13 ± 6 years, range 1 - 21 years) with suspected abdominal or soft-tissue abscess underwent routine MRI including diffusion-weighted free-breathing single-shot echo planar imaging. Seventeen randomly chosen age-matched patients with non-purulent abdominal free fluid collections served as controls. Mean ADC values were measured for abscess, muscle, liver, spleen and kidney tissue as well as for various body fluids.

Results: All abdominal (n = 9) and soft tissue (n = 8) fluid collections were identified on diffusion-weighted images. Twelve of 13 confirmed abscess formations showed an ADC < 1.0 ×10[-3] mm[2]/s with a mean value of 0.80 ± 0.38 mm[2]/s. One tuberculous soft-tissue abscess had a higher ADC of 1.85 ×10[-3] mm[2]/s. There were no false-positive findings in the control group.

Conclusion: Diffusion-weighted MRI reliably detects fluid collections in paediatric patients and distinguishes between abscess and non-purulent fluid collections. DWI facilitates free-breathing rapid image acquisition without the need of i.v. contrast application and constitutes a particularly useful choice in paediatric imaging.

SS 9.11

Comparison between opaque and transparent distension of the colon in multidetectorCT enteroclysis in intestinal endometriosis detection

E. Biscaldi, S. Ferrero, V. Remorgida, G.A. Rollandi; Genoa/IT

Purpose: To compare the effectiveness of two multidetectorCT enteroclysis (MDCTe) protocols, with opaque or transparent distension of the colon, in the assessment of nodule detection and in evaluation of intestinal infiltration.

Material and Methods: A total of 96 consecutive patients (mean age 28 years), with a strong suspicion of deep infiltrating endometriosis, were assigned alternatively to opaque (48)/transparent (48) colon distension.The intestinal preparation and CT protocol were standardised: contrast-enhanced MDCT (64 rows), portal phase. The opaque distension was performed by retrograde enema of tap water (2000 cc) with 80 cc of iodinated contrast (to reach a density of 250-300 HU), and the transparent distension was done with tap water alone.Two expert radiologists, blinded, investigated the intestinal nodule detectability (scoring nodules as 'well' or 'not well' detectable), and the colon (rectum/sigmoid/other segments) infiltration. The diagnosis of infiltration was made on consensus. All patients underwent surgery and the results were compared to MDCTe.

Results: Transparent MDCTe: the radiologists in 19/48 patients detected 17 sigmoid and 10 rectal nodules, 1 sigmoid polyp and 1 cecal lesion. All infiltrating nodules were scored as 'well detectable'. At surgery, in 21 positive patients, MDCTe missed (3) small serosal nodules not infiltrating. Opaque distension detected endometriosis in 18 patients, and 15 sigmoid and 9 rectal nodules. Three of 24 nodules scored as 'not well detectable' were misinterpreted, and 1 sigmoid nodule was missed. Sensibility, specificity, PPV and NPV were: in transparent distension 91, 100, 100 and 93%; in opaque distension 82, 100, 100 and 87%. The mean X-ray dose was similar in both protocols.

Conclusion: The transparent enteroclysis is more effective in parietal nodule detection: the window between hypodense lumen and hyperdense wall highlights the detectability of lesions. The hyperdense lumen in opaque distension limits detection of both mucosa and small penetrating nodules.

11:00 - 12:30 **Moorfoot**

Scientific Session 10

Hepatocellular carcinoma

SS 10.01

The value of gadobenate dimeglumine-enhanced MR imaging with dynamic and hepatobiliary phases in the characterization of small (≤2cm) nodular hepatic arterial phase enhancing: only lesions identified at contrast-enhanced CT in liver cirrhosis

E. Quaia, L. De Paoli, E. Pantano, B. Cabibbo, M.A. Cova; Trieste/IT

Purpose: The purpose of this study was to assess the value of gadobenate dimeglumine (Gd-BOPTA)-enhanced MR imaging in the characterization of small (≤2cm) nodular hepatic arterial phase enhancing (HAPE), only lesions identified at contrast-enhanced CT in patients with liver cirrhosis.

Material and Methods: This prospective study was approved by the ethics committee and informed consent was obtained from all patients. We recruited 125 cirrhotic patients (age: 68 ±12.36 years) who revealed up to five HAPE, only nodular lesions (≤2cm) at contrast-enhanced CT. All patients were scanned by MR imaging before and after Gd-BOPTA injection during hepatic arterial (HAP), portal venous (PVP), equilibrium (EP), and hepatobiliary phase (HP). Lesion characterization was based on MR imaging features considered typical for hepatocellular carcinoma (HCC) (n=34), imaging follow-up (n=105), or histology (n=12). Two experienced radiologists (5 and 10 years) analyzed the MR images in consensus, and multivariable logistic regression was conducted to test the significance of the MR image findings with HCC diagnosis.

Results: One hundred fifty-one HAPE-only lesions were identified, including 115 benign nodules and 36 HCCs. PVP-EP washout and HP hypointensity not combined (OR 263.48, 95% confidence intervals, CIs: 25.14–2761.25; P<.05) or combined with T2 hyperintensity (OR 327.43; 95% CIs: 28.19–3802.23; P<.05) or HAP hyperintensity (OR 256.43; 95% CIs: 24.49–2685.65; P<.05) on multivariable analysis were related to malignancy diagnosis.

Conclusion: Small HAPE-only lesions in cirrhotic patients are mainly benign and may be characterized by Gd-BOPTA-enhanced MR imaging.

SS 10.02

C-arm CT tumour-to-liver contrast in patients with HCC: intraindividual comparison of three protocols

C. Koelblinger, W. Schima, V. Berger-Kulemann, J. Lammer; Vienna/AT

Purpose: The purpose of this study was to compare the effect of three different protocols on the tumour-to-liver contrast (TLC) of HCCs using C-arm CT (CACT).

Material and Methods: After signed informed consent, 16 patients (15 male, 1 female; mean age 65 years), treated with TACE for HCC, were included in this prospective IRB approved study. Three different CACT protocols were acquired in each patient in random order. Therefore, a 5F catheter was placed in the common hepatic artery and diluted (100 mg iodine/ml) contrast medium (CM) was injected with a flow of 4 ml/s. With the early acquisition, CACT protocol (EA) acquisition, which lasted 8 s, started 4 s after the start of contrast medium application (total CM: 48 ml). With the intermediate acquisition, CACT protocol (IA) acquisition started with a delay of 8 s (total CM: 64 ml). With the late acquisition, CACT protocol (LA) acquisition started with a delay of 12 s (total CM: 80 ml). One experienced radiologist measured the TLC by placing ROIs within the liver parenchyma and the tumor. A total of 33 HCCs, which had been proven by pre-interventional MDCT or MRI, were evaluated. Univariate analysis of variance was used for statistical analysis.

Results: Mean TLC was 184 HU for EA, 254 HU for IA, and 245 HU for LA. IA and LA were significantly superior to EA (p<.01).

Conclusion: Compared to 4 s delay, TLC of HCC using CACT is significantly improved using 8 s or 12 s delay.

SS 10.03

Dual-energy CT for detection of hepatocellular carcinoma (HCC) incidentally diagnosed during pathological workup in patients with liver cirrhosis after liver transplantation

C.M. Sommer, J. Schmoee, T. Longerich, P. Schirmacher, M. Mieth, P. Schemmer, N. Bellemann, U. Stampfl, H.U. Kauczor, B. Radeleff, W. Stiller; Heidelberg/DE

Purpose: The purpose of this study was to quantitatively define image quality of contrast-enhanced dual-energy CT for detection of hepatocellular carcinoma (HCC) incidentally diagnosed during pathological workup in patients with liver cirrhosis after liver transplantation.

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Material and Methods: This prospective study had two inclusion criteria: (I) CT examination comprising dual-energy acquisition in the arterial phase (AP-DEA), and non-enhanced, venous and late phase acquisitions each in single-energy technique 24 h before liver transplantation, and (II) incidentally diagnosed HCCs in explanted livers with hyperdense correlates in AP-DEA. Nine patients (8 men; mean age 58.9±7.9 years) with 13 HCCs (mean diameter 1.6±0.8 cm) were included. Mean MELD score was 10.0±1.3 and mean AFP level was 15.0±19.2 IU/ml. From AP-DEA, four datasets were evaluated: 80kVp, 120kVp-equivalent, optimum-contrast and pure-iodine image datasets. Attenuation and image noise of liver parenchyma, HCC, and aorta as well as HCC-to-liver-parenchyma contrast-to-noise ratio (CNR) were compared.
Results: For HCC, highest attenuation and image noise was found in 80kVp datasets, and lowest in pure-iodine datasets (147.8±33.1 HU vs. 56.6±26.7 HU [P<0.001] and 21.6±6.2 HU vs. 9.0±4.3 HU [P<0.001]). For HCC, attenuation was significantly higher in optimum-contrast compared to 120kVp-equivalent datasets (123.2±30.7 HU vs. 108.2±21.3 HU [P<0.001]). HCC-to-liver-parenchyma CNR was significantly higher in pure-iodine and optimum-contrast datasets compared to 80kVp datasets (5.2±3.2 and 4.0±2.3 vs. 2.6±1.4 [both P<0.001]). CNR was significantly higher in pure-iodine compared to 120kVp-equivalent datasets (5.2±3.2 vs. 3.3±1.9 [P<0.001]).
Conclusion: Combination of optimum-contrast and pure-iodine datasets demonstrated best quantitative image quality for detection of HCC.

SS 10.04

Differentiating mass-forming intrahepatic cholangiocarcinoma from atypical hepatocellular carcinoma using gadoxetic acid-enhanced MRI

Y. Chong, W.J. Lee, S.H. Kim, H. Rhim, M.J. Park, J.H. Lim, H.J. Park; Seoul/KR

Purpose: The purpose of this study was to examine the differential features of mass-forming intrahepatic cholangiocarcinoma (ICC) from atypical hypovascular hepatocellular carcinoma (HCC) on gadoxetic acid-enhanced MRI.
Material and Methods: IRB approved this retrospective study and waived informed consent. Seventy patients with pathologically proven ICCs (35) and hypovascular atypical HCCs (35) who had undergone preoperative gadoxetic acid-enhanced MRI were enrolled. Images were analyzed as to the shape of the lesions and the presence of hyperintensity on the T1-weighted image (T1WI) and hypo- or hyperintense areas on the T2-weighted image (T2WI). In addition, images were analyzed as to the presence of linear hyperintensity or multifocal tiny hyperintense foci on T2WI and the presence of rim enhancement during early dynamic phases and a central enhancement with hypointense rim (target appearance) on 10-min and 20-min hepatobiliary phase image. The significance of these findings was determined by the X[2] test.
Results: Univariate analysis revealed that the following significant parameters favor ICC or hypovascular HCC: Presence of T2 hypo- and hyperintense areas and target appearance on the 10-min hepatobiliary phase for ICC; presence of T2 linear hyperintensity and multifocal hyperintense foci for hypovascular HCC (P<0.05). Multivariate analysis revealed that only target appearance on 10-min hepatobiliary phase was predictive of ICC (P=0.002, 85.7%). However, the target appearance was also observed in all six scirrhous HCCs.
Conclusion: Target appearance on 10-min hepatobiliary phase is the best predictor for identifying mass-forming ICC on gadoxetic acid-enhanced MRI.

SS 10.05

Comparison of diffusion-weighted imaging with dynamic contrast enhanced MRI for detection of HCC in cirrhosis

N. Kalra, S. Shankar Mp, P. Singh, R. Srinivasan, A. Duseja, Y. Chawla, N. Khandelwal; Chandigarh/IN

Purpose: The purpose of this study was to compare diffusion-weighted imaging (DWI) with dynamic contrast-enhanced MRI (DCEMRI) for detection of HCC in cirrhosis using a 3-T MRI scanner.
Material and Methods: 20 consecutive cirrhotics with focal liver lesions on US were enrolled. Patients underwent MRI which included T1-, T2-weighted imaging, DCEMRI, and axial DWI (b values 0, 100, 500 and 1000 mm[2]/sec). Two radiologists independently evaluated the DWI and DCEMRI and were blinded to each other. Average apparent diffusion coefficient (ADC) values were calculated from the lesions. Findings on DCEMRI were taken as the gold standard. FNA was taken from the lesions seen on DCEMRI.
Results: DWI had a sensitivity of 95% (CI 95%), accuracy of 95% and positive predictive value of 100%. There was high degree of agreement (kappa value= 0.898) between DWI and DCEMRI. ADC values of well, moderately and poorly differentiated HCC showed decreasing trend but 'p' value (0.118) was statistically insignificant.
Conclusion: DWI is a useful imaging sequence for detection of HCC in cirrhosis. A correct prediction of the grade of HCC is not possible preoperatively because of the overlap of the ADC values.

SS 10.06

Single-energy low-voltage arterial phase scanning increases conspicuity of hypervascular lesions of the liver: an intra-patient study

G.A. Zamboni, M.C. Ambrosetti, E. Zivelonghi, C. Cavedon, R. Pozzi Mucelli; Verona/IT

Purpose: The purpose of this study was to compare a intra-patient single-energy low-voltage arterial-phase protocol and a 120 kV protocol for detecting hypervascular focal liver lesions (hFLL).
Material and Methods: 27 patients with chronic liver disease and ≥1 hFLL underwent abdominal MDCT with 80 kV arterial phase (test group) on a 64-row scanner. This was compared to a previous 120 kV scan. Mean interscan interval was 139 days; lesions were not treated between exams. Scans were compared for attenuation and standard deviation in the liver, aorta and largest hFLL, image noise, CNR, CTDI and DLP (paired t-test). Effective dose for each protocol was estimated with TLD measurements on an anthropomorphic phantom.
Results: All scans were of diagnostic quality, according to the reporting radiologist. Mean attenuation was significantly higher at 80 kV than at 120 kV in aorta (501.7±148.3 vs 273.6±82.9 HU), liver (78.5±14.3 vs 60.9±11.9 HU) and hFLL (160.0±32.2 vs 107.9±23.2 HU; all p<0.0001). CTDI and DLP were significantly lower at 80 kV (6.4±0.4 vs 12.96±4.3 mGy and 194.3±27.5 vs 405.4±117.4 mGy cm, respectively; all p<0.0001). Lesion conspicuity (HU~nodule~ -HU~liver~) was significantly higher at 80 kV (83.8±35.5 vs 48.8±21.5 HU; p=0.0008). Mean image noise was significantly higher at 80 kV (12.3±3.6 vs 8.5±2.4 HU; p<0.0001). Lesion CNR was not significantly different between the two protocols. Estimated effective dose was significantly lower at 80 kV (0.157 vs 0.201 mSv; p=0.0083).
Conclusion: The use of a 80-kV arterial phase protocol for abdominal CT increases conspicuity of hFLL, possibly improving identification, while allowing significant dose reduction.

SS 10.07

Validation of diagnostic criteria using gadoxetic acid-enhanced and diffusion-weighted MR imaging for small HCC (≤2.0 cm)

S.H. Kim, W.J. Lee, M.J. Park, J. Hwang, M.H. Lee, J.H. Lim; Seoul/KR

Purpose: The purpose of this study was to validate usefulness of MRI criteria using combined gadoxetic acid-enhanced MRI and diffusion-weighted imaging (DWI) for diagnosis of small HCC ≤2 cm.
Material and Methods: One hundred and eight patients who had pathologically proven 102 HCCs and 23 benign nodules (21 dysplastic nodules and 2 regenerative nodules, ≤2.0 cm) detected during surveillance with MDCT underwent liver MRI including the gadoxetic acid-enhanced imaging and DWI. Index MR criteria for HCC were: (1) arterial hyperenhancement and hypointensity on hepatobiliary phase (HBP) with/without hyperintensity on DWI; (2) hypovascular nodule with hyperintensity on DWI; (3) arterial hyperenhancement and either iso- or hyperintensity on HBP, with hyperintensity on DWI and (4) hyperintensity only on DWI. According to the MR criteria, MRI findings for HCCs and benign nodules were independently classified by two reviewers.
Results: On MDCT, 64 HCCs (62.7%) showed typical enhancement pattern for HCC. Eighty-three HCCs (82.4%) showed arterial hyperenhancement and hypointensity on HBP, and hyperintensity on DWI. For each observer, 101 (99.0%) and 100 HCCs (98.0%) were discernible with MR criteria, respectively. Three dysplastic nodules also fitted into MR criteria, thus specificity was 90.9% for both observers. The remaining benign nodules were seen as hypointense only on HBP. The kappa value for two observers was 0.904 for lesion categorization, indicating excellent inter-observer agreement.
Conclusion: With the proposed HCC criteria based on combined gadoxetic acid-enhanced MRI and DWI, it is possible to reliably diagnose HCC ≤ 2.0 cm, including early hypovascular HCC.

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SS 10.08

Liver perfusion CT for noninvasive assessment of response to sorafenib therapy in patients with advanced HCC: preliminary findings

L. Faggioni, P. Vagli, F. Pancrazi, R. Sacco, E. Neri, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to assess treatment response to sorafenib therapy in patients with advanced HCC by means of perfusion CT (pCT).

Material and Methods: Ten patients with a total of 16 previously diagnosed HCC underwent liver pCT immediately before the beginning of sorafenib therapy and one month thereafter. pCT was carried out on a 64-row CT scanner (LightSpeed VCT, GE Healthcare, Milwaukee, WI) with a 4-cm longitudinal coverage on the target lesion. Using dedicated software, regions of interest were traced inside the HCC and in the surrounding liver parenchyma, and the following perfusion parameters were computed: blood flow (BF), blood volume (BV), mean transit time (MTT), hepatic arterial fraction (HAF), and permeability-surface product (PS). Serum alpha-fetoprotein levels (αFP) were also measured immediately prior to each pCT scan.

Results: Baseline BF, BV, HAF, and PS were significantly higher, and MTT values were significantly lower in HCC lesions than in the surrounding liver parenchyma ($p<0.01$). At 1-month pCT follow up, in all patients, αFP was significantly reduced at baseline, while MTT values were significantly higher (8.98±2.86 vs 5.15±1.87 seconds, $p=0.0097$). A statistically significant inverse correlation was also found between baseline MTT and post-treatment αFP reduction ($r=-0.6685$, $p=0.0125$).

Conclusion: In patients with advanced HCC under sorafenib therapy, MTT prolongation at 1-month pCT follow up can be used as a marker of biochemical treatment response. Baseline MTT could predict treatment response in patients candidate to sorafenib therapy.

SS 10.09

Measurement of CT attenuation of various tumor portions in Lipiodol-retaining hepatocellular carcinomas on CT images of low and high tube voltages: usefulness of dual energy CT

W.J. Lee, S. Shin, S.B. Shin, J. Kim; Seoul/KR

Purpose: The purpose of this study was to determine usefulness of DECT in detecting viable tumor portion (VTP) in Lipiodol-retaining HCCs by measuring CT attenuation of various TPs including VTP, necrotic TP (NTP), and Lipiodol-retaining TP (LTP) on CT images of low and high tube voltages.

Material and Methods: Thirty HCC patients treated with TACE, who had suspected VTP clinically and underwent follow-up DECT, formed our study population. Three-phase DECT was performed with Somatom Definition Flash, of which HAP was obtained 18 sec after peak aortic enhancement (300 mgI/mL, 0.6 g/kg, 30 sec injection duration). HU of five groups (19 VTPs, 14 NTPs, 22 LTPs, 30 livers, and 30 aortas) was measured on HAP images of 80 kVp and 140 kVp. Attenuation ratio (AR=HUs of 80 kVp/HUs of 140 kVp) of these groups was calculated.

Results: HUs of LTP, aorta, VTP, liver, and NTP on HAP images of 80 versus 140 kVps were 2328.35±574.31 versus 963.12±405.11, 516.65±70.63 versus 206.95±24.75, 199.57±54.93 versus 99.07±18.03, 91.05±17.14 versus 70.55±8.77, and 52.22±18.72 versus 44.89±14.97, and corresponding ARs were 2.56±0.41, 2.49±0.06, 1.99±0.25, 1.29±0.15, and 1.16±0.14. All ARs were different with statistical significance ($p<0.001$) except two occasions (LTP vs. aorta and liver vs. NTP). All ARs of VTPs were above 1.54, while those of NTPs were below 1.41.

Conclusion: ARs were related to iodine contents of each group, and particularly VTP was successfully differentiated from NTP using AR. Accordingly, DECT could be useful in detecting VTP in Lipiodol-retaining HCCs only with HAP.

SS 10.10

Usefulness of gadoxetic acid (Gd-EOB-DTPA, Primovist) in the detection and characterization of indeterminate liver nodules in cirrhotic patients studied with gadobutrol (Gd-DTPA, Gadovist)

E. Ballesteros, D. Gil-Bello, J. Martin, M.J. Prieto, M. Solà, A. Malet, J. Puig; Sabadell/ES

Purpose: The purpose of this study was to evaluate the usefulness of Gd-EOB-DTPA (Primovist[R]) in the detection and characterization of indeterminate liver nodules in cirrhotic patients studied with Gd-DTPA (Gadovist[R]).

Material and Methods: 19 patients (13 men, 6 women; mean age: 65 years) with 28 liver nodules classified as indeterminate on gadobutrol-enhanced MRI studies underwent gadoxetic acid-enhanced MRI. The diagnosis was reached by biopsy (n=17) and/or by imaging characteristics (n=11). Nodules were classified as hypointense, isointense or hyperintense in the portal venous phase in gadobutrol-enhanced MRI studies and in the hepatobiliary phase in gadoxetic acid-enhanced MRI. We correlated the signal intensity in the hepatobiliary phase with the diagnosis and compared the number of nodules detected with the two techniques, both overall and in the portal venous phase in gadobutrol studies versus in the hepatobiliary phase in gadoxetic acid studies. Student's t-tests and Chi-square tests were used for different variables, as appropriate.

Results: The nodules (mean size: 14 mm) were hepatocellular carcinomas (HCC, n=17), dysplastic nodules (DN, n=10) and an adenocarcinoma (n=1). We found no relation between the signal intensity of the nodules in the hepatobiliary phase in gadoxetic acid studies and the diagnosis. More lesions were detected in the hepatobiliary phase of gadoxetic acid studies (n=32) than in the portal venous phase of gadobutrol studies (n=9, $p<0.05$).

Conclusion: Gadoxetic acid-enhanced MRI does not differentiate between HCC and DN, but it detects more lesions than gadobutrol-enhanced MRI.

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11:00 - 12:30 **Pentland**

Scientific Session 11

CT Colonography 2 - Technical performance

SS 11.01

Detection of extracolonic pathology by CT colonography in symptomatic patients: clinical consequences and outcomes versus colonoscopy or barium enema: multicentre randomised controlled trial

S. Halligan[1], K. Wooldrage[1], E. Dadswell[1], C. Von Wagner[1], C. Kay[2], J. Wardle[1], R. Lilford[3], W. Atkin[1], T. Siggar Investigators[1]; [1]London/UK, [2]Bradford/UK, [3]Birmingham/UK

Purpose: CT colonography (CTC) simultaneously examines the colorectum and extracolonic organs. We performed a multicentre randomised controlled trial to quantify the frequency and clinical consequences of extracolonic findings.

Material and Methods: 8484 symptomatic patients referred for barium enema or colonoscopy were registered at 21 centres. 5384 eligible patients were consented and randomised to CTC or default in a 1:2 ratio. We determined the frequency of extracolonic findings, number and nature of subsequent investigations, and ultimate diagnosis. Extracolonic cancers were matched with national registries.

Results: 1748 CTC examinations were analysed: 1042 (59.6%) had ≥1 extracolonic finding (1,945 individual findings), rising with age ($p<0.0001$). 149 patients (8.5%) underwent subsequent investigation, 52 of whom (34%) underwent multiple procedures, 32 (21.5%) underwent surgery. 79 extracolonic neoplasms were diagnosed, 29 malignant. Overall, neoplasia was diagnosed in 79 (4.5%) patients having CTC, malignant in 29 (1.7%). Positive predictive value of symptoms for extracolonic disease was low. The proportion of patients diagnosed with extracolonic cancers or dying did not differ significantly between procedures within 3 years of randomisation. 14 (0.8%) patients had extracolonic abdomino-pelvic cancer diagnosed within 3 years of apparently normal CT colonography.

Conclusion: Most symptomatic patients have extracolonic findings on CTC, approximately 2% malignant. Surprisingly, offering CTC as a primary procedure does not significantly increase the proportion of patients diagnosed with extracolonic malignancy at 3 years when compared with colonoscopy or barium enema.

SS 11.02

Preliminary 2D reading of CTC studies on the iPad2®: comparison with a conventional desktop workstation

L. Faggioni, E. Neri, P. Vagli, S. Angeli, L. Cini, E. Picano, D. Caramella, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to evaluate the effectiveness of the iPad2[®] as a mobile device for 2D reading of CTC datasets.

Material and Methods: We retrospectively reviewed 37 CTC examinations performed in a colorectal cancer screening setting, for a total of 68 polyps sized between 5 mm and 26 mm. All datasets were wirelessly imported in DICOM format on an iPad2[®] 64GB (Apple Inc, Cupertino, CA) running OsiriX HD[®] (www.osirix-viewer.com) from a Macintosh desktop computer (iMac[®] 3.06GHz) connected to our hospital PACS and running OsiriX 4.0. Two experienced raters read CTC datasets independently on the iMac[®] and on the iPad2[®]. Detection rate and segmental localization of lesions were recorded for each CTC dataset as well as the time needed for complete reading of each CTC examination. Image quality was also visually assessed using a three-point scale (1=poor, 2=fair, 3=good).

Results: All lesions detected on the iMac[®] were also identified on the iPad2[®], and their segmental localization was correctly assessed in 100% of cases. Image quality was good with both devices, while image reading time was longer on the iPad2® than on the iMac[®] (6.24±2.32 vs 4.06±2.28 minutes, respectively [mean±standard deviation], $p<0.05$).

Conclusion: The iPad2[®] allows to effectively display all colonic lesions detected on the iMac[®], at the expense of a longer image reading time, suggesting that the iPad2[®] is more suitable for preliminary 2D reading than for primary reporting of CTC examinations.

SS 11.03

Detection of colorectal cancer at CT colonography

P. Simons[1], L. Van Steenbergen[2], M. De Witte[1], M. Janssen-Heijnen[1]; [1]Venlo/NL, [2]Eindhoven/NL

Purpose: CTC is a less burdensome alternative for colonoscopy in excluding colorectal cancer (CRC) in symptomatic patients. We evaluated the proportion of patients who underwent CTC in whom CRC was missed.

Material and Methods: Patients who underwent CTC in the VieCuri Medical Centre, Venlo, The Netherlands, in the period 1-1-2007 to 1-1-2011 were merged with all cases of CRC recorded in the population-based Eindhoven Cancer Registry between 1-1-2007 and 1-7-2011 to identify all patients who had undergone CTC less than 2 years before CRC has been diagnosed. A missed cancer was defined as a patient being diagnosed with CRC, whereas suspicious colonic mass, indeterminate lesion or polyp >1 cm was not found in the CTC report.

Results: In 53 out of 1857 patients who underwent CTC, CRC was diagnosed. Of these, 40 patients were suspected for CRC and 5 patients were diagnosed with large polyps on CTC. In 5 patients with an indeterminate mass, further investigation confirmed malignancy. One cancer in the coecum was missed because of poor distension. Two cancers, one located in the distal rectum and one in the ascending colon, were missed. Sensitivity of CTC for CRC was 94% (95% CI 88-100%). The true miss rate, excluding the inadequate distended study, was 2 out of 53 (3.8%).

Conclusion: This study shows that the miss rate for CTC is low, which means that CTC is accurate in excluding CRC.

SS 11.04

Comparison study of 2-day versus 4-day limited bowel preparation regimens for fecal-tagging CT colonography

K. Meric, N.U. Bakal, E. Yencilek, G. Kilicoglu, M.M. Simsek, O. Cakir; Istanbul/TR

Purpose: The aim of this study was to compare tagging efficacy and the amount of residual stool and residual fluid in 2-day versus 4-day limited bowel preparation regimens using barium-based fecal-tagging agent in incomplete conventional colonoscopy patients.

Material and Methods: Sixty consecutive patients were prospectively enrolled and randomly divided into 2-day and 4-day low-residue diet groups. We used barium sulfate suspension for fecal tagging and Bisacodyl for stool softening. Two radiologists graded residual stool (5=< >=6 mm and 1:none/scattered to 4:>50% circumference), residual fluid (1:no fluid to 4:>50% AP diameter) and tagging efficacy for stool (1:untagged to 5:100% tagged) using a system adapted from Taylor et al. Following CTC, a questionnaire was administered for investigating patient experience of the reduced laxative tagging regimen. Statistical analysis was performed between 2 groups using the Mann-Whitney U test.

Results: There was no significant difference between 2-day and 4-day preparation group for residual stool, residual fluid and fecal tagging efficacy. In all patients, there was statistically difference for residual stool and residual fluid between right hemi-colon and left hemi-colon.The fecal tagging efficacy was 87.6% for >=6 mm residual stool in all colonic segments. Patient acceptability in 2-day preparation was higher than 4-day preparation.

Conclusion: Two-day limited bowel preparation regimen for fecal-tagging CTC offers the patient a well-tolerated preparation and improves high fecal-tagging efficacy.

SS 11.05

CTC after fecal tagging: comparison between supine-only and prone/supine approach

D. Caruso[1], M.M. Maceroni[1], F. Vecchietti[1], D. Bellini[1], M. Rengo[2], A. Laghi[1]; [1]Latina/IT, [2]Rome/IT

Purpose: The purpose of this study was to retrospectively compare double prone/supine scans and single supine scan in a population of patients prepared with fecal tagging and to evaluate the feasibility of performing CTC studies only on the supine scan.

Material and Methods: Two radiologists in consensus evaluated only the supine scans of 20 patients, with 30 endoscopically proved polyps (from 6mm to 12mm), chosen from our database. After one month, prone and supine scans of the same dataset were evaluated. All patients were prepared for CTC with a dedicated low-residue diet. Fecal tagging was performed by the oral administration of a fixed amount of 200 ml of Gastrografin at major meals starting three days before the examination. We evaluated sensitivity, specificity and mean reporting time for the two approaches.

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Results: All patients with optimal distention and tagging on both supine and prone scans and negative for polyps could be evaluated on supine scans only. In the four patients positive for polyps at supine scan, the combined evaluation of prone scan was necessary in order to improve lesion conspicuity.
Conclusion: Performing CTC only on supine position seems to be a feasible approach, in patients prepared with fecal tagging and with good colonic distention and with negative findings. This will reduce the dose to the patients and the reporting time.

SS 11.06

The use of sodium picosulphate to prepare the patient for CT colonography

I. Lefere[1], M. Lefere[1], P. Lefere[2], S. Gryspeerdt[2], C. Silva[3], A. Rodrigues[3]; [1]Leuven/BE, [2]Hooglede/BE, [3]Funchal/PT

Purpose: The purpose of this study was to assess the efficacy of a CTC preparation based on sodium picosulphate.
Material and Methods: 510 patients undergoing CTC and optical colonoscopy were prepared with 2 days of a low residue diet, augmented the day before CTC with a clear liquid diet, fecal tagging and cleansing with sodium picosulphate and bisacodyl. Quality of preparation was assigned a score 1-3: score 1, failed preparation with non-tagged stool hampering interpretation; score 2, non-tagged or inhomogeneous stool making primary 3D read difficult, but not hampering 2D interpretation; score 3, clean colon with homogeneous tagging allowing primary 3D interpretation. Per-patient sensitivity, specificity, positive (ppv) and negative (npv) predictive values with 95% confidence intervals (95%CI) were calculated for lesions ≥ 6 mm.
Results: This preparation enabled primary 3D read in the majority of patients. On the same day, optical colonoscopy was performed in all patients without additional preparation. Score 1 was assigned to 9 patients (1.8%), score 2 to 40 patients (7.8%) and score 3 to 461 patients (90.4%). Non-tagged stool caused a false positive ≥6mm in 3 patients. For all lesions ≥ 6 mm, CTC obtained a per-patient sensitivity, specificity, ppv and npv of 95.6% (87-98.9% 95%CI), 93.9% (91.1-95.9% 95%CI), 71.7% (61.2-80.4% 95%CI), and 99.3% (97.7-99.8% 95%CI), respectively. CTC diagnosed all patients with advanced neoplasia ≥ 6mm. There were no major side effects.
Conclusion: This preparation based on fecal tagging and sodium picosulphate proved successful for polyp detection.

SS 11.07

Effect of training, experience and computer-aided detection (CAD) on CT colonography interpretation

G. Iussich[1], L. Correale[2], P. Falco[2], C. Senore[2], N. Segnan[2], D. Campanella[1], F. Iafrate[3], E. Neri[4], A. Laghi[5], D. Regge[1]; [1]Candiolo/IT, [2]Turin/IT, [3]Rome/IT, [4]Pisa/IT, [5]Latina/IT

Purpose: The purpose of this study was to assess performance of radiologists using a double reading with CAD as a first reader (DR CAD-FR) after a 2-day specific training program and to correlate readers performance with their level of experience in CT colonography (CTC).
Material and Methods: 12 radiologists entering the educational training had different levels of experience (>300 studies, very experienced; 100-300, moderately experienced; <100, inexperienced). During the course, 46 training cases were interpreted and discussed by experts. Day 3 was dedicated to a final test including 30 cases read using DR CAD-FR (only CAD-prompts evaluation followed by unassisted review for mass detection). Per-patient and per-polyp sensitivity and specificity were calculated. Receiver operating characteristic (ROC) curve was generated for each reader. Relationship between prior experience in CTC and correct case classification were assessed using logistic regression statistics.
Results: 14/30 cases were positive. There were a total of 24 polyps≥6-mm. CAD sensitivity was 88% (21/24); there was an average of 11 false positives per scan. Across all readers, per-patient sensitivity was 75% (95% CI: 68-81%). Reader specificity ranged from 75 to 100%. ROC curve values varied between 0.79 and 0.98. Average per-polyp sensitivity was 58% (range: 29-75%). Per-polyp sensitivity of very experienced readers was significantly greater than that of moderate experienced readers (P=0.04) and low experienced readers (P=0.03).
Conclusion: A 2-day structured training probably does not reduce performance gap between very experienced and less experienced readers. Additional training is, therefore, required.

SS 11.08

Computer-aided detection (CAD) for CT colonography: incremental benefit for inexperienced over experienced readers

D. Boone[1], S. Halligan[1], S. Mallett[2], O. Hrydziuszko[2], J. McQuillan[1], S.A. Taylor[1], D. Altman[2]; [1]London/UK, [2]Oxford/UK

Purpose: Computer-assisted detection (CAD) is known to be useful for both inexperienced and experienced readers of CT colonography (CTC). We aimed to quantify the incremental benefit for inexperienced over experienced readers.
Material and Methods: 16 experienced (mean 264 validated cases) and 10 inexperienced radiologists read 102 individual CTC cases (56 with polyps), with and without CAD assistance, with temporal separation between interpretations. Diagnostic accuracy was determined via comparison to a joint endoscopic/radiological reference standard. The primary outcome was a per-patient analysis of the change in polyp sensitivity + specificity with/without CAD (all polyp diameters; weighted 3:1 in favour of sensitivity), adjusted for prevalence. Meta-analysis was used to average across the two reader groups. 500 bootstraps were used to calculate 95% confidence intervals for this abstract; 1999 will be presented.
Results: The difference between inexperienced and experienced readers was 8.6 (95%CI 0.6, 16.9): % change in sensitivity with CAD was 14.3 (7.0, 20.8) for inexperienced, 4.7 (0.2, 9.4) for experienced. % change in specificity was -5.8 (-11.3, -0.7) for inexperienced, -2.8 (-5.7, 0.4) for experienced. The incremental benefit for inexperienced readers was greatest for 6mm+ polyps; 12.53 (5.07, 19.7) versus experienced readers.
Conclusion: Both inexperienced and experienced readers benefit significantly from CAD. Overall, the incremental benefit for inexperienced readers is approximately 4x that for experienced readers. This appears to be because inexperienced readers are relatively poorer at detecting polyps 6 mm or larger.

SS 11.09

Computer-aided detection (CAD) for CT colonoscopy: polyp size estimation and clinical patient categorization

G. Iussich[1], L. Correale[2], C. Senore[2], N. Segnan[2], D. Campanella[1], C. Laudi[1], G. Galatola[1], D. Regge[1]; [1]Candiolo/IT, [2]Turin/IT

Purpose: The purpose of this study was to compare polyp size measurement as determined by CAD-assisted CTC interpretation with endoscopic visualization.
Material and Methods: We performed a secondary analysis of a prospective trial comparing diagnostic performance of first and second reader CAD (CAD1 versus CAD2) where FOBT positive patients underwent both CTC and colonoscopy. Polyps size was measured on 2D images for CAD2 and CAD1, and at CC with open biopsy forceps. Agreement was evaluated using descriptive statistics and Bland-Altman methodology.
Results: Colonoscopy found 285 all size lesions in 125 patients (reference size: 2-100 mm). Of these, 145 were found by CAD2 and 129 by CAD1. There was no significant difference between colonoscopy and CTC size estimation both for CAD2 (mean difference: -0.23 mm, P=0.4) and CAD1 (mean difference: -0.6 mm, P=0.2). Intervals of agreement between colonoscopy and CTC were (-6.5; 6.5-mm) for CAD2 and (-5.4; 5.4-mm) for CAD1. When simulating a 3-risk classes (polyps > 9 mm, referral to colonoscopy; polyps 6-9 mm, CTC surveillance and polyps < 6 mm, not reported), 10-18% of patients with advanced adenomas at colonosopy were placed into the surveillance class. Preview and finish
Conclusion: For both CAD reading modes, CTC polyp size was not different from colonoscopy reference size. However, stratifying patients into 3-risk classes, 10-18% of patients with advanced adenoma could have polypectomy delayed at least 3 years.

SS 11.10

Computed-aided detection software in CT colonography: effect in training of novice readers

D. Bellini, D. Caruso, M. Rengo, F. Vecchietti, M. Maceroni, A. Laghi; Latina/IT

Purpose: The purpose of this study was to evaluate the influence of computer-aided detection (CAD) in the learning process of five inexperienced readers, using 3D fly-through as first approach.
Material and Methods: We retrospectively selected 50 patients, all positive for polypoid lesions, for a total of 150 polyps endoscopically confirmed, with a diameter between 6 mm and 40 mm (mean diameter 8.6 mm). Five doctors with any previous experience in CT colonography reading were enrolled.

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Each reader examined the same case, at first, without CAD, and after two months, to reduce the recall bias, assisted by the analysis software CAD. For each reader, either for the first or the second reading, five testing sessions over 2 weeks were set up, each one with 10 exams for a total of 30 polyps per session. For each polyp, readers expressed the degree of diagnostic confidence. After all, we performed per-polyp analysis including calculation of detection and false-positive rates.
Results: Polyps detection rate calculated from all reader and for all analysis, race from 69% (without CAD) to 81% (with CAD, P value< 0.05). Using McNemar test to compare single analysis session, with and without CAD, no statistically significant differences were found (P value >0.05).
Conclusion: CAD software increases polyp detection rate and, for novice readers, seems to reduce the number of false positives. However, the curves obtained from analysis with and without CAD show similar shape (CAD does not change the learning curve).

11:00 - 12:30 **Fintry**

Scientific Session 12
GI tract malignancy: treatment response

SS 12.01
The predictive value of ultrasound elastography to response in patients with rectal cancer treated with chemoradiation
S.R. Rafaelsen, C. Vagn-Hansen, T. Sørensen, J. Lindebjerg, J. Pløen, A. Jakobsen; Vejle/DK

Purpose: The current literature has described several predictive markers in rectal cancer patients treated with chemoradiation, but so far none have been validated for clinical use. The purpose of the present study was to compare quantitative elastography based on ultrasound measurements in the course of chemoradiation with tumour response based on the Mandard classification (TRG).
Material and Methods: From April 2010 to October 2011, we prospectively examined 24 patients with rectal cancer planned for high-dose radiochemotherapy. Surgery was performed after the end of treatment. A baseline ultrasound elastography scan was performed prior to chemoradiation and followed by re-scan two and six weeks after initiation of the treatment. The elastography shear wave velocity was compared to the TRG score.
Results: The baseline mean tumour elasticity was 3.12 m/s (95% CI: 2.9–3.4). Two and six weeks after start of chemoradiation, the velocities were 2.21 m/s (95% CI: 1.9-2.5) and 1.97 m/s (95% CI: 1.7-2.2), respectively, $p < 0.0001$. Patients with a tumour TRG 1 response had a tumour elasticity of 2.37 m/s (95% CI: 1.8–2.9) after six weeks. In patients with TRG > 1, the velocity was 1.76 m/s (95% CI: 1.3–2.2) after six weeks, $p < 0.05$.
Conclusion: Ultrasound elastography seems to hold predictive information as to response to chemoradiation. It also seems able to identify scar tissue after treatment.

SS 12.02
DW-MRI and D-CE-MR: evaluation of the response in rectal cancer before, during and after neoadjuvant treatment
R. Del Vescovo, R. Cazzato, F. Giurazza, R.F. Grasso, B. Beomonte Zobel; Rome/IT

Purpose: The purpose of this study was to evaluate the response of rectal adenocarcinoma to chemoradiation therapy (CRT) calculating changes of apparent diffusion coefficients (ADCs) before, during and after treatment and to correlate with the changes of dynamic contrast-enhanced MR (D-CE-MR) values.
Material and Methods: We enrolled 25 patients (pts) with primary rectal carcinoma who were undergoing preoperative CRT. DWI and D-CE-MR were performed with a 1.5-T system in all patients before, during and after preoperative CRT. All patients underwent histopathologic postoperative staging. ADC values were calculated through the specific formula, while tumor perfusion was calculated by a semiquantitative perfusion software (DYCHO), developed on Matlab. We evaluated the changes of ADCs and D-CE-MR dividing patients into two groups: not-downstaged group (not-responders, NR) and downstaged group (responders, R) at histologic postoperative staging.
Results: 6 patients were NR while 19 patients were R. Pretreatment ADC values were significantly low; we observed a progressive increasing of ADC values during treatment in R, while there was no significant ADCs increase in the NR ($p = 0.003$). The R showed 48% increase of local peak intensity (LPI) with respect to LPI before treatment; on opposite, the NR showed 18% decrease of LPI compared to LPI before treatment.
Conclusion: The increase of mean tumor ADCs correlates with good response to CRT; tumor response more likely occurs in pts who report higher LPI values on D-CE-MR analysis during treatment with respect to pre-treatment.

SS 12.03
Comparison of diffusion-weighted imaging MR and FDG-positron emission tomography for the prediction of pathologic response to neoadjuvant therapy in patients with locally advanced rectal cancer
D. Ippolito, P.A. Bonaffini, L. Monguzzi, C. Trattenero, C. Capraro, S. Sironi; Monza/IT

Purpose: The purpose of this study was to evaluate the correlation between the changes of SUVmax and of apparent diffusion coefficient (ADC) before and after neoadjuvant therapy, in order to predict therapy response in patients with locally advanced rectal cancer (LARC).
Material and Methods: Thirty patients with LARC who underwent CRT were recruited for our study. All patients underwent a whole body 18FDG-positron emission tomography (PET)/CT scan and a pelvic MR examination including diffusion-weighted imaging (DWI) for staging (PET/CT1RM1) and after the chemoradiation therapy (PET/CT2RM2). Histopathologic analysis of rectal specimen, according to Tumour Regression Grade (Mandard's criteria), was used as standard reference. MR and PET-CT images were analyzed and measurements of ADC values and SUVmax were performed. Diagnostic performance for selection of complete responders (TRG 1-2) and overall diagnostic accuracy for each item were calculated.
Results: After neoadjuvant therapy, all patients were submitted to surgery. According to Mandard's criteria, 21 tumors showed complete (TRG1) or subtotal regression (TRG2) and were classified as responders; 9 tumors were classified as non-responders (TRG 3, 4 and 5). In all patients, mean value of SUVmax in PET/CT1 was higher than those of PET/CT2 ($p<0.001$), whereas mean ADC value was lower in RM1 than RM2 ($p<0.001$) with a significant percentage decrease of values after the treatment ($p<0.005$). The best predictors' cut-off values for TRG response were: SUVmax of 4.4 and ADC of 1.28x10[3]mm[2]/s, with sensitivity, specificity, accuracy, negative predictive value, and positive predictive value of 77.3%, 88.9%, 80.7%, 61.5%, and 94.4%, respectively.
Conclusion: MR DWI and FDG-PET/CT have a complementary diagnostic role in follow up of patients with LARC who underwent chemoradiation therapy, by differentiating fibrosis from viable tumor tissue.

SS 12.04
Comparison between diffusion-weighted-based volumetry and apparent diffusion coefficient in the assessment of response in patients with rectal cancer treated with neo-adjuvant therapy
S.F. Carbone, M. Palumbo, V. Ricci, T. Carfagno, S. Lazzi, L. Pirtoli, L. Volterrani; Siena/IT

Purpose: The purpose of this study was to assess the diagnostic accuracy of volumetry based on diffusion-weighted imaging (VDWI) and apparent diffusion coefficient (ADC) in the evaluation of response in patients with rectal cancer treated with chemoradiotherapy (CRT).
Material and Methods: We retrospectively examined 25 patients (mean age 67.8 years) with rectal cancer, who have performed MRI before and after 45 ± 15 days of the CRT after undergoing anterior resection of the rectum. After surgery, ypTN and tumor regression grading (TRG) according to Mandard classification were obtained. We considered responders' patients with TRG 1-2 or with a negative follow-up recurrence in the next 6 months (only three cases). Two radiologists, in consensus and using commercial software, have extrapolated pre- and post-CRT VDWI of the lesions and calculated the ADC.
Results: ADC did not show significant differences between responders and non-responders ($p = 0.078$ pre-CRT, $p = 0.101$ post-CRT); the VDWI of responders was significantly lower in both pre-CRT ($p = 0.0065$) and in post-CRT ($p = 0.0058$) compared to non-responders of VDWI. The accuracy in the evaluation of response was of 68% and 92%, respectively, for the ADC and VDWI.
Conclusion: The VDWI is more reliable than to assess the response to CRT in patients with rectal cancer.

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SS 12.05

Withdrawn by the authors

SS 12.06

Could the magnetic transfer ratio play a role to evaluate post-radiation fibrosis in rectal cancer management?

M.H. Martens[1], D.M.J. Lambregts[1], N.K. Papanikolaou[2], R.G. Riedl[1], A. Zur Hausen[1], L.A. Heijnen[1], M. Maas[1], G.L. Beets[1], R.G.H. Beets-Tan[1]; [1]Maastricht/NL, [2]Heraklion/GR

Purpose: Magnetization transfer is a MR technique that utilizes differences in the magnetization interaction of free, 'unbound' water protons and macromolecular-bound protons. The effect of magnetization transfer is quantified by determining the magnetization transfer ratio (MTR). The hypothesis is that fibrosis shows a higher MTR than normal tissue and/or tumour. The aim of this study was to evaluate if MTR may be used to identify fibrosis and differentiate it from normal rectal wall/tumour in rectal cancer patients treated with chemoradiotherapy.

Material and Methods: 11 patients who were treated with chemoradiotherapy received a standard axial T2W-MRI. A single axial MTR slice was obtained at the former tumour location. In two additional patients, MRI including MTR was obtained from the surgical resection specimens. Whole-mount histological sections with Sirius-red staining were used as the reference to determine the areas of fibrosis.

Results: There was a good correlation between the areas of fibrosis as visualized on the T2 images and the areas of increased MTR on the MTR maps. The normal rectal wall had an average MTR of 16.9% (0-35.6), as compared to 31.9% (15.1-40.5) for the areas of fibrosis (p=0.001). The areas of fibrosis on the whole-mount sections with Sirius-red staining correlated well with the MTR maps of the two surgical specimens.

Conclusion: Our preliminary results show that MTR discriminates fibrosis from other tissue. This could be promising for the unsolved dilemma of interpreting post-radiation fibrosis in rectal cancer.

SS 12.07

Accurate identification of complete responders after CRT for rectal cancer with endoscopy and MRI

M. Maas[1], D.M. Lambregts[1], J.W. Leijtens[2], M. Sosef[3], K.W. Hulsewé[4], G.L. Beets[1], R.G. Beets-Tan[1]; [1]Maastricht/NL, [2]Roermond/NL, [3]Heerlen/NL, [4]Sittard/NL

Purpose: Chemoradiation (CRT) for rectal cancer leads to complete tumor response (CR) in 15-25%. Accurate identification of a CR is necessary to allow for less invasive treatment (e.g. local excision or wait&see). Standard imaging cannot accurately identify a CR. The aim was to evaluate the accuracy of endoscopy for identification of a CR and compare it to T2W- and diffusion-weighted MRI (DWI).

Material and Methods: 20 patients who underwent CRT and T2W-MRI+DWI and endoscopy 8 weeks after completion of CRT were included. One reader scored the T2W images followed by immediate evaluation of the DWI images with the T2W images at his disposal. A second reader scored the endoscopy images. Readers were blinded for histology and each others' results. Scoring was performed with a confidence level score (0=definitely residual tumour, 4=definitely CR).

Results: Of the 20 patients, 9 had residual tumour and 11 had CR. The AUCs for T2W-MRI, T2+DWI and endoscopy were 0.65, 0.65 and 0.91, respectively. Corresponding sensitivities and specificities were 36% and 78% for T2W, 46% and 89% for T2+DWI and 73% and 89% for endoscopy.

Conclusion: Endoscopy is more accurate in identifying a CR after CRT than MRI(+/-DWI), mainly because of a higher sensitivity, which corrects for understaging of a CR with MRI. MRI remains crucial to evaluate the presence of any extramural tumour/N+. A combination of endoscopy and MRI+DWI is therefore recommendable to identify patients with a CR post-CRT, making less invasive treatment after CRT feasible.

SS 12.08

Quantitative assessment of changes in the T2-weighted MR signal intensity in the tumor for detection of complete response after chemoradiation for rectal cancer

M. Maas, E. Kluza, E. Rozeboom, M.H. Martens, J. Slenter, D.M. Lambregts, G.L. Beets, R.G.H. Beets-Tan; Maastricht/NL

Purpose: The purpose of this study was to determine the diagnostic value of the change in signal intensity of the tumour on T2-weighted MR images after neoadjuvant chemoradiotherapy for identification of complete response (yT0N0) in rectal cancer patients.

Material and Methods: 40 patients with locally advanced rectal cancer who were treated with chemoradiation (CRT) and surgery were included. T2-weighted images were acquired at 1.5 T before and 8 weeks after CRT. The calculated signal intensities in tumor voxels were normalized to the mean signal intensity of the obturator internus muscle. The relative T2-weighted signal intensity (rT2wSI) distribution in the tumor was characterized by the descriptive parameters. Receiver operating characteristic curves were used to determine the diagnostic performance. The tumor regression grade (TRG) was used as a reference standard.

Results: CRT induced a significant decrease of circa 50% in all rT2wSI descriptives for complete responders (TRG1). This drop was significantly higher compared to incomplete response groups (TRG2–TRG4). The highest diagnostic performance for identification of complete responders was found for the Δ95[th] percentile, ΔSD and Δmean of the rT2wSI with accuracies of 92%, 90% and 82%, respectively.

Conclusion: Quantitative assessment of the CRT-induced changes in the tumor T2-weighted signal intensity can be of high diagnostic value for selection of complete responders after CRT for rectal cancer. With this additional information, a radiologist can select complete responders more accurately and this can facilitate less invasive treatment after CRT.

SS 12.09

Monitoring treatment response in oncology: does reshuffling of radiologist's tasks to radiologist assistants impact diagnostic performance?

A.M.H. Sailer, D. Douwes, V.C. Cappendijk, F.C. Bakers, J.E. Wildberger, A.G. Kessels, R.G.H. Beets-Tan; Maastricht/NL

Purpose: Decision making whether or not cancer (chemo)therapy needs to be continued is based on precise but time consuming RECIST-measurements on consecutive CTs. The aim of our study was to evaluate whether it is feasible to free radiologist's time by reshuffling the task to radiology assistants and whether it would reduce diagnostic performance.

Material and Methods: 177 measurements on baseline and 2 consecutive CTs in 20 patients were performed following RECIST1.1: (A) According to the standard practice where several radiologists read scans random of all patients; (B) According to the experimental setting where a technician with CT-unit experience of >10yrs reads all scans, based on the radiologist's 1[st] measurements, blinded to their results. Measurements of arm A was taken as reference standard and compared with B. Intraclass correlation coefficient was calculated as well as the coefficient of determination based on a linear regression model.

Results: RECIST-measurements performed according to the single-reading of radiology assistant (B) showed a high correlation with standard clinical practice reading (A): ICC 0,961, R^2 0,924; SD 4 mm for difference between A&B. Sensitivity and specificity for radiology assistant for assessing progressive disease was 100% and 94%, respectively.

Conclusion: RECIST-measurements by a single-reader radiology assistant is feasible and equal in performance to the radiologists' measurements in standard practice. This could impact the way radiologists may work, opening ways to reshuffle important but time consuming tasks and free radiologists' time.

SS 12.10

The change of 18FDG uptake in lymph nodes after neoadjuvant chemotherapy as a predictor of malignant involvement in patients with esophageal carcinoma: a PERCIST study

P. Fencl, T. Harustiak, M. Zemanova; Prague/CZ

Purpose: To determine whether metabolic activity, measured by PERCIST protocol before and after neoadjuvant chemotherapy, is able to predict the absence of malignant involvement in surgical specimens of lymph nodes.

Material and Methods: 51 patients (pts) with esophageal carcinoma or carcinoma of esophageal-gastric junction were prospectively investigated on High Definition PET/CT scanner by 18FDG-PET/CT at base line (BL) and after finishing three courses of therapy (ChT3). All pts underwent surgical treatment 113 days (median) after BL, i.e. 7.1 (median) weeks after ChT3. The findings in histological specimens of lymph nodes were correlated to 18FDG-PET/CT stage. For negative stage was taken all negative findings on BL and positive ones on BL, if neoadjuvant chemotherapy induced complete metabolic response (CMR) at ChT3.

Results: At ChT3, using maximal 18FDG uptake as response criterion, sensitivity (SE), specificity (SP), and accuracy (ACC) were 37.5%, 74.1%, and 56.9%, respectively. Using total lesion glycolysis as response criterion, SE, SP, and ACC were 37.5%, 81.5%, and 60.8%, respectively. On both tests, there were 15 false negative findings (FN) at ChT3, but 11 out of 15 FN investigations were FN even at BL, representing 73.3% of all FN.

DOI: 10.1007/s13244-012-0171-2

Conclusion: Despite using High Definition PET/CT scanner in all standardized investigations, 18FDG-PET/CT was not able to exclude malignant involvement of lymph nodes due to low sensitivity of the test even at BL and inability to prove residual malignancy when metabolic activity decreased to the CMR level on ChT3.

11:00 - 12:30 **Sidlaw**

Scientific Session 13

Focal Liver Lesions: Imaging assessment

SS 13.01

The spectrum of imaging and aetiological factors in focal nodular hyperplasia presenting in the paediatric population

A. Deganello, R. Inchingolo, M. Samyn, M. Sellars, P.A. Kane, J. Karani; London/UK

Purpose: Focal nodular hyperplasia (FNH) is a rare benign liver tumour in children. Previous studies have described an increased incidence of FNH in patients treated for cancer or in the presence of congenital or acquired vascular disorders. The aim of this study is to set a light on the risk factors and radiological features of FNH in a large paediatric population.

Material and Methods: Single-centre retrospective clinical, radiological and histopathological review of children diagnosed with FNH between January 1990 and April 2011.

Results: A total of 25 children (52% females) with FNH were identified. Median age at presentation was 9 years. 36% had no associations and 12% had a previously treated extra-hepatic malignancy. A congenital portosystemic shunt was detected in 40%. One child had a surgical portocaval shunt created following acute Budd Chiari Syndrome. The lesion was unifocal in 60% and multifocal in 40%; a central scar was identified in 36% of the cases. All patients treated for cancer had multiple lesions; solitary lesions were found in all except one of the patients with sporadic FNH and in 54% of the patients with portosystemic shunts.

Conclusion: Portosystemic shunts and treated malignancy are recognised risk factors for the development of FNH in children, the underlying link being a congenital or acquired alteration of the portal venous flow. Recognising the features of FNH and its predisposing factors leads to appropriate diagnosis and treatment.

SS 13.02

Added value of Gd-EOB-DTPA-enhanced hepatobiliary phase MRI of solid focal hepatic lesions: a ROC analysis

M. Haimerl[1], I. Platzek[2], C. Nießen[1], A.G. Schreyer[1], E.M. Jung[1], C. Stroszczynski[1], P. Wiggermann[1]; [1]Regensburg/DE, [2]Dresden/DE

Purpose: The purpose of this study was to determine the added value of hepatobiliary phase images in the Gd-EOB-DTPA-enhanced MRI in the differentiation of solid focal hepatic lesions.

Material and Methods: 84 patients underwent Gd-EOB-DTPA-enhanced MR examinations. 64 patients had malignant focal hepatic lesions proven by histology (HCC: n= 34, metastases: n=30), 20 patients had benign liver lesions (FNH: n=14, hemangioma: n=3, adenoma: n=3). Five radiologists independently reviewed three sets of MR images using a score from 1 (benign) to 5 (malignant): set 1, unenhanced T1- and T2-weighted; set 2, unenhanced T1- and T2-weighted + gadoxetic acid-enhanced dynamic images; set 3, set 2 + hepatobiliary phase images.

Results: Diagnostic accuracy, compared using the area under the alternative free-response receiver operating characteristic curve (A~Z~), was significantly improved by the addition of gadoxetic acid-enhanced dynamic images: A~Z~ in set 1 was 0.708, A~Z~ in set 2 was 0.833. With the addition of the hepatobiliary phase, A~Z~ value was 0.941 in set 3.

Conclusion: Hepatobiliary phase images obtained after Gd-EOB-DTPA-enhanced dynamic MRI may improve the differentiation of focal hepatic lesions.

SS 13.03

Apparent diffusion coefficient (ADC) in discriminating between solid benign and malignant focal liver lesions (FLLs) with diffusion-weighted imaging (DWI): comparison of ADC thresholding versus normalized ADC thresholding and lesion-to-liver ADC ratio

S. Pullini, R. Girometti, L. Cereser, G. Como, C. Zuiani, M. Bazzocchi; Udine/IT

Purpose: The purpose of this study was to compare the diagnostic performance of three different methods of ADC estimation in differentiating solid benign and malignant FLLs.

Material and Methods: We included forty-five patients with 75 FLLs detected on a 1.5 T system, and proven to be malignant and benign in 55 and 20 cases, respectively (cysts/haemangiomas excluded). During separate reading sessions, two readers in consensus evaluated DWI images and the ADC map. FLLs were assessed as benign or malignant: (a) according to the threshold established by a receiver operating characteristic (ROC) analysis, without (ADC-T) and with (ADC-TS) normalization for the spleen, respectively; (b) by calculating the lesion-to-liver ADC ratio (ADC-R; cut-off <1). End-points for the three methods were the positive- and negative-predictive value (PPV, NPV) for malignancy and the area under the curve (AUC) values.

Results: ADC threshold for malignancy was 1.06 x10^{-3} mm^2/sec for ADC-T and 1.27 x10-3 mm^2/sec for ADC-TS. ADC-T, ADC-TS and ADC-R showed high PPV (89.2%, 84.6% and 78.1%, respectively), but low NPV (42.1%, 38.9% and 30.2%, respectively). AUCs of ADC-T (0.70) and ADC-TS (0.65) were higher as compared to that of ADC-R (0.55), showing a significant difference between ADC-T and ADC-R ($p<0.01$). Main source of false-negative cases was hepatocarcinoma (22-30/55).

Conclusion: Normalizing FLLs ADC for the spleen or providing the ADC-R did not improve the diagnostic performance of ADC-T, which is limited by a low NPV.

SS 13.04

Predictive value of liver MRI parameters in patients with liver metastases of neuroendocrine tumors

W. Sommer, P.M. Paprottka, F. Ceelen, M.F. Reiser, D. Theisen; Munich/DE

Purpose: The aim of this study was to define pretherapeutic MRI predictors for treatment response of radioembolization in patients with hepatic metastases from neuroendocrine tumors.

Material and Methods: In 45 patients with proven hepatic metastases of neuroendocrine tumors (NET), MRI examinations were performed at baseline in all patients, consisting of standard T1w and T2w sequences as well as post-contrast sequences. The following imaging predictors were defined: patient age and gender, proliferation marker Ki-67, tumor load in the liver (%), vascularisation of metastases, tumor necrosis, hemorrhage and fluid-fluid levels. As primary endpoint, we defined the progression-free survival (PFS) using RECIST criteria in MRI follow-up examinations. The effect of the predictors on the PFS has been analyzed using Kaplan-Meier statistics.

Results: The mean PFS was 699 days (95% CI 326-964). Hypovascular metastases showed significant earlier progress (255 vs. 727 days; $p<0.01$). A proliferation marker <2% (G1) was significantly associated with a longer PFS than a proliferation marker between 2 and 20% (G2) or >20% (G3) ($p<0.001$). Patient age, gender, tumor load in the liver, tumor necrosis, hemorrhage as well as radioreceptor status of pre-SIRT did not show any impact on PFS ($p>0.05$).

Conclusion: Selective internal radiation therapy in neuroendocrine tumors turns out to be most efficient in hypervascular tumors with low proliferation index. Tumor-liver-ratio as well as radioreceptor status do not have influence on the progression-free survival in contrast to other therapeutic options in NETs.

SS 13.05

High sensitivity of diffusion-weighted MRI for the detection of liver metastases from neuroendocrine tumors compared with T2-weighted and dynamic gadolinium-enhanced MRI, using surgical and histological findings as a standard of reference

G. D'Assignies[1], P. Fina[2], O. Bruno[1], M. Ronot[1], M.P. Vullierme[1], V. Paradis[1], A. Sauvanet[1], V. Vilgrain[1]; [1]Clichy/FR, [2]Rome/IT

Purpose: The purpose of this study was to assess and compare the sensitivity of diffusion-weighted (DW) MR imaging for the detection and characterization of liver metastases from neuroendocrine tumors (NET) to T2-weighted fast spin-echo (T2WFSE) and dynamic gadolinium-enhanced MRI, using surgical and histopathological findings as the standard of reference.

DOI: 10.1007/s13244-012-0171-2

Material and Methods: Forty-one patients with 162 liver metastases from NET underwent MR imaging including DW, T2WFSE, and dynamic gadolinium-enhanced MR imaging. Images were retrospectively reviewed by two independent abdominal radiologists for the detection and characterization of liver metastases. MR findings were compared to histopathological and intraoperative ultrasound findings on a lesion-by-lesion basis to determine the sensitivity of each MR sequence, alone and combined.
Results: There was excellent agreement for lesion characterization between observers 1 and 2 for the per-lesion analysis. DW-MR was more sensitive (Se=71.6%; 95% CI: 64.2-78.0 and Se=71.0%; 95% CI: 63.6-77.4 for observers 1 and 2, respectively) than T2-weighted fast spin-echo, and dynamic gadolinium-enhanced MR (Se=55.6%; 95% CI: 47.9-63.0, and Se=47.5%; 95% CI: 34.0-55.2 for observer 1 and Se=55.6%; 95% CI: 47.9-63.0 and Se=48.1%; 95% CI: 40.6-55.8 for observer 2). The sensitivity of the three types of sequences combined was 80.3% (95% CI: 73.2-85.8) for both observers.
Conclusion: DW-MR imaging was more sensitive for detecting and characterizing liver metastases from NET than T2WFSE and dynamic gadolinium-enhanced MR imaging. We, therefore, recommend performing this sequence in patients for preoperative disease staging.

SS 13.06

Enteric and pancreatic neuroendocrine liver metastasis: comparison of vascular behavior on triple-phase MDCT

G. D'Assignies, F. Cuccioli, M.P. Vullierme, M. Ronot, O. Bruno, V. Vilgrain; Clichy/FR

Purpose: The purpose of this study was to describe vascular behavior of liver metastases (LM) from enteropancreatic neuroendocrine tumor (EPNET) and to look for differences between enteric (ENLM) and pancreatic (PNLM) neuroendocrine liver metastases and to identify the best phase for their detection.
Material and Methods: 78 patients with pathologically proven EPNETs and untreated liver metastases were retrospectively analyzed. 559 LM were seen on triple-phase (non-contrast, arterial and portal) MDCT and characterised as hypo, iso or hyper-attenuating on each phase. Best phase for lesion depiction was evaluated per patient.
Results: 45 patients (58%) had LM from pancreatic origin and 33 (42%) from enteric origin. On non-contrast-enhanced phase, PNLM were hypoattenuating in 189 (72%), whereas 105 (34%) ENLM were hypoattenuating ($p < 0.05$). 385 LM (69%) were hypervascular on arterial phase, including 201 ENLM (68.7%) and 184 PNLM (70%, ns). The classical pattern (hypervascularity on arterial phase and hypoattenuation on portal venous phase) was present in 50 patients (64%) including 31 patients (40%) with other vascular behaviors. Best phase for tumor depiction was portal venous phase for ENLM (19 patients, 58%) and arterial phase for PNLM (36 patients, 80%).
Conclusion: Neuroendocrine LM were hypervascular on arterial phase in only 2/3 of cases. Nearly half of patients with hypervascular LM also had other CT patterns. Both portal venous and arterial phases are important for LM depiction.

SS 13.07

Comparison of three methods of apparent diffusion coefficient evaluation in assessing solid focal liver lesions with diffusion-weighted imaging (DWI)

R. Girometti, S. Pullini, L. Cereser, M. Del Pin, G. Como, M. Bazzocchi, C. Zuiani; Udine/IT

Purpose: The purpose of this study was to compare the performance in diagnosing focal liver lesions (FLLs) malignancy of the apparent diffusion coefficient thresholding (ADC-T) method versus two variants of the lesion-to-liver ADC ratio (ADC-R).
Material and Methods: Examinations were performed on a 1.5 T system. Analysis was applied to 50 FLLs proven to be malignant and benign in 34 and 16 cases, respectively. Cysts and haemangiomas were excluded from the analysis. We estimated the positive-predictive value (PPV) and negative-predictive value (NPV) for malignancy of ADC-T and two variants of the ADC-R, calculated without (ADC-R1) and with (ADC-R2) the inclusion of the parenchymal ADC standard deviation value, respectively. An ADC-R < 1 was considered as malignant. A receiver operating characteristic (ROC) analysis was performed to establish ADC-T threshold for malignancy and to compare the areas under the curve (AUC).
Results: The ADC-T threshold for malignancy was $\leq 1.09 \times 10^{-3}$ mm²/sec. PPV and NPV were 87.5% (95%C.I.: 74.4-94.7) and 50.0% (95%C.I.: 35.7-64.3) for ADC-T versus 75.0% (95%C.I.: 60.4-85.7) and 36.7% (95%C.I.: 23.9-51.5) for ADC-R1 versus 90.9% (95%C.I.: 78.5-96.8) and 38.5% (95%C.I.: 25.4-53.3) for ADC-R2, respectively. Most false-negative FLLs were represented by hepatocellular carcinoma. ADC-T showed an AUC (0.71) significantly higher ($p<0.05$) than ADC-R1 (0.56), but not than ADC-R2 (0.61).
Conclusion: Regardless of the ADC evaluation method, NPV was low, while the PPV was high, especially by comparing lesion and parenchymal ADCs with ADC-R2. However, the use of an ADC threshold provided higher diagnostic performance in terms of AUC.

SS 13.08

Accuracy of visual assessment versus apparent diffusion coefficient quantification in differentiating malignant and solid benign focal liver lesions with diffusion-weighted imaging

R. Girometti, M. Del Pin, S. Pullini, L. Cereser, G. Como, M. Bazzocchi, C. Zuiani; Udine/IT

Purpose: The purpose of this study was to compare the accuracy of diffusion-weighted imaging (DWI) visual analysis (VA) versus the apparent diffusion coefficient quantification (ADC-Q) in assessing malignancy of solid focal liver lesions (FLLs).
Material and Methods: Two radiologists in consensus retrospectively assessed as benign or malignant 50 FLLs (16 benign, 24 malignant) on 32 patients examined on a 1.5 T. Two different methods were used in separate reading sessions: (a) VA of signal intensity on DWI images at b=800 sec/mm2 and ADC-map; (b) lesion ADC measurement on the ADC-map. Reference standard included histology and follow-up confirmation of a consensus panel diagnosis. We estimated the accuracy for malignancy of both methods and the ADC-Q threshold as assessed by a receiver operating characteristic (ROC) analysis.
Results: Because of 20 false-negative hepatocarcinoma, VA showed lower accuracy than ADC-Q (52.0% vs. 68.0%). However, stratified accuracy for metastases was higher than VA (75.0 vs. 66.7%). ADCs and signal features of malignant and benign FLLs largely overlapped.
Conclusion: VA performed worse than ADC-Q for hepatocarcinoma, and better for metastases, possibly in relation with the T2-shine-through phenomenon. Overall, the accuracy of both methods was limited because of the overlap in visual appearance and ADC values between solid benign and malignant FLLs.

SS 13.09

Hypervascular liver lesion at dual-energy CT: enhancement evaluation at different tube voltages

P. Cabassa, A. Colleoni, A. Scrimieri, R. Maroldi; Brescia/IT

Purpose: The purpose of this study was to compare attenuation values of hypervascular liver lesion with 80 kvp-images, 140 kvp-images and with weighted-average (WA) simulated 120 kvp-images, using dual energy CT (DECT).
Material and Methods: 58 patients (47 male) underwent (in a 6 months period) prospectively abdominal DECT for suspected or known hypervascular lesions. An arterial phase with DE technique (80Kvp, 140Kvp and WA) and a venous acquisition (120 kvp) were performed. Arterial images were obtained after a standard triggered threshold. The attenuation values were calculated using ROIs placed in arterial DE images on 6 different areas: lesion, aorta, psoas muscle, subcutaneous fat, healthy right and left liver. The LLR (lesion-to-liver ratio) and the CNR (contrast-to-noise ratio) were calculated independently by two radiologists: CNR by (ROI lesion - ROI healthy liver)/(SD subcutaneous fat) and LLR by mean value of the lesion/mean value of healthy liver. Student-t test was used for statistical analysis.
Results: Twenty lesions were detected. The mean attenuation values of the lesions were 157.19±55.26 HU for 80kv-images, 86.51±19.21 HU for 140Kv-images, 109.51±26.69 HU in WA images. LLR was 2.48 in 80Kv-images, 1.55 in 140Kv-images ($p<0.005$) and 1.89 in WA images ($p=0.003$). The mean CNR was 3.40 in 80Kv-images, 1.27 in 140Kv-images ($p<0.005$) and 2.51 in WA images ($p=0.21$).
Conclusion: 80 kvp images demonstrated a higher LLR than acquired images at 140kvp and at WA-120KvP. The 80KVp images could be used in clinical practice to better evaluate hypervascular liver lesions.

SS 13.10

Phase contrast computed tomography of focal liver lesions using a conventional X-ray source

A.A. Fingerle[1], M. Willner[2], J. Herzen[2], P.B. Noël[1], D. Hahn[2], E. Drecoll[1], D. Münzel[1], E.J. Rummeny[1], F. Pfeiffer[2]; [1]Munich/DE, [2]Garching/DE

Purpose: The purpose of this study was to evaluate grating-based phase contrast computed tomography (PCCT) for the detection and characterization of ex vivo focal liver lesions in comparison to standard absorption-based computed tomography and histopathology.

DOI: 10.1007/s13244-012-0171-2

Material and Methods: Formalin-fixed liver specimens with benign and malignant focal liver lesions were scanned with an experimental grating-based PCCT setup using a conventional X-ray tube (ENRAF Nonius rotating anode X-ray tube, single photon counting detector Pilatus II, Dectris). Tube voltage was 35 pkV, tube current 70 mAs. Phase contrast and conventional absorption CT data were obtained. The reconstructed images were correlated with hematoxylin and eosin staining of the specimens and compared for imaging features like contrast, lesion delineation and depiction of internal structures.
Results: Grating-based PCCT images of ex vivo focal liver lesions show a marked improvement of soft-tissue contrast compared to standard absorption CT. In PCCT images, lesion delineation is significantly improved and internal structures are visible.
Conclusion: When introduced to the clinic, grating-based phase contrast computed tomography has the potential to be a valuable tool for the characterization of structural information of focal liver lesions.

11:00 - 12:30 **Tinto**

Scientific Session 14
Biliary imaging

SS 14.01
Ultra-high-field imaging of the biliary tract at 7 Tesla: initial results of Gd-EOB-DTPA-enhanced MRCP
A. Fischer, O. Kraff, S. Orzada, M.E. Ladd, L. Umutlu, T.C. Lauenstein; Essen/DE

Purpose: The aim of this study was to assess the feasibility and diagnostic potential of imaging of the biliary tract using biliary secreted Gadoxetic acid at 7 Tesla in comparison to T2-weighted MRCP at 3 Tesla.
Material and Methods: 10 healthy volunteers were examined on a 7T whole-body MR system using a custom-built 8-channel body coil. The following sequences were included: T1w 3D FLASH VIBE, 3D FLASH with inversion recovery, and T2w TSE in coronal orientation. For dynamic imaging, Gadoxetic acid was administrated with a clinical standard dosage. Acquisition of a dynamic series started after 20, 70, and 120 seconds with additional acquisitions performed at 5, 10, 15, 20, 25 and 30 minutes after injection. All volunteers underwent a non-enhanced T2-weighted MRCP on a 3T MR system.
Results: Dynamic contrast-based MRCP at 7T showed a homogeneous depiction of the intra- and extrahepatic biliary tract. While T1w 3D VIBE imaging provided a moderate delineation of the biliary tract, it also yielded near isointense liver tissue and vasculature. In contrast, 3D FLASH imaging with inversion recovery enabled a high-quality assessment of the biliary duct due to a strong saturation of hepatic tissue and vessels. T2w TSE showed only poor to moderate image quality.
Conclusion: Our results demonstrate the feasibility of contrast-enhanced imaging of the biliary tract at 7 Tesla. In particular, 3D FLASH MRI with inversion recovery enabled high-quality assessment of the biliary tract.

SS 14.02
Ischemic-type biliary lesions after orthotopic liver transplantation: evaluation with MR cholangiography and diffusion-weighted MR imaging at 3T
P. Boraschi, F. Donati, R. Gigoni, F. Filipponi, F. Falaschi, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to determine the usefulness of MR cholangiography (MRC) and diffusion-weighted MR imaging (DW-MRI) at 3T for evaluating ischemic-type biliary lesions (ITBLs) in liver transplant recipients.
Material and Methods: Twenty-two liver transplant patients with ischemic changes of the biliary tree at ERCP/PTC underwent MRI at 3T device (GE-DISCOVERY MR750;GE-Healthcare). After acquisition of T1w/T2w images, MRC was performed through thin-slab 3D-FRFSE and thick-slab SSFSE T2w sequences. DW-MRI of the liver was performed using an axial respiratory-triggered spin-echo echo-planar sequence with multiple b-values (150, 500, 1000, 1500 s/mm^2) in all diffusion directions. Two blinded observers reviewed all images in consensus and recorded the presence of biliary and liver abnormalities. ADC values of liver parenchyma in ITBL group and normal control group (n=10) were, respectively, calculated using a dedicated software fitting the curve obtained from the corresponding ADC for each b-value.
Results: Abnormal findings of bile ducts were observed in all patients; the most common findings were intrahepatic bile duct dilatation (22/22), strictures involving hepatic bifurcation (20/22), extrahepatic biliary wall thickening (20/22) and sludge/stone formation (17/22). DW-MRI areas of persistent high signal intensity in the liver parenchyma were observed in 14/22 ITBL patients. Fitted ADC values of liver parenchyma in ITBL group were significantly lower than those in normal control group (p-less-than-0.05).
Conclusion: In liver recipients with ITBLs, MRC and DW-MRI at 3T reveal characteristic features that may allow differentiation from other complications after liver transplantation.

SS 14.03
Contrast-enhanced MR perfusion of solid pancreatic lesions: utility of time-signal intensity curves
F. Donati, P. Boraschi, R. Gigoni, G. Gherarducci, F. Pacciardi, F. Falaschi, C. Bartolozzi; Pisa/IT

Purpose: The purpose of this study was to evaluate the usefulness of time-signal intensity curve (TSIC) using dynamic contrast-enhanced MR perfusion of solid focal pancreatic lesions.
Material and Methods: Twenty patients without pancreatic disease and forty-five with pathologically confirmed pancreatic lesions (ductal adenocarcinoma, n=23; endocrine tumor, n=6 with 9 lesions; focal chronic pancreatitis, n=13; autoimmune pancreatitis, n=3) underwent MRI at 1.5T device. Dynamic contrast-enhanced MR perfusion consisted of a 3D axial free-breathing LAVA sequence (TR/TE, 2.28 ms/1.05 ms; 10.0 mm thk/-0.0 mmsp; matrix, 128x128; 0.75 NEX; 1 second) repeated up to 5 minutes. A dose of 7 mL gadobenate-dimeglumine (Gd-BOPTA; MultiHance) with 20 mL saline flush was injected at 4 mL/sec. MR perfusion images were processed by two radiologists 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); 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 23 ductal adenocarcinomas and in 1 endocrine tumor; TSIC-type 3 was recognized in 13 patients with focal chronic pancreatitis and in 16 post-obstructive chronic pancreatitis; TSIC-type 4 was identified in all cases of autoimmune pancreatitis, and TSIC-type 5 in the 8 lesions of 5 patients with endocrine neoplasms.
Conclusion: Dynamic contrast-enhanced MR perfusion using TSIC could improve the diagnosis of solid focal pancreatic lesions.

SS 14.04
Improved detection of cholesterol gallstones using dual energy CT: results in an anthropomorphic phantom model
R.W. Bauer, S. Hohertz, J. Schulz, M.C. Larson, T. Vogl; Frankfurt am Main/DE

Purpose: Cholesterol gallstones elude detection on regular 120 kV CT scans. The potential of dual energy CT (DECT) post-processing for the correct classification of gallstones in an anthropomorphic phantom model was assessed.
Material and Methods: 34 gallstones with known chemical composition (11 pure cholesterol, 12 non-cholesterol, 11 cholesterol core and non-cholesterol shell) were put into a standard plastic specimen container functioning as artificial gallbladder and then into a water-filled cylindrical acrylic glass phantom with a diameter of 32 cm that contained porcine organs and spine to simulate noise levels of a human abdomen. DECT scans were performed with a first-generation Dual Source scanner (Definition, Siemens). DECT prototype post-processing software was used to selectively highlight cholesterol information by color overlay. 80 kV, 140 kV grayscale images and color-coded images were analyzed for the presence and characteristics of gallstones.
Results: Pure cholesterol stones were not visible at 140 kV, 6/11 were not detected at 80 kV, but all were detected on post-processed color-coded DE images. Non-cholesterol stones appeared hyperdense on grayscale images and were visible on both the 140 kV and 80 kV series. The appearance of core/shell stones was best defined at 80 kV; however, the conspicuity of cholesterol parts was more pronounced on color-coded images.
Conclusion: DECT post-processing allowed for reliable identification of cholesterol gallstones in this anthropomorphic phantom simulating a human abdomen. This may be beneficial in patients with abdominal pain and no primary finding on regular abdominal CT.

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SS 14.05

Dual energy CT in patients with acute RUQ pain: is it possible for virtual non-enhanced images to replace true non-enhanced images?

Y.H. Lee, S.N. Moon, D.M. Kang, S.H. Wee, S.W. Im; Iksan/KR

Purpose: The purpose of this study was to determine whether virtual non-enhanced (VNE) images derived from dual energy computed tomography (DECT) replace true non-enhanced (TNE) images in patients with acute RUQ pain.

Material and Methods: Among the 93 patients who had acute RUQ pain underwent MDCT including non-enhanced scan and dual phases enhanced scans. Total 58 patients with surgically and ultrasonographically proven gallstones or bile duct stones were selected. Portal phase enhanced CT images were obtained using DE technique. For quantitative analysis, CT numbers were measured on the stone, liver and GB. Contrast to noise ratio (CNR) of stone to liver and stone to bile was tested with a Student's t-test. Effective radiation doses were calculated. For qualitative analysis, two blinded readers independently compared the image qualities and artifact for VNE and TNE images.

Results: TNE images showed significantly higher mean CT numbers ($p<0.05$) than VNE images. CNR of stone to bile was significantly higher in VNE images than TNE images ($p<0.05$). Stone size was not significantly different between the TNE and VNE images ($p<0.05$). By skipping the TNE images, we could reduce the radiation dose about 30%. The image quality and artifacts of VNE were not significantly different from that of TNE ($P<0.05$) images. Interobserver agreement of showed good ($k=0.687$).

Conclusion: DECT provides high-quality VNE images, which can be used as reasonable alternative to TNE images, in patient with gallstones or radioopaque bile duct stones.

SS 14.06

Early biliary decompression prior to preoperative staging of hilar and extrahepatic cholangiocarcinomas: What happens?

E.S. Lee, J.Y. Lee, S.H. Kim, J.M. Lee, J.K. Han, B.I. Choi; Seoul/KR

Purpose: The purpose of this study was to compare the accuracy of preoperative CT before and after biliary decompression in the evaluation of local tumor extent and resectability of hilar and extrahepatic cholangiocarcinomas using surgery and histological results as the reference standard.

Material and Methods: Thirty-six patients who had undergone surgery due to hilar or extrahepatic cholangiocarcinomas from June 2006 to December 2009 were included in this study. All of them underwent triple-phase before and after endoscopic or percutaneous biliary decompression prior to the surgery. Three experienced radiologists independently and blindly evaluated the pre-decompression and post-decompression CT images separately in terms of Bismuth type of tumor, the presence of involvement of second order branch of intrahepatic ducts, the presence of intrapancreatic CBD involvement, lymph node metastasis, and tumor resectability. Diagnostic accuracy was calculated and compared between pre- and post-decompression CT scans. For statistical analysis, the McNemar test was used.

Results: Mean diagnostic accuracies were significantly lowered after biliary decompression for Bismuth type ($P=0.01$), second-order branch involvement of IHD ($P=0.007$), and intrapancreatic CBD involvement ($P=0.001$). However, mean accuracies were not significantly changed after biliary decompression for lymph node metastasis ($P > 0.05$) and resectability ($P > 0.05$).

Conclusion: Early biliary decompression prior to preoperative staging CT influenced on the evaluation of local tumor extent of hilar or extrahepatic cholangiocarcinomas. However, it did not influence on the determination of resectability.

SS 14.07

The utility of secretin-enhanced MRCP in diagnosing pancreatic sphincter of Oddi dysfunction

K. Sandrasegaran, M. Tann, F. Akisik; Indianapolis, IN/US

Purpose: The purpose of this study was to assess the usefulness of secretin-enhanced MRCP in diagnosing sphincter of Oddi dysfunction (SOD), defined as basal sphincteric pressure of > 40 mmHg. Theoretically, the presence of SOD should result in persistently distended main pancreatic duct and reduced rate of entry of exocrine fluid into the duodenum, following intravenous secretin stimulation.

Material and Methods: Retrospective review found 70 patients with SMRCP and ERCP manometric measurements, without intervening sphincteric therapy. MRCP was performed using 1.5 T MRI (Magnetom Harmony or Avanto, Siemens, Erlangen, Germany) using previously published protocol (Sandrasegaran et al. AJR 2010;195:42). All patients had 300 mL of oral ferumoxsil (GastroMark, Mallinckrodt Inc, St Louis) prior to MRCP, ensuring a dark duodenal luminal signal at baseline. Studies were anonymized and independently reviewed by two reviewers for the dynamic changes in pancreatic duct (PD) caliber and semiquantitative measurement of duodenal fluid content (DFC) during SMRCP (Cappeliez et al. Radiology 2000;312:358).

Results: There was no difference in incidence of chronic pancreatitis or divisum between the SOD (n=43) and non-SOD (n=27) groups. MRCPS parameters of maximum PD caliber, time to maximum PD caliber, maximum DFC, and time to maximal DFC did not correlate with the presence of SOD or severity of elevation of manometric pressure (all $p>0.05$).

Conclusion: Previous reports had suggested a correlation between MRCPS parameters and SOD. We did not find such a correlation.

SS 14.08

Radiological features of malignancy combined with inflammation in pancreatobiliary system

K. Jee, S.A. Lee, M. Park; Cheonan/KR

Purpose: The purpose of this system was to evaluate the radiological features and clinical findings of chronic inflammation combined with malignancy in pancreatobiliary systems.

Material and Methods: For 10 years, pathologically and clinically confirmed chronic inflammation combined with malignancy in pancreatic (n = 6) and biliary (n = 20) systems were evaluated about radiological and clinical findings. Mean age was 63.8 and male to female ratio was 21 to 5. Radiological examinations of CT (n = 26), ERCP (n = 19), MRCP (n = 19) and EUS (n = 6) were done. Clinical records were evaluated.

Results: Biliary cases were RPC with cholangioca (n = 12) and biliary intraepithelial neoplasm (n = 5), IPMT with stones (n = 2), cholangioca with clonorchis infestation (n = 1). 70% of RPC were in left lobe. Radiological tumor detectability was 55% with six bile ductal wall thickening and five mass-forming patterns. CA 19-9 was elevated in 52.9 %. Pancreatic cases were carcinoma (n = 5) and pancreatic intraepithelial neoplasm (n = 1) with chronic pancreatitis. P-duct dilatation showed all, parenchymal atrophy in five and calcification/stones in three. Tumor detectability was 83%. Lymph node enlargement in 68% but all were pathologically negative. CA 19-9 was elevated in 80%.

Conclusion: Pancreatobiliary ductal malignancy could have combined chronic inflammation and reveals multistep process of malignant change. Serial imaging and tumor marker follow-up can be helpful for early diagnosis of pancreatobiliary malignancy in underlying chronic inflammation.

SS 14.09

The role of diffusion-weighted imaging and ADC values in the evaluation of hilar strictures

M. Alkhouri[1], J. James[2], L. Brits[3], A. Sanderson[1], A. Milson[1], J.V. Macpherson[1]; [1]Devon/UK, [2]Plymouth/UK, [3]Milton Keynes/UK

Purpose: The purpose of this study was to assess the role of diffusion-weighted imaging (DWI) in the evaluation of hilar strictures and to correlate the apparent diffusion coefficient (ADC) values of the obstructing lesion with the final diagnosis.

Material and Methods: Patients who had an MRCP with DWI showing a hilar structure were included. The area of bile duct obstruction was assessed for high signal on b=800 DWI. If identified, the ADC value for that area was derived from the ADC map in $x10^{-3}mm^2/s$ by two observers. Statistical analysis was performed. The final diagnosis was reached by tissue diagnosis, follow-up imaging of appropriate clinical course. Correlation was made between the final diagnosis and the ADC value.

Results: 19 patients with hilar stricture were identified from 2009 to 2011 with follow up of 4-26 months: 16 with malignancy and 3 with benign disease. There were 8 cholangiocarcinomas, 3 gallbladder carcinomas, 5 liver metastases, 2 benign anastomotic strictures and 1 Mirizzi's. 10 patients had a tissue diagnosis. Two observers derived the ADC value and it ranged from 0.774 to 1.256 in the cholangiocarcinoma, 0.736-1.290 for gallbladder carcinoma and 0.470-1.281 for metastases. The one case of small cell carcinoma had the lowest ADC values at 0.470 and 0.481. No high signal causing obstruction on b=800 DWI compared to adjacent normal structures was seen in the benign cases.

Conclusion: DWI is useful in the evaluation of hilar strictures, by differentiating benign from malignant strictures.

SS 14.10

Attenuation value of gall bladder fluid on multidetector computed tomography in acute unspecified pancreatitis: comparison with normal control group

C.S. Choi, S.H. Bae, E.J. Yun, D.Y. Yoon, Y.L. Seo, K.J. Lim, S. Baik, A. Han; Seoul/KR

Purpose: The purpose of this study was to retrospectively compare the computed tomography (CT) attenuation value (HU) of gall bladder (GB) fluid in patients with acute unspecified pancreatitis with those of normal control group.

Material and Methods: From January 2009 to April 2011, 59 consecutive patients with acute unspecified pancreatitis and 59 normal control subjects

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were enrolled in this study. The control group was consisted of normal healthy population. Disease patients were 43 males and 16 females with average age of 44.8 years. Normal control subjects were 33 males and 26 females with average age of 49.8 years. The CT scanner was 16 channel multidetector Mx8000 (Phillips, Haifa, Israel) with automated modulation of mAs with fixed 120 kVp. We measured HU in the central portion of GB with region of interest (ROI) of 2cm[2] in portal phase on DICOM images. Student t-test and Chi-square test were employed as statistical methods. p-value less than 0.05 was considered as statistically significant.
Results: HU of GB fluid in disease patients was 23.74 ±10.44 and that in control group was 17.66 ± 8.19 (p= 0.001). HU over 30 was observed in 15 in acute pancreatitis compared with 3 in control group. No difference between two groups in age and sex distribution was observed.
Conclusion: GB fluid attenuation of disease patients was higher than those of control group. Probably, calcium bilirubinate crystal juice might be one of causes of acute unspecified pancreatitis.

11:00 - 12:30 **Moorfoot**

Scientific Session 15
Liver 2

SS 15.01
Does diffusion-weighted imaging contribute to differentiation of benign and malignant portal vein thrombus?
K. Sandrasegaran, B. Tahir, F. Akisik, M. Tann; Indianapolis, IN/US

Purpose: The purpose of this study was to determine whether diffusion-weighted imaging (DWI) adds to the differentiation of benign from malignant portal vein thrombus (PVT) in cirrhotic patients.
Material and Methods: Retrospective review of MRI examinations was performed for reports containing phrase “portal vein thrombus”. PVT was considered tumor thrombus (n=15) if it progressed in distribution in <3 months in the presence of HCC, or there was tumor thrombus on portal vein cytology. Bland thrombus was diagnosed if PVT remained stable for >12 months follow up (n=19). Images were analyzed by two radiologists, blinded to follow up, for signal intensity on DWI of PVT compared to liver (hypo, iso or hyperintense) and ADC measurements of PVT, HCC and unaffected liver.
Results: MRI parameters that were significant on logistic regression analysis were distance of thrombus from HCC (p<0.01), arterial enhancement of PVT (p<0.01), venous enhancement of PVT (p=0.04), and size of HCC (p<0.01). Signal characteristics of PVT on DWI, ADC measurements of PVT, ADC ratios of PVT to liver were not significant. The presence of at least two of three MRI findings, (a) distance from tumor to PVT of < 5 cm, (b) HCC size of > 10 cm, and (c) arterial enhancement of PVT, had a sensitivity of 100% (95% CI 78-100%) and specificity of 90% (95% CI 55-98%) for malignant PVT.
Conclusion: DWI does not add to the differentiation of malignant and benign PVT.

SS 15.02
1.5 Tesla versus 3 Tesla versus 7 Tesla abdominal MRI: the more Tesla, the better?
L. Umutlu, S. Maderwald, A. Fischer, M. Forsting, M.E. Ladd, O. Kraff, T.C. Lauenstein; Essen/DE

Purpose: The aim of this study was to investigate and to compare the diagnostic ability of 1.5, 3 and 7 Tesla in vivo abdominal MRI.
Material and Methods: 12 volunteers were examined on a 1.5 T, 3 T and 7 T MR system with equivalent FOV and acquisition times including: (1) T1w fs 2D and (2) 3D FLASH, (3) T1w fs VIBE, (4) T1w 2D i.-and-op. phase, (5) True-FISP and (6) T2w TSE. Qualitative image analysis was performed regarding (1) overall image quality, (2) delineation of abdominal vasculature, (3) delineation of the biliary duct system and (4) image impairment. For correlation of signal intensities, regions-of-interest were assessed in parenchymatous organs.
Results: Overall image quality was rated comparably high for T1w imaging in all three field strengths, with 7T T1w MRI showing its superiority in the assessment of non-enhanced abdominal vasculature due to a hyperintense vessel-signal (mean1.5T 1.2, mean3T 1.2, mean7T 3.6). T2w TSE showed a statistical significant strong impairment in 7 T MRI (mean1.5T 3.4, mean3T 3.5, mean7T 1.5). Quantitative image analysis revealed an increase in the mean organ signal from 1.5 T to 3 T of 1.45 on average (p=0.04) with a mild further increase from 3 T to 7 T (1.19).
Conclusion: Our results demonstrate the benefits and the limitations of an increase of magnetic field strength from 1.5 T to 3 T to 7 T, offering improved and highly detailed delineation of anatomical and vascular structures in T1w imaging.

SS 15.03
Role of diffusion-weighted MR imaging in detection of hepatic abscesses and their differentiation from non-infected fluid collections in the liver
C. Schmid-Tannwald[1], R. Neumann[1], C. Schmid-Tannwald[1], A. Oto[2], M.F. Reiser[1], K. Nikolaou[1], C. Rist[1]; [1]Munich/DE, [2]Chicago, IL/US

Purpose: The purpose of this study was to evaluate the role of diffusion-weighted MRI (DW-MRI) in differentiation between hepatic abscesses versus biloma.
Material and Methods: In this retrospective study, 22 abscesses and 27 bilioma in 27 patients who underwent abdominal MRI including DW-MRI were included. Two independent observers reviewed T2-weighted (T2w) images alone, T2w images with DW-MR images and T2w images together with contrast enhanced T1-weighted (CET1w) images at three different sessions to detect liver abscesses and biloma based on a confidence scale. Sensitivity, confidence level and mean ADC values of abscesses and biloma were calculated and compared.
Results: Detection of abscesses improved significantly by combining T2w images with DW-MRI [both observer: 21/22 (95.5%), p<0.01] or with T1CE images [observer 1: 21/22 (95.5%), observer 2: 22/22 (100%), p<0.01] in comparison to T2w images alone [observer 1: 11/22 (50%) and observer 2: 12/22 (54.4%)]. 20/27 (74.0%) and 18/27 (66.6%) biloma were dected on T2w images by observer 1 and 2, respectively. Observer 1 and observer 2 detected more biloma on their review of T2w+DW-MRI [observer 1: 23/27 (85.2%), p=0.006, observer 2: 24/27 (88.9%), p=0.008]. The detection rate significantly improved by combining T2w images with CET1w images [both observer: 26/27 (96.3%), p<0.001]. Mean ADC of abscesses was significantly lower (0.83±0.24x10[-3]mm²/s) compared to mean ADC of biloma (2.25±0.6x10[-3]mm²/s, p<0.001).
Conclusion: DW-MRI is a valuable adjunct to T2w images to detect and differentiate hepatic abscesses from non-infected fluid collections in the liver. Furthermore, ADC measurements may help to distinguish liver abscesses from biloma.

SS 15.04
Diffusion-weighted imaging of the liver: value of apparent diffusion coefficient and influence of region of interest
J.P. Filipe, L. Curvo-Semedo, C. Marques, F. Caseiro-Alves; Coimbra/PT

Purpose: The purpose of this study was to investigate the usefulness of diffusion-weighted imaging (DWI) in the differential diagnosis of hepatic disease, by measuring apparent diffusion coefficient (ADC) of hepatic parenchyma and focal liver lesions (FLL), and the influence of region of interest (ROI) characteristics in the results.
Material and Methods: Ninety-three patients were retrospectively evaluated and 90 lesions were analyzed: 14 hepatocellular carcinomas (HCC), 18 metastases, 10 focal nodular hyperplasias (FNH), 4 adenomas, 30 hemangiomas and 14 cysts. ADC was measured in liver parenchyma with ROIs in four segments and in FLL, using three circular centimetric ROIs and one ROI encompassing the full lesion area (b-values of 50 and 700 s/mm[2]). Reference standard was the histopathological data or, alternatively, a consensus between imaging methods, follow-up and clinical history. ADCs were statistically compared, with P<0.05 being significant.
Results: Mean ADCs (×10[–3]mm[2]/s) were 1.45, 1.28, 1.25 (normal, cirrhotic, steatotic parenchyma) and 1.16, 1.18, 1.30, 1.64, 1.89, 2.77 (metastases, HCCs, adenomas, FNHs, hemangiomas, cysts). ADCs of malignant lesions were significantly lower than all benign lesions but with overlap between malignant and solid benign lesions. The AUC for malignancy determination was 0.94 (89.7% sensitivity, 90.6% specificity), for a cut-off ADC of 1.43. No significant differences were found between ROI sampling methods in homogeneous lesions.
Conclusion: ADC measurements are useful in differentiating normal from pathological liver parenchyma and in the characterization of FHLs. The ROI size does not influence ADC measurements in homogeneous lesions.

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SS 15.05

Is a liver size measurement as accurate as automated volumetry for predicting hepatomegaly? Preliminary results on liver transplant patients

S. Nougaret[1], H. Addley[2], S. Al Sharif[3], S. Fujii[4], B.P. Gallix[1], C. Reinhold[3]; [1]Montpellier/FR, [2]Cambridge/UK, [3]Montreal, QC/CA, [4]Tottori/JP

Purpose: The aim of our study was to compare several liver length measurements and liver automated volumetry on CT to liver weight in order to find an easy and accurate method to assess hepatomegaly on CT. Indeed, automated volumetry needs trained users and dedicated software. In clinical practice, it may be desirable to have a simple method for rapid estimation of hepatomegaly.

Material and Methods: We compared, in forty liver pretransplant patients, automated CT volumetry to liver weight on pathology to describe the correlation between weight and automated volumetry. For each patient, we measured on CT craniocaudal, maximal transverse, midclavicular, oblique craniocaudal at the level of the hepatic veins and maximal oblique craniocaudal lengths and compared these results liver weight on pathology.

Results: There was a statistically excellent positive correlation (r[2]= 0.95[0.90-0.98], p<.0001) between liver volume and liver weight. The regression line was y = 0.94x+40, where x and y indicate the measured weight and volume, respectively. 14 patient presented hepatomegaly on pathology predicted on every cases on automated volumetry. Using liver size measurements, the maximal oblique craniocaudal length was best correlated to liver weight (r2=0.80[0.72-0.85], p<.0001). According to ROC curve, a maximal oblique craniocaudal length of over 175 mm was associated with hepatomegaly (sensitivity 90%, specificity 87%, AUC= 0.91[0.85-0.95], p=0.0001).

Conclusion: Automated volumetry is a reliable method to predict liver weight. However, in clinical practice, maximal oblique craniocaudal could be used to easily predict hepatomegaly.

SS 15.06

Gadoxetate-enhanced MRI after liver resection for hepatocyte damage quantification

S. Bickelhaupt[1], C. Kim-Fuchs[2], D. Candinas[2], P. Studer[2], J.M. Froehlich[1], M.A. Patak[1]; [1]Zurich/CH, [2]Bern/CH

Purpose: Intraoperative handling procedures during liver resection may inevitably result in damaged liver tissue slightly larger than the usual resection surface. Its assessment and quantification might be crucial in patients with preoperatively calculated borderline liver volumes. The aim was to determine the feasibility of evaluating hepatocyte damage using hepatocyte-specific contrast (Primovist®, Gd-EOB, Schering, Berlin, Germany) as an MRI marker for viable hepatocytes after liver resection.

Material and Methods: 15 patients were prospectively included in this study prior to elective liver resection. Gadoxetate-enhanced MRI (3T, Verio, Siemens, Erlangen Germany) was performed 3-7 days after surgery. T1-w GRE (Vibe) series were acquired after contrast administration. SNR of the resection border was compared to healthy liver rim and the area of non-viable tissue was compared with a standardized intraoperative area measurement. The paired Student's t-test was used statistically.

Results: 2 patients dropped out, 12 of the remaining 13 patients showed sufficient image quality for measurement. Mean MRI resection surface was 75.65cm[2] (±28.65, depending on resection modality). Mean contrast enhancement was significantly reduced (p<0.05) in the tissue next to the resection surface (mean SNR: 67.95 ±29.05) compared to healthy liver rim (mean SNR: 81.79 ±35.96).

Conclusion: After liver resection, contrast enhancement at the resection border was significantly reduced suggesting an intraoperative affection of remaining liver tissue. Gadoxetate as a surrogate marker of tissue viability thus seems a promising approach.

SS 15.07

Liver diffusion-weighted imaging (DWI) on 3-T MRI: Gd-EOB-DTPA effects on low b value images

C.N. De Cecco[1], M. Rengo[1], M. Maceroni[2], P. Lucchesi[1], G. Muscogiuri[1], A. Laghi[2]; [1]Rome/IT, [2]Latina/IT

Purpose: The purpose of this study was to evaluate Gd-EOB-DTPA effects on low b value diffusion-weighted imaging (DWI) of the liver.

Material and Methods: Twenty consecutive patients were studied with a 3 T MRI (Discovery MR750, General Electrics). A multi-b DWI sequence (b-values: 0, 10, 20, 30, 50, 70, 100 s/mm^2) was acquired with respiratory trigger before and after the administration of Gd-EOB-DTPA (0.025 mmol/kg) using the following parameters: ET 65.1 ms, RT 667 ms, NSA 2, thickness 5.0 mm, gap 1 mm. Two blinded radiologist evaluated liver image quality. Signal intensity (SI) of the right and left liver lobe were measured for unenhanced and enhanced images using a a 1-cm^2 manual ROI. A Student's t-test was used to demonstrate significant difference.

Results: No significant difference in mean image quality was observed (p>0.05). Liver SI on enhanced images was significantly lower (p<0.05) than on unenhanced images.

Conclusion: Gd-EOB-DTPA affects DWI at low b values resulting in a SI reduction. The SI modification could influence the perfusion fraction quantification applying intravoxel incoherent motion (IVIM)-based biexponential analysis.

SS 15.08

Low-tube-voltage, intermediate-tube-current multidetector liver CT with sinogram affirmed iterative reconstruction (SAFIRE) algorithm for detection of hypervascular hepatocellular carcinoma

M.H. Yu, J.M. Lee, J. Yoon, J.H. Baek, J.K. Han, B.I. Choi; Seoul/KR

Purpose: The purpose of this study was to assess the image quality, lesion conspicuity and radiation dose of sinogram affirmed iterative reconstruction (SAFIRE) compared with filtered back projection (FBP) for low-tube-voltage (80-kVp), intermediate-tube-current (300-mA) liver CT for detection of hypervascular hepatocelluar carcinoma (HCC).

Material and Methods: 126 patients suspected of having HCCs who underwent multiphasic liver CT using dual-energy scanning (300 mAs for each 80-kVp tube) were included. The late arterial scans of one tube (half-dose) were reconstructed with FBP, iterative reconstruction in image space (IRIS) and 5 difference SAFIRE percentage sets (S1-S5), respectively, and then compared with corresponding full-dose virtual scans (mixed ratio of 0.5: 600mA) with FBP. Quantitatively, image noise; contrast-to-noise ratio (CNR) relative to muscle for the liver, aorta, portal vein; CNR of lesion- to-liver were assessed. Qualitatively, two abdominal radiologists scored image noise, vessel sharpness, lesion conspicuity and overall image quality in consensus. The results of image assessment were compared among FBP, IRIS and SAFIRE.

Results: The image noise on SAFIRE was significantly lower and CNRs on SAFIRE were significantly higher than on FBP (p<0.001). CNR of lesion-to-liver on SAFIRE (S5) was significantly higher than on both IRIS and full-dose FBP (p<0.05). For all qualitative analysis, half-dose SAFIRE acquired higher score than FBP and similar score to full-dose FBP. Mean CTDI~vol~ for half-dose late arterial scans was 2.63 mGy.

Conclusion: Half-dose 80-kVp liver CT protocol with SAFIRE may increase image quality and maintain diagnostic accuracy at reduced radiation dose, compared with full-dose protocol with FBP.

SS 15.09

Radiation dose in multiphasic CT of the liver using filtered back projection and iterative reconstruction: how low can we go while preserving diagnostic accuracy?

S.T. Schindera, D. Odedra, H. Mehrez, P. Rogalla; Toronto, ON/CA

Purpose: The purpose of this study was to compare image quality and diagnostic accuracy at different radiation dose levels with filtered back projection (FBP) and iterative reconstruction (IR) for multiphasic CT of the liver.

Material and Methods: Two liver phantoms with simulated HCC during the arterial and portal-venous phase were designed. Both phantoms contained 12 tumors with four diameters (5, 10, 15 and 20 mm) and three tumor-to-liver contrast values (±10, ±20 and ±40HU). A fat ring was added to the phantoms to mimic a medium size patient (total diameter, 30 cm). The phantoms were scanned using standard abdominal imaging protocol [120 kVp; standard deviation (SD) value 15]. Low dose protocols were acquired at 70, 60, 50, 40, 30 and 20% of the standard protocol. CT data sets were reconstructed with FBP and IR (AIDR 3D, Toshiba). Image noise was measured and contrast-to-noise ratio (CNR) of the tumors was calculated. Tumor detection was performed by two readers.

Results: IR reduces image noise by 45-66% and increases CNR by 82-204% compared to FBP depending on the dose level and enhancement phase. Sensitivity for tumor detection of the standard protocol was maintained while lowering the dose to 70% with FBP and to 40% with iterative reconstruction in both simulated phases.

Conclusion: The radiation dose of arterial and portal-venous hepatic CT can be reduced up to 30% with FBP and up to 60% with IR technique while preserving diagnostic accuracy.

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SS 15.10

Comprehensive evaluation of liver changes in primary sclerosing hepatitis using MRI

J. Kovac, B. Banko, G. Lilic, M. Kratovac Dunjic, R. Milenkovic, R. Jesic, R. Maksimovic; Belgrade/RS

Purpose: The purpose of this study was to evaluate magnetic resonance imaging (MRI) findings in the patients with primary sclerosing cholangitis (PSC) and to determine the value of diffusion-weighted imaging in the assessment of liver fibrosis.

Material and Methods: The following MRI findings were reviewed in 32 patients: periportal hyperintensity (T2-weighted hyperintensity around portal venous branches), lymphadenopathy, splenomegaly, ascites, morphological liver changes and magnetic resonance cholangiopancreatography (MRCP) findings. Apparent diffusion coefficient (ADC) was calculated for six locations in the liver for b=800 s/mm[2].

Results: Periportal hyperintensity was observed in 10 patients (31.2%). Lymphadenopathy was noted in 31% and signs of portal hypertension in 55.5% of patients. The most common morphological liver change was left lobe hypertrophy (30.8%), while spherical liver shape was observed in 2 patients. 78.6% of patients had bile duct irregularities, with left and right hepatic stenoses occurring most frequently (67.8%). The mean ADCs (x10[-3]mm[2]/s) were significantly different at stages ≤II versus ≥III. There was significant negative correlation between ADCs and histological stage (ρ=- 0.749, p<0.001). Areas under receiver operating characteristic curves were 0.899 (stage≥II) and 0.936 (stage≥III).

Conclusion: MRI should be used as a part of standard diagnostic protocol in the evaluation of disease progression in PSC patients.

11:00 - 12:30 **Carrick Suite**

Scientific Session 16

Ultrasound

SS 16.01

Intraoperative high-resolution linear contrast-enhanced ultrasound (IOUS) for the detection of microvascularization of malignant liver lesions before surgery or radiofrequeny ablation

E. Jung, A. Agha, J. Rennert; Regensburg/DE

Purpose: The aim of this study was to evaluate the value of linear contrast-enhanced intraoperative ultrasound (CE-IOUS) to improve detection of malignant liver lesions before surgery or radiofrequency ablation (RFA).

Material and Methods: 50 patients were included for surgery of malignant liver tumors [mean age 61 years (19-80); male n=35, female n=15], suffering from HCC (n=15), colorectal liver metastasis (n=28), CCC (n=2) or other malign liver lesions (n=5). Preoperative CE-CT (n=38), CE-MRI (n=23) or PET-CT (n=8) confirmed hepatic tumor manifestation. Before undergoing surgery, intraoperative conventional (IOUS) as well as CE-IOUS was performed by one experienced examiner in all cases using multifrequency linear probes (6-9 MHz, 6-15 MHz). CE-IOUS was performed after bolus injection of 5 ml up to 15 ml SonoVue® (Bracco, Italy). Digitally stored images of CE-IOUS were compared with fundamental B-Scan and preoperative imaging (CE-CT, CE-MRI and PET-CET).

Results: In 28 of 50 patients (56%), additional lesions were found using CE-IOUS (mean tumor size 8 mm, range 4-12 mm). This required a change of surgical strategy or an intraoperative RFA in 27 patients (54%). Modification of therapy due to additionally found liver lesions was statistically significant.

Conclusion: This is the first study using contrast-enhanced ultrasound with high resolution linear probes for intraoperative detection of malignant liver lesions. Compared to preoperative imaging and also conventional IOUS, more than 40% additional lesions were found leading to therapeutic consequences of patients.

SS 16.02

Volume navigation with contrast-enhanced ultrasound and image fusion for percutaneous interventions: first results

L.M. Dendl, E. Jung, C. Stroszczynski, A.G. Schreyer; Regensburg/DE

Purpose: The purpose of this study was to assess the feasibility and efficiency of biopsies and interventions using ultrasound (US) volume navigation (V Nav) with real-time needle tracking and real-time image fusion with contrast-enhanced (ce) CT, MRI or US.

Material and Methods: 23 patients underwent ultrasound-navigated biopsies or interventions using V Nav image fusion of live fundamental ultrasound with ceCT, ceMRI or CEUS, which were acquired before the intervention. A CEUS data set was acquired in all patients. An image fusion was established for CEUS and CT or CEUS and MRI using anatomical landmarks in the area of the targeted lesion. The definition of a virtual biopsy line with navigational axes targeting the lesion was achieved by the usage of sterile trocar with a magnetic sensor embedded in its distal tip employing a dedicated navigation software for real-time needle tracking.

Results: In all 10 biopsies of suspect lesions of the liver, a histological confirmation was achieved with a puncture from extrahepatic subcostal. We also used V Nav, a biopsy of the abdominal wall (metastasis) and for radiofrequency ablations (4 ablations). In 8 cases of inflammatory abdominal lesions, 9 percutaneous drainages were successfully inserted.

Conclusion: Percutaneous biopsies and drainages, even of small lesions involving complex access ways, can be accomplished with high success rate using 3D real-time image fusion together with real-time needle tracking.

SS 16.03

The diagnostic value of small bowel wall vascularity after sulfur hexafluoride-filled microbubble injection in the differentiation of inflammatory and fibrotic stenoses in patients with Crohn's disease

E. Quaia, B. Cabibbo, T. Stocca, E. Pantano, M.A. Cova; Trieste/IT

Purpose: The purpose of this study was to assess the value of small bowel wall vascularity on contrast-enhanced US to differentiate inflammatory from fibrotic stenoses in patients with Crohn's disease (CD).

Material and Methods: Twenty-two patients (10 male and 12 female; mean age ± SD, 45.12 ± 13.25 years; range 23-63) with a biopsy-proven diagnosis of CD involving at least one ileal loop (wall thickness >5mm) were included. In each patient, the thickest ileal loop segment was scanned by contrast-enhanced US after sulfur hexafluoride-filled microbubble injection, and digital cine-clips (60 secs) were stored. Echo signal was quantified in grey-scale levels (0-255) by a manually drawn ROI encompassing the bowel wall. The percentage of enhancement compared to baseline, time to peak enhancement, and area under curve were quantified.

Results: All patients revealed diffuse transparietal contrast enhancement, except for 5 patients with fibrotic stenosis who revealed contrast enhancement limited to the submucosa (n=3) or absent enhancement (n=2). Inflammatory versus fibrotic stenoses did not differ in the percentage of enhancement (46.43 ± 5.67 36.81 ± 17.38 vs 43.25 ± 4.99%; P>.05) and in the time to peak enhancement (9.28 ± 4.42 vs 14.5 ± 7.33 secs; P>.05), while differed in the area under the enhancement curve (1148.51 ± 474.15 vs 680.69 ± 274.36; P<.05).

Conclusion: Bowel wall vascularity quantitation on contrast-enhanced US may differentiate inflammatory from fibrotic stenoses in patients with CD based on the area under the enhancement curve.

SS 16.04

Contrast-enhanced ultrasound for differential diagnosis of suspected GvHD in patients after allogeneic transplantation

L.M. Dendl, G. Schill, C. Stroszczynski, E. Jung, A.G. Schreyer; Regensburg/DE

Purpose: GvHD is a serious complication in patients after allogeneic transplantation presenting with unspecific symptoms. Early differential diagnosis of GvHD (vs. viral or bacterial enteritis) is highly important. Recently, we detected penetration of microbubbles through the bowel wall as a diagnostic indicator for GvHD. In this study, we evaluate contrast-enhanced ultrasound (CEUS) as a new differential diagnostic tool in GvHD.

Material and Methods: We examined 23 patients with abdominal symptoms after allo-SCT. All patients underwent CEUS with particular attention to penetration of the intravenously applied microbubbles in the bowel lumen. The resulting examinations were documented digitally.

Results: Out of 17 patients with confirmed GvHD of the GI tract, 14 showed penetration of the intravenously applied microbubbles into the bowel lumen, leading to a sensitivity and specificity of 82% and 100% for transmural bubble penetration for GvHD of the GI-Tract, since the patients without GvHD of the GI tract showed no transmural bubble penetration. In patients with viral or bacterial infections of the GI tract, no transmural penetration of the microbubbles into the bowel lumen was observed.

Conclusion: Using CEUS showing microbubble penetration as a criterion for GvHD of the GI-Tract, a negative predictive value of 67%, and a positive predicative value of 100% was calculated. Therefore, we consider CEUS as an excellent differential diagnostic tool in patients with the suspicion of GvHD.

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SS 16.05

Wash out of hypervascular malignant lesions on CEUS: quantification using a semiquantitative index

L. Sottocornola, P. Cabassa, M. Ravanelli, A. Giardini, R. Maroldi; Brescia/IT

Purpose: The purpose of this study was to quantify the wash out of malignant liver lesions at CEUS, using a semiquantitative index.

Material and Methods: From the institutional database of focal liver lesions studied with CEUS 103 hypervascular lesions were retrospectively analysed. Inclusion criteria were: histologically proven malignant lesions; at least 12 months of follow up for benign lesions (with adequate imaging); no previous (<3 months) treatments with chemotherapy or TACE/RF. CEUS was performed with 2.4 ml of SonoVue with dedicated software (contrast coherent imaging). One significant frame (in bitmap format) of portal phase was chosen for each lesion and analysed by software (AdobePhotoshop 7.0). Two circular defined regions of interest (ROI) for each image were drawn encompassing the lesion and the adjacent normal parenchyma. Sonography videotape intensity (VI) was measured in gray-scale levels (0-255) through histogram analysis for each ROI. Background VI was set at the same level for each image. A semiquantitative index (VItumor–VIliver/VIliver) was calculated. Results were compared with the final diagnosis and statistically analysed.

Results: Final diagnosis was: 54 HCCs, 10 cholangiocarcinomas, 19 metastasis and 20 benign lesions (mainly FNH). A statistically significant different index was found between benign and malignant lesions ($p<0.005$). Among malignant lesions, the index was significant different between HCCs and CCCs/metastasis ($p<0.005$) but not between CCCs and metastases.

Conclusion: CCCs and metastasis shows a different quantifiable wash out than HCCs. This could help in the discrimination among focal liver lesions in different scenarios.

SS 16.06

Should sonographers or radiologists perform ultrasound scans of the gallbladder?

H.Y. Leung, Z. Toumi, K.G. Pursnani; Lanchashire/UK

Purpose: The purpose of this study was to evaluate the reliability of ultrasound scan (USS) performed by sonographers and radiologist in detecting gallstones.

Material and Methods: Patients were identified by retrieving all cholecystectomies operation notes of a single surgeon (May 2005-November 2011). The accuracy, sensitivity and specificity of USS performed by sonographers and radiologists in identifying gallstones were evaluated by comparing with histology and operative report.

Results: Among 515 patients identified (393 female, 76%), 444 were included (91 have insufficient data available). Median age was 51 (range 16-90). Sonographers performed 339 USS (76%). The overall sensitivity, specificity and accuracy were 97.2% (95% confidence interval, CI, 95.6-99.8%), 25.0% (95% CI 12.8–37.3%) and 89.4%, respectively. Positive and negative predictive values were 91.4% and 52.2%, respectively. Positive and negative likelihood ratios were 1.30 and 0.11, respectively. The prevalence of gallstone in our study population was 89.2%. Radiologists and sonographers have no significantly different ($p>0.05$) sensitivity (97.0% vs. 97.3%), specificity (40.2% vs.18.2%) and accuracy (89.7% vs. 89.3%). Radiologists had significantly higher specificity than sonographers among female patients (50.0% vs. 11.8%, $p<0.01$), while sensitivity and accuracy were similar and not significantly different. No significant difference was observed in male patients. The sensitivity and positive predictive value of detecting gallbladder polyp were 66.7% and 40%, respectively (n=6).

Conclusion: Sensitivity and accuracy in this study were comparable, but specificity was lower than previous reports. Recommendation: Radiologist repeats USS if female patient has negative result reported by sonographer.

SS 16.07

Ultrasound in clinically equivocal appendicitis: the real world experience

N.D. Grunshaw[1], P.L.S. Cheong[2]; [1]Barrow in Furness/UK, [2]Darlington/UK

Purpose: Whilst imaging can reduce the negative appendicectomy rate, a variety of strategies exist. Much of the available data relates to CT and comes from specialist centres. In our institution, clinical review remains the primary assessment, imaging reserved for clinically equivocal cases. The purpose of this study is to review the value of ultrasound in reducing negative appendicectomy in clinically equivocal cases in a District General Hospital setting.

Material and Methods: Review of 8 years ultrasound in clinically equivocal appendicitis was performed. CT was used as secondary test. Final outcome was determined by case note review and operative histology. All examinations were performed by one operator, appendicitis was diagnosed on the basis of appendiceal thickening (>6mm) and periappendiceal inflammatory change. Review was performed of histology of non-imaged appendicectomies during the same period.

Results: 265 cases were identified. Ultrasound sensitivity was 83%, specificity 92%, PPV 75%, NPV 95%, LR+ 10.3, LR- 0.19. The normal appendix was visualised in 25% of negatives. In 16%, ultrasound suggested significant alternative diagnoses. This strategy together with clinical re-evaluation resulted in only 7 (3%) normal appendices being removed compared with 19% in the non-imaged group. Overall CT usage was 14%.

Conclusion: Primary ultrasound can significantly reduce the negative appendicectomy rate and necessity for CT scanning in clinically equivalent appendicitis. The reduction in false negative appendicetomy rate is such that wider use of a primary ultrasound imaging strategy should be considered.

SS 16.08

Pretherapeutic histological evaluation of gastric submucosal tumour by endoscopic ultrasound-guided fine needle aspiration

K. Akahoshi, M. Oya, Y. Motomura, M. Kubokawa, S. Itaba, J. Gibo, K. Komori, N. Nakama, M. Yamada, Y. Minoda, K. Tokumaru; Iizuka/JP

Purpose: Diagnosis of gastric submucosal tumour (SMT) using EUS imaging alone is very difficult. EUS-guided fine needle aspiration (EUS-FNA) is a promising technique to obtain tissue samples with minimal risks. The aim of this study was to evaluate the efficacy and accuracy of EUS-FNA in the diagnosis of gastric SMT.

Material and Methods: From September 2002 to November 2011, 165 consecutive EUS-FNAs of gastric hypoechoic solid SMT diagnosed by standard EUS were evaluated prospectively. The reference standards for the final diagnosis were surgery (n=98), or clinical follow-up (n=67). Additionally, immunophenotyping of specimens obtained by EUS-FNA and surgical resection specimens were compared.

Results: In 5 cases, puncture was not performed because of anatomical problems. The diagnostic rate of the gastric hypoechoic solid SMT was 86% (137/160). The diagnostic rate according to the tumour size and location was 75% (59/79) in less than 2 cm, 97% (66/68) in 2-5 cm, and 92% (12/13) in 5 cm or more, 79% (23/29) in the lower portion, 86% (77/90) in the middle portion, and 90% (37/41) in the upper portion. In 92 surgically resected cases, the diagnostic accuracy of EUS-FNA using immunohistochemical analysis of gastric hypoechoic solid SMT was 96% (88/92). No major complications were encountered.

Conclusion: EUS-FNA with immunohistochemical analysis is an effective and accurate method in the pretherapeutic diagnosis of gastric SMT, irrespective of tumor size and location.

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SS 16.09

Diagnostic performance of contrast-enhanced ultrasound and MDCT in the characterization of focal liver lesions: comparison between readers with different levels of experience

R. Basilico, E. Rodolfino, V. Calamita, A.R. Ferri, A.R. Cotroneo; Chieti/IT

Purpose: The purpose of this study was to assess the diagnostic performance of contrast-enhanced ultrasound (CEUS) and MDCT in the diagnosis of focal liver lesions by comparing readers with different levels of experience.

Material and Methods: 130 focal liver lesions, studied by means of CEUS and MDCT, were randomly reviewed by two readers with 10 and 3 years of experience in both CEUS and MDCT studies. They scored the lesions as benign, malignant or uncertain and gave the most likely etiologic diagnosis on each imaging modality, being unaware of the clinical history of the patients. Final diagnosis was based on pathology, confirmatory imaging and on at least 6-month imaging follow up.

Results: Final diagnoses were 40 benign lesions (20 hemangiomas, 9 FNHs, 4 focal steatosis areas, 4 focal fatty sparing, 1 abscess, 1 adenoma, 1 regenerative nodule) and 90 malignancies (73 metastases, 15 HCCs, 2 cholangiocarcinomas). For both readers, CEUS showed higher diagnostic performance than MDCT in differentiating benign from malignant lesions. The most experienced reader correctly characterized 125/130 lesions on CEUS and 128/130 on MDCT; the less experienced reader correctly characterized 110/130 on CEUS and 105/130 on MDCT.

Conclusion: The diagnostic performance of CEUS and MDCT in the characterization of focal liver lesions depends on the observer's level of experience. Less experienced reader better characterized liver lesions by means of CEUS than MDCT due to the capability of CEUS to easily differentiate benign from malignant lesions.

SS 16.10

Low dose CT for renal calculi: detection rate of gastrointestinal findings

J. Sammon, P. McLaughlin, M. Twomey, S. O'Neill, S.A. Hayes, O.J. Flanagan, M. Maher; Cork/IE

Purpose: Unenhanced helical CT of the abdomen and pelvis (CT KUB) is the diagnostic test of choice in patients with suspected renal tract calculi. The purpose of this study is to assess the impact of a mean dose reduction of 83% ($p<0.0001$) on the ability to detect additional abdominal findings.

Material and Methods: Following ethical approval, 30 patients referred for clinically indicated CT KUB (57% male) consented to undergo an additional low-dose (LD) CT KUB as well as a conventional dose (CD) CT KUB. The LD CT KUB protocol was designed to have an effective dose of 0.5 mSv (mean dose 0.49±0.12mSv), the equivalent of an abdominal radiograph. All LD images were reconstructed with 70% adaptive statistical iterative reconstruction (ASIR). The CD and LD images were reviewed by two radiologists who recorded additional gastrointestinal findings as well as the presence or absence of calculi on both sets of images.

Results: There were 23 additional findings on CD imaging (n=4 were clinically important). Only 13 (56%) of the additional findings were detected on LD imaging ($P<0.0019$); sensitivity 56.5% (95%CI 0.36-0.76). None of the 4 clinically important findings were detected.

Conclusion: LD CT KUB imaging using ASIR may allow adequate detection of renal calculi; however, our study demonstrates a significant difference in the identification of relevant abdominal findings and the failure to diagnose clinically important abdominal findings in the emergent setting.

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