Scientific Sessions

Session numbers are prefixed by SS. Presentation numbers are prefixed by the letter B. Sessions and abstracts are listed by days. Presentations for which the author(s) have submitted additional material and images to EPOS™ are marked with the icon.

Thursday ........................................... 139
Friday ............................................... 199
Saturday .......................................... 249
Sunday ........................................... 275
Monday ........................................... 305
Thursday, March 1
**SS 111a**  
**Neurovascular - MRI**

**Moderators:** G. Guarneri; Naples/IT  
Z. Merhic: Sarajevo/BA

### B-0001 10:30  
**Non-invasive CVR assessment using ASL and BOLD**

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**Purpose:** We aimed to develop a reproducible protocol for non-invasive assessment of cerebrovascular reactivity (CVR) combining a breath hold (BH) challenge with CBF measurements using ASL, in comparison with a matching BOLD protocol.

**Methods and Materials:** A group of 10 healthy subjects was studied over 2 sessions on a 3 T MRI. BOLD images were obtained using GE-EPI sequence and ASL images were obtained using Q2TIPS-PICORE sequence from 9 contiguous slices. The BH protocol consisted on 3 (BOLD)/8 (ASL) cycles of 20s BH alternated with normal breathing. The data were analysed using FSL, including standard pre-processing steps and general linear model statistical analysis. Both BOLD and CBF maps of CVR were obtained for each subject and session, showing significant responses to BH, especially in grey matter. CVR measurements were obtained as percent signal changes averaged across the activation maps associated with the BOLD and CBF responses. Intra and intersubject variability was measured in terms of the respective coefficients of variation (CV).

**Results:** The mean percent signal change averaged across the CVR maps was 1.0±0.2% and 1.6±0.2% for BOLD sessions 1 and 2, 0.6±0.1% and 0.7±0.1% for BOLDASL sessions 1 and 2, and 74±7% and 73±9% for CBF sessions 1 and 2. The intra and intersubject variability was: CVintra=12% and CVinter=36% for BOLD, CVintra=17% and CVinter=25% for BOLDASL, and CVintra=31% and CVinter=36% for CBF.

**Conclusion:** Non-invasive CVR assessed by fMRI by measuring the BOLD and CBF responses to breath hold (BH) challenges is a reproducible method.

### B-0002 10:39  
**Acute-onset migrainous aura mimicking acute stroke: MR perfusion imaging features**

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**Purpose:** In a very limited number of cases, acute migrainous aura may present clinically as acute brain infarction. Since these patients increasingly undergo stroke workup, the aim of this study was to evaluate patterns of perfusion abnormalities in acute migrainous aura.

**Methods and Materials:** In a retrospective analysis, 1850 MR studies performed for the suspicion of acute brain infarction were analysed for patients suffering from acute migrainous aura and not from stroke (clinically and imaging based). All patients were examined clinically by two neurologists and underwent a stroke MRI protocol including perfusion-weighted imaging. Two radiologists reviewed perfusion maps visually and quantitative for presence, vascular territory and grade of perfusion abnormality.

**Results:** Among 1850 MR studies, 20 (1.08%) patients were found who received acute migrainous aura as the final diagnosis after complete clinical and imaging workup. Hypoperfusion was found in 14 of 20 patients (70%) with delayed mTT and TTP and decreased rCBV and rCBF, not confined to a single vascular territory. Bilateral hypoperfusion was seen in 3/14 cases, in 11/14 cases hypoperfusion with a posterior predominance was found. TTP and mTT were the best maps to depict perfusion changes at visual assessment, but also rCBF maps demonstrated significant hypoperfusion at quantitative analysis. In all patients, clinical and imaging follow-up was negative for stroke.

**Conclusion:** Acute migrainous aura is a rare, but important differential diagnosis among patients referred for MR under the suspicion of acute brain infarction. Characteristic perfusion abnormalities can be seen in the majority of cases.

### B-0003 10:48  
**Remission of diffusion lesions in acute stroke MR imaging: a follow-up study with 176 consecutive patients**

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**Purpose:** The mismatch concept in stroke MR is based on the assumption that diffusion-weighted imaging indicates infarct core representing irreversibly damaged tissue. However, this thesis has not yet been proven in a large patient cohort with adequate MR follow-up. Thus, the aim of this study was to analyse temporal evolution of restricted diffusion at follow-up MR within 24 hours.

**Methods and Materials:** 176 consecutive stroke patients (within 12 months) demonstrating restricted diffusion at initial MR examination were evaluated. Extension of diffusion restriction was judged both on initial MR as well as on follow-up after 24 hours. Changes in lesion extension were assessed by two radiologists independently, as well as overall image quality (4-tier scale).

**Results:** Extension of lesions with restricted diffusion at follow-up MR was identical to the initial scan in 105/176 (59.7%) and increased in 67/176 (38.1%). The lesions were decreased (meaning partial involution of the lesion) in 3/176 (1.7%) and completely resolved in 1/176 (0.5%). Mean rating of image quality was 2.1 for initial MRI and 2.3 for follow-up. That means, in 97.8% the initial lesion with restricted diffusion proved to be the infarction core indeed, whereas in 1.7% partial resolution was seen. Only in 0.6% of all patients the initial lesion did not result in complete infarction.

**Conclusion:** Our findings prove the existing assumption that diffusion restriction represents infarct core, which may remain unchanged or increase in volume over time, indicating an accuracy of almost 98%. Partial or complete resolution of diffusion-restriction is extremely rare.

### B-0004 10:57  
**Arterial hypertension is associated with rostral ventrolateral medulla neurovascular compression**

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**Purpose:** Ventrolateral medulla (VLM) is the vasomotor centre comprising neurons which control blood pressure through efficient parasympathetic connections. Previous studies suggest that hypertension in hemifacial spasm (HFS) patients is caused by VLM vascular compression.

**Methods and Materials:** 89 HFS patients and 59 controls (matched according to age and sex) were scanned with MRI. Hypertension was confirmed according to WHO criteria. The compression was graded from 0 to 3 (0-lack of vessel contact with brain stem, 1-vessel contact with no stem compression, 2-vessel contact with moderate stem compression, 3- vessel contact with marked brain stem compression and its deformation/displacement). Statistical analysis was carried out using Chi-squared test.

**Results:** VLM vascular compression was significantly more frequent among participants with vs. without hypertension in HFS (53.7% vs 31.4%, χ²=4, p=0.04) as well as in control group (70.4% vs 40.6%, χ²=2, p=0.02). The occurrence of VLM compression was not related to the body side. Marked compression graded as 2 and 3 correlated with arterial hypertension in HFS patients.

**Conclusion:** Hypertension in both groups - with and without HFS is present significantly often in patients with VLM compression on the right or the left side (without lateralization). Hypertension is present more often with 2nd and 3rd grade VLM vascular compression comparing to grade 0 and 1. The study confirmed correlation between occurrence of hypertension and VLM vascular compression not only in HFS but also in patients referred for MRI due to other diseases. The central mechanism of hypertension should be further evaluated.

### B-0005 11:06  
**Carotid atherosclerotic plaque morphology and ischaemic vascular brain disease on MRI**

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**Purpose:** Vulnerable plaque components in carotid arteries can be detected non-invasively with magnetic resonance imaging (MRI). In asymptomatic persons, the relation between carotid plaque composition and vascular brain disease is not well studied. We studied the association between carotid atherosclerotic plaque characteristics and ischaemic brain disease on MRI.

**Methods and Materials:** From the population-based Rotterdam Study, 952 participants with carotid wall thickening on ultrasound > 2.5 mm underwent both carotid MRI and brain MRI. Maximum carotid wall thickening, degree of stenosis and...
Presence of intraplaque haemorrhage, lipid core and calcification were assessed in both carotid arteries. Associations between plaque characteristics and white matter lesions (WMLs), lacunar and cortical infarcts were investigated per participant and additionally per carotid artery. Analysis were adjusted for cardiovascular risk-factors.

**Results:** Carotid stenosis (OR per 10% stenosis increase 1.2), 95% confidence interval (1.0-1.4), maximum carotid wall thickness (per mm increase 3.1-1.1-1.6) in the presence of intraplaque haemorrhage (1.9-1.1-1.3-3) were all found to be significantly associated with the presence of cortical infarcts, both in the participant-based analysis and in the carotid artery-based analysis. There were no associations between any plaque characteristics and presence of lacunar infarcts. In the subject-based analysis, maximum plaque thickness, presence of intraplaque haemorrhage and calcification were associated with WML-volume. In the artery-based analysis only the association for calcifications remained.

**Conclusion:** Presence of carotid intraplaque haemorrhage and measures of carotid plaque size are independently associated with cortical infarcts, but not with lacunar infarcts. Plaque calcification, but not vulnerable plaque components, is related to WML-volume.

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**B-0007** 11:15

Progression of the multiple hypointense vessel sign on the susceptibility weighted images after recanalisation in patients with hyperacute ischaemic stroke

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**Purpose:** The multiple hypointense vessel sign (MHVS) on the SWI has been reported to identify the ischaemic territory in pts with hyperacute ischaemic stroke. We evaluated the progression of this MHVS on the immediate SWI after recanalisation and its clinical implications.

**Methods and Materials:** 11 hyperacute ischaemic stroke pts who were treated with intraarterial or intravenous thrombolysis within 6 hours of Sx. onset and who underwent immediate MRI after recanalisation were enrolled in this study. The recanalisation status was evaluated in cerebral infarction (TICI) score before and after thrombolysis. The SWIs were evaluated for the presence of MHVS in the ischaemic territory. The veins in the ischaemic territory were classified into 3 grades.

**Results:** The initial TICI grades were 0 in 9 cases and 2b in 2 cases. After thrombolysis, the TICI grades were 3 in all cases. The SWIs showed the MHVS over the affected side in all 5 pts before recanalisation (5/5). After recanalisation, all 11 pts did not show the MHVS on SWI. The observed veins in the affected area were equal in 6 pts, less in 4 pts and equal and less together in one pt.

**Conclusion:** The MHVS on SWI can be indicative of acute thromboembolic occlusion and its change immediately after recanalisation can be used to predict the status of the final infarction. After recanalisation, the appearance of the equal cortical vessel sign (return to normal) on SWI was associated with a favourable clinical outcome and escaped infarction in our small series study.

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**B-0008** 11:24

Utility of susceptibility-weighted imaging for detection of carotid cavernous fistula: a case control study

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**Purpose:** To determine the utility and accuracy of susceptibility-weighted MRI (SWI) for the detection of carotid cavernous fistula.

**Methods and Materials:** We retrospectively identified 9 patients (group 1) of DSA proved carotid cavernous fistula (CCF) [case group], 19 patients (group 2) DSA negative for CCF [control group] and 2 patients of cavernous sinus thrombosis with prominent SOV (group 3). For all patients SWI sequence was available. Using uniform region-of-interest (ROI), signal intensity within superior ophthalmic vein (SOV) and superior sagittal sinus (SSS) were measured in magnitude image. SOV/SSS signal intensity ratio was calculated in each patient; mean values of the three groups were compared for accuracy.

**Results:** 11 SOV/SSS signal intensity ratios in group 1, 38 in group 2 and 4 in group 3 were included. Mean ± standard deviation of SOV/SSS ratios for group 1, group 2, group 3, indirect type and direct type were 0.93 ± 0.29, 0.40 ± 0.11, 0.35 ± 0.10, 0.84 ± 0.14 and 1.34 ± 0.19, respectively. Mann-Whitney (2 tailed) test between group 1 and 2 and group 1 and 3 was statistically significant with P < 0.0001 (P < 0.05 significant). All cases and controls were reliably distinguishable and with SOV/SSS signal intensity ratio of 0.64 as cut off. This increased signal intensity ratio was because of arteriovenous flow in SOV secondary to CCF.

**Conclusion:** SWI is feasible as well as accurate for detection of both direct and indirect carotid cavernous fistula and non-invasive follow-up of treated patients.
B-0011 10:30
Diffusion-weighted imaging: an imperfect biomarker for the malignancy of breast tumours
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Purpose: To evaluate differences in apparent diffusion coefficient (ADC) values of different types and grades of malignant breast tumours and the influence of these differences on the diagnostic accuracy of diffusion-weighted (DWI) MRI at 3 T.

Methods and Materials: 233 patients with 279 pre-detected focal breast lesions were included. All scans were performed on a 3 T MRI imager, before the application of any therapy. A T2-weighted sequence, a diffusion-weighted single-shot echo planar imaging diffusion-weighted sequence with (b-values: 0/850 sec/mm²) and a dynamic, contrast-enhanced (DCE)-T1 sequence were applied. Lesions were identified on the DCE-sequence and ADC was measured in the corresponding ADC-maps, using 2-dimensional regions of interest. An ADC-threshold of 1.25 x10⁻³ mm²/s was used to differentiate benign from malignant lesions. All lesions were biopsied and histopathologically classified using the TNM-system.

Results: While ADC-values were significantly lower in all subtypes of malignant tumours, than in benign lesions, ADC-values of non-invasive lesions were significantly higher than those of invasive ones. Tumour grades inversely correlated with ADC values. While the overall sensitivity (89.9%) and specificity (90.0%) of DWI were 100% and 78.2%, respectively, for non-invasive tumours, the sensitivity and specificity for invasive tumours were 90.0% and 92%, respectively. Tumour grades inversely correlated with ADC values, but the difference was only significant between grade I and grade III lesions. While the overall sensitivity (89.9%) and specificity (90.0%) of DWI were 100% and 78.2%, respectively, for non-invasive tumours, the sensitivity and specificity for invasive tumours were 90.0% and 92%, respectively.

Conclusion: Non-invasive breast tumours may present significantly higher ADC values than invasive ones. This may lead to many false negative results, which has to be considered when using DWI as a diagnostic tool.

B-0012 10:39
A new diffusion-weighted MR imaging approach for evaluating response to sorafenib treatment in advanced hepatocellular carcinoma
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Purpose: To prospectively evaluate the apparent diffusion coefficient (ADC), the pure diffusion coefficient (D) and the perfusion fraction (f) in advanced hepatocellular carcinoma (HCC) patients receiving sorafenib.

Methods and Materials: Diffusion-weighted imaging (DWI) was performed in 12 patients using b values of 0, 200, 400 and 800 s/mm². Two lesions were analysed in each patient at baseline, 2-weeks and 2-months treatment. ADC, D and f were calculated by statistical regression.

Results: The means of lesion size, ADC and D values did not change under treatment (respectively, 47.8 ± 31 mm; 1.34 ± 0.14 x 10⁻³ mm²/s and 1.18 ± 0.22 x 10⁻³ mm²/s). However, at 2 weeks and 2 months, in seven responder patients, f values significantly increased (+38.39%, P=0.005 and +50.94%, P=0.005, respectively) whereas in five non-responder patients f values decreased (-41.93%, P=0.008 and -23.46%, P=0.108, respectively). Furthermore, f-values were inversely correlated with αFP levels (P=0.032) and responder patients showed a higher overall survival (OS) than non-responder patients (12.29 ± 4.46 vs 7.8 ± 4.97 months). The relative variation of f over baseline at 2-month treatment was highly correlated with OS (P=0.038) and symptomatic time to progression (P=0.022).

Conclusion: In contrast to ADC and D, the perfusion fraction f is significantly affected by sorafenib and could be a potential marker of early response to treatment.

B-0013 10:48
Multi-zone tumour model exposed by multiparametric, dynamic contrast-enhanced and diffusion-weighted MR imaging
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Purpose: To correlate kinetic parameters derived from dynamic contrast-enhanced MR imaging (DCE-MRI) with apparent diffusion coefficient (ADC) values determined by diffusion-weighted MR imaging (DWI) in a spatially resolved, multiparametric imaging approach for phenotyping of tumour biology in living organisms.

Methods and Materials: In 16 chemo-naïve patients with histologically proven adenocarcinomas of the lung or the gastrointestinal tract 40 lesions were imaged (D1, DCE-MRI). Transfer constant Ktrans, rate constant kep, and fractional extravascular extracellular space ve were calculated for each pixel (Tissue 4D software, Siemens) and correlated with ADC values. Whole tumour regions of interest (ROIs) were compared using the Spearman’s rank correlation coefficient. Additionally, parameters were correlated on a pixel-by-pixel basis and, to reflect spatial heterogeneity, all tumour sections were divided into pixel rings (periphery to centre).

Results: For whole tumour ROIs no significant correlation between ADC values and kinetic parameters could be demonstrated. However, pixelwise analysis of ADC and kinetic parameters revealed a distinct pattern in spatial distribution of the parameters: restricted ADC, highest Ktrans and ve values in the tumour rim; very high ADC values and break down in perfusion in the centre; increasing ADC values, constant Ktrans, and increasing kep in a transitional zone when approaching from peripherally to centrally.

Conclusion: Non-invasive multiparametric assessment of the spatial heterogeneity of tumour biology is feasible using DCE-MRI and DWI. Combining both functional imaging methods identifies tumour regions with different biological characteristics exposing a multi-zone tumour model.

B-0014 10:57
Perfusion CT sub-classes FDG-PET metabolic responders in oesophageogastric adenocarcinoma
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Purpose: Identifying predictive biomarkers to optimise treatment selection in oesophagogastroduodenal adenocarcinoma (OGC) and to avoid ineffective treatment is important. Around 50% of oesophageal cancer patients that have a metabolic response (MR) to chemotherapy with FDG-PET at 14 days go on to respond to the full course of treatment. As part of a larger study, we investigated the predictive accuracy of combining perfusion CT (PCT) with FDG-PET for chemotherapy response.

Methods and Materials: Locally advanced/metastatic OGC patients were recruited into the PCT arm of the study (n=20). Imaging was performed on days 0 and 14 after chemotherapy (FDG-PET and PCT). Patients were classified MR if standard uptake values (SUV) decrease was > 35%. PCT was performed with 52 frames (100Kvp, 120 mA). 50 ml of Omnipaque350 was infused at frame 3. Images were analysed offline using in-house software. Perfusion and blood volume were calculated using the maximum slope model. 15 PCT patients have been analysed. Radiologic response (RR) was assessed by RECISTv1.1. (assessments were based on assessment of the primary tumour).

Results: 10/15 patients were classified as metabolic responders, 3/10 were also radiologic responders. Tumour perfusion was significantly increased (p=0.016) in FDG-PET MRs (mean increase 39%) that do go on to have a RR as compared to those that do not have a RR (mean increase 7%).

Conclusion: PCT potentially sub-classes FDG-PET metabolic responders into patients that will and will not go onto to have a radiological response. PCT may have clinical utility in combination with FDG-PET as a predictive biomarker to optimise treatment selection in OGC.

B-0015 11:06
Intravoxel incoherent motion (IVIM) analysis of breast carcinomas: a pilot study
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Purpose: To characterise changes in diffusion and perfusion effects in breast carcinomas using intravoxel incoherent motion (IVIM) analysis.

Methods and Materials: 24 female patients with biopsy-proven breast carcinomas were prospectively evaluated. All MRI examinations were performed on a 3 T MRI scanner (MAGNETOM Trio, Siemens) using a dedicated 4-channel phased array coil. A single-shot echo-planar imaging DWI protocol was performed to obtain...
A rapid and significant decrease in liver metastases of UM under treatment with sorafenib.

**Conclusion:**

A decrease in DCE-MRI parameters was not associated with therapy response or time-to-progression.

**Results:**

Dtrue of breast carcinomas (0.65 ± 0.22 x 10-3 mm2/s) was significantly lower (p < 0.001, two-tailed Wilcoxon matched pairs test) than that of fibrolamellar liver tissue (1.29 ± 0.48 x 10-3 mm2/s). Moreover, significant difference (p < 0.05) in Pscan was observed in breast carcinomas (0.20 ± 0.10) and fibrolamellar tissue (0.31 ± 0.22), while similar Dpseudo in breast carcinomas (26.02 ± 4.82 x 10-3 mm2/s) and fibrolamellar tissue (20.86 ± 4.08 x 10-3 mm2/s) were observed.

**Conclusion:**

IVIM analysis revealed decreased Dtrue and Pscan in breast carcinomas, showing that alterations in both cellularity and perfusion effects contribute to the changes in apparent diffusion using DWI. IVIM analysis may be valuable for characterising breast carcinomas and monitoring its progression non-invasively.

**B-0016**

**Early assessment of tumour response to sorafenib in uveal melanoma with liver metastases using semi-quantitative DCE-MRI**

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**Purpose:**

Evaluation of semi-quantitative dynamic contrast-enhanced MRI (DCE-MRI) to assess therapy response in patients with liver metastases of uveal melanoma (UM) treated with Sorafenib.

**Methods and Materials:**

This study was approved by our local institutional review board. Seventeen patients with liver metastases of UM were treated with Sorafenib and examined by DCE-MRI (1.5 T Avanto, Siemens) at baseline and for follow-up scans every 6 weeks. The lesion with the longest diameter was selected as target. Measurements were performed peracronorally for 300sec using a T1-Flash sequence (7 mm slice-thickness, temporal resolution 1sec) and Gadobutrol (0.1 mmol/kg, flow 3 ml/sec). Automated respiratory motion correction was applied to the image series, thereafter the target lesion was manually delineated by a region of interest. Contrast-enhancement time curves were fitted using smoothing spline interpolation and semi-quantitative parameters were calculated: maximum slope during initial contrast agent uptake (Sliopemax) and initial area under the curve to 60 (AUC60) and 90 seconds (AUC90) after the onset time. Therapy response was assessed according to response evaluation criteria in solid tumors (RECIST) with a mean time-to-progression of 390 days.

**Results:**

After 6 weeks Sliopemax, AUC60 and AUC90 showed a statistically significant mean decrease of 41.71% (±32.44), 29.00% (±20.09%) and 26.97% (±18.48%), respectively (each p < 0.01), before subsequently entering steady state. A decrease in DCE-MRI parameters was not associated with therapy response or time-to-progression.

**Conclusion:**

Respiratory motion corrected semi-quantitative DCE-MRI shows a rapid and significant decrease in liver metastases of UM under treatment with sorafenib, but a correlation to clinical outcome could not be observed.

**B-0017**

**Combined qualitative and quantitative analysis of DWI in early assessment of poor responders after chemoradiation therapy: preliminary results in locally advanced rectal cancer**

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**Purpose:**

To evaluate the potential role of DWIBS and ADC map in identifying poor responders to neoadjuvant chemoradiation treatment (CRT) for LARC.

**Methods and Materials:**

40 patients (mean age 60) with biopsy-proven diagnosis of rectal cancer were prospectively enrolled in our study. MR examinations were performed prior to therapy (T3-T4 or N+ stage) and after CRT (6 weeks after the completion of treatment) on a 1.5 Tesla (Achieva, Philips) scanner with a pelvic phased array multi-coil; multiplanar T1 and T2TSE and DWIBS sequences (b factor:0 and 1000 mm2/sec) were acquired. For quantitative analysis, mean ADC values of the tumours were measured by 2 radiologists, by manually (Dtrue) ROI (covering entire tumour regions on ADC maps). Mean pre- and post-CRT ADC values were compared between responders and non-responders, being the histopathologic response (according to Mandard's criteria) as the reference standard.

**Results:**

After surgical resection, imaging findings were compared with pathological results. Twenty-seven patients (68%) showed complete (TRG1) or subtotal regression (TRG2) and were considered as responders; while 13 (32%) were classified as poor responders (TRG3-5). The mean post-CRT ADC value of poor responders (1.19±0.25x10-3 mm2/sec) was significantly (p < 0.001) lower than that of responder group (1.40±0.22x10-3 mm2/sec). The best cut-off ADC value in distinguishing responders from non-responders was 1.28x10-3 mm2/sec on the basis of post-CRT ADC yielded a good specificity (87%); combining qualitative analysis of DWI to morphological findings we could lead to more accurate results.

**Conclusion:**

DWI/ADC represents a powerful and effective tool to monitor therapeutic response in LARC, being able to detect cellular changes in treated tumours.

**B-0018**

**Assessment of tumor heterogeneity: CT texture as a biomarker of overall survival in primary colorectal cancer**

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**Purpose:**

To determine if CT texture is related to overall survival in primary colorectal cancer.

**Methods and Materials:**

Following IRB approval 57 patients (26 males, 31 females, mean 67.8 years) underwent staging contrast-enhanced CT (120 kV, 280 mA, 0.6s rotation time, 5 mm slice collimation; 100 mL 340 mg/ml ioxilanodinated contrast at 5 mL/s, 75 second delay). The entire colorectal tumour texture features were assessed using proprietary image texture analysis software (TexRAD) deriving entropy (E), uniformity (U), kurtosis (K), skewness (S) and standard deviation (SD) of the CT images without filtration and with filter values corresponding to fine (1), medium (1.5, 2.0), and coarse (2.5) textures. Patients were followed up till death, or censored at 5 years if alive. ROC and Kaplan-Meier analysis was performed to determine the relationship, if any, between CT texture and 5-yr overall survival.

**Results:**

Data were available from 55 patients. There were 8 stage I, 19 stage II, 17 stage III and 11 stage IV cancers. Fine texture Kaplan Meier survival plots for E, U, K and SD were significantly different (p=0.002, p=0.018, p=0.032, p=0.008 and p=0.002, respectively) for thresholds of <= 7.89 (E), > 0.01 (U), <= 2.48 (K), > 0.38 (S) and <= 61.83 (SD), respectively. Cox regression analysis showed these parameters were independent predictors of overall survival with stage.

**Conclusion:**

Lower entropy, kurtosis and SD, and higher uniformity and skewness at fine textures are predictors of poorer 5-year overall survival in colorectal cancer.

**B-0019**

**Evaluation of radiological prognostic factors of hepatic metastases in patients with pancreatic neuroendocrine neoplasms**

C. Ihm1, A. Blaug1, G. E. Steffen1, E. B. Tischer1, M. Pavel1, T. Denecke1, Berlin/DE (alexander.baur@charite.de)

**Purpose:**

Pancreatic neuroendocrine neoplasms (pNEN) are rare tumours and often diagnosed at an advanced stage of disease. The liver is the most frequent site of metastases and progression of hepatic metastases often determines prognosis. Evaluation of radiological prognostic factorsof hepatic metastases often diagnosed at an advanced stage of disease. The liver is the most frequent site of metastases and progression of hepatic metastases often determines prognosis.

**Methods and Materials:**

To evaluate the potential role of DWIBS and ADC map in identifying poor responders to neoadjuvant chemoradiation therapy: preliminary results in locally advanced rectal cancer

**Results:**

During surveillance 14 patients received biotherapy (octreotide LAR) and 30 patients obtained no antitumoral therapy. Median time to progression of patients with biotherapy and patients without therapy was 12.1 and 6.0 months, respectively (HR, 3.0; 95%-CI, 1.3-6.9; p=0.009). The only significant radiological factor shown to have a less favourable independent prognostic significance is the hypovascularisation (defined as hypoenhancement during the early arterial and portal venous phases) of hepatic metastases (HR, 2.6; 95%-CI, 1.0-6.7; p=0.042). This significantly predicted early progression in the subgroup without octreotide therapy (1-year progression rate with hypervascularisation, 38.3%; hypovascularisation 100%, p=0.034, while bK), skewness (S) and standard deviation (SD) were not significant predictors (all patients, p=0.506).

**Conclusion:**

Patients treated with octreotide LAR had a significantly longer time to tumour progression. Hypovascularised metastases might be an easy accessible risk factor for tumour progression and therefore important to take into account when deciding on therapeutic approach.
B-0020 11:51
CT-based response assessment of advanced gastrointestinal stromal tumour: is dual energy CT a more predictive imaging biomarker of response than RECIST or Choi criteria?
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Purpose: Dual energy CT (DECT) allows the assessment of iodine distribution in tumours. This may be considered as a surrogate marker for perfusion and tumour vascularity. This study evaluated whether DECT allows a better prediction of survival than established response criteria (RECIST and Choi criteria).

Methods and Materials: Seven-teen patients with advanced GIST treated with tyrosin-kinase inhibitors were assessed by contrast-enhanced DECT after 2 and 6 months follow-up. Response was rated according to RECIST, Choi criteria and DECT analysis of iodine related attenuation. Progressive disease was defined as a 20% increase of tumour size (RECIST) and tumour density (Choi) or either an increase greater than 50% of tumour size or iodine-related attenuation on DECT. Progression-free survival (PFS) and overall survival (OS) were calculated by Kaplan-Meier analysis.

Results: Independent from the used response criteria patients with partial response or stable disease had a significantly longer median PFS than patients with progressive disease (median: 9-29 months vs. 2.6 months; p < 0.0228). Only DECT at 6 months allowed a valid discrimination of patients with good or poor OS (median: 32 vs. 18 months; p < 0.0496).

Conclusion: This study indicates that DECT is a promising predictive imaging biomarker of response if compared to established response criteria as it allowed the best prediction of survival.

10:30 - 12:00
Chest

SS 104
Neoplasms: staging, risk and surgery

Moderators: S. Ley; Toronto, ON/CA
K. Malagari; Athens/GR

B-0021 10:30
The presurgical T staging of non-small cell lung cancer: efficacy comparison of 64-MDCT versus 3.0 T MR imaging
T.W. Tang, W.N. Wu, O.H. Ouyang, H.Y. Huang, L.L. Liu, L.M. Li, W.Y. Wang, X.X. Xu; Beijing/CN (nickywax@hotmail.com)

Purpose: To compare prospectively the diagnostic efficacies of 64-MDCT and 3.0 T MRI for determining T staging in NSCLC.

Methods and Materials: To compare prospectively the diagnostic efficacies of 64-MDCT and 3.0 T MRI for determining T staging in NSCLC.

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Methods and Materials: A prospective study compared the diagnostic efficacies of 64-MDCT and 3.0 T MRI for determining T staging in NSCLC.

Results: Diagnostic efficacies for T staging of NSCLC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test. Diagnostic efficacies for T staging of NSCC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test. Diagnostic efficacies for T staging of NSCLC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test.

Conclusion: Diagnostic efficacy for T staging of NSCLC was 65% on non-enhanced MRI, 67% on enhanced MRI, and 70% on enhanced CT. Diagnostic efficacies for T staging of NSCLC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test. Diagnostic efficacies for T staging of NSCLC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test. Diagnostic efficacies for T staging of NSCLC on non-enhanced MRI, enhanced MRI and enhanced CT were compared using the McNemar test.

B-0022 10:39
Single source dual energy CT improving differentiation between atelectasis and tumour in central lung cancer: clinical practice of a novel technique
Y. Chen, L. Tang, X.-T. Li, L.-P. Qi, Y.-L. Li, X.-Y. Zhang, Y. Cui, Y.-S. Sun, X.-P. Zhang; Beijing/CN (tanglei@bjcancer.org)

Purpose: To evaluate the performance of single source dual energy CT for differentiation between atelectasis and tumour in central lung cancer.

Methods and Materials: The study comprises 27 consecutive patients with confirmed central lung cancer associated with atelectasis on single source dual energy CT. The optimised mono-chromatric images were obtained by selecting the best CNR, and the iodine-based material decomposed images were obtained with iodine concentration measured. Images were assessed by two radiologists working in consensus for the displayment of tumour-atelectasis interface. The iodine concentrations between tumour and atelectasis was compared by paired t test with SPSS.

Results: The optimal energy level was in the range of 40-68 keV (median 52 keV) for displaying tumour-atelectasis interface at 30s delayed scanning phase and in the range of 40-70 keV (median 50 keV) at 90s delayed scanning phase. Tumour-atelectasis interface could be defined in 16 (59.3%) and 26 (86.3%) patients using combination of the optimised mono-chromatric images with iodine-based material decomposed images at 30s and 90s delayed phase, respectively, more than 9 (33.3%) and 16 (59.3%) using the optimised mono-chromatric images alone, with p=0.056 and p=0.001, respectively. The iodine concentrations of atelectasis was much higher than tumour, p < 0.001, and the iodine-based material decomposed images enabled differentiation between atelectasis and tumour in 4 more patients.

Conclusion: The single source dual energy CT could improve differentiation between atelectasis and tumour in central lung cancer with the optimised CNR technique and material decomposition technique. This modality manifested as a potentially useful radiologic tool for routine clinical diagnosis.

B-0023 10:48
Predictive features of FDG-PET/CT and CT in diagnosing nodal metastasis of T1 non-small cell lung cancers manifesting as part-solid nodules
H. Kim, C.M. Park, S.M. Lee, J.C. Paeng, J.M. Goo, H.J. Lee; Seoul/KR (kny.sruh@gmail.com)

Purpose: To retrospectively investigate the predictive factors of FDG-PET/CT and CT for LN metastasis in T1 NSCLCs manifesting as part-solid nodules (PSNs).

Methods and Materials: The institutional review board approved this study and waived informed consent. From January 2005 to May 2011, 144 patients with pathologically proven T1 NSCLCs manifesting as PSNs with LN staging were included in this study. SUVmax and CT features of primary tumours were evaluated to investigate predictive factors for LN metastasis. In addition, optimal cut-off values for each predictor were determined and the diagnostic performance of the prediction model using the predictors was evaluated using a receiver-operating characteristic (ROC) analysis.

Results: LN metastases were found in 9 of 144 patients (6.25%). No LN metastasis was present in patients with solid proportion < 77%. There were significant differences in SUVmax, solid proportion, and lesion location of the primary tumour between patients with and without LN metastasis (P < 0.05). Multivariate analysis revealed that higher SUVmax [odds ratio (OR), 1.823; P=0.030], larger solid proportion [OR, 1.150; P=0.027] and central location [OR, 17.902; P=0.011] were independent predictors for LN metastasis. The optimal cut-off values of SUVmax and solid proportion were 2.98 and 77.23, respectively. The area under the ROC curve of the predictive model using all three variables was 0.951.

Conclusion: Higher SUVmax, larger solid proportion and central location of the primary tumour are significant independent predictors for LN metastasis in T1 NSCLCs manifesting as PSNs which can enable a very accurate preoperative prediction of LN status in these cancers.

B-0024 10:57
Prevalence, clinical significance and diagnostic value of extrapleural and cardio-phrenic lymph nodes
C. Maurel, B. Feragalli, N. Civitareale, R. Polverosi, A. Tartaro, A. Cotonone; Chieti/IT

Purpose: To evaluate the prevalence, clinical meaning and diagnostic value of extrapleural and cardio-phrenic lymph nodes sometimes observed on CT scans of the chest. To define a CT dimensional cut-off value for extrapleural and cardio-phrenic
nodes. To evaluate the frequency of these nodes in different diseases, particularly in primary or secondary malignant pleural diseases.

Methods and Materials: We included 750 consecutive patients, who underwent MDCT of the chest for different clinical purposes (370 non-neoplastic patients, 250 with extrathoracic neoplasm, 100 with intrathoracic neoplasm and 30 with pleural metastasis) and 91 patients with histologically proven malignant pleural mesothelioma (MPM). For each group of patients we analysed the presence of extrapleural and cardio-pleural nodes, their number (single or multiple) and their size (≤5 mm, between 6 and 10 mm and > 10 mm).

Results: The prevalence of extrapleural nodes, independently from their size, resulted less than 1% in all groups of patients, except for patients with MPM (62/91- 68%). The prevalence of cardio-pleural nodes > 5 mm was 66% (60/91) in patients with MPM, 53% (16/30) in patients with pleural metastasis and less than 2% in all other groups of patients. No significant differences in the prevalence of cardio-pleural nodes ≤5 mm in all groups of patients (p> 0.05) were found.

Conclusion: The presence of extrapleural nodes of any size and cardio-pleural nodes greater than 5 mm have a significant diagnostic value in malignant pleural diseases, either primary or secondary, while they are extremely rare in other diseases, neoplastic or not.

B-0025 11:06
Diffusion-weighted imaging add diagnostic value to MRI in differentiating thoraco-mediastinal lesions: comparison with PET-CT
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Purpose: The aim of this study was to assess the diagnostic accuracy of diffusion-weighted MRI sequences versus PET-CT in the detection and characterisation of thoraco-mediastinal district lesions, using the histopathological findings as gold standard.

Methods and Materials: 34 patients with thoraco-mediastinal lesions underwent PET-CT and MRI; standard and diffusion-weighted sequences were performed and ADC maps were generated. To optimise the comparison between PET-CT and MRI in discriminating benign from malignant lesions, an ADC cut-off value was stated (1.5x10⁻³ mm²/s). Considering the findings of histopathological lesions as "gold standard" reference, values of sensitivity, specificity, diagnostic accuracy, positive predictive value (PPV) and negative predictive value (NPV) of MRI and CT-PET were calculated.

Results: The obtained values showed diffusion-weighted MRI having a sensitivity comparable to CT-PET (90% vs 87%) and greater specificity (100% vs 33%). Overall, the diagnostic accuracy of diffusion-weighted MRI returned a value of 91%, compared to 85% of PET-CT. The PPV obtained with diffusion-weighted sequences was similar to the one obtained with PET-CT (100% vs 98%), with diffusion-weighted NPV sequences being more accurate than PET-CT (57% vs 33%). No statistically relevant differences among the sensitivity and specificity values of the two methods were found after a comparison with the McNemar’s test.

Conclusion: Calculation of the ADC with diffusion-weighted MRI has proved to be extremely sensitive in the thoraco-mediastinal masses discrimination, and it may be an important technical feature to complete basic MRI sequences with or without contrast media.

B-0026 11:15
Do pleural plaques carry an excess risk of lung cancer in asbestos-exposed workers?

Purpose: Most studies evaluating relationships between pleural plaques and lung cancer have been based on chest radiographs and due to the low sensitivity and specificity of chest radiograph to identify pleural plaques, their results are still controversial. The aim of this study was to evaluate whether the presence of pleural plaques detected using low-dose chest CT leads to an additional risk of lung cancer to that provided by asbestos exposure without presence of plaques.

Methods and Materials: A large screening programme for formerly asbestos-exposed workers was organised in France from 2003 to 2005, including exposure assessment measured by a cumulative exposure index and detection of pleural and lung abnormalities by low dose computed tomography. Reading was performed blindly independently by 2 readers. Cases of incident lung cancer in this population were counted up to January 2011. Relationship between presence of pleural plaques and occurrence of lung cancer was assessed by adjusted odds ratios (OR) for age, sex, smoking status and asbestos exposure.

Results: The study population included 5825 subjects. The mean duration of follow-up was 6.29 years. Data regarding the presence of pleural plaques were available in 73 subjects among the 75 cases of lung cancer identified. Adjusted OR estimating the risk of lung cancer associated with pleural plaques was 1.14 (95% confidence interval: 0.65 to 2.00).

Conclusion: Among a population of formerly asbestos-exposed workers, the presence of pleural plaques does not lead to an excess risk of lung cancer.
**B-0029**  11:42
Lung volume in patients with pectus excavatum: quantifying the pulmonary involvement?
J. Valinejos, C. Capunay, P. Carrascosa, M. Martinez Ferro, J. Carrascosa

**Purpose:** To quantify the lung volume of pectus excavatum (PE) patients using chest multi-slice computed tomography (MDCT), and to compare these with a control group.

**Methods and Materials:** Thirty-six patients (mean age: 17.2 year-old) with PE and 12 controls underwent low dose chest MDCT. The volume of lung parenchyma in each examination was determined by performing a three-dimensional reconstruction. We determined values for the volume of the right lung, left lung, and the pulmonary volume index (PVI: right/left). Severity indices of the deformity were calculated using standard indicator index (HI), chest wall symmetry index (CWA), and sternum tilt angle index were also calculated from CT scans. Statistical differences of measurements were calculated using the Student-t and Kruskall-Wallis tests.

**Results:** We found evidence (p=0.01) of a lower PVI in PE patients (1.21±0.17) in comparison with control patients (1.09±0.4). The PVI was directly correlated with the HI (r=0.33, p=0.04) and with the CCI (r=0.44, p < 0.01).

**Conclusion:** This preliminary study showed differences in lung volumes between PE patients and control group. Therefore PVI correlated with severity indices. These findings suggest that lung volume quantification may be a severity index of pulmonary involvement.

**B-0030**  11:51
Prediction of postoperative pulmonary function by single-breath dual energy xenon CT: a preliminary report
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**Purpose:** Chronic obstructive pulmonary disease (COPD) is common and lung cancer is still one of the leading causes of death worldwide. So it is important to ascertain operability of patients having both COPD and lung cancer. The purpose was to assess the ability of xenon dual energy CT to predict postoperative pulmonary function.

**Methods and Materials:** Sixty patients (mean age: 62 year-old) with COPD and lung cancer were enrolled in this study. Institutional review board approved this study and written informed consent was obtained from all patients. They were scanned with a dual source CT scanner in dual energy mode (80 kV/Sn 140 kV) during a breath-hold after single vital-capacity breath of a mixture of xenon and oxygen in the ratio of 35:65 (35%-xenon). Xenon images (Xe-images) were calculated by three-material decomposition. The sum of the pixel values of the Xe-images within the part of the lung to be remained after resection (A) and that of the whole lung (B) were enumerated. We multiplied A/B and pre-operative forced expiratory volume in one second (FEV1) or forced vital capacity (FVC) to predict postoperative FEV1 or FVC. Predicted FEV1 and FVC were compared with measured postoperative FEV1 and FVC, and regression was tested by t-statistics.

**Results:** The predicted values of FEV1 and FVC from Xe-images correlated to the postoperative measurements (R = 0.66, 0.72), and the regression was significant for FVC (p = 0.07, 0.04).

**Conclusion:** Predicted postoperative FEV1 and FVC with the Xe-images correlated to the postoperative FEV1 and FVC.

**Interventional Radiology**

**SS 109** Genitourinary, gastrointestinal and biliary interventions
Moderators: M. Given; Dublin IE T. Jargiello; Lublin PL

**B-0031**  10:30
Uterine artery embolisation: pre-interventional prediction of the best tube angle obliquity for visualisation of the uterine artery origin using 3D reconstructed contrast-enhanced MR angiography
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**Purpose:** To test the accuracy of 3D-reconstructed contrast-enhanced MR angiography (3D-CE-MRA) in predicting the best tube angle obliquity to visualise the uterine artery origin (UAO) before uterine artery embolisation (UAE).

**Methods and Materials:** Three different examinations (mean age: 45.4 years) to whom UAE was performed were before UAE and 3D-images were reconstructed using Inspace-application. The 3D-figure was rotated in all directions to determine the best angle for visualising the UAE by two radiologists in consensus. The suggested angle was provided to the interventionist for optional usage. After UAE the actual angle used for visualisation was recorded and compared with the suggested angle. Correlation between the suggested angle and actual angle was tested using Spearman’s correlation test.

**Results:** For visualising the left UA the suggested-angle in the side-to-side direction showed a mean of 0.38°(right ±28.6°), the actual-angle was 7.3°right ±28.7°. In the cephalo-caudal direction the suggested-angle was 2.5°“caudal ±6.52”, the actual-angle was 2.5°“caudal ±6.52”. A statistically significant strong positive correlation was detected in the side-to-side (rho=0.981, p < 0.0001) and cephalo-caudal directions (rho=1, p < 0.0001). For the right UA the suggested-angle in the side-to-side direction was 9.95°left ±27.5°, the actual-angle was 7.98°left ±29.1°. In the cephalo-caudal direction the suggested-angle was 0.38°“caudal ±6.67°, the actual-angle was 0.38°“caudal ±6.67°. A statistically significant strong positive correlation was detected in the side-to-side (rho=0.865, p < 0.0001) and cephalo-caudal directions (rho=1, p < 0.0001).

**Conclusion:** Pre-interventional 3D CE-MRA can accurately predict the best tube angle obliquity for visualisation of the uterine artery origin before UAE.

**B-0032**  10:39
Advantages of the brachial approach in uterine arteries embolisation
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**Purpose:** Description of advantages of the brachial approach in uterine arteries embolisation.

**Methods and Materials:** 4020 consecutive cases of uterine fibroids embolisation using brachial approach. Some parameters that permit the estimation of this technique's results, the complications and the postprocedure quality of life were followed.

**Results:** The catheterisation of bilateral uterine arteries was possible in 99.95% of cases. The mean time of the intervention was 42 min (SD ± 11 min). Radioscopy time ranged between 2.8 minutes and 18.2 minutes with a mean time of 3.6 minutes (SD ± 2.4 minutes). The complications at the puncture site were: brachial artery spasm in 3.75% of cases, local haematoma in 1.56% of cases, brachial artery thrombosis in 0.12% of cases and 1 case of tegument adherence to the deeper layers. Readmission for complications was necessary in 3 cases. The postembolisation pain was percepted less intense (mean 4 on a scale 0-10), 100% of the patients appreciated the absence of any constraint to rest as an important advantage.

**Conclusion:** The brachial approach is a successful technique, superior to femural approach, that permits a significant reduction in radioscopy time and radiation dose. Complications at the puncture site are very rare, in direct relation with operator’s experience. The patient’s comfort during first 24 hours after intervention is significantly increased. The postembolisation pain is less intense. Microcatheters were not necessary as diagnostic catheters were used in all the interventions, thus leading to cost reductions.
**B-0033** 10:48

Arterial embolisation for cervical leiomyoma: should we treat it as adenomyosis?1 J. Koh, M. Kim, M. Lee, D. Jung, S. Park, M. Lee, J. Won, D. Lee, K. Lee; Seoul/KR (qhsr@yuhs.ac)

**Purpose:** The aim of this study is to compare the effectiveness of uterine artery embolisation (UAEM) in treating symptomatic fibroids in the uterine cervix to that in the uterine body or fundus.

**Methods and Materials:** From the data for 537 patients who underwent UAE between 2007 and 2010, we retrospectively analysed the data for 10 patients with fibroids located in the uterine cervix. Seven of the 10 patients presented a total of 10 fibroids in the uterine body or fundus as well as in the uterine cervix. The effects of UAE and vascularity on angiographic findings were compared between fibroids in the cervix and fibroids in the uterine body or fundus. Necrosis of fibroids was assessed by MRI 3 months after UAE. Statistical analysis was performed using the Mann-Whitney test and Fisher’s exact test.

**Results:** Complete necrosis of leiomyomas in the uterine cervix was seen in only 2 patients of the 10, while all fibroids in the uterine body or fundus were completely infarcted (p < 0.05). Partial necrosis was seen in 6, and no necrosis in 2. One patient underwent hysterectomy as removal of incompletely infarcted fibroid. Poor vascularity was noted in 5 of 9 patients (55.6%) with cervical fibroids but in none of the patients with fibroids in the uterine body or fundus (p < 0.05).

**Conclusion:** Poor vascularity were frequent finding in cervical leiomyomas and outcomes of UAE for cervical leiomyomas were disappointing and indicate caution in selecting and counselling patients for this treatment.

**B-0034** 10:57

Transcatheter pelvic arterial embolisation for control of obstetric haemorrhage M. Ferrer-Puchol¹, C. Lanciego², E. Esteban³, J. Ciampi³, M. Edo³, S.E. González⁴, S.E. González⁵; Alzira/ES, Toledo/ES (lolesferrer@ono.com)

**Purpose:** Excessive blood loss is considered to be greater than 500 ml in vaginal delivery or 1000 ml after caesarean section. The purpose of this work is to present our experience in emergency selective arterial embolisation in two hospitals.

**Methods and Materials:** We present 27 women who underwent intractable obstetric bleeding. Mean patient age was 26 years ± 7. In both hospitals there was a trained team on call for interventional procedures. Indication for selective arterial embolisation was made by gynaecologists and anaesthetists. Non-selective pelvic arteriography was performed via transfemoral approach to demonstrate the anatomy and points of bleeding. We performed intraarterial embolisation using gelatine sponge, particles or coils depending on bleeding source.

**Results:** 24/27 were primary haemorrhages and 2/27 were secondary. Causes were: 20 after vaginal deliveries: 1 placenta accreta, 1 cervical tear and 18 uterine atony. 5 after caesarean section: 2 uterine tears, 2 uterine atony and 1 pseudoaneurysm. 1 after abortion: pseudoaneurysm. 1 after ectopic cervical pregnancy. The two secondary haemorrhages were due to pseudoaneurysms. Catheterisation of both uterine arteries was performed in 25 patients. Embolisation material: 17/27 we employed gelatine sponge, 9/27 using PVA particles and 1 patient with coils. We report complications related to procedure. The result was satisfactory in 24 patients with complete cessation of bleeding, but two cases presented some hours later embolisation an episode of rebleeding that underwent emergent hysterectomy.

**Conclusion:** Intraarterial embolisation is an alternative to surgical measures, offers good results, is safe and preserves fertility of women.

**B-0035** 11:06

A novel technique of percutaneous closure of enterocutaneous fistula B. Sekovski, L. Cambj Sapunar; Split/HR (budimir4@yahoo.com)

**Purpose:** Patients with a postoperative enterocutaneous fistula have significantly reduced quality of life. Recently, several minimally invasive methods were developed as an alternative to surgical therapy for this condition. We present our technique of percutaneous closure of enterocutaneous fistula under fluoroscopy guidance.

**Methods and Materials:** Five patients who have developed low-output enterocutaneous fistula since March 2010 were included in this study. Enterocutaneous fistula occurred as a postoperative complication of colorectal carcinoma in four patients and in one patient fistula was a post-surgery complication of a perforated diverticulitis. N-butyl cyanoacrylic glue mixed with lipiodol as an embolisation material was deployed in a fistula through 4 F hydrophilic catheter under fluoroscopy guidance. Procedure takes less than 10 minutes and requires approximately 30 seconds of fluoroscopy.

**Results:** In all five patients fistula was immediately closed and there were no complications considering our procedure. In one patient local cancer recurrence occurred 4 months after the intervention and in the patient with diverticulitis 15 months later the new episode of diverticulitis caused abscess formation.

**Conclusion:** Percutaneous closure of low-output enterocutaneous fistulas with cyanoacrilate glue under fluoroscopy guidance is a simple and effective method that represents a good alternative to surgical therapy. Advantage of this method is that the gluing of the fistula could be easily detected under fluoroscopy since lipiodol makes the glue visible. Short-term results of this novel technique are excellent but further evaluation of long-term results is required.

**B-0036** 11:15


**Purpose:** To investigate the immediate and long-term results following the fluoroscopically guided oesophageal balloon dilatations for the management of dysphagia, in a series of patients suffering from epidermolysis bullosa dystrophica (DEB).

**Methods and Materials:** Thirty patients suffering from dysphagia due to epidermolysis bullosa dystrophica (DEB) were included in this study. Procedures were performed by a team of specialists. For each patient, balloon dilatations were performed unilaterally or bilaterally until the desired result was achieved and dysphagia was significantly reduced. The mean number of balloon dilatations per patient was 7 (range: 1-21) and the mean time of follow-up was 57 months (range: 12-120).

**Results:** Of the 30 patients, 26 were DEB patients and 4 were patients with a similar clinical condition. Eight patients underwent balloon dilatations on both sides, and 22 patients underwent balloon dilatations on one side. The mean number of balloon dilatations was 7 (range: 1-21). The mean time of follow-up was 57 months (range: 12-120). Most of the patients had a history of previous GI bypass surgery (e.g. subtotal gastrectomy with Billroth I or II, roux-en-yoplasty with PPH). The specific method demonstrated a significant clinical improvement of dysphagia and long-term satisfactory re-intervention rates, while no major complications were noted.

**Conclusion:** Fluoroscopically guided balloon dilatation for the management of dysphagia caused by oesophageal strictures owing to DEB is safe and effective. The specific method demonstrated a significant clinical improvement of dysphagia and long-term satisfactory re-intervention rates, while no major complications were noted.

**B-0037** 11:24

Effectiveness of percutaneous biliary stone removal as primary treatment compared with endoscopic retrograde technique: in cases of IHBD stones, ≥15 mm bile duct stones, history of GI bypass surgery S. Choi, Y. Han, S. Lee, H. Yu; Jeonju-un/KR (maumzoa@gmail.com)

**Purpose:** To evaluate the effectiveness of percutaneous biliary stone removal as primary treatment compared with endoscopic retrograde technique, in cases of IHBD stones, ≥15 mm bile duct stones, history of GI bypass surgery.

**Methods and Materials:** From March 2004 to May 2011, a total of 122 consecutive patients with biliary stones underwent percutaneous biliary stone removal as primary treatment (group I, n=40) or secondary treatment after endoscopic retrograde techniques had failed (group II, n=82). In group I, the patients who satisfied the inclusion criteria were 17 (group I', M: F=14:3, Mean age: 72 years) and 33 (group II', M:F=21:12, Mean age: 78 years), respectively. The inclusion criteria were as follows: patients who i) had IHBD stones, ii) had ≥15 mm bile duct stones, iii) had history of previous GI bypass surgery (e.g. subtotal gastrectomy with Billroth I or II, roux-en-yoplasty with PPH), iv) had a technical success rate of ≥90%.

**Results:** Success rate was 97.6% (78/80 procedures). There were no major complications. Mean re-intervention free interval was 10 months, while post-procedural dysphagia score was significantly lower compared to baseline (0.72, 95% CI 0.56-0.87 vs. 2.50, 95% CI 2.35-2.65, respectively; p < 001). The works of post-procedural hospital stay was not significantly different (P= 0.27 and 0.47, respectively).

**Conclusion:** Percutaneous biliary stone removal as primary treatment compared with endoscopic retrograde technique, in cases of IHBD stones, ≥15 mm bile duct stones, history of GI bypass surgery was effective and safe. There was no major complication related to procedure.

**References:**

**Scientific Session**
The comparison of visualisation among balloon-occluded retrograde transvenous venography using iodine contrast and carbon dioxide gas, and the subsequent obliteration by foam sclerosants for gastric varices under DSA

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Purpose: Previously we applied carbon dioxide gas DSA for balloon-occluded retrograde transvenous venography (BRTV) prior to obliteration (BROTO) using foam sclerosants, and clarified CO2 demonstrated gastric varices (GV) more clearly than iodine contrast. However, the physiological properties of CO2 and foam are different. Thus, we compared the visualisation of them under DSA.

Methods and Materials: For fifteen patients with GV, BRTV using iodine contrast were performed first and then CO2 second. These BRTV were repeated after changing patient’s habits, the catheter positions or downgraders. When GV were opacified on CO2-BRTV, foam sclerosants were injected. Each visualisation grade of GV (grade 1; GV only, 2; GV>collaterals, 3; GV<collaterals, 4; collaterals only) was determined by two observers. C-arm CT was performed to confirm the reach of air into GV.

Results: Thirty-four pairs of BRTV were performed for fifteen patients. The grades on CO2-BRTV (1.8±0.8) were significantly (p < 0.01) smaller than the grades on iodine-BRTV (3.3±0.9). On the other hands, the grades on foam-BROTO (1.1±0.4) are similar to the last grades on CO2-BRTV (1.1±0.4), while significantly (p < 0.01) different from the last grades on iodine-BRTV (3.1±1.0). In all patients GV were opacified by foam on C-arm CT and complete thrombosis of GV was obtained without any complications.

Conclusion: CO2-BRTV visualised GV better than iodine-BRTV and provided a good simulation of BROTO using foam sclerosants leading successful thrombosis of GV.

B-0038 11:33
Retrieval of covered stent in the treatment of benign biliary strictures: intermediate-term outcomes
C. Kim, D. Gwon, G.-Y. Ko, K.-B. Sung, H.-K. Yoon, J. Shin, J. Kim, H.-Y. Song; Seoul/KR (cherynkim@dreamwiz.com)

Purpose: To investigate the intermediate-term outcomes of a retrievable covered stent in the treatment of benign biliary strictures.

Methods and Materials: From April 2007 to February 2010, 33 patients with benign biliary strictures were enrolled in this study. Seventeen patients had not previously undergone interventional treatment. Sixteen patients had recurrent or refractory strictures despite prolonged catheter interposition after balloon dilation procedures. The retrievable stent was fully PTFE (polytetrafluoroethylene)-covered, self-expandable nitinol stent. Technical success, clinical success (drainage catheter removal after percutaneous treatment using a retrievable stent), and primary patency rate were evaluated.

Results: A total of 49 retrieval-covered stents were placed due to stent migration (n=5, 15%) or persistent stricture (n=27, 21%) after 1-3 sessions of stent removal procedures. The stents were successfully placed and removed in all cases. The mean stent indwelling period was 2.8 months (range, 1-6 months). Clinical success was achieved in 30 patients (91%). During the mean follow-up of 27.5 months (range, 13.3-48 months), three of 30 patients had recurrence of clinically significant strictures. The primary patency rates at 1, 2, and 3 years were 87%, 83%, and 63%, respectively.

Conclusion: Intermediate-term outcomes indicate that percutaneous treatment of benign biliary strictures using a retrievable covered stent appears to be feasible and clinically effective method.

B-0039 11:42
Percutaneous Y-configured covered stent placement for malignant hilar biliary obstruction: a prospective pilot study
S. Seo, D. Gwon, G.-Y. Ko, K.-B. Sung, H.-K. Yoon, J. Shin, J. Kim, H.-Y. Song; Seoul/KR (almdsdl@hanmail.net)

Purpose: To investigate the technical and clinical safety and efficacy of percutaneous Y-configured covered stent placement in patients with malignant hilar biliary obstruction.

Methods and Materials: This is a prospective, pilot study that enrolled 20 consecutive patients with malignant hilar biliary obstructions from October 2009 to December 2010. This study was approved by the Institutional Review Board of our Institution and informed consent was obtained from each patient. All patients were treated with percutaneous transhepatic placement of partially ePTFE (expanded polytetrafluoroethylene)-covered stents in a Y configuration.

Results: Bilateral Y-configured covered stent deployment was technically successful in all patients. Minor complications including procedure-related complications (self-limiting haemobilia [n=1] and rapidly resolving cholangitis [n=3]) occurred in four patients (20%). Bilirubin level decreased significantly following stent placement (p < 0.001). Median patient survival and stent patency times were 218 days (95% confidence interval [CI], 112-324 days) and 375 days (95% CI, 55-695 days), respectively. Seven patients (35%) presented with stent occlusion due to sludge incrustation (n=6) and tumour overgrowth (n=1), and required repeated PTBD. Tumour ingrowth, acute cholecystitis or stent migration was not observed in any of these patients.

Conclusion: The preliminary results of percutaneous palliative treatment of malignant hilar biliary obstruction with Y-configured covered stents suggest that they are safe and clinically effective.

B-0041 10:30
Impact of exercise on bone mineral density
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Purpose: To assess the impact of caloric restriction diet versus caloric restriction diet in addition to aerobic exercises on bone mineral density in obese women.

Methods and Materials: Forty obese women were classified randomly into two groups equal in number. The first group received caloric restriction diet, while the second received caloric restriction diet in addition to a program of aerobic exercises, over 3 months. The variables measured included body mass index, fat weight, lean mass, basal metabolic rate, and bone mineral density.

Results: Comparison between both groups showed significantly higher post-treatment lean mass, basal metabolic rate, and bone mineral density in weight-bearing bones (tibial spine and hip) in the second group compared to the first one. On the other hand, the bone mineral density of the radius showed significant decrease between the pre- and post-treatment results in both groups with no significant differences between the two groups.

Conclusion: Significant increase in the bone mineral density of the weight-bearing bones was noted in obese women undergoing caloric restriction in addition to aerobic exercises than in those not undergoing exercises. Aerobic exercises should be added to weight loss programs for obese women to reduce the adverse effects of caloric restriction diet on bone mineral density.

B-0042 10:39
Quantitative ultrasound at the phalanges in a cohort of twins of different ages
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Purpose: Preliminary study of bone tissue quality by quantitative ultrasound (QUS) at the phalanges in twin children and adults.

Methods and Materials: 129 twin couples of healthy children under 18 years of age (N=42) and of adults (N=87) in the age range 19-71 years were recruited for QUS measurement at the phalanges. Anthropometric data (sex, age, height, and weight) were recorded, together with amplitude-dependent speed of sound (AD-SoS) and bone transmission time (BTT).

Results: Mean age in children group was 11.6±5.2 yrs, height 143±29 cm, weight 41±19 kg. Mean age in adult group was 31.2±12.5 yrs, height 170±9 cm, weight 62±12 kg. In children, AD-SoS and BTT were positively correlated with age (r=0.91, r=0.91), height (r=0.88, r=0.90) and weight (r=0.81, r=0.87); in adults AD-SoS was negatively related to age (r=-0.36), AD-SoS and BTT were positively related to height (r=0.37, r=0.58). Correlation coefficients for AD-SoS and UBPI between coupling of twins are significantly higher for children (r=0.985 for AD-SoS and r=0.987 for BTT) than for adults (r=0.882 for AD-SoS and r=0.920 for BTT). The absolute value of the differences between twins for AD-SoS and BTT is significantly higher in adult twins
B-0043 10:48
Bariatric surgery and radiologists: besides complications, an important role in the evaluation of treatment efficacy and effects

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Purpose: Bariatric surgery is the most effective way of controlling severe obesity and its medical comorbidities. Our aim was to investigate the impact of bariatric treatment on body composition (BC) and bone metabolism over a period of 24 months following the surgical intervention and to determine the role of dual energy x-ray absorptiometry (DXA) in the management of obesity.

Methods and Materials: We prospectively enrolled 22 female patients (46.5±8.0 years, BMI 47±7.3 kg/m²) who underwent vertical banded gastroplasty (VBG) with or without a jejuno-ileal bypass. Whole body and lumbar spine DXA scans were obtained before treatment and after 3-6-12 and 24 months. BC parameters were assessed (fat mass-FM; lean mass-LM; bone mineral content, and density-BMD) on vertical and horizontal scans. All patients underwent whole body and lumbar spine DXA scans before treatment and after 3-6-12 and 24 months. BC parameters were assessed (fat mass-FM; lean mass-LM; bone mineral content, and density-BMD) on whole body and regional-basis. Thus, differential rates of mass and BMD changes were calculated to define the trend in the overall weight loss.

Results: Body mass index decreased in the first 12 months and grew steadily between 12 and 24 months (p < 0.05). A decrease of FM/LM ratio was observed in both total and android region at 12 months (FM/BLM), while slightly increased between 12 and 24 months (FM/BLM). Similar trend was observed for central and peripheral fat distribution ratio (Δ=3.9%±1.7% and Δ=6.1%±2.3%, respectively; p < 0.05). A reduction of total and lumbar BMD was observed at 12 months, even stronger at 24 months compared to pre-treatment values (Δ=-3.9%±1.7% and Δ=-1.4%±1.3%, respectively; p < 0.05).

Conclusion: BC and bone metabolism are significantly modified after bariatric surgery. DXA is fundamental in the investigation of patients submitted to surgical treatment for morbid obesity and in their clinical management.

B-0044 10:57
Fat fraction and T2* values of vertebral bone marrow utilising a new fat separation MR technique in peri-menopausal women: comparison with bone mineral densitometry

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Purpose: To use fat fraction and T2* values to investigate bone mineralisation level using a new MR technique called “iterative decomposition of water and fat with echo asymmetry and least squares estimation quantification” in peri-menopausal women.

Methods and Materials: Between October and December 2010, 45 (mean age, 40.4 years, max; 64, min; 28) consecutive patients who agreed to undergo MRI and who had a spinal dual energy x-ray absorptiometry (DEXA) examination constituted the study population. 3D fast gradient recalled echo (FGRE) pulse sequence with six asymmetric echoes was used. Fat fraction and T2* values were measured from L1-L4 vertebrae by placing ROIs. Depending on t-scores derived from BMD, vertebrae were classified into 3 groups (1, normal; 2, osteopaenia; 3, osteoporosis). One-way ANOVA or Welch ANOVA was performed to compare the differences among groups. The ability of fat fraction for the prediction of osteoporosis/osteopaenia was evaluated by ROC analysis.

Results: For fat fraction, the mean values were found to be different in three groups (P<0.001). Group 1 had the highest fat fraction (7.3%) and Group 3 the lowest (2.4%). The area under ROC curve for fat fraction was 0.80 (95% CI, 0.72-0.86). The optimal cut-off point was obtained as 39%. For this, sensitivity and specificity of fat fraction were 80% and 66%, respectively. For T2* there was no statistically significant difference between the groups (P=0.155).

Conclusion: It is possible to estimate the level of bone mineralisation by quantification of the fat fraction with the new MR technique with an acceptable sensitivity and specificity levels.

B-0045 11:06
Scaling relations between trabecular bone mass and 3D microstructure in two locations of the human femur

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Purpose: To investigate possible site-differences of bone mass-microstructure scaling relations that may be related to different loading conditions according to Wolff's law of bone remodelling.

Methods and Materials: Cylindrical bone specimens with a diameter of 8 mm were harvested from human femora. Eighty-eight specimens were taken from the femoral neck and 126 specimens from the greater trochanter. 3D micro-CT images with isotropic spatial resolution of 26 micrometre were obtained. Bone mass (BV/TV) of each specimen was calculated. To determine the local structure of the trabecular network as well as its alignment with the direction of the external force acting on the bone, anisotropic and isotropic scaling indices (alpha-z) were computed. Then the moments of the distribution (mean: μ; variance: σ) of the isotropic and anisotropic scaling indices were calculated. Scaling exponents were determined as the slope of a linear fit in the double-logarithmic representation of the correlations of BV/TV against the moments of the distribution of the scaling indices.

Results: All correlations obeyed very accurately power laws with scaling exponents of 0.48 and 0.45 (alpha), -1.45 and -1.59 (var (alpha)), 0.50 and 0.44 (alpha-z), and -1.47 and -1.32 (var (alpha-z)) (neck and trochanter, respectively). Thus, bone mass-microstructure scaling relations of the bone probes taken from two different sites of the femur showed surprisingly small variations.

Conclusion: In the femur, trabecular bone mass-microstructure scaling relations may have a rather universal character and do not depend so much on the type of external mechanical forces.

Scientific Session

B-0047 11:15
Quantitative analysis of perfusion parameters in osteoporotic patients with acute vertebral fracture using dynamic contrast-enhanced MRI

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Purpose: To evaluate the potential of quantitative dynamic contrast-enhanced MRI (DCE-MRI) in vertebral bone marrow (vBM) of patients with osteoporosis and acute vertebral compression fractures.

Methods and Materials: 26 patients with acute fractures (16 females, 10 males, median age 72, range 48-89) and 10 subjects without known history of osteoporosis (6 females, 4 males, median 65, 31-77) were examined using two-dimensional DCE-MRI. ROI-Data in fractured (n=26) and normal appearing vertebrae (n=27) were analysed with a two compartment tracer-kinetic-model, providing estimates of at least 3 independent parameters: plasma flow (PF), plasma volume (PV) and extraction flow (EF). Parameters were correlated with dual x-ray absorptiometry (DXA) (n=15) and quantitative computed tomography (QCT)-densitymetry (n=10).

Results: Mean PF was significantly higher in fractures than in normal appearing vertebrae (69.37 vs 11.7 mL/100 mL/min, p<0.001). Similarly, mean PV and EF differed significantly (24.29 vs 4.49 mL/100 mL and 10.42 vs 0.06 mL/100 mL/min). Mean PF was significantly decreased in normal appearing vBM of osteoporotic patients compared to the control group (11.72 vs 17.55 mL/100 mL/min, p = 0.008). Mean values of PF and PV were significantly decreased in lumbar compared to thoracic vertebrae (p<0.002). PV showed a significant correlation with QCT (p = 0.002).

Conclusion: DCE-MRI is useful to differentiate normal appearing vBM in osteoporotic patients from healthy subjects, as well as acute compression fracture. Furthermore, it may serve as a tool to grade osteoporosis.

B-0048 11:24
Role of diffusion-weighted whole body MRI with background body signal suppression (DWIBS) for disease detection in patients with multiple myeloma: preliminary results

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Purpose: To assess the overall diagnostic capability of whole body MRI with DWIBS technique, combined with standard T1 and T2* sequences, for detection of bone marrow lesions in patients with multiple myeloma (MM).

Methods and Materials: 45 patients with MM underwent 1.5 T (Achieva, Philips) WB-MRI study from skull vertex to feet, using a built-in-body coil and stepping
Methods and Materials: the protocol consisted of coronal and sagittal short tau inversion recovery (STIR) T2, T1 TSE and axial DWIBS sequences, in order to characterise bone involvement in terms of pattern, size and distribution. DWIBS images matrix compared with T1 and STIR image in five districts: skull; spine; sternum and ribs; pelvis; upper and lower limbs), in patients with focal (23), diffuse (16) or combined (8) disease. All patients were clinically staged according to Durie and Salomon System. Results: In focal and combined disease, 165 focal bone lesions were detected; 159 (98%) were correctly identified with T1/T2 sequences and 150 (95%) with DWIBS alone. In patients with diffuse disease DWIBS always showed homogeneously increased signal intensity within the bones involved, with greater sensitivity in demonstrating widespread involvement of bone marrow than T1/T2 sequences, due to their inhomogeneous alteration of intensity signal. 7 patients were correctly staged as diffuse disease with DWIBS, while T1 and T2 sequences showed focal or combined disease.

Conclusion: WB-MRI with DWIBS sequences in patients with MM appears to be technically feasible and a promising, non-invasive tool for early detection and characterization of bone marrow lesions, particularly in widespread form.

**B-0049** 11:33
Diagnostic value of whole body low-dose computed tomography (WB-LDCT) in the staging of patients with multiple myeloma

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Purpose: To assess the role of whole body low-dose computed tomography (WB-LDCT) in the diagnosis and staging of patients with suspicion of multiple myeloma (MM).

Methods and Materials: A total of 138 patients, with early multiple myeloma, underwent unenhanced whole body low-dose CT protocol study, performed on 16-slice scanner (Philips, Brilliance, 16P): tube voltage 120 kV; tube current time product 40 mAs; collimation 16 x 0.75. All the patients were clinically staged according to Durie and Salmon System. Diagnosis of osteolytic lesions was performed on the basis of axial and multiplanar reformatted images, whereas the assessment of spinal misalignment and fracture was done using multiplanar reformatted images.

Results: In all 138 patients, image resolution was diagnostic, allowing correct classification of multiple myeloma patients. WB-LDCT showed a total of 328 pathologic bone findings in 81 patients. CT scanning resulted in complete evaluation of the bone lesions in these areas of the skeleton: skull (42), humerus (15), femur (20), ribs (7), scapulae (13), pelvis (35), clavicle (13), sternum (10), cervical (39), dorsal (65), lumbar (48) and sacral rachis (21). In 40 patients the CT detection of bone involvement was the only criterion for the treatment. Furthermore, in 19 patients WB-LDCT scanning demonstrated pulmonary or pleural lesions (11 cases due to infective source and 7 cases due to multiple myeloma localisations) and 1 case of renal neoplasia as a related pathology. The overall dose delivered to each patient was 3.2 mSv.

Conclusion: Whole body low-dose CT investigational protocol is a reliable imaging-based method for the direct management of patients with multiple myeloma. WB-LDCT has a superior reproducibility and it is faster than conventional radiography, being, furthermore, able to demonstrate extracranial findings.

**B-0050** 11:42
Quantitative assessment of perfusion and permeability in osteochondritis dissecans lesions: feasibility and initial results

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Purpose: While the exact pathophysiology of osteochondritis dissecans (OCD) has not yet been clearly understood, determination of the best management of the condition still remains continuously discussed [O’Loughlin 2010] [Kocher 2006]. Purpose of this study was to evaluate the feasibility of I) detection II) quantitative assessment III) monitoring of perfusion and permeability in OCD lesions by 3D DCE-MRI.

Methods and Materials: 14 (mean age 15y) patients with OCD of the medial femoral condyle/the medial talar dome (n=6/8) underwent DCE-MRI at 3 T (Magnetom-Vision; Siemens-Aclarations-Medical-Solutions-Germany) using a view-sharing 3D-GE-sequence (TE/TR=16/78 ms, flip angle=15°, spatial resolution=0.5x0.5x3.0 mm, matrix size=256x256x16, temporal resolution=3.0s) after bolus injection of 0.2 mmol/kg Gd-DTPA. 3 patients obtained follow-up scan after an average of 4.5 months. The AIF was measured in the popliteal artery (knee)/in the anterior tibial artery (ankle). ROIs in OCD lesions were drawn on AUC-maps; haemodynamic parameters in these regions were determined using a 2-compartment-exchange-model, yielding estimates of plasma flow (PF), plasma volume (PV), permeability surface product (PS) and interstitial volume (VEE) [Sourbron 2009].

Results: In all patients, OCD lesions were clearly visible on the AUC-maps and showed strongly elevated perfusion and permeability. Median values (SD) were: PF=68 (54.5)/100 ml/min, PV=15.2 (8.4)%; PS=11.4 (6.4)/100 ml/min and VEE=16.0 (8.5)%. The 3 follow-up-scans indicated a decrease of the median PV from 15% to 8%.

Conclusion: Our study shows the feasibility of DCE-MRI to I) detect OCD lesions, II) quantify perfusion and permeability using a 2-compartment model and III) reveal changes of PV in different disease stages. This quantitative approach provides additional information on the pathophysiology of the condition, might influence disease management and could offer a non-invasive means of therapy monitoring.

**SS 101a**
Crohn’s disease and intestinal inflammation

Moderators: A. Gupta; London/UK
S. Romano; Naples/IT

**B-0051** 10:30
MR perfusion of normal small bowel


Purpose: To determine the feasibility of quantitative analysis of small bowel perfusion using dynamic contrast-enhanced MRI (DCE-MRI) and compare perfusion patterns of jejunum and ileum.

Methods and Materials: Six normal subjects were prospectively enrolled under MR-enterography. Regions of interest were drawn over the jejunum, ileum and terminal ileum (TI) to calculate the volume transfer constant (K-trans) and extravascular extracellular space (Ve). The difference between the small bowel regions was assessed using paired t-test.

Results: The jejunum demonstrates earlier and more intense enhancement compared to the ileum and TI. The mean K-trans (min-1) at the jejunum, ileum and TI, respectively, were 0.97±0.23, 0.34±0.14, and 0.41±0.11. The mean Ve (%) at the jejunum, ileum and TI, respectively, were 0.23±0.08, 0.13±0.04, and 0.15±0.05. The K-trans was significantly higher in the jejunum compared to the ileum (P < 0.005) and TI (P < 0.007). The Ve was significantly higher in the jejunum compared to the ileum (P < 0.005) and TI (P < 0.003). There was no significant difference between the ileum and TI in K-trans and Ve (P=0.3 and 0.6, respectively).

Conclusion: DCE-MRI is a feasible method for quantitative analysis of small bowel perfusion. The jejunum demonstrates earlier and more intense enhancement compared to the ileum. Better understanding of small bowel perfusion is important for accurate identification of diseased segments.

**B-0052** 10:39
Dark lumen bowel MRI in patients with Crohn’s disease: two-step whole intestinal preparation with polietilenglicol

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Purpose: The dark lumen technique (MRE and MRC) is an excellent modality for small bowel assessment in patients with IBD, but it can cause discomfort for patients. We propose an alternative method to distend and evaluate both small and large bowel by applying the dark lumen technique: 2 time polietilenglicol (PEG) administrations.

Methods and Materials: 158 patients with known CD were asked to drink twice 1.5 L of PEG solution: 2-4 hours and during 45 minutes before MR examination. A biphasic-lumen MR (1.5 T scanner) examination was performed: on axial and coronal planes we obtained T2- and T1-weighted sequences before and after i.v. dynamic administration of gadolinium. Scanner Time was ~23 min (range: 21-28 min). Grading of bowel distension, cleansing and parietal contrast (achieved in 125/158 pts), in 169 sick segments MR enterography. Regions of interest were drawn over the jejunum, ileum and terminal ileum (TI) to calculate the volume transfer constant (K-trans) and extravascular extracellular space (Ve). The difference between the small bowel regions was assessed using paired t-test.

Results: The jejunum demonstrates earlier and more intense enhancement compared to the ileum and TI. The mean K-trans (min-1) at the jejunum, ileum and TI, respectively, were 0.97±0.23, 0.34±0.14, and 0.41±0.11. The mean Ve (%) at the jejunum, ileum and TI, respectively, were 0.23±0.08, 0.13±0.04, and 0.15±0.05. The K-trans was significantly higher in the jejunum compared to the ileum (P < 0.005) and TI (P < 0.007). The Ve was significantly higher in the jejunum compared to the ileum (P < 0.005) and TI (P < 0.003). There was no significant difference between the ileum and TI in K-trans and Ve (P=0.3 and 0.6, respectively).

Conclusion: DCE-MRI is a feasible method for quantitative analysis of small bowel perfusion. The jejunum demonstrates earlier and more intense enhancement compared to the ileum. Better understanding of small bowel perfusion is important for accurate identification of diseased segments.
Conclusion: The combination of MRE and MRC allows a complete assessment of inflammation in small and large bowel in patients with CD, requiring minimal effort to patient. So whole bowel assessment with "2 steps" distension is feasible, satisfying, does not require any particular preparation or retrograde manual colon distension and it lacks of ionising radiation.

**B-0053** 10:48

Diffusion-weighted MR imaging of acute appendicitis in paediatric patients: comparison with conventional MRI and surgical findings

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**Purpose:** The aim of this study is to determine the value of diffusion-weighted magnetic resonance imaging for the diagnosis of acute appendicitis in paediatric patients.

**Methods and Materials:** Forty-five consecutive patients with a clinical diagnosis of acute appendicitis underwent abdominal MRI; 36 were operated on for acute appendicitis. First, the DWI alone was reviewed, followed by conventional MRI alone, and then conventional MRI and DWI were reviewed by two observers. The surgical findings were compared with the MRI results. Sensitivity, specificity, and accuracy were calculated for DWI, conventional MRI, and combined DWI and conventional MRI for the depiction of acute appendicitis.

**Result:** A combination of DWI and conventional MRI was the most sensitive and the most accurate, with corresponding sensitivity and accuracy for observers 1 and 2 (sensitivity of 0.91 and 0.88, respectively; accuracy of 0.92, 0.87, respectively).

Using DWI alone the sensitivity was found to be 0.86 and 0.83, and accuracy of 0.84 and 0.82, for observers 1 and 2, respectively. Using conventional MRI alone, sensitivity of 0.80 for both, and accuracy of 0.84 and 0.82, was found, respectively, for the two observers. The accuracy of the depiction of acute appendicitis was superior using the combination of DWI and conventional MRI for both observers.

**Conclusion:** The use of combination of DWI and conventional MRI is a valuable technique in the diagnosis of acute appendicitis, especially in children after sub-optimal or nondiagnostic sonography.

**B-0054** 10:57

MRI-derived small bowel motility as a marker of disease activity in Crohn’s disease using a histopathological standard of reference

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**Purpose:** To investigate the relationship between software-derived small bowel motility index and histopathological grading of Crohn’s disease activity.

**Methods and Materials:** A software solution designed to quantify bowel wall motion was applied to coronal breath hold cine FISP sequence (20 second breath hold, TR 4 ms, TE 1.7 ms, slice thickness 10 mm, 1 slice/0.8sec) through the terminal ileum (TI) in 27 Crohn's disease patients (15 females, mean age 32) undergoing standard MR enterography. The previously validated software uses non-rigid registration to track intensity changes over time using a manually placed linear region of interest within the bowel, providing automated estimation of bowel wall displacement, expressed as the standard deviation of jacobian determinant (motility index). All patients underwent subsequent colonoscopy and TI biopsy within a mean of 7 days. Histopathological grading of TI activity was undertaken by two experienced pathologists who derived an endoscopic acute inflammatory score (eAIS), based on the presence of ulceration, neutrophils in the lamina propria, cryptitis, crypt abscess formation, inflammatory exudates and granulomas (1 ‑ present, 0 ‑ absent). The MRI motility index was correlated with the eAIS using Kendall’s rank correlation.

**Results:** The mean motility index and pathology score was 0.29 (range 0.07-0.56), and 2 (range 0-5), respectively. There was a statistically significant negative correlation between the motility index and activity score (Kendall tau -0.32, p=0.03).

**Conclusion:** Quantified small bowel motility is negatively correlated with histopathological scores of disease activity suggesting it may be used as a quantitative marker of inflammation.

**B-0055** 11:06

Proposal of a qualitative MRI activity index for Crohn's disease

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**Purpose:** To propose a MRI activity index for Crohn’s disease (CD).

**Methods and Materials:** 50 patients with CD underwent ileocolonoscopy (gold standard) and MR Enterography. Endoscopic (CDEIS), biological (BA) and clinical activity (CDAI) were assessed and scored 0-3 (absent, low, definitely present, marked activity). Three activity MRI parameters were qualitatively scored 0-3:

- wall oedema (a) mesenteric oedema (b) on T2-w images; GD-enhancement on T1-weighted images (c). Two quantitative parameters were assessed: presence and number of lymph nodes (d), wall thickening (4-6 mm, 7-10 mm, > 10 mm) (e). These 5 parameters produced a basic activity score ranging between 0 and 15: 0-2 suggesting inactivity; 3-5 low activity; 6-12 activity. 13-15 high activity. This score was correlated with CDEIS, BA and CDAI. It was further multiplied for a factor 1.5 or 2 according to the length of the affected segment (length >30 cm or > 50 cm), obtaining a length-activity score (B); then for a factor 1.5 to 2 in the presence of fistulas, abscesses or perianal disease, in relation to their extent and severity, providing a complication-activity score (C). A final integrated MRI score (D) ranged 0-60.

**Results:** Significant correlation between basic score and CDAI (r=0.75), CDEIS (r=0.87) and BA (r=0.74) p < 0.0001 was obtained. High correlation (r=0.89) was obtained between complication-activity score and B, good correlation between length-activity score and CDEIS (r=0.80).

**Conclusion:** The basic MRI activity index correlated with clinical and endoscopic activity. Integrated scores (B, C, D) correlated with BA or endoscopy.

**B-0056** 11:15

MR activity assessment in Crohn’s disease of the terminal ileum: free-breathing diffusion-weighted imaging (DWI) and dynamic motility evaluation as a possible alternative to MR with intravenous contrast agent

I. Sansoni, C. L. Piccolo, F. Pitocco, R. Del Vescovo, M. Cicala, B. Beomonte Zobel; Rome/IT

**Purpose:** Contrasted-enhanced dynamic MR-enterography (D-CE-MRE) is an accepted method to assess Crohn’s disease (CD) activity; it needs for gadolinium contrast materials. Recently, diffusion-weighted MR imaging (DWI) and its related ADC map have been used in multiple clinical condition including bowel study and Crohn’s disease activity. Our aim is to investigate the value of free-breathing DWI MR imaging in the assessment of small bowel CD activity.

**Methods and Materials:** 77 patients with terminal ileum CD underwent MR ex- amination after bowel oral distension with polyethylenglycol solution. We based MR-assessment of disease activity on morphology and motility of small bowel and perivisceral structures (true-FISP, cine-true-FISP, HASTE T2W sequences), perianal signal intensity in DWI and dynamic assessment of perianal contrast enhancement (FLASH T1W-sequence). Patients were divided into three categories (negative, inactive, active disease), basing on endoscopic biopsy as the standard reference (38 cases); whole of clinical findings and MRI sequences (24 cases).

**Results:** On DWI, Inflammatory bowel tracts showed higher signal compared to normal segments (accuracy: 89.1%, sensitivity: 89.7%, specificity: 88.2%, PPV: 92.9%, NPV: 83.3). ADC value in active disease was lower than in inactive disease (negative: 1.9x10⁻³±0.3x10⁻³ mm²/s, inactive: 1.38x10⁻³±0.26x10⁻³ mm²/s, active: 1.08x10⁻³±0.22x10⁻³ mm²/s). In all patients a complete MR examination allowed to perform a detailed and panoramic evaluation of small bowel.

**Conclusion:** Cine-MR mode adds suitable functional information about motility of affected loops and condition of proximal loops. Free-breathing-DWI is useful in visual assessment of CD activity; ADC values may facilitate quantitative analysis of disease activity, decreasing in inflamed bowel segments, because of restricted diffusion.

**B-0057** 11:24

Non-invasive assessment of bowel wall fibrosis in Crohn’s disease: role of the qualitative elastographic imaging (EI) and correlation with baseline (US), colour Doppler (CD-US) and contrast-enhanced ultrasound (CE-US) patterns

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**Purpose:** To correlate the ultrasonographic scores for morphologic (US), vascular (CD-US) and perfusion (CE-US) patterns with a new qualitative elastographic evaluation (FLASH T1W-sequence). Patients were divided into three categories (negative, inactive, active disease), basing on endoscopic biopsy as the standard reference (38 cases); whole of clinical findings and MRI sequences (24 cases).

**Results:** On DWI, Inflammatory bowel tracts showed higher signal compared to normal segments (accuracy: 89.1%, sensitivity: 89.7%, specificity: 88.2%, PPV: 92.9%, NPV: 83.3). ADC value in active disease was lower than in inactive disease (negative: 1.9x10⁻³±0.3x10⁻³ mm²/s, inactive: 1.38x10⁻³±0.26x10⁻³ mm²/s, active: 1.08x10⁻³±0.22x10⁻³ mm²/s). In all patients a complete MR examination allowed to perform a detailed and panoramic evaluation of small bowel.

**Conclusion:** Cine-MR mode adds suitable functional information about motility of affected loops and condition of proximal loops. Free-breathing-DWI is useful in visual assessment of CD activity; ADC values may facilitate quantitative analysis of disease activity, decreasing in inflamed bowel segments, because of restricted diffusion.

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scores to assess layer (1 - 5), vascularisation (1 - 4), intraparietal or transparietal enhancement (1 - 4), characteristics, respectively, were used. We defined a new score of fibrosis comparing abdominal and bowel wall stiffness (1 - 4). Correlation between EI score and US, CD-US, CE-US scores were evaluated with the non-parametric Spearman rank test.

**Results:** Elastographic score was significantly correlated with US score (p=0.0001) and qualitative CE-US score (p < 0.0001). Significant correlation neither with CD-US nor with PEAK, TTP and RBV were obtained with Quantrast.

**Conclusion:** The introduction of dedicated US software for elastographic assessment of fibrosis can improve the US diagnosis in the assessment of fibrotic versus inflammatory involvement in CD.

### B-0058 11:33

**Magnetic resonance imaging is correlated with faecal calprotectin level in the evaluation of small bowel and colonic Crohn’s disease**


**Purpose:** Therapeutic strategy in Crohn’s disease requires knowledge of the overall disease burden. A new MRI score of activity was tested against validated clinical reference standards reflecting global activity - Harvey Bradshaw index (HBI) and faecal calprotectin.

**Methods and Materials:** 27 patients (13 males) median age 33 (range 20-78) with known or suspected Crohn’s disease underwent standard 1.5 T MR enterography (axial and coronal HASTE, TrueFlip and post-gadolinium coronal VIBE), completed a HBI questionnaire and provided a stool sample for faecal calprotectin. Two observers qualitatively graded bowel wall thickness, mural T2 signal, mesenteric oedema, T1 enhancement, haustal loss (colon) from 0 (normal) to 3 (most abnormal) for jejunum, proximal ileum, terminal ileum and colon (divided into 6 segments). The length of disease in each segment was measured and the individual segmental score multiplied as follows: 0-5 cm x 1, 6-15 cm x 1.5, and >16 cm x 2. A score of 5 was added for each of the following if present: lymphadenopathy, comb sign, abscesses and fistulae. Kendall’s rank correlation was used to evaluate the relationship between MRI score, faecal calprotectin and HBI.

**Results:** The mean MRI score activity was 13 (range 0-49). A positive correlation was found between the MRI score and calprotectin, Kendall’s tau b=0.37 (95% CI 0.1 to 0.6) p=0.01. No correlation was found between MRI and HBI, Kendall’s tau b=0.01, p=0.9.

**Conclusion:** Global Crohn’s disease’s activity measured using a simple clinical MRI score is correlated with the faecal calprotectin level. MRI is useful for the global assessment of disease activity in Crohn’s disease.

### B-0059 11:42

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

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**Purpose:** To assess the value of small bowel wall vascularity after microbubble contrast agent injection to differentiate inflammatory from fibrotic stenoses in patients with Crohn’s disease.

**Methods and Materials:** Fifteen patients (7 males and 8 females; mean age ± SD, 40 years ± 6) with a biopsy-proven diagnosis of Crohn’s disease - Crohn’s disease activity index (CDAI) > 150 (n=12 patients) or < 150 (n=3) - involving at least one ileal loop (wall thickness measured by unenhanced US, > 5 mm) were included. In each patient the terminal loop was scanned by contrast-enhanced ultrasound (CEUS) after sulphur hexafluoride-filled microbubble injection, and digital cine-clips (30 seconds) were stored in DICOM format. The vascularity of the terminal loop was quantified in grey-scale levels (0-255) by a manually drawn ROI encompassing the thickened bowel wall and it was correlated with CDAI. The percentage of enhancement compared to baseline, the time to peak enhancement, and the area under curve were calculated.

**Results:** All patients revealed diffuse transparietal contrast enhancement after microbubble injection, except for 3 patients with fibrotic stenosis who revealed contrast enhancement limited to the submucosa. In inflammatory stenoses, the quantitative analysis of bowel wall hypervascularity on CEUS may differentiate inflammatory from fibrotic stenoses in patients with Crohn’s disease.

### B-0060 11:51

**Low-dose CT in initial evaluation of Crohn’s disease in the emergency setting? Toward replacing the PFA**

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**Purpose:** Crohn’s disease (CD) patients are “at risk” for exposure to significant cumulative effective doses of radiation from diagnostic imaging studies. The purpose of this study is to compare the diagnostic yield of low dose CT (LDCT) with iterative reconstruction to that of conventional plain film of abdomen (PFA).

**Methods and Materials:** Following ethical approval, 50 patients with CD referred for clinically indicated CT abdomen/pelvis (CTAP) were prospectively recruited to undergo additional LDCT at time of CTAP. Of these, 34 patients had a contemporaneous PFA (within 24 hrs of CT) (male:female; 13:21; mean age, 37 years, range 19-39; mean BMI 24.6 kg/m2, range 17.4-35.5). The effective dose (ED) in mSv for each LDCT was calculated, 2 radiologists, in consensus, reviewed the LDCT images and the PFAs (9 months later) with a validated Crohn’s-specific coding system.

**Results:** The mean ED for LDCT was 1.21±0.7mSv (range, 0.46-3.2mSv) (p < 0.001), a mean dose reduction of 74% from conventional CT, without loss of diagnostic utility. The mean ED for BMIs ≥ 25kg/m2 was 8.8±0.2mSv and for BMIs >25kg/m2 was 1.8±0.7mSv. The approximate mean ED of a PFA is 0.7mSv. There was agreement between PFA and LDCT in 4 patients only (no abnormal findings). Findings on LDCT missed on PFA included abscesses (n=3), obstruction (n=5), colitis (n=13) and enteritis (n=18). LDCT detected more clinically significant incidental findings.

**Conclusion:** LDCT with iterative reconstruction yielded far superior diagnostic information than PFA at an ED that approximates to 1-2 PFAs. LDCT may represent a feasible replacement for initial PFA, imparting very little additional radiation exposure.

SS 107

**Prostate MR imaging**

Moderators: J.J. Fütterer; Nijmegen/NL
J. Richenberg; Brighton/UK

**B-0061 10:30**

**Functional prostate MRI: evaluation of a scoring system**

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**Purpose:** Functional prostate MRI is performed in varying combinations of T2-weighted images with diffusion-weighted imaging (DWI), dynamic contrast-enhanced MRI (DCE-MRI) and spectroscopic imaging (MRSI). Recently, a European consensus meeting proposed the use of a simple 5-point scale for estimating the probability of a lesion to be malignant. This recommendation has not been validated so far, which is the aim of the present study.

**Methods and Materials:** The appearance of 108 predefined lesions in three different MR sequences (T2-weighted images, DWI, and DCE-MRI) in 50 functional prostate MRI examinations have been retrospectively scored by three blinded radiologists using the 5-point scale for each MR sequence. After scoring T2/DWI and T2/DWI/DCE-MRI every lesion was graded based on its probability for malignancy. Inter-observer reliability was evaluated using Kappa statistics (k).

**Results:** With respect to T2-weighted images, DWI and DCE-MRI k were 0.5, 0.96, and 0.78, respectively. Combined scoring of T2-weighted images and DWI demonstrated correct tumour diagnosis (true positive) in 71%–88% (depending on reader) of cases (k=0.81). The accuracy was further improved to 88%-96% after scoring all three MR sequences including DCE-MRI (k=0.91).

**Conclusion:** The use of a simple 5-point scoring system for T2-weighted images, DWI, and DCE-MRI is feasible in functional prostate MRI and comes along with a high inter-observer reliability.
B-0062  10:39  Prostate cancer screening: the role of pre-biopsy MRI of the prostate in ruling out prostate cancer  
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Purpose: To evaluate the role of prostate magnetic resonance imaging (MRI) in patients with suspected prostate cancer.  
Methods and Materials: Ethics board approval was received for this retrospective analysis of prospectively acquired data. Ninety men (median age 66 years; median PSA 4.8 ng/ml) underwent combined endorectal/oblique phased-array coil 1.5-Tesla MRI before their first systematic 12-core biopsy with transrectal ultrasound (TRUS) guidance. MR images were analysed independently by three radiologists. The radiologists divided the prostate into 12 regions corresponding to the biopsy scheme and evaluated each region for the presence of cancer in a standardised manner using a 5-point scale. At statistical analysis, scores were dichotomised as benign (0–1) vs. malignant (2–5). Results were analysed by sextant. Receiver operating characteristic (ROC) analysis was done and descriptive statistics were calculated.  
Results: Systematic TRUS-guided 12-core biopsy found cancer in 48/90 patients (28 low-grade cancer (Gleason score = 3+3); 22 high-grade cancer (Gleason score ≥ 3+4)), and 185/1080 cores (76 low-grade cancer, 109 high-grade cancer). Areas under ROC curves were for the three readers by sextants 0.61±0.65 for overall prostate cancer detection and 0.64±0.72 for detection of high-grade cancer. Descriptive statistics for detection of all cancers/high-grade cancers by sextant were as follows: negative predictive value, 81.7%–83.0%/91.9%–92.4%; specificity, 73.2%–80.2%/73.1%–80.1%; sensitivity, 44.0%–50.8%/58.6%–64.3%; and positive predictive value, 35.7%–40.4%/28.8%–33.3%.  
Conclusion: In patients with suspected prostate cancer, negative MRI findings rule out high-grade prostate cancer on subsequent TRUS-guided 12-core biopsy with a high probability. However, sensitivity is low, and patients should undergo close follow-up.

B-0063  10:48  Prostate cancer: role of pretreatment multiparametric MRI in predicting biochemical recurrence following radical prostatectomy  
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Purpose: To retrospectively determine whether pretreatment multiparametric MRI findings can predict biochemical recurrence (BCR) in patients who undergo radical prostatectomy (RP) for prostate cancer.  
Methods and Materials: 282 patients (median age, 64 years; age range, 38-88 years) with biopsy-proven prostate cancer who received RP underwent pretreatment multiparametric MRI at 3 T, including T2, DWI and DCE-MRI images were analysed by two readers, included apparent tumour presence at T2WI+DWI, T2WI+DCEI, and T2WI+DWI+DCEI, extracapsular extension, seminal vesicle invasion and tumour size at DWI or DCEI. Clinical variables included pretreatment prostate-specific antigen (PSA), clinical T stage and Gleason score. Areas under ROC curves were for the three readers by sextants 0.61±0.65 for overall prostate cancer detection and 0.64±0.72 for detection of high-grade cancer. Descriptive statistics for detection of all cancers/high-grade cancers by sextant were as follows: negative predictive value, 81.7%–83.0%/91.9%–92.4%; specificity, 73.2%–80.2%/73.1%–80.1%; sensitivity, 44.0%–50.8%/58.6%–64.3%; and positive predictive value, 35.7%–40.4%/28.8%–33.3%.  
Results: After a median follow-up of 26 months, BCR developed in 61 patients (22%). Univariate analysis revealed that MRI and clinical variables were all significantly related to BCR (P < 0.01). Multivariate analysis revealed that pretreatment MRI findings were significant independent predictors for BCR. Apparent tumour presence at T2WI+DWI+DCEI was an independent predictor of borderline significance for BCR following RP, and pretreatment PSA and Gleason score are significant independent predictors for this endpoint.

B-0064  10:57  Assessment of aggressiveness and tumour volume of prostate cancer: correlation of ADC with histologic grade and pathological tumour volume  
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Purpose: To correlate apparent diffusion coefficient (ADC) values, tumour volume (TV) with Gleason score (GS) and pathological volume of prostate cancer (PCa) on whole mount radical prostatectomy (RP) specimens.  
Methods and Materials: 144 PCa, 97 in the PZ and 47 in the TZ were evaluated in 84 patients by endorectal prostate MRI at 1.5 T, including T2-weighted and diffusion-weighted MRI, before RP. MRI-tumour volume was compared to pathological findings of digitised slides of whole mount RP. Correlation between ADC values and GS was performed in the PZ and the TZ for tumours with no high Gleason grade (group1) versus tumours with 0–20 (group2), 30–50 (group3), and more than 50% of high Gleason grades (group4). TV were compared by the Bland-Altman test.  
Results: ADC values were not significantly different between groups 1 and 2 and between groups 3 and 4. When groups 1+2 versus groups 3+4 were compared, ADC values were significantly lower in group 3+4 (866a272vs1378a370, in the PZ and 828a251vs1153a5a2, p < 0.0001). Distinction between these two groups was achieved with a sensitivity of 78% and 84% and a specificity of 81% and 71%, respectively. Comparison of pathological with T2WI-MRI and DW-MRI tumour volume showed a mean difference of 15% (range-128%+157) and of 25% (range-91%+141), respectively. When both sequences predicted a TV>0.5 cc, concordance with the pathological volume was observed in 86% cases.  
Conclusion: Tumours with more than 20% of high Gleason cancers can be predicted by measurement of the ADC value. Concordance between TV on MRI and pathological volume was high for tumours<0.5 cc.

B-0065  11:06  Multi-parametric MR imaging for detection and localisation of transition zone prostate cancer  
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Purpose: To retrospectively determine detection and localisation accuracy for Gleason grade (GG) 2-3 and GG 4-5 transition zone (TZ) cancers of T2-weighted (T2WI) MR imaging (MRI) versus multi-parametric MR imaging (MP-MRI) using radical prostatectomy specimens (RP) as gold standard.  
Methods and Materials: Inclusion criteria were TZ cancer > 0.5 cm3 upon RP and 3 T endorectal MP-MRI (T2WI, diffusion weighted MRI + apparent diffusion coefficient maps (ADC) and dynamic contrast-enhanced MRI (DCE-MRI)). From 98 RP, 20 patients with TZ cancers were included. Twenty-two patients without TZ- with peripheral zone (PZ) cancer were randomly selected as control-group. Four radiologists randomly scored T2WI, T2WI+ADC, T2WI+DCE-MRI and T2WI+DCE-MRI with a two-week interval. T2 cancer suspicion was rated on a 5-point scale in 6 TZ regions of interest (ROI). A 4-5 score was a positive detection accuracy result. Localisation accuracy was analysed using ROI-ROC with generalised estimation equations.  
Results: Significantly more GG 4-5 (86-91%) versus GG 2-3 (28-47%) TZ cancers were detected (p < 0.001). Only for GG 2-3 TZ cancers detection accuracy was significantly improved by MP-MRI compared to T2WI (61% versus 44%, p=0.02). Using MP-MRI localisation accuracy was improved for GG 4-5 TZ cancers only (AUC: 0.94 for MP-MRI versus 0.91 for T2WI, p=0.02).  
Conclusion: Detection rates of GG 4-5 TZ cancers are significantly higher than those of GG 2-3 TZ cancers. MP-MRI compared to T2WI improves detection accuracy for GG 4-5 TZ cancers only. MP-MRI slightly improves TZ cancer localisation accuracy compared to T2WI.

B-0066  11:15  Retrospective correlation between pathological specimens and multiparametric MRI for detection of prostate cancer  
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Purpose: To understand causes of failure to identify cancer lesions.  
Methods and Materials: 42 patients with biopsy diagnostic of prostate cancer (PCa) underwent MRI examination at 1.5 T. T2WI and DCE-MRI images were analysed for the identification of PCa. On the basis of pathologic examination after surgery, MRI findings were reanalysed by an expert radiologist to evaluate MRI features of PCa missed at the first analysis.  
Results: Pathologic analysis found 87 PCa, 60 had a pathological volume >0.2 ml. Before prostatectomy MRI detected 45/60 lesions > 0.2 ml (sens.75%), 40/48 (sens.83%, mean ADC.0.82) in the peripheral zone (PZ) and 5/12 (sens.42%, mean ADC.0.69) in the transitional zone (TZ). Pathology-based MRI reanalysis allowed to recognise 54/60 PCa, 45/48 in PZ and 9/12 in TZ. The 5 missed lesions in PZ had smaller volumes (0.68±0.23 vs 1.7±1.59 ml). Among 9 missed lesions only one, localised in PZ, had an ADC> 1.1; 7/9 had and ADC values< 1 and 1/9 an ADC of 1.07. A mild hypointense lesion, interpreted as prostatitis, had a type1 T/I ADC:0.69) in the transitional zone (TZ). Pathology-based MRI reanalysis allowed to recognize 54/60 PCa, 45/48 in PZ and 9/12 in TZ. The 5 missed lesions in PZ had smaller volumes (0.68±0.23 vs 1.7±1.59 ml). Among 9 missed lesions only one, localised in PZ, had an ADC> 1.1; 7/9 had and ADC values< 1 and 1/9 an ADC of 1.07. A mild hypointense lesion, interpreted as prostatitis, had a type1 T/I signal.
0.66 and 0.6, respectively). A PZ lesion was missed for its linear shape (ADC < 1). 2/4 TZ lesions with low ADCs (mean 0.73) were interpreted as stromal adenomas.

Conclusion: We found many causes of diagnostic failure: hypovascularised lesions in PZ and TZ, thin lesions in PZ, gland inhomogeneity especially in TZ, lesions size, intermediate ADC values. MRI reanalysis identifies in ADC values the most accurate method to identify prostate cancer.

B-0067 11:24
Is it possible to model the risk of malignancy of focal abnormalities found at prostate multiparametric MRI?
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Purpose: To evaluate whether focal abnormalities (FAs) depicted by prostate MRI could be characterised using simple semiotic features.

Methods and Materials: 154 patients who underwent T2-weighted, diffusion-weighted and dynamic contrast-enhanced MRI at 1.5 T before prostate biopsy were prospectively included. FAs visible at MRI were characterised by experienced uro-radiologists using their shape, the degree of signal abnormality (0=normal to 3=maximally abnormal) on individual MR sequences, and a subjective score (SS1=probably benign to SS3=probably malignant). FAs were then biopsied under US guidance.

Results: 56/233 FAs were positive at biopsy. The subjective score significantly predicted biopsy results (p < 0.01). As compared to SS1 FAs, the odds ratios (OR) of malignancy of SS2 and SS3 FAs were 9.1 (1.8-55.9) and 163.8 (11.5-2331). The shape of FAs was not a significant predictor of biopsy results in the peripheral zone (PZ), its predictive value was not tested in the transition zone due to the small number of cases. In contrast, a simple combination of MR signal abnormalities (into “low-risk”, “intermediate” and “high-risk” groups) significantly predicted biopsy results (p < 0.008). As compared to “low risk” FAs, the OR of malignancy of “intermediate” and “high-risk” FAs were 4.5 (1.1-18.4) and 52.7 (6.8-407) in the overall population and 5.4 (1.1-27.2) and 118.2 (6.1-2301) in PZ. Conclusion: A simple combination of signal abnormalities of individual MR sequences can significantly stratify the risk of malignancy of FAs and give similar results to a subjective score assigned by expert uroradiologists. This holds promise of a more standardised interpretation of MRI by readers with varying experience.

B-0068 11:33
Accuracy of ultrahigh b values (b2000) to differentiate benign from malignant prostatic nodules on endorectal diffusion-weighted imaging
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Purpose: To assess the accuracy of endorectal diffusion-weighted MRI (erDWI-MRI) at 1.5 Tesla with ultrahigh b values to differentiate benign from malignant prostatic nodules.

Methods and Materials: 67 consecutive patients with no previous biopsy, a normal digital rectal examination and a PSA level of 4-10 nanograms/ml were referred underwent erT2-weighted and DWI-MRI (100-value apparent-diffusion-coefficient (ADC) mapping and b2000 images) was performed before sextant and TRUS-MRI image fusion-guided biopsies. On b2000-DWI, signal intensity (SI) was prospectively measured on hyperintense nodules originating in the peripheral and transition zone (PZ and TZ) and on the remaining surface on the same slice. SI of the corresponding areas on ADC and b1000 images was measured. Nodule/prostate SI ratios were calculated for b1000 and b2000, and b2000/b1000 ratio was then calculated. Areas under the curves (AUC) of ADC mapping and b2000/ratio/b1000 ratio were compared to biopsy results.

Results: MRI examination showed 58 nodules in 41 patients (26 in the PZ and 32 in the TZ). Twenty-nine nodules were malignant (29/58.5%), b2000/ratio/b1000 ratio value was significantly higher in malignant nodules than in benign nodules (p=0.0001). AUC value of the b2000/ratio/b1000 ratio was not significantly higher than that of ADC (0.82 vs.0.71, p=0.052). Sensitivity and specificity were 93 vs 62% and 76 vs 72%, respectively.

Conclusion: b2000/ratio/b1000 ratio SI value helps to differentiate benign from malignant prostatic nodules, both in the PZ and TZ. Although performance was better than that of ADC mapping, the difference only approached significance.

B-0069 11:42
Feasibility and reliability of MR-guided biopsy of the prostate gland: comparison to histopathological outcome
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Purpose: A relevant number of patients suffering from prostate cancer remain undetected after ultrasound guided biopsy. Prostate-MRI and MR-guided biopsy might overcome this diagnostic gap.

Methods and Materials: As a result of a diagnostic prostate MRI (Phillips Intera-Achieva; 1.5 T), performed at patients who underwent ultrasound-based biopsy of the prostate gland with a negative result, 68 lesions were detected to be suspicious due to pathological contrast uptake (+200% initial uptake, dynamic series 14s, 11 series) and suspicious diffusion coefficient. These lesions were biopsied MR-guided using CAD-guidance for access (DynaCAD for prostate Invivo-Philips, NL) and related hardware (DynaTRIM). Intervention was performed with a 18G biopsy needle.

Results: 26/68 histologically verified lesions were proven to be malignant/preservation (38.2%). In 11/194 samples no prostatic tissue was found (5.7%). Among the 21 verified invasive malignant lesions, 4 were summarised as high grade, 7 intermediate and 9 low grade. 4 malignant lesions were histologically confirmed as T1, 9 as 2a and 8 as 2b. Mean Gleason-score was 6.2. 5 lesions were verified as high risk ASPA-lesions, 4 of were of other benign histology. Among the benign entities prostatitis was commonly observed in 21 cases, hyperplasia in further 8 cases and atrophic glandular tissue in 9 cases (13.6%). Only 2 malignant lesions were located in the peripheral zone, 4 in the central zone exclusively.

Conclusion: MR-guided prostate biopsy is a precise technique with a high detection rate of prostate cancer to be recommended as the method of choice after a negative sonographical biopsy with suspicious diagnostic prostate-MRI.

B-0070 11:51
MRI and ultrasound-guided prostate biopsy using real time soft image fusion (Koelis®): a pilot study
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Purpose: Transrectal ultrasound (TRUS)-guided biopsies are the gold standard when diagnosing prostate cancer. However, exact biopsy locations cannot be verified, and there is a high rate of false negative biopsies. Magnetic resonance imaging (MRI) can identify tumours, but it is still not possible to document biopsy positions during TRUS. A new 3D-guided TRUS biopsy method (Koelis®), can document exact biopsy locations, and with real time soft image MRI fusion, targeted biopsies can be performed. The aim of the study was to evaluate Koelis® 3D ultrasound and MRI fusion-guided biopsy technique.

Methods and Materials: Ninety patients (50-80 yrs, mean 64 yrs, mean PSA 7 ng/ml) underwent MRI prior to prostate biopsies. Subgroups: primary biopsy: 11 pts, 1st-5th rebiopsies: 62 pts, and biochemical recurrence (BCR) after radiotherapy: 17 pts. Ninety patients (50-80 yrs, mean 64 yrs, mean PSA 7 ng/ml) underwent MRI prior to prostate biopsies. Subgroups: primary biopsy: 11 pts, 1st-5th rebiopsies: 62 pts, and biochemical recurrence (BCR) after radiotherapy: 17 pts.

Results: 121 nodules were biopsied. Positive biopsies according to degree of suspicion: high 47/52 (90%), medium 6/22 (27%) and low 4/47 (9%). Random biopsies were positive in 164/7 (13%). Biopsy positive subgroups: primary biopsy positive 9/11 (81%), 1st-5th biopsy 32/62 (51%), BCR after radiotherapy: 13/17 (76%).

Conclusion: The Koelis® method is feasible and allows accurate targeted biopsies. Hence, false negative biopsies and the use of random biopsies can be reduced.
B-0071 10:30
The influence of hormonal fluctuations on quantitative diffusion-weighted magnetic resonance imaging (DW-MRI) of the glandular breast tissue in healthy premenopausal participants at 3T

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Purpose: To determine whether the cyclical changes in the hormonal levels affect quantitative values of apparent diffusion coefficient (ADC) and transverse relaxation time (T2) for glandular tissues in healthy premenopausal women.

Methods and Materials: The study was performed using a 3 T MRI Philips Scanner and a dedicated bilateral 16 channel phased array breast coil. Participants were scanned four times during the menstrual cycle. ADC map was generated from a diffusion-weighted imaging (DWI) pulse sequence with four b values (0, 50, 150, and 800 s/mm²). T2 map was generated from a multiple spin echo (SE) pulse sequence with four echo times (TE) (20, 40, 60, and 80 ms). Regions of interest (ROI) were placed in the glandular tissue at each of the four different phases of the menstrual cycle in each breast.

Results: Quantitative measurements were obtained in 20 healthy participants (22-50 years old) with regular menstrual cycle. The results of the ADC (x 10-3 mm²/s) were (61.8±7.7, 61±8, 61.7±7.6, and 62±7 respectively) and T2 values (ms) were (61.8±7.7, 61±8, 61.7±7.6, and 62±7 respectively). ANOVA test showed that there was no statistically significant influence of menstrual cycle on mean ADC or T2 values. However, there was a significant change of cycle interaction.

Conclusion: There was no significant difference in mean ADC and T2 values across the weeks of the menstrual cycle. However, age can be considered as influencing factor.

B-0072 10:39
Effects of inhomogeneous radiofrequency power deposition on the apparent diffusion coefficient of the normal breast at 3.0 T
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Purpose: To investigate whether the apparent diffusion coefficient (ADC) quantification in the breast is affected by the inhomogeneity of radiofrequency power deposition (RPD) inherent to 3.0 T systems.

Methods and Materials: We enrolled 21 patients without evidence of breast lesions at bilateral breast magnetic resonance imaging performed on a 3.0 T magnet. Before contrast administration, two sequences were consecutively acquired: a) a transmit magnetic field (B1)-mapping sequence generating a B1-map; b) a diffusion-weighted echo-planar sequence generating b= 0, 500 and 1000 sec/mm² images together with an ADC-map. In each patient, breasts were divided into four per-side symmetrical regions (I-IV) on the axial slice passing through the nipples, in order to calculate - on a per region basis: a) the percent of RPD flip-angle from B1-map; b) the apparent diffusion coefficient (ADC) of fibroglandular tissue (FIT). Analysis was performed with a Kruskal Wallis test and the u-Mann-Whitney test. Results: RPD was significantly higher in left breast regions as compared to the right ones (p < 0.0001). Lowest RPD was found in the right internal region (rIII) (41.1±5.60%). The same trend was observed for the FIT-ADC value, although differences were not statistically significant (average ADC of 0.88±0.53 x 10-3 mm²/sec at the region rII).

Conclusion: Inhomogeneity in RPD at 3.0 T affected the right breast. Although not statistically significant, related difference between right and left breast FIT-ADC suggests that ADC quantification is potentially unreliable at 3.0 T unless systems to homogenise RPD are used.

B-0073 10:48
Accuracy of 3 T magnetic resonance imaging with a high-relaxivity contrast agent in assessing treatment response in patients undergoing neoadjuvant chemotherapy
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Purpose: To assess the accuracy of magnetic resonance imaging at 3 T (3 T MRI) in evaluating residual disease after neoadjuvant chemotherapy (NAC) in patients with advanced breast cancer.

Methods and Materials: Between March 2010 and July 2011, 17 women with advanced breast cancers underwent dynamic 3 T MRI before and after NAC. The MRI protocol comprised precontrast FSE T2w IDEAL sequence and VIBRANT 3D T1w sequence acquired before and after administration of gadobenate dimegluquine (Multihance) at 0.1 mmol/kg body weight. A dedicated bilateral breast coil was used. For each patient tumour size was determined before and after NAC. If bilateral, multifocal or multicentric disease was present, only the major lesion was considered. The MRI evaluation of treatment response was classified based on RECIST criteria. Residual tumour sizes obtained using MRI were compared with pathological findings.

Results: A total number of 20 lesions were evaluated. The sensitivity, specificity and accuracy of MRI in detecting residual disease was 100%, 78%, and 90%, respectively (area under ROC curve: 0.941). MRI overestimated the presence of residual tumour in 2 cases. The mean of the largest diameters measured at baseline MRI, post-treatment MRI and histology were 32.4, 9.25 and 5.45 mm, respectively. The tumour size difference between MRI and histology was not statistically significant (P value=0.19). We found a statistically significant correlation between MRI and pathology measurements (Spearman r = 0.6114; P value=0.0042).

Conclusion: The presence and size of residual disease in breast patients treated with NAC could be accurately evaluated using 3 T MRI and high-relaxivity contrast agent.

B-0074 10:57
MR-mammography at 3 T in clinical practice: prospective single centre experience
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Purpose: Higher magnetic field strength leads to higher signal-to-noise ratio, which may be invested in higher spatial or temporal resolution for breast imaging. While stronger chemical shift between fat and water may be useful in fat saturated 3D gradient echo imaging, B0 and B1 inhomogeneities may negatively affect imaging. We report on our prospective experience using 3 T MR-mammography (MRM) in clinical practice.

Methods and Materials: Consecutive patients underwent MRM (3 T, Rapid 16-channel breast coil) according to European recommendations (dynamic T1w fat saturated 3D-VIBE, 0.1 mmol/kg Omniscan, T2w-TSE, STIR, acquisition time 15 min). Reference standard was histopathology or follow-up >31 months. Results from double reading by two experienced radiologists in clinical practice were recorded prospectively. Results per breast were compared with the reference standard using contingency tables. Sensitivity, specificity, positive and negative likelihood ratio (LR+ , LR-) were calculated.

Results: 224 breasts in 112 patients were included. Indications for MRM were un­clear (n=42) or suspicious (n=54) results in conventional imaging, aftercare (n=24), clinical findings (n=6), follow-up of benign lesions (n=22) and contralateral findings (n=76). Sensitivity, specificity, LR+ and LR- of 98.0%, 90.8%, 10.7 und 0.02 were observed. Regularly, inhomogeneous fat saturation due to B0 inhomogeneities was observed which did not have a detrimental influence on diagnostic accuracy. All false positive findings presented as non-mass enhancements.

Conclusion: MRM at 3 tesla showed excellent diagnostic accuracy. Similar to MRM at 1.5 T, non-mass like enhancements were diagnostically challenging. 3 T typical artefacts did not have a detrimental effect on diagnostic performance.

B-0075 11:06
Back to the future: non-contrast breast MRI (nc-BMRI) using a combination of T1-weighted, diffusion-weighted and STIR imaging
R.M. Trimboli¹, N. Verardi¹, L.A. Carbonaro¹, F. Cartia¹, G. Di Leo², F. Sardanelli¹; San Donato Milanese/IT (pascal.baltzer@med.uni-jena.de)

Purpose: To assess per-breast sensitivity and specificity of nc-BMRI.

Methods and Materials: A consecutive series of women who underwent breast MRI at our institution from November 2009 to December 2010 was included in this retrospective study. Two blinded readers with 3- (R1) and 1-year (R2) of
BMRI experience evaluated nc-BMRI studies performed using gradient-echo T1-weighted, T2-weighted STIR, and diffusion-weighted imaging (b=0 and 750-1,000 s/mm2) assigning a BI-RADS 1-5 score for each breast. Readers were blinded to contrast-enhanced (CE) BMRI and final diagnosis. Breasts assigned BI-RADS 1-3 were considered as negatives and those assigned BI-RADS 4-5 as positives. Sensitiv- ity, specificity, and accuracy were estimated. A combination of mammography, ultrasound, CE-BMRI (0.1 ml/kg of gadobenate dimeglumine), and pathology was considered as a standard of reference. Interoberver agreement was estimated using Cohen kappa statistics.

Results: A total of 133 breasts in 68 patients aged 55±12 years (range 24-88 years) were analysed. Per-breast cancer prevalence was 33/133 (25%): IDC (n=24), ILC (n=2), DCIS (n=3); cancers not otherwise specified (n=4). R1 had sensitivity of 26/33 (79%), specificity of 86/98 (88%), and accuracy of 112/133 (85%); R2 had sensitivity of 26/33 (79%), specificity of 90/98 (90%), and accuracy of 116/133 (87%). For R1, false negatives were four IDC, one DCIS, and one ILC, one cancers not otherwise specified. For R2, false negatives were four IDC, one DCIS, and one ILC, one cancers not otherwise specified. Interobserver agreement was almost perfect (k=0.925).

Conclusion: A combination of T1-weighted, diffusion-weighted, and STIR imaging allowed for a good diagnostic performance with high specificity.

B-0076 11:15
Breast MRI at 3 T: a pilot study estimating sensitivity and specificity of unenhanced MRI (DWI combined with T2 IDEAL sequence) vs CE-MRI in the assessment of response to neo-adjuvant chemotherapy using a 3 T Magnet.

Methods and Materials: Consecutive patients undergoing neo-adjuvant chemothera- py for biopsy-proved breast cancer > 2 cm underwent 3-T MRI prior to chemo- therapy (every two cycles) and before surgical excision. MR protocol comprised an FSE-T2-IDEAL and DWI sequences, and Vibrant 3D T1-weighted sequence acquired before and after administration of contrast media. Tumour response was classified using RECIST criteria using tumour size at MRI. Tumour response at MRI after chemotherapy was compared to histological specimen after surgery. Two blinded observers rated unenhanced MRI and then CE-MRI for the evaluation of tumour response. Lesion size, ADC values and FSE-IDEAL descriptors were assessed.

Results: 32 patients were enrolled. Sensitivity of unenhanced MRI was 92% (observer 1) and 98% (observer 2). Sensitivity of CE-MRI was 100% for both observers. Specificity was 82% (unenhanced MRI) and 86% (CE-MRI) for both observers. The differences between both methods and observers were not statistically significant (P > 0.05). Lesion size measurements did not differ significantly between both sequences analysed. Tumour ADC values demonstrated significant differences between responders and non-responders after the first II cycles of treatment.

Conclusion: Combination of DWI and T2-IDEAL allow to obtain similar value of sensitivity and specificity of CE-MRI in the evaluation of tumour response to neo- adjuvant chemotherapy. ADC values could be used for differentiating responders from non-responders earlier during the treatment.

B-0077 11:24
To contrast or not to contrast? A new approach to unenhanced MR mammography

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Purpose: To assess sensitivity, specificity, positive and negative predictive value (PPV, NPV) of unenhanced (UE) MR-mammography (MRM).

Methods and Materials: We enrolled all patients undergoing contrast-enhanced (CE) MRM in our institution between February and May 2010, with histological diagnosis or one-year follow-up. Patients undergoing neoadjuvant chemotherapy were excluded. Using a 1.5 T-scaner, STIR-T2W, DW and T1W images before and after Gadolinium injection were acquired. Two readers in consensus prospectively assessed UE-MRM (i.e. T2W, DW and T1W images acquired before Gadolinium injection), without the knowledge of clinical, mammography, ultrasound and pathological diagnosis. Based on morphological features (asymmetry, architectural distortion or mass - for masses: shape, margins, signal features) and ADC-values (cut-off: 1.2±0.3 mm2/s), readers reported whether they were confident in exclud- ing an underlying malignancy or not, hypothetically addressing patients to contrast agent injection only in the second case. Clinical, mammography, ultrasound, ceMRR, pathological findings and follow-up data were considered the reference standard (RS). Sensitivity, specificity, PPV and NPV of UE-MRM were assessed. A Chi-square test was used to assess any statistically significant differences between UE-MRM and the RS.

Results: 112 patients fulfilled our selection criteria. 5 were affected by 2 different lesions. 30 malignancies were diagnosed. After UE-MRM, 3 of 30 malignanceries were not hypothetically addressed to ceMRR and were considered as false-negative. Sensitivity, specificity, PPV and NPV of UE-MRM were 90% (27/30=0.94), 51.7% (45/87-p < 0.0001), 39.1% (27/69-p < 0.0001), 93.7% (45/48), respectively.

Conclusion: Compared to the RS, UE-MRM sensitivity and NPV were not statisti- cally different. In patients who cannot receive Gadolinium injection, UE-MRM could be a safe, highly informative technique.

B-0078 11:33
A comparison between FAST technique and standard breast MRI: are we ready for MR screening?

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Purpose: Breast MRI offers advantages over mammography in screening breast cancer among young women, but specificity should be improved to reduce expen- sive follow-up. Diffusions-weighted imaging (DWI) can increase positive-predictive value of dynamic MRI. We compared the diagnostic performance of a FAST tech- nique (including DWI) with standard examination in this setting.

Methods and Materials: We retrospectively selected 161 breast MRI (T2. DWI, dynamic study) showing enhancing lesions > 5 mm, which was assessed cyto-histologically or with follow-up. Two trained radiologists in consensus reviewed each examination, considering the informations derived from a “short” dynamic study (1st post-contrast subtraction only) plus DWI (FAST-MRI) separately from standard examination (T2 and 5 post-contrast subtraction), and comparing their diagnostic performance.

Results: FAST-MRI detected 167/169 (98.8%) enhancing lesions identified with standard exam (no cancer was missed). Quantitative DWI with assessment of ADC (apparent diffusion coefficient) was possible in 161/169, showing lower ADC values in malignant lesions than benign (0.99±0.37 vs 1.8±0.36, P < 0.0001). In standard examination, the kinetic analysis showed limited value, with only 29% of cancers exhibiting a type 3 curve, and most (63.5%) an indeterminate curve. ADC was more predictive of benign or malignant nature using a cut-off of 1.29 mm²/s (ROC analysis). FAST-MRI accuracy was superior than standard-MRI (98.2±7%), with a significantly better negative-predictive value (93.4±77.6%) and contribution for BI-RADS 3-4 lesions.

Conclusion: In our experience, FAST-MRI showed a better accuracy than stand- ard examination, due to the superiority of ADC over dynamic criteria. The higher negative-predictive value and the shorter examination time could potentially extend the application of MRI in a screening context.

B-0079 11:42
Subgroup analysis of the final results of the Austrian screening trial for familial breast cancer

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Purpose: To assess the value of mammography, ultrasound, and MRI of the breast in the surveillance of various subgroups of women at high risk for breast cancer.

Methods and Materials: In a prospective trial, women at high risk for breast cancer were offered annual surveillance examinations, consisting of mammography, ultra- sound, and MRI. Sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio and negative likelihood ratio of the three surveillance modalities were assessed for various subgroups of participants, dichotomised by mutation status, age, menopausal status and personal history of breast cancer.

Results: In 558 patients 1365 complete imaging rounds were performed. A total number of 38 cancers were detected with sensitivities for mammography, ultra- sound, and MRI of 50%, 38%, and 90%, respectively (p > 0.01). Of 38 cancers 18 (47%) were DCIS. For these mammography, ultrasound, and MRI demonstrated sensitivities of 50%, 28% and 90%, respectively (p > 0.01). Mammography, ultra- sound, and MRI led to 38, 41, and 147 false-positive findings, which resulted in specificities of 98%, 97%, and 92%, respectively (p > 0.05). Of these, 49 were atypi- cal ductal hyperplasias. Of these premalignant lesions, mammography, ultrasound, and MRI detected 31%, 16% and 94% (p < 0.05). Comprehensive subgroup analyses revealed a higher specificity of MRI in the subgroup of mutation carriers (94%) and premenopausal women (97%) compared to non-mutation carriers (86%) and peri- menopausal women (88) (with P < 0.001).
Conclusion: The use of MRI improves the detection of invasive and preinvasive cancers, as well as of high risk lesions. Specificities for MRI are highest for mutation carriers and postmenopausal women.

B-0080 11:51
Treatment of invasive breast cancer: initial clinical experience using high intensity focused ultrasound therapy with 3 T magnetic resonance guidance
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Purpose: To determine the efficacy of non-invasive high-intensity MR-guided focused ultrasound (MRgFUS) treatment for biopsy-proven invasive ductal breast cancer (IDC) (stage T1 M0 N0) scheduled to surgical resection and sentinel lymph node biopsy.

Methods and Materials: Under the IRB approval, 6 patients with unifocal biopsy-proven IDC less than 2 cm in size scheduled and consented to surgical (lumpectomy or mastectomy) resection and sentinel lymph node biopsy, and in which breast MRI confirmed an enhancing lesion in a treatable location underwent MRgFUS treatment using the ExAblate 2000 system (InSightec). Treatments were done in a single session, in an ambulatory setting. Effectiveness of the treatment was evaluated at pathology after surgery.

Results: All 6 lesions were treated. No enhancement was seen at breast MRI evaluated at pathology after surgery. Treatment using the ExAblate 2000 system (InSightec). Treatments were done to breast MRI confirmed an enhancing lesion in a treatable location underwent MRgFUS breast cancer.

Conclusion: MRgFUS is a promising noninvasive treatment modality for unilateral breast cancer.

10:30 - 12:00 Room G/H

Neuro

SS 111b
White matter diseases
Moderators:
C. Auger Acosta; Barcelona/ES
M.P. Wattjes; Amsterdam/NL

B-0081 10:30
Comparison of 1.5 T and 3 T scanners for evaluating myelination in neonatal brains
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Purpose: MR imaging is presently the most sensitive method for the in-vivo evaluation of white matter maturation in neonatal brains. Evaluating myelination is technically conditioned by the sequence and the scanner field intensity. The objective of this study was to retrospectively compare the level of myelination of various cerebral structures in two groups of term and pre-term neonates evaluated with either a 1.5 or 3 T scanner.

Methods and Materials: Routine brain MR of 77 neonates was retrospectively evaluated: 56 preterm. After informed consent was obtained from legal guardians, all neonates were sedated and underwent MR exams at a gestational age between 38 and 44 weeks (equivalent corrected age for pre-terms). 1.5 T scanner was used in 44 (34 pre-term) and 3 T in 33 (22 pre-term) neonates. Two blinded neuroradiologists independently evaluated myelination on TSE-T2-weighted axial images in the brainstem, inferior cerebellar peduncle, inferior colliculus, cerebellar vermis, globus pallidus, ventroposterolateral thalamic nucleus, internal capsule, optic radiation, corona radiata and precentral gyrus. Statistical differences were evaluated using a Pearson’s Chi-squared test: p < 0.05.

Results: Myelination of the cerebellar vermis (p=0.008), globus pallidus (p < 0.001), internal capsule (p=0.04), and optic radiation (p < 0.001) was identified with a higher frequency with 3 T than both the pre-term and full term neonates. The detection of contrast-enhanced (Gd+) demyelinating lesions is important for the diagnosis and treatment of multiple sclerosis. The aim of our study was to evaluate the applicability of subtraction MRI images for the detection of active MS lesion at 3 Tesla using a 32-channel head coil.

Methods and Materials: We prospectively included 108 patients (82 females, mean age: 39 ±12.83 years) with proven multiple sclerosis. MRI imaging was performed at 3 Tesla using a 32 channel head coil. All patients received intravenous contrast media (Gadovist-1.0%, Bayer Schering Pharma, Berlin) with a dose of 0.1 mmol Gd/kg body weight. Follow-up MRI was performed after 3 months. In all patients we acquired axial T2w and T1w fI3d images before and 5 minutes after administration of Gadobutrol. Precontrast images were subtracted from the postcontrast. Enhancing lesions were counted on pre- and postcontrast images. Lesion count was evaluated by two independent neuroradiologists.

Results: Lesion load on T2w images was 12.91±5.15. Using unsubtracted post-contrast images 38 Gd+ lesions (mean: 2.92±2.10) in 13 patients were identified. On subtraction images, 97 Gd+ lesions in 20 patients were detected. In 7 of these patients 14 Gd+ lesions were not identified on unsubtracted images. In 10 patients 31 additional Gd+ lesions were detected and in 3 patients the size of the lesions increased. There was good interreader agreement (κ=0.83).

Conclusion: Using a 32 channel head coil and contrast-enhanced 3D subtraction MRI images improve the diagnosis yield of MRI at 3 Tesla for detection of active MS lesion.

B-0082 10:48
Value of DIR MR sequences in comparison to FLAIR and DP/T2 when identifying cortical and juxtacortical lesions in patients with multiple sclerosis
M. Vera Cartas, V. Schonstedt Geldres, C. Auger Acosta, R. Miliana Penella, A. Rovira-Cañellas; Barcelona/ES (martavera2@gmail.com)

Purpose: The detection by MR of cortical-juxtacortical lesions in patients with the diagnostic suspicion of multiple sclerosis is of great relevance. The purpose of this work is to compare the sensitivity of “double inversion recuperation” sequence (DIR) in comparison to fluid attenuated inversion recovery (FLAIR) and protonic density sequence (DP/T2) in identifying demyelinating cortical-juxtacortical lesions in this patients.

Methods and Materials: 46 patients were included (65% women; 38.9 middle age ± 11.0) with the diagnosis of a single neurologic syndrome or multiple sclerosis. All the studies were made in a 3 T equipment and included sequences DIR, FLAIR and DP/T2 obtained in an axial shot with contiguous images 3 mm width. One observer identified the cortical-juxtacortical lesions in each sequence independently and as a whole.

Results: Of a total of 173 lesions detected in the three sequences as a whole, FLAIR identified by itself 73.4% of them, DP/T2 77.5% and DIR 82.1%. The comparison between the DIR sequence and the FLAIR and DP/T2 shows a gain in the number of detected lesions of a 12% when comparing DIR to FLAIR and of a 6% when comparing DIR to DP/T2. When comparing FLAIR and DP/T2 as a whole to DIR sequence by itself the gain is of a 6% (p=0.01).

Conclusion: The DIR sequence is significantly more sensitive in detecting demyelinating cortico-juxtacortical lesions than FLAIR and DP/T2. Nevertheless, the combination of the three sequences offers a higher sensitivity in detecting this lesions, which is relevant to confirm the diagnosis of multiple sclerosis.

B-0083 10:57
Intraterrorial lesions in multiple sclerosis: Improved detection with T2 TIRM MR imaging at 1.5 T magnet
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Purpose: To prospectively compare the depiction of intraterrorial lesions using fluid-attenuated inversion-recovery (FLAIR), and T2-TIRM magnetic resonance (MR) imaging in patients with multiple sclerosis.

Methods and Materials: Local ethics review board approval and informed consent were obtained. Conventional FLAIR in axial plane and T2 TIRM images in sagittal plane (2.5 mm thick) were acquired in 250 patients with multiple sclerosis (162 women, 88 men) and 100 age-matched healthy control subjects (60 women, 40 men). Mean age was 36 years (range, 17-54 years) in patients and 35 years
Purpose: Intralesional veins and perivenous inflammation are known to be a pathohistological hallmark of multiple sclerosis (MS). Susceptibility-weighted imaging (SWI) at 7T allows the imaging of veins as small as 0.2 mm in diameter. The purpose of our study was the identification of intralesional characteristics of veins in MS patients.

Methods and Materials: 10 patients, mean aged 42 years, with relapsing-remitting MS (RRMS; n=6) and secondary-progressive MS (SPMS; n=4) with an expanded-disability-status-scale (EDSS) ≤ 6.5 were included. The MR protocol at 7T comprised a FLAIR-FSE-sequence and a SWI-sequence (TR/TE 28/15 ms, voxel size 0.3x0.3x1.2 mm³). The examination was performed at baseline and 1 year after. Data from 8 patients (RRMS, n=6; SPMS, n=3) could finally be analysed. 18 plaques and its corresponding normal appearing white matter (NAWM) were assessed for lesion-volume and vein-volume with a 3D-Software.

Results: Patients with a relapsing-remitting-course showed a mean intralesional vein-density of 13.9%, patients with secondary-progressive multiple sclerosis a mean of 7.3%. This indicates a twofold higher vein-density in RRMS-plaques (13.9%). Vein-density in NAWM constantly accounted for a mean of 3.6% in patients with RRMS and SPMS. Compared to the corresponding NAWM, RRMS-plaques show a threefold higher vein-density and SPMS-plaques a twofold-higher vein-density. We could further precisely display intralesional small veins, partially showing a straight-lined course. Additionally, we could depict three newly developed vein-associated MS-plaques within 1 year.

Conclusion: Patients with a relapsing-remitting course of multiple sclerosis represent a higher intralesional vein-density than patients with a secondary progressive course of multiple sclerosis.

Purpose: Free iron is discussed to contribute as a neurotoxic agent to neuroinflammation. Ultra-high-field MRI detected iron accumulation in multiple sclerosis brain.

Methods and Materials: Twenty-eight patients with CIS, 28 patients with RRMS and 51 healthy controls (HC) were included. All participants were scanned with a 1.5 T MRI scanner. T1 and DTI images were acquired. We constructed the white matter structural network for each participant. Based on the FN-weighted network for each subject, we calculated the network properties, including the strength, global efficiency and local efficiency at the global level, and the regional efficiency at the nodal level. A multiple linear regression analysis was performed on each network metric between any two groups, P < 0.05 (corrected) was regarded as significant.

Results: Small-world characteristics of the WM structural networks were identified in both the controls and the patients. Among the three groups, we found the MS patients have the lowest network efficiency. Compared with HC, the CIS patients exhibited significant decreases in the strength and global efficiency of their WM structural networks. For all the network properties, the CIS network exhibited intermediated values. Compared with HC, the CIS patients exhibited a reduction in the nodal efficiency in bilateral precentral gyrus and left postcentral gyrus, while the MS patients have widespread efficiency reduction in many brain regions.

Conclusion: Disrupted topological organisation in the white matter network is already found at the CIS. The most significant regional changes were located at the primary sensorimotor system in CIS.
B-0090

Early and progressive signs on MRI in patients with progressive multifocal leukoencephalopathy

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Purpose: To illustrate early and progressive signs on MR images in patients with progressive multifocal leukoencephalopathy (PML).

Methods and Materials: MRI images of seven patients with PML were reviewed. All patients underwent repeated MR examinations on 1.5- or 3.0-tesla MR units for the initial diagnostic workup and treatment control.

Results: In all patients, MR images worsened over time. Duration of follow-up studies was 0 to 32 months. Newer margins in spreading lesions showed heterogeneous mild hyperintense with numerous dots of severe hyperintense on T2-weighted images (“Milky way appearance”), heterogeneous mild-slight hypointensity on T1-weighted images, and hyperintense on diffusion-weighted images with mild decreased or increased diffusion. With the progress, signal intensity of these lesions gradually increased on T2-weighted images and inversely decreased on T1-weighted images with increase of diffusion, finally near CSF intensity with atrophy. These findings seemed to correspond the pathological findings of numerous foci with myelin and axon loss that merge together to be large demyelinating lesion and finally to be severe atrophy and cavity.

Conclusion: “Milky way appearance” on T2-weighted images and hyperintense areas on diffusion-weighted images may be early and progressive signs in patients with PML.

10:30 - 12:00 Room IVK

Abdominal Viscera

SS 101b

Biliary tract

Moderators:
T. Denecke; Berlin/DE
G.G. Karmazanovsky; Moscow/RU

B-0091

10:30

Gadoxetic acid-enhanced T1-weighted MR cholangiography in primary sclerosing cholangitis

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Purpose: To determine the value of gadoxetic acid-enhanced 3-dimensional T1-weighted MR cholangiography (T1w-MRC) in comparison with 3-dimensional T2-weighted MR cholangiography (T2w-MRC) in patients with primary sclerosing cholangitis (PSC).

Methods and Materials: We retrospectively evaluated 34 MR exams in 29 patients (46.0±16.1 years (18-81); 80.5±13.9 kg (56.7-115.2 kg); 19men/10women). Scans were performed at 1.5 T with an eight-channel phased-array torso coil. 3D-T2w-MRCP was performed with a spatial resolution of 1.1x1.1x1.8 mm3, interpolated to 0.6x0.6x0.9 mm3 through zero-filling. T1w-MRC was achieved 20-25 min after injection of 0.5 mmol/kg gadoxetic with a navigator-gated 3D spoiled gradient recalled echo (SPGR) sequence with intermitted spectrally-selective partial inversion-recovery fat suppression (LAVA). The spatial resolution of 1.4x1.3x1.8 mm3 was interpolated to 0.7x0.6x0.9 mm3. Image quality was evaluated in a blinded fashion regarding image contrast, image quality degradation due to artefacts, and visualisation quality of ducts by two abdominal radiologists. Reader preference and number of orders of visualised biliary tree branches were recorded. A helpfulness scoring of gadoxetic acid-enhanced T1w-MRC was performed in consensus.

Results: Image quality of T1w-MRC and T2w-MRCP was graded good to excellent in all cases. There were advantages for both T1w-MRC (functional information, less artefact degradation) and T2w-MRCP (higher order of visualised branches, better branch depiction). Both readers showed preference for T2w-MRCP (reader 1: 17/34, reader 2: 20/34); however, in the majority of cases (38/34 cases, 88.2%), both readers agreed that gadoxetic acid-enhanced T1w-MRC was helpful.

Conclusion: Gadoxetic acid-enhanced T1w-MRC is complementary to, but should not replace, T2w-MRCP. T1w-MRC is a useful adjunct for morphologic evaluation and provides additional diagnostic information.

B-0092

10:39

Biliary-enteric anastomoses: usefulness of Gd-EOB-DTPA-enhanced MR cholangiography

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

Purpose: To assess the usefulness of Gd-EOB-DTPA-enhanced MR-cholangiography (MRC) in patients with biliary-enteric anastomoses.

Methods and Materials: Forty-four patients with pre-existing biliary-enteric anastomoses and clinical-radiological follow-up (PIMVSIT; Bayer HealthCare), followed by injection of isotonic saline (20 ml), T1w sequence was also obtained after 90-120 minutes in 5/44 cases. Visualisation of each segment of the biliary tree and anastomotic bowel was graded by two radiologists in conference on a four-point scale: 0, absent; 1, poor; 2, good; 3, excellent. All segments were assessed for the presence of ducal dilatation, stricture, bile leakage, intraductal filling defects and other abnormalities. MRI findings were compared to surgical findings, when scheduled, and/or a six-month-lasting clinical-radiological follow-up.

Results: Gd-EOB-DTPA-enhanced MRC significantly out-performed conventional MRC in the visualisation of the extra-hepatic biliary system and anastomotic region and in the assessment of anastomotic strictures and pneumobilia (p < 0.05). The grading of visualisation and depiction of dilation of the second and third order intra-hepatic bile ducts was significantly superior on T2w MRC (p < 0.05). No significant difference was identified between the two techniques in the detection of biliary stones.

Conclusion: Contrast-enhanced MRC using Gd-EOB-DTPA can improve the diagnostic performance of conventional T2w MRC in the post-operative assessment of biliary-enteric anastomoses since it provides both anatomical and functional information of the biliary tract.

B-0093

10:48

Characterisation and staging of hilar cholangiocarcinoma (Klatskin Tumour): evaluation of the hepatocyte-specific contrast agent gadoxetate disodium

K.I. Ringsby; 1, K. Hektas; 2, B.P. Ringe; 1, P.J. Op kern; 1, A. Reichelf; 2, F. Wacker; 2, J. Lotz; 2, B.C. Meyer; 1, Hannover/DE, 1Göttingen/DE (ring_kristina@mh-hannover.de)

Purpose: To assess the value of gadoxetate disodium for characterisation and staging of hilar cholangiocarcinoma (hCCC).

Methods and Materials: This prospective HIPAA-compliant study was IRB approved. 14 patients (8 males, 6 females; 36-80y) with clinical suspicion of central bile duct stenosis (CBDS) underwent preoperative MRI. Images were assessed for aetiology of CBDS. A modified Bismuth classification was applied for tumour extension. To estimate the value of hepatocyte biliary phase images, in addition to T2w-MRC (T2), only post-contrast images (CM), or both image datasets were assessed in three reading sessions by 3 readers (two weeks interval). Agreement of each reading session with the intraoperative findings in terms of CBDS aetiology and tumour extension (weighted kappa statistic) was calculated.

Results: CBDS was caused by hCCC (n=9), gallbladder carcinoma (n=4) and pancreatic carcinoma (n=1). Characterisation of CBDS aetiology was correct by use of T2w images in 57%, 64% and 50%; by use of CM images in 64%, 57% and 50%; by combination of both in 71%, 64% and 64%. Agreement comparing reading sessions and intraoperative findings regarding tumour extension was poor (κ range = 0.21-0.23), but fair to moderate (κ=0.21 (T2); 0.34 (CM); 0.54 (both)) as a result of common understaging. Interobserver agreement for tumour extension was fair (κ range = 0.31-0.33).
Conclusion: By means of combined evaluation of T2w sequences and postcontrast images after injection of gadoxetedisodium, a more reliable characterization of CBDS was possible. Even though CBDS tended to be underestimated before as well as after contrast injection, assessment of exact tumour extension was improved by contrast administration.

B-0094  10:57
Relationship between biliary complications and hepatic arterial buffer response after liver transplantation, based on ultrasound data
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Purpose: Biliary stricture and leakage are common complications after liver transplantsations (LT). One of the main cause is arterial ischaemia. The relationship between arterial and portal vein flow (hepatic arterial buffer response) concerning late biliary complications are not frequently analysed.

Methods and Materials: 70 consecutive LTx intra- and postoperative ultrasound examinations were retrospectively analysed and compared with the one-year follow-up clinical results focusing on biliary strictures and leakage. The ultrasound data were composed of the routine controls, arterial resistive index (RI), hepatic vein velocity curves and portal vein velocities.

Results: Altogether 22 minor (symptom-free) and major (treatment required and performed) biliary complications were diagnosed. In 8 cases low RI suggesting arterial stenosis were noticed while the remaining 14 cases showed consequent high (>50 cm/s) portal venous velocities and RI values (>0.75). On the contrary, 25 cases were found with the same flow patterns without any signs of biliary complications.

Conclusion: The high portal velocity and high RI may only roughly represent hepatic arterial buffer response; however, these values are measured routinely after LT. Half of our patients (55%) showed this flow combination, but only 20% developed biliary complications of any severity. The routinely measured parameters are not sufficient enough to predict late biliary complications, although medical, surgical or interventional treatment of excessively high portal flow combined with high RI arterial flow may be beneficial. The decision of potential treatment should be made individually.

B-0095  11:06
Steady state free precession sequences can add valuable diagnostic details to conventional MR cholangiography
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Purpose: Adding a steady-state free precession sequence (SSFP) to the conventional 3D-T2-weighted magnetic resonance cholangiography sequence (3DC) provides additional diagnostic data.

Methods and Materials: In 130 consecutive patients that underwent MR cholangiography examination along 6 years for suspected biliary obstruction or biliary diseases received 2-3 non-breath-hold coronal oblique SSFP sequences after the conventional 3DC sequence. The SSFP sequences in all the examinations were retrospectively examined by one expert reader to confirm the 3DC sequence diagnosis and search for additional details that could contribute to the main diagnosis.

Results: In all the cases (100%) the breathing artefacts were not influencing the diagnostic quality of the sequences. In 92/130 (70.8%) cases the 3DC diagnosis was confirmed by SSFP, in the remaining 38/130 (29.2%) cases SSFP identified the correct diagnosis that was not clear with 3DC alone. In 75/130 (57.7%) cases added some details that were not visible in the 3DC.

Conclusion: SSFP is a useful sequence that can add details to the conventional 3DC sequence, due to better resolution, high extra-luminal and biliary wall details, lower sensitivity to breathing artefacts and does not add significant time to complete the examination.

B-0096  11:15
Functional imaging using Gadoxetate disodium-enhanced 3.0-T MR cholangiography versus conventional 3.0-T MR cholangiography: comparison with ERCP in patients with primary sclerotic cholangitis
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Purpose: To evaluate the diagnostic value of Gadoxetate disodium-enhanced 3.0-T MR cholangiography delayed hepatobiliary phase versus conventional 3.0-T MR cholangiography in comparison to ERCP in patients with primary sclerotic cholangitis.

Methods and Materials: 21 patients with primary sclerotic cholangitis confirmed by ERCP, clinical presentation and laboratory tests as standard of reference, who underwent Gadoxetate (Primovist, Bayer Health Care, Berlin, Germany)-enhanced 3.0-T MR cholangiography, were retrospectively evaluated. Conventional T2-weighted MR cholangiography and Gadoxetate-enhanced MR cholangiography in delayed hepatobiliary phase in coronal and axial planes were separately assessed and then compared to ERCP. The presence of peripheral and central stenosis, dilatation and contour irregularities for characterisation of PSC was evaluated using a 5-point scoring system.

Results: The study cohort consisted of 21 patients (14 females) with a mean age of 54.3 years (range 36 - 75 years). Mean time between ERCP and MR imaging was 58 days. In patients with PSC features, delayed hepatobiliary phase showed an excellent correlation with ERCP (κ=1.00, p=1.00), whereas correlation of T2-weighted MR was only moderate (κ=0.694; p=0.708). Furthermore, delayed hepatobiliary phase demonstrated a statistically significant better detection of obstructive central stenosis in comparison to conventional MRC (p=0.005). The corresponding AUCs were 0.796 versus 0.607 in comparison with ERCP.

Conclusion: Delayed hepatobiliary phase of Gadoxetate-enhanced MR increases accuracy for early depiction of PSC features and provides additional functional information of bile ducts which shows appropriate treatment of PSC associated clinically significant central stenosis.

B-0097  11:24
Role of GD-EOB-DTPA-enhanced magnetic resonance cholangiography (MRC) in the evaluation of biliary strictures after orthotopic liver transplantation (OLT): preliminary results
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Purpose: To describe the role of GD-EOB-DTPA-enhanced magnetic resonance cholangiography (MRC) in the evaluation of biliary strictures in liver-transplanted patients.

Methods and Materials: Between July 2010 and September 2011, 4 liver-transplanted patients with clinical suspected biliary strictures were evaluated with GD-EOB-DTPA-enhanced MRC. Axial and coronal T1-w and T2-w sequences, radial 2D-SSFSE, coronal 3D-T2wFSE sequences were acquired in precontrastographic phase. T1-w3DGR sequences were performed before and after injection of GD-EOB-DTPA (0.1 ml/kg), including dynamic and delayed hepatobiliary phases acquired 15, 20, 30 minutes after GD-EOB-DTPA administration. Diagnostic confirmation was obtained with hepatobiliary scintigraphy (HBS) and percutaneous transhepatic cholangiography (PTC).

Results: In all cases GD-EOB-DTPA-enhanced MRC depicted 7 biliary strictures (6 intrahepatic; one bilo-enteric anastomotic stricture). At GD-EOB-DTPA-enhanced MRC, when intrahepatic strictures were associated with areas of liver parenchyma without GD-EOB-DTPA excretion for diminished hepatobiliary function caused by biliary obstruction, strictures were considered relevant. In one case, dilatation of upstream biliary tree and lack of GD-EOB-DTPA excretion into the bilo-enteric anastomoses was associated with bilo-enteric anastomotic stricture. HBS confirmed areas of liver parenchyma with unhomogenous and delayed uptake of radiotracer, as depicted at MRC. All intrahepatic strictures detected at GD-EOB-DTPA-enhanced MRC were confirmed at PTC. Three intrahepatic strictures associated with parenchymal areas of no GD-EOB-DTPA excretion were treated with PTC, with normalisation of biliary tree. One bilo-enteric anastomotic stricture received no confirmatory treatment.

Conclusion: GD-EOB-DTPA-enhanced MRC is a useful technique in the evaluation of biliary strictures after OLT as it allows the selection of strictures associated with abnormal parenchymal function.

B-0098  11:33
Ultrasound scoring system for preoperative evaluation of cholelithiasis: how accurate it is for preoperative prediction of difficult laparoscopic cholecystectomy
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Purpose: Laparoscopic cholecystectomy (LC) has become treatment of choice for cholelithiasis, but there are still some patients requiring conversion to open cholecystectomy (OC) mainly because of technical difficulty. Our aim was to develop a standardised ultrasound-based scoring system for preoperative prediction of difficult LC.

Methods and Materials: Ultrasound findings of 300 patients who underwent LC were retrospectively reviewed. Four parameters (time taken, biliary leakage, injury to duct or artery, and conversion to OC) were analysed to classify LC as easy or difficult. Ultrasound findings were analysed with emphasis on GB wall thickness, pericholecystic collection, distended GB, impacted stones, multiple stones, CBD diameter and liver size. A score of two was assigned for the presence of each finding with a total score of 14. A cut-off value of 6 was taken to predict easy and difficult
B-0099 11:42
Hepatobiliary excretion of gadoxetate disodium (Primovist) in patients with primary sclerosing cholangitis (PSC)
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Purpose: To evaluate hepatobiliary excretion of Gd-EOB-DTPA into different segments of the hepatobiliary system in patients with PSC, and to assess possible correlation with liver function tests (LFT).

Methods and Materials: This retrospective study was IRB approved. 54 patients (16 PSC; 38 non-PSC) with confirmed diagnosis of PSC who underwent contrast-enhanced hepatic MRI after injection of 1.1 ml/kg body weight were included. Delayed phase images acquired between 10 and 20 minutes after contrast injection were assessed for the presence of contrast agent in the intrahepatic bile ducts (IBD), common bile duct (CBD), gallbladder and duodenum. A Kruskal-Wallis test was performed to determine whether excretion was significantly different by LFT. Hepatobiliary excretion was compared with data collected in a previous study from patients without liver disease by means of a Mann-Whitney U test.

Results: 20 minutes after contrast initiation, Gd-EOB-DTPA could be detected in the IBD in 55.3%, CBD in 53.7%, gallbladder in 38.8%, duodenum in 13%, respectively. Contrast excretion into the IBD, CBD and gallbladder was significantly affected by serum bilirubin levels, but not by alkaline phosphatase, γ-glutamyltransferase, patient sex or age.

Conclusion: Contrast excretion into all hepatobiliary segments is significantly reduced in patients with PSC compared to patients without liver disease, and is further dependent on serum bilirubin level. Within 20 minutes post-contrast initiation Gd-EOB-DTPA can be expected in the IBD and CBD in only about 50% of patients. Delayed phase images therefore need to be carried out significantly longer in PSC patients in order to assess functional information.

B-0100 11:51
Secretin-stimulated magnetic resonance cholangio-pancreatography: safety, reliability, and assessment of pancreatic exocrine function
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Purpose: To investigate the safety, reliability of secretin-stimulated magnetic-resonance-cholangio-pancreatography (SS-MRPC), and assessment of pancreatic exocrine function (PEF) in volunteers.

Methods and Materials: The study was IRB approved. 995 volunteers (538 men, mean age 51.9±3.4 years) underwent navigator-triggered T2-weighted 3D-MRCPs before and after secretin stimulation (1 μg/kg BW) using a 1.5 T MR system (Avanto, Siemens). The mean time between intravenous secretin injection and the SS-MRPC was 11.9±2.8 min. For 2 hours after injection of secretin, adverse reactions were evaluated. Improvement of duct visualisation after secretin stimulation was observed by two readers (r1/r2) subjectively and quantitatively through measurement of duct size diameters. PEF was assessed subjectively using Matos criteria’s by two readers and quantified with calibrated volumetric measurement of total excreted volume (TEV) and pancreatic flow output (PFO).

Results: Minor adverse reactions were observed in only 2 cases (0.2%), consisting of flushing, and no major reactions were observed. Subjectively, duct visualisation after secretin stimulation was improved in r1/r2: 59%/60%, unchanged in r1/r2: 38%/37%, and worse in r1/r2: 3%/3%, (inter-rater-agreement; kappa=0.910). Duct diameters increased significantly after secretin stimulation (head: 2.0±2.2 mm; body: 1.7–1.9 mm; tail: 1.3–1.4 mm; p=0.001). PEF, evaluated using Matos criteria’s, was restricted in Matos 0: 1/2: 1/1%, Matos 1: r1/r2: 5/5%, Matos 2: r1/r2: 31/26%, and Matos 3: r1/r2: 63/68%, (kappa=0.828). The mean TEV was 110.7±87.7 ml and the mean PFO was 9.5±1.1 ml/minute. According to the time, normal values of TEV/PFO were regressed to a logarithmic function (R2TEV=0.937; R2PFO=0.912).

Conclusion: SS-MRPC provides an improvement in main pancreatic duct visualisation and a non-invasive quantification of PEF with negligible risk of side effects.

B-0101 10:30
In vivo molecular MRI of the estrogen receptor in breast cancer using a targeted contrast agent
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Purpose: Developing in vivo molecular MRI for detecting estrogen receptor (ER) expression in a breast cancer animal model utilising a novel ER targeted contrast agent.

Methods and Materials: ER-targeted contrast agent based on pyridinium-tetracetate-Gd (III) chelate (PATA-Gd) conjugated to 17β-estradiol (EPTA-Gd) was synthesised and characterised in solution, and in stably transfected with ER (positive) and wild type MDA-MB-231 (ER-negative) human breast cancer cells, as well as tumours implanted orthotopically in the same mouse. In vivo pharmacokinetics and DCE-MRI studies were conducted on 9.4T scanner. Imaging processing included model-based and model-free analyses.

Results: The affinity of EPTA-Gd to ER was found to be in the micromolar range. The T1 relaxivity in solution was 6.8 (mM-1s-1) and increased to 28.5 (mM-1s-1) in ER-positive breast cancer cells. In vivo DCE- MRI using a low dose of EPTA-Gd (0.03–0.075 mmol/kg) demonstrated high enhancement in ER-positive breast cancer tumours as compared to the enhancement in ER-negative tumours, and in normal muscle tissue. In contrast, both tumours showed similar enhancement and hence, vascular perfusion, in DCE of non-targeted diffusible contrast agent (Gd-DTPA and PATA-Gd). Furthermore, specific interaction of EPTA-Gd with ER was validated by in vivo competition DCE-MRI experiments with tamoxifen.

Conclusion: The results in the breast cancer animal model provide a proof of principle of the ability of EPTA-Gd to be targeted in vivo to ER and identify ER-positive tumours. In addition, these results provide a basis for the clinical translation as a means for detecting, localising, and monitoring ER non-invasively.

B-0102 10:29
PET imaging of therapy-induced prostate cancer cell death by targeting the internal epitope of prostate-specific membrane antigen
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Purpose: We report the preparation and use of 89Zr-desferrioxamine B (DFO)-7E11, a novel 89Zr-labeled monoclonal antibody (mAb) construct for targeted immuno-position emission tomography of prostate-specific membrane antigen (PSMA), a prototypical cell surface marker highly overexpressed in prostate cancer (PC). We present an approach to monitor PC therapy using the 89Zr-DFO-7E11 as a marker of response. 7E11 recognises an intracellular epitope of PSMA and thus can only bind its cognate antigenic epitope when the cell membrane is disrupted, as in dead or dying cells.

Methods and Materials: 7E11 as a marker of dying cells was studied by flow cytometry and microscopy of cells after antiandrogen-, radio- and chemotherapy treatment in LNCaP and PC3-PSMA positive cells. The in vivo behaviour of 89Zr-DFO-7E11 was characterised in mice bearing subcutaneous LNCaP (PSMA-positive) by biodistribution studies, immuno-PET and optical imaging. The potential of assessing tumour response was evaluated in vivo after radiotherapy and chemotherapy treatment.

Results: In vitro studies correlated 7E11 binding with markers of necrosis/ apoptosis. In vivo biodistribution experiments revealed high, target-specific uptake of 89Zr-DFO-7E11 in LNCaP tumours after 24 h (20.3±5.7%ID/g), 48 h (22.8±5.8%ID/g), 96 h (36.9±4.7%ID/g) and 120 h (25.3±4.8%ID/g). Excellent image contrast was observed with immuno-PET. 7E11 uptake was statistically increased in treated versus control tumour as measured by immuno-PET and biodistribution studies. Blocking studies at 48 h confirmed binding specificity.

Conclusion: 89Zr-DFO-7E11 displays high tumour-to-background tissue contrast in immuno-PET and can be used as a tool to monitor the tumour response in PSMA-positive PC.
B-0103 10:48
Molecular imaging of apoptosis in the early course after myocardial infarction using hybrid fluorescence molecular tomography/x-ray computed tomography FMT-XCT targeting Annexin V
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Purpose: To investigate Annexin V targeted molecular imaging of cardiomyocyte apoptosis in the early course after murine myocardial infarction.

Methods and Materials: Myocardial infarction (MI) was induced in C57BL/6J mice by 30 minutes ligation of the left anterior descending artery (LAD) with subsequent reperfusion. Mice were injected with the Annexin V targeted molecular imaging probe Annexin-Vivo750 4 hours prior to imaging. Additionally, mice were injected with a long-circulating iodine-based contrast agent (Exitron 12000) prior to imaging for better visualisation of cardiac anatomy with subsequent facilitated organ segmentation. Hybrid FMT-XCT was performed 6 hours, 24 hours and 7 days after induction of ischaemic injury. Molecular imaging signal for Annexin-Vivo750 was validated by ex-vivo immunohistochemistry and flow cytometry.

Results: Successful image acquisition of both FMT and CT angiography was achieved in all mice. Molecular imaging signal for Annexin-Vivo750 could be localised to the anterior-lateral wall of the left ventricle at the site of myocardial infarction. FMT signal for Annexin V peaked at 6 hours after myocardial infarction with subsequent decrease at 24 hours and 7 days after onset of ischaemic injury. FMT signal for Annexin V colocalised with apoptosis staining (Caspase 3) using immunohistochemistry and flow cytometry. Hybrid acquisition of x-ray computed tomography allows exact localisation of the FMT signal to the left-ventricle and facilitates organ segmentation and attenuation correction.

Conclusion: Hybrid FMT-XCT targeting Annexin V enables accurate in-vivo assessment of apoptosis in the early course after myocardial infarction in a murine ischaemia-reperfusion model.

B-0104 10:57
First parallel, specific visualisation of inflammatory activity and consecutive demyelination in experimental multiple sclerosis (MS) in-vivo using dual-channel optical molecular imaging
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Purpose: A method for continuous surveillance of central-nervous inflammatory processes and underlying pathophysiology was desired for examination of murine models of disease. Activated macrophages have been shown to play a crucial role in initialisation and maintenance of inflammation. Previous work proved expression of macrophage-related protein S100 A9 to be correlated with local disease activity and optical imaging (OI) of S100 A9 has successfully been performed. Near-infrared fluorescent 3.3'-diethylthiatricarbocyanine-iodide (DBT) has been shown to selectively bind myelin.

Methods and Materials: MS-equivalent lesions were induced in C57BL6J mice by Cuprizone-application over 35 days. Healthy mice served as control. Anti-S100 A9 or Immunoglobulin G (IgG; control for non-specific label distribution) were labelled with Cy5.5 for OI. Tracer doses per animal were 100µg anti-S100 A9-Cy5.5, 24h and 2µg DBT. 5 min prior to fluorescence-mediated tomography with excitation/ emission of 680/700nm (Cy5.5) and 750/780nm (DBT). For correlation of in-vivo OI, magnetic resonance tomography (MRI) for lesion-detection and immunohistochemistry were performed. Statistical analysis: student-t-test.

Results: In Cuprizone-treated animals, injection of anti-S100 A9-Cy5.5 resulted in three-fold higher tracer accumulation than in healthy animals (3.65pmol vs. 1.2pmol; p=0.02); whereas unpecific IgG-Cy5.5 accumulated to a significantly lower scale (2.3pmol vs. 3.65pmol; p=0.03). Myelin-associated DBT-accumulation dropped from 30.7pmol (healthy) to 1.5pmol (Cuprizone), reflecting significant demyelination. For all measurements, a ROC-analysis of the corpus callosum-region was performed, wherefore FMT and MRI for Annexin V colocalised with apoptosis as depicted by OI.

Conclusion: Anti-S100 A9-Cy5.5 in combination with DBT may serve for specific visualisation of central-nervous inflammation like MS and allows for grading according to immune-cell activity and demyelination.

B-0105 11:06
Can molecular imaging of breast tumours with high-field multiparametric MRI obviate unnecessary breast biopsies? K. Ficker-Domenig, H. Bickel, H. Magometschnigg, B. Brueck, S. Gruber, W. Bogner, M. Schernthaner, D. Berzacyz, T.H. Heibich; Vienna/AT (katja.pinker@medunivien.ac.at)

Purpose: To evaluate if multiparametric assessment of breast lesions with proton MR spectroscopy (3D-1H-MRSI), diffusion-weighted MR imaging (DWI) and, contrast-enhanced (CE-MRI) obviates unnecessary breast biopsies.

Methods and Materials: 112 patients with breast lesions detected by mammography or ultrasound and classified as BI-RADS 3-5 were included in this IRB approved prospective study. All patients were examined multiparametric MRI of the breast at 3 T. MRI protocol included: 3D-1H-MRSI before application of contrast agent to avoid contamination of spectra, a DWI, a T2-weighted sequence and a combined contrast-enhanced high temporal and spatial resolution 3D-T1w-sequence before and after application of a standard dose Gd-DOTA. MRI was assessed for lesion morphology and EH-kinetics according to the BI-RADS classification, restricted diffusivity and increased Choline (Cho)-levels. An ADC threshold 1.25 x10-3 mm²/s and a signal-to-noise ratio of the Cho resonance peak > 2.55 were defined as a marker of malignancy. A predefined evaluation algorithm was used for assignment of a final BI-RADS classification. All lesions were histopathologically verified.

Results: 3D-1H-MRSI had a sensitivity of 69% and a specificity of 81%. DWI had a sensitivity of 95% and a specificity of 95%. CE-MRI demonstrated a sensitivity of 100% and a specificity of 76%. Multiparametric MRI increased sensitivity to 100%, specificity to 89% and had a very good diagnostic accuracy of 96%. Breast biopsies could have been spared in 89% of benign lesions.

Conclusion: Multiparametric MRI of the breast at 3 T improves differentiation between benign and malignant breast lesions obviating unnecessary breast biopsies.

B-0106 11:15
Effect of cyclopamine on 18 F-FDG-uptake of pancreatic cancer xenografts in nude mice: evaluation by clinically implemented high-resolution PET-CT
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Purpose: We quantitatively analysed the effects of cyclopamine on the 18 F-FDG-uptake of pancreatic cancer xenografts (PCX) using a clinically implemented PET-CT scanner with high-resolution reconstruction.

Methods and Materials: PCX from two pancreatic cancer cell lines were induced subcutaneously in the hip and shoulder of nude mice. PCX were treated with the anti-hedgehog signalling agent cyclopamine intraperitoneally for one week. Mice were injected intravenously with 7.4 MBq 18 F-FDG and scanned with a 40-detector mCT-scanner (Siemens Healthcare Sector, Erlangen, Germany). To adapt for the small size of mice, we changed the zoom to 10 instead of 1, the scan time pro bed position to 10 minutes instead of 3 minutes and we used 1 mm Gaussian Filter instead of 3 mm. The dataset was reconstructed and quantified using the TrueX and TrueD softwares.

Results: MiaPaCa-2 cells; which respond to cyclopamine, showed decreased 18 F-FDG-uptake without changes in tumour size. The HP tumours showed a reduction of the SUVmax by -24.5 ± 9.2%, the SUVavg by -33.5 ± 7.0% and SUVmin by -30.3 ± 16.7% (p < 0.05). The shoulder tumours showed reduction of the SUVmax by -14.7 ± 7.5%, SUVavg by -12.6 ± 6.3 and SUVmin by -30.3 ± 16.7% (p < 0.05). Capan-1 cells; which do not respond to cyclopamine, did not show significant SUV changes.

Conclusion: The clinically implemented PET-CT scanner with high-resolution reconstruction can detect minimal changes in response to low-dose short-term therapy of pancreatic cancer xenografts even without changes in tumour size and thus offers the potential for translational research in anti-tumour therapy.

B-0107 11:24
Impact of normal tissue uptake using 68Ga DOTATOC-PET/CT in patients with neuroendocrine tumour - a follow-up study
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Purpose: Imaging with somatostatin analogues such as 68Ga-DOTA-(0)-Phe-(1)-Tyr-(3)-octreotide (DOTATOC) became a standard approach for staging and restaging the neuroendocrine tumours. The aim of this study is to assess the impact of the normal tissue uptake using 68Ga-DOTATOC-PET/CT in patients with neuroendocrine tumour prior and after 4-6 cycles of peptide receptor radionuclide therapy (PRRT) with 90Y-DOTATOC and 177Lu-DOTATOC.
Conclusion: ADC measurements can help to distinguish between different tumour types and could serve as a prognostic marker for the uptake of molecules into tumours.

**B-0110** 11:51
Comparison of consecutive bolus tracking and flash replenishment measurements for the assessment of tissue haemodynamics using contrast-enhanced ultrasound (CEUS) in an experimental squamous cell carcinoma model

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**Purpose:** To evaluate “bolus-tracking” (BT) and “flash-replenishment” (FR) for the assessment of tissue haemodynamics by contrast-enhanced ultrasound (CEUS) in an experimental small-animal-squamous-cell-carcinoma-model. Since the underlying tissue is the same, strong correlations between parameter outcomes of both techniques are expected.

**Methods and Materials:** Human hypopharynx-carcinoma-cells were subcutaneously injected into the left flank of 18 female athymic-nude-rats. After 14 days of subcutaneous tumour growth, BT and FR measurements were performed in each rat after bolus-injection of SonoVue via the lateral tail vein using a high-end ultrasound system with a 15 MHz probe. Video-sequences were exported; both modalities were analysed with VueBox (Bracco-Suisse). BT yields the parameters peak enhancement (PE), area-under-the-curve (AUC), rise-time (RT), mean-transit-time (MTTb), wash-in-rate (wiRb) and perfusion-index (PIb); FR yields relative-blood-volume (rBV), MTTi, PIf and wFr.

**Results:** Highly significant correlations were observed between rBV and PE (r=0.609 p<0.007), rBV and AUC (r=0.799 p<0.001), rBV and mTTb (r=0.64 p=0.004), MTTb and MTTi (r=0.560 p=0.016), PIF and PE (r=0.813 p<0.001), PIF and AUC (r=0.693 p<0.001) and wFr and PIf (r=0.688 p=0.002).

**Conclusion:** Whereas bolus tracking can be used in a wide range of modalities including CEUS, CT and MR, FR as a technique for the assessment of tissue haemodynamics is unique to CEUS. Although BT and FR yield different parameters, the underlying tissue haemodynamics are equal. In this work, we were able to demonstrate strong correlations between different parameters of both modalities in a small-animal-tumour-model, indicating that flash-replenishment is a valid alternative to the more established bolus-tracking technique. Although the lack of absolute, quantitative parameters hinders a direct comparison of both modalities, FR and BT should both be suitable for a relative comparison, e.g. between baseline and follow-up examinations.
pericardial effusion/haematoma (n=21) and intramural haematoma of the pulmonary arteries (n=5). The 5 IMH of the pulmonary arteries were combined with an IMH of the aorta in thread and a dissection of ascending aorta in 2 cases. All intramural haematoma were detected at best on the non-contrast enhanced scans.

Conclusion: Non-enhanced CT scans are a prerequisite for the accurate detection of intramural haematoma in patients with suspicion of acute aortic syndrome. Our directed analysis of high-resolution MDCT scans showed that intramural haematoma of the pulmonary artery are more frequent than expected.

B-0112 10:39
Measuring aortic and pulmonary trunk diameters in epidemiologic research: do we need gadolinium and orthogonal slices? B. Mensel, J.P. Kühn, S. Langner, N. Hosten, R. Puls; Greifswald/DE (birger.mensel@uni-greifswald.de)

Purpose: Cardiovascular magnetic resonance imaging has become increasingly popular in population-based research. Our study evaluates the validity and reliability of measuring the diameters of the aorta and pulmonary trunk from plain axial VIBE (volume-interpolated breath-hold examination) images.

Methods and Materials: The study included 50 male subjects from the population-based Study of Health in Pomerania (SHIP). In these subjects, the thoracic and abdominal aorta and pulmonary trunk were imaged at 1.5 Tesla using a plain VIBE sequence and contrast-enhanced magnetic resonance angiography (CE-MRA). Diameters were measured at predefined anatomic sites from axial VIBE images and reformatted orthogonal CE-MRA images. The measurements were validated using Pearson correlation and Bland-Altman analysis. Reliability was assessed using the Bland-Altman method.

Results: Comparison of the diameters revealed strong correlation for the ascending and descending aorta with r=0.95 (p < 0.0001) and 0.88 (p < 0.0001), respectively. Moderate correlation was found for the aortic arch and pulmonary trunk with r=0.78 (p < 0.0001) and r=0.74 (p < 0.0001), respectively. The abdominal aorta showed strong correlation as well with r=0.90 (p < 0.0001) and r=0.92 (p < 0.0001) for the infradiaphragmal and suprarenal aorta and r=0.87 (p < 0.0001) and r=0.86 (p < 0.0001) for the infrarenal aorta and aortic bifurcation. Mean bias was less than or equal to 0.1 cm (7%), 95% limits of agreement were less than 0.5 cm (20%). Intra- and interobserver agreement was excellent.

Conclusion: Axial measurement of the diameters of the thoracoabdominal aorta and pulmonary trunk using plain VIBE images is highly valid and reliable.

B-0113 10:48
Intraobserver and interobserver variability of CT-based volumetry and diameter measurements of abdominal aortic aneurysms after endovascular aneurysm repair W.H. Sommer, M. Haack, F. Meinel, M.F. Reiser, R. Weidenhagen; Munich/DE (wieland.sommer@med.uni-muenchen.de)

Purpose: To determine the most reproducible and suitable measurements for changes of abdominal aortic aneurysms after endovascular aneurysm repair (EVAR).

Methods and Materials: 14 consecutive patients successfully treated by EVAR underwent 128-row follow-up CTA in 1.5-mm collimation. Manual diameter and volumetric measurements were performed twice by two blinded and experienced readers with at least a 4-week interval between readings. Maximum axial and orthogonal aortic diameters, as well as volumetry of the abdominal aortic aneurysm were performed using Osiris software. Intra- and interreader variabilities were determined by concordance correlation coefficients (CCC). Mean time for semiautomated volumetry of the aortic aneurysm and for diameter measurements was recorded.

Results: Interreader agreement was significantly higher for volumetry (CCC=0.996; 95% CI: 0.986-0.999), than for the axial diameter (CCC=0.994; 95% CI: 0.986-0.990) and the orthogonal diameter measurement (CCC=0.943; 95% CI: 0.897-0.982) (p < 0.001). Both for readers 1 and 2, interreader agreement at 1.5 Tesla using a plain VIBE sequence and contrast-enhanced magnetic resonance angiography (CE-MRA) was superior to 3D SSFP-MRA measurements of the aortic root as well as 3D SSFP-MRA measurements of the sinuses of Valsalva (r = 0.690). Image quality as well as intra- and interobserver agreement of measurements of the sinuses of Valsalva was significantly better for SSFP-MRA than for CE-MRA.

Conclusion: 3D SSFP-MRA measurements of the aortic root are superior to 3D CE-MRA measurements and should be used for establishing the diagnosis of aortic enlargement.

B-0114 10:57
Screening for aortic root aneurysms in patients with suspected or known Marfan syndrome: intra-individual comparison of enhanced and unenhanced MR angiography with echocardiography P. Bannes, M. Groth, M. Rybczynski, S. Sheikhzadeh, Y. von Kodolitsch, J. Grassner, G. Lund, A. Adam, C. Habermann; Hamburg/DE (p.bannes@uke.de)

Purpose: Patients with Marfan syndrome have to be screened for internal assessment and follow-up of aortic root dilatation. Our purpose was to evaluate intra-individually the performance of unenhanced (3D SSFP-MRA) with contrast-enhanced (3D CE-MRA) magnetic resonance angiography for aortic root diameter measurements and to compare the results with routinely performed echocardiography in patients with Marfan syndrome.

Methods and Materials: Aortic roots were examined prospectively in 51 consecutive patients with suspected or known Marfan syndrome using a 3D SSFP-MRA and a 3D CE-MRA at 1.5 Tesla. Two readers independently measured aortic root diameters at the annulus, sinuses of Valsalva and sinutubular junction in both datasets and compared results with echocardiographic data. Intraclass correlation coefficient, Pearson’s correlation coefficient, Bland-Altman, and two-sided t-test were used to assess agreement between observers and methods.

Results: 38 (74.5%) of the included 51 patients (mean age 37±13.7 years) had Marfan syndrome, the remaining 13 were healthy individuals (25.5%). Both, SSFP-MRA and CE-MRA measurements of the sinuses of Valsalva revealed a strong correlation with echocardiography (r=0.893 and r=0.895, respectively). Intraclass correlation was markedly better for SSFP-MRA (r = 0.994) when compared to CE-MRA (r = 0.990). Image quality as well as intra- and interobserver agreement of measurements of the sinuses of Valsalva was significantly better for SSFP-MRA than for CE-MRA.

Conclusion: 3D SSFP-MRA measurements of the aortic root are superior to 3D CE-MRA measurements and should be used for establishing the diagnosis of aortic involvement in Marfan syndrome and monitoring the course of aortic enlargement.

B-0115 11:06
Feasibility of time-resolved MR angiography with interleaved stochastic trajectories (TWIST) for the diagnosis of thoracic outlet syndrome T.C. Lauenstein, L. Umutlu, A. Fischer, C. Kloeters, A. Quinsten, S. Kinner; Essen/DE (thomas.lauenstein@uni-due.de)

Purpose: The thoracic outlet syndrome (TOS) is defined as a positional compression of the vertebral and subclavian artery. TOS can be diagnosed by magnetic resonance angiography (MRA) in conjunction with postural manoeuvres. This technique requires high amounts of gadolinium and exact timing of contrast delays. A new time-resolved MRA technique (TWIST) combines parallel imaging with a 3D view sharing implementation. Hence, 3D datasets can be collected with only little intravenous gadolinium, but high temporal resolution. We aimed to assess whether TOS can be diagnosed with TWIST MRA.

Methods and Materials: 21 patients with suspected TOS were studied. Examinations were performed on a 1.5-T system (MAGNETOM Avanto; Siemens). A Body Matrix RF surface coil was used for signal reception of the upper thorax. Following the i.v. administration of 3 cm³ gadobutrol (Gadovist, Bayer) at a flow-rate of 3 cm³/s, 20 consecutive coronal T1-weighted 3D datasets were acquired using a TWIST protocol (TR/TE/TI = 2.5 ms/0.9 ms/25°; matrix: 384x202; 60 slices; temporal resolution: 3.0 s). The acquisition was performed twice: with the arms alongside the body and after elevation. Images were analysed concerning stenotic changes of the subclavian arteries. Results of subsequent B-mode and colour duplex ultrasonography were used as standard of reference.

Results: 6 patients did not reveal a stenosis of the right or left subclavian artery. In 15 patients a compression of the subclavian artery was observed after arm elevation (unilateral n=9, bilateral n=6). Findings were confirmed by the standard of reference.

Conclusion: TWIST MRA is a fast and robust technique to identify patients with TOS.
**B-0116** 11:15
Quantification of microvascular vessel wall characteristics of abdominal aortic aneurysms with MRI: feasibility, reproducibility and initial experience
V.L. Nguyen1, W.H. Backes1, E.M. Kooi1, M.C.J. Wishaupt1, F.A.M.V. Hellenthal1, M.E.H. Bosboom1, R.J. Van der Geest1, G.W.H. Schurink1, T. Leiner2; 1Aartselaar/F, 2Maasstricht/NL, 3Eindhoven/NL, 4Leiden/NL, 5Utrecht/NL (vl.nguyen@maastrichtuniversity.nl)

**Purpose:** A prominent characteristic of the abdominal aortic aneurysm (AAA) vessel wall is neovascularisation, which has been linked with AAA progression and rupture. The aim of the present study was to investigate the potential of dynamic contrast-enhanced-MRI (DCE-MRI) to characterise AAA vessel wall neovascularisation by quantification of the enhancement dynamics.

**Methods and Materials:** 30 patients underwent DCE-MRI of the abdominal aorta at 1.5 Tesla. Enhancement dynamics were quantified by calculating the transfer constant (Kr), using arterial input function (AIF) modelling and the area-under-curve (AUC). Ten patients were imaged twice on different occasions. Intraclass correlation coefficients (ICC) were determined to investigate interscan, inter- and intraobserver variability. Associations between Krans, AUC and maximal diameter were computed as a Pearson correlation coefficient (r).

**Results:** In total, 28 of the 30 MRI examinations could be included for pharmacokinetic analyses. Interscan, inter- and intraobserver variability for Krans and AUC measurements were excellent (ICC > 0.88). The maximal diameter (mean ± SD: 49.5 ± 5.9 mm) was significantly correlated with Krans (0.024 ± 0.009 min⁻¹) (r = 0.51; p = 0.006), but not with AUC measurements.

**Conclusion:** Dynamic CTA in the post-EVAR follow-up revealed that the peak enhancement of endoleaks and aorta are significantly different and not covered sufficiently by conventional biphasic scTA protocols. The use of dCTA is associated with a significantly increased detection rate of endoleaks.

**B-0117** 11:24
Using engineering, mathematical models and CT 4D imaging to understand the haemodynamic after aortic prosthesis insertion
L.V. Forzenigo1, P. Biondetti1, M. Domanin1, C. Vergara2, B. Barberis1; 1Milan/IT, 2Ranica/IT

**Purpose:** The main goal of this study is to demonstrate the possibility of mathematical modelling of the blood flow in cardiovascular pathologies such as AAA both before and after endovascular treatment (EVAR), using dynamic 4D CT imaging.

**Methods and Materials:** Since 2007 till 2011 we enrolled 19 who underwent endoprosthesis insertion because of AAA. Each patient was studied before and after intervention with Doppler Ultrasound and Double Source ECG-gated 64 Rows CT Angiography. CT DICOM data were for 3D model/geometry extraction and Mesh generation, and for mathematical modelling of aortic haemodynamic before and after prosthesis insertion. From these data maps of peak wall stress, of flow velocity profiles and of inward/outward wall displacement during one cardiac cycle were calculated.

**Results:** Preliminary results show that in the native AAA the systolic outward wall displacement is correlated with the peak velocity, high pressure and flow velocity profiles. After endoprosthesis insertion there is an increase of intra-prosthesis flow velocity, with a decrease of lateral pressure. Deformation and pulsation of the metallic stent structure happened after the first year of follow-up. The midsection of the deformation well correlated with the location of the maximum velocity change during cardiac pulsation. The rigid prosthesis interrupts the pressure wave originated by the cardiac pulsation, with generation of backward components with possible long-term negative effects on the cardiac function.

**Conclusion:** Computational blood flow dynamics using 4D CT data could predict the risk of aneurismal rupture. Late deformation of EVAR can be explained by changes in blood flow dynamics.

**B-0118** 11:33
Dynamic (dCTA) versus static (sCTA) computed tomography angiography after abdominal aortic endovascular aneurysm repair (EVAR): influence of enhancement patterns and optimal bolus timing on endoleak detection
C. Andres, C. Luecke, B. Foldyna, M. Grothoff, S. Nitzsche, A. Schmidt, D. Scheinert, M. Gublerer, L. Lehmkuhl; Leipzig/DE (claudia.andres.mail@googlemail.com)

**Purpose:** To assess differences of aortic and endoleak enhancement in patients after EVAR using the recently introduced dCTA versus sCTA, to evaluate the impact of enhancement patterns on the endoleak detection rate and to define the optimal scan timing.

**Methods and Materials:** Seventy-one patients (72±8 years) after EVAR of the abdominal aorta were retrospectively included. All patients underwent dCTA with 10 uni-directional scan phases on a second generation dual source CT (80 kV, 120Ref.-mA, z-FOV=283 mm, temporal resolution 5sec; 80 ml [4 ml/sec] contrast [400 mg iod/ml]), bolus tracking; 90 HU, followed by a venous phase) and a preliminary biphasic scTA. Enhancement was assessed for all scan phases by ROI measurements in aorta and detectable endoleaks. Image quality was rated by a 5-point confidence scale.

**Results:** In dCTA, the highest mean enhancement could be achieved 12sec post-threshold (p.t.), the highest mean endoleak enhancement considerably later at 22sec p.t. Within a total of 48 endoleaks, 14 (37.8%) were newly detected not visible in preliminary scTA. Detection rates differed significantly in-between the dCTA phases (p < 0.01). The highest detection rate (n=44) was obtained 27sec p.t., when the differences between aortic and endoleak enhancement, and therefore the contrast reached its maximum. The mean dose-length product differed by 11% (dCTA: 1344±131 mGy·cm, scTA 1224±165 mGy·cm, p < 0.01).

**Conclusion:** Dynamic CTA in the post-EVAR follow-up revealed that the peak enhancement of endoleaks and aorta are significantly different and not covered sufficiently by conventional biphasic scTA protocols. The use of dCTA is associated with a significantly increased detection rate of endoleaks.

**B-0119** 11:42
One year after endovascular abdominal aortic aneurysm repair (EVAR) one third of the aneurysm sac still consists of unorganised thrombus in patients with and without detectable endoleak
S.A. Cornelissen1, E.-J. Vonken2, J. Van Pratten1, H.J.M. Verhagen1, F.L. Moll5, L.W. Bartels1; 1Amersfoort/NL, 2Utrecht/NL, 3Rotterdam/NL (sap.cornelissen@meandmcn.nl)

**Purpose:** The purpose of this study was to monitor thrombus organisation during the first year after EVAR with MRI.

**Methods and Materials:** In this IRB-approved prospective study 30 patients underwent MRI-exams pre-operatively, < 6 weeks postoperatively, 6 months and 1 year after EVAR. Pre-contrast T1-, T2- and postcontrast T1-w images were acquired. An experienced radiologist subdivided the aneurysm sac into regions of endoleak, unorganised and organised thrombus based on the signal intensities on the differently weighted images using custom written software.

**Results:** The mean unorganised thrombus volume pre-operatively was 23 ml (95%CI 16-30 ml), postoperatively 51 ml (95%CI 41-61 ml), after 6 months 39 ml (95%CI 29-48 ml), and after 1 year 32 ml (23-41 ml). There was a significant increase in unorganised thrombus volume postoperatively compared with pre-operatively (paired t-test, p < 0.05) after which the unorganised thrombus volume significantly decreased after one year (paired t-test, p < 0.05). 10 patients had a type II endoleak on the postoperative CT-exam. In these patients a larger part of the aneurysm sac consisted of unorganised thrombus after 6 months than in patients without a type II endoleak (mean 48% of aneurysm sac volume, 95%CI 38-58% vs. mean 33% of aneurysm sac volume,95%CI 25-41%, independent t-test p < 0.05).

**Conclusion:** Measurement of the degree of thrombus organisation of the intra-aneurysmal thrombus after EVAR is possible with MRI. After EVAR the unorganised thrombus volume decreases in time, however, both in patients with and without endoleak, one year after EVAR still one-third of the aneurysm sac consists of unorganised thrombus of unknown aetiology.

**B-0120** 11:51
Validation of radically undersampled 5-point-encoded 4D flow MR (PC-VPR) in thoracic aorta and main pulmonary artery
A. Frydrychowicz1, E. Niespodzany2, S.B. Reeder2, O. Wieben2, K.M. Johnson1, C.J. Francois1, 3Madison, WI/US, Lübeck/DE, 4Madison, WI/US (alex.frydrychowicz@uksh.de)

**Purpose:** To validate radially undersampled 5-point velocity-encoded 4D-flow MR (PC-VPR) for quantification of aortic (AAO) and main pulmonary artery (MPA) flows in comparison to cardiac MR volumetry and 2D phase contrast imaging (2D-PC-MRI).

**Methods and Materials:** 14 cardiovascular healthy volunteers (39.2±16.8years (22-73); BMI 26.1±3.3 (20.6-31.4)) were scanned at 3 T with 20 elements of a 32-channel-coil. Left and right ventricular volumetry using CINE-bSSFP in contiguous short-axis slices and 2D-PC-MRI in AAO and MPA served as references. All 2D-PC-MRI exams and B14 PC-VPR exams were phantom-corrected according to Chernobelsky et al. PC-VPR was performed with venc=150 cm/s reconstructed to 20 time frames. PC VPR data were automatically corrected for eddy currents
and Maxwell terms. Contrast-enhanced MRA using 0.03 mmol/kg gadofosveset trisodium was performed to facilitate 2D plane placement simultaneously providing constantly high signal-to-noise ratio throughout the exam. Bland-Altman analysis (average difference ± 2SD) and correlation were applied for statistical testing. Results: Bland Altman analysis shows a marked bias between non-corrected PC-VIPR and CINE-bSSFP (AAO: −11.9 mL (BA-window −48.0 to 24.1); MPA: −6.7 mL (−33.4 to 19.9)) and between non-corrected PC-VIPR and phantom-corrected 2D-PC-MRI (AAO: −14.3 (−44.0 to 15.4); MPA: −11.7 mL (−63.0 to 39.5)). Phantom-correction of PC-VIPR data improved the bias towards both CINE-bSSFP and 2D-PC-MRI. The best correlation was reached between phantom corrected PC-VIPR and 2D-PC-MRI (R2=0.62).

Conclusion: PC-VIPR with 5-point velocity-encoding permits the measurement of blood flow in the thoracic aorta and pulmonary artery simultaneously to morphologic and haemodynamic information. This ongoing evaluation is limited by the variability of the reference methods and outliers influencing the results disproportionately.

10:30 - 12:00
Room P

Physics in Radiology

SS 113 Functional imaging

Moderators:
C. Leidecker; Forchheim/DE
M. Onu; Bucharest/RO

B-0121 10:30

Metal artefact reduction in dual source computed tomography using monoenergetic extrapolation: a systematically optimised protocol
F.G. Meinelt1, G. Zhang1, F. Bamberger2, B. Bischoff3, M.P. Reiser4, T.R.C. Johnson1,5; Munich/DE, Hangzhou/CH

Purpose: Monoenergetic extrapolation is a promising strategy to reduce metal artefacts in dual source computed tomography (DSCT). We performed this study to systematically optimise image acquisition and reconstruction parameters for this approach.

Methods and Materials: A standard hip phantom was loaded with titanium and cobalt chromium models of hip prostheses and scanned on a DSCT scanner (Somatom Definition Flash, Siemens, Forchheim, Germany). Tube spectra, tube current ratio, collimation, pitch, rotation time, and extrapolated energies were optimised in a step-wise process. Artefacts and image noise were quantified by measuring the standard deviation (SD) of the CT density in a circular region of interest placed over the range typically found for tumours. Simulated curves were analysed with all models and results compared.

Results: Sn140/100 kVp proved superior to Sn140/80 kVp and 140/100 kVp, especially for thick cobalt chromium elements (SD 339 HU vs. 434 HU). There was an increase of tube current ratio from 1:1 to 3:1 - but not beyond - in favour of the Sn140 kVp spectrum (SD 49 HU vs. 69 HU for cobalt chromium). Artefacts were less severe for a collimation of 32x0.6 as compared to 40x0.6 (SD 30 HU vs. 43 HU for cobalt chromium). A pitch of 0.5 at a rotation time of 0.5 was chosen as optimal when comparing different combinations with comparable scanning times. The optimal extrapolated photon energies were 105-110kV for titanium, and 110-135kV for cobalt chromium.

Conclusion: The acquisition time in CT perfusion studies significantly affects patient’s dose exposure. In order to reduce the radiation dose, reduced time CT perfusion acquisitions are tested to measure PS with a deconvolution method.

PS was calculated with repeated measurements (n=259) while truncating the time density curve at different time values in 11 CT perfusion studies conducted for lung cancer (n=2), Hodgkin lymphoma (n=7) and renal cell carcinoma (n=2), using CT perfusion 4D software (GE Healthcare). The median acquisition time of CT perfusion studies was 62 sec (range 49-120 sec). To verify the accuracy of the deconvolution algorithm, a variation of the truncated PS within the error measurements was searched, i.e. within 3 standard deviations from the mean nominal error provided by the software. As a sanity check the test was performed for all the parameters measured using CT Perfusion 4D software.

Results: PS was consistent within 7% in ~10-~20 seconds; and within 0.9% in ~20~23 seconds; PS was constant after 25 to 35 sec. A consistent result lasted for all the observed parameters (MTT, BV, BF) as expected from their analytical dependence.

Conclusion: Thirty-five seconds are enough to obtain a reliable IRF (impulse residual function). For an accurate measurement of the PS a 45 sec acquisition time should be an optimal compromise to obtain reliable PS measurements and a reasonable dose exposure. No additional information can be provided with longer perfusion acquisition times.

B-0124 10:57

Improving image quality of volumetric helical perfusion CT at 100 kV using spatiotemporal filtering: a strategy for dose reduction
A. Radhakrishnan, I. Simcock, J. Stirling, A. Khan, R. Glynn-Jones, V.J. Goh; London/UK

Purpose: To assess the change in image quality of pelvic volumetric helical perfusion CT techniques with the application of a spatiotemporal filter.

Methods and Materials: Following ethical approval and informed consent, 23 patients (11 males, 12 females) with pelvic cancers underwent a volumetric helical perfusion CT study (Somatom Definition, Siemens) using the following parameters: (100 kV, 120 mA, 4D adaptive spiral, 1.5-3s cycle time; 11.4 cm z-axis; 50 mL 350 mg/mL ioversol IV at 6 mL/Sec). Following motion correction, images were reconstructed at 3 mm and 5 mm slice thickness with and without application of a spatiotemporal filter (4D noise reduction). Image noise was assessed by placement of a region of interest within muscle and tumour at 3.0 and 5.0 mm slice thickness, respectively. The standard deviation of the ROI, equivalent to ‘noise’, was recorded. The tumour contrast-to-noise ratio (CNR) was calculated by dividing tumour enhancement by noise. CNR before and after filter application were compared using paired t-testing with significance at 5%.

Results: Mean noise decreased following filter application from 25.3 to 23.2 at 3 mm and 22.6 to 21.8 at 5 mm for muscle; and from 27.5 to 26.3 at 3 mm and 23.9 to 21.8 at 5 mm for tumour. Contrast-to-noise ratio increased from 1.97 to 2.16 (+9.22%) at 3 mm (p=0.008) and 2.29 to 2.36 (+6.58%) at 5 mm (p=0.39).

Conclusion: Application of a spatiotemporal filter decreases noise and significantly increases the contrast-to-noise ratio at 3 mm. This has the effect of increasing the CNR at 3 mm to an equivalent 5 mm slice thickness.
B-0125 11:06

Functional imaging on an interventional C-arm flat detector CT system
P. Brauwlder, F. Elia, M. Hupfer, T. Nowak, D. Kohlskitz, W.A. Kailender; Erlanger DE (Robert.Brauwlder@impi.uni-erlangen.de)

Purpose: To investigate the potential of dynamic C-arm CT to assess functional parameters from a time-resolved sequence of volumetric images.

Methods and Materials: Measurements were performed on an experimental robotic C-arm flat detector CT system allowing for a scan time of 2 s/s180° and for validation purpose on a clinical CT scanner. For half-scan reconstructions the resulting temporal sampling was 2 s, for full-scan reconstructions 4 s. On the clinical CT we performed scans at 1, 2, 3 and 4 s temporal sampling. We used a perfusion phantom which provides reproducible contrast curves. Three different water flow rates were utilised to simulate different functional behaviour. Scans were repeated three times and post-processed using the maximum slope method to assess the functional parameters blood volume (BV), blood flow (BF), mean transit time (MTT) and time to peak (TTP).

Results: For each sampling rate and all functional parameters, reproducibility errors did not exceed 5% for both clinical CT and C-arm CT. For 2 s temporal sampling, interventional C-arm CT and clinical CT were in agreement with deviations below 10% for BF, BV and TTP and below 15% for MTT. For lower temporal samplings of 3 s and 4 s, functional parameters deviated by up to 40% compared to the 1 s sampling case.

Conclusion: The assessment of functional parameters by C-arm CT shows promising results and may save valuable time in patient treatment, when no additional CT or MRI scan is required before or during therapeutic intervention.

B-0126 11:15

Virtual non-contrast in second-generation, dual energy computed tomography: reliability of attenuation values
M. Toepfer1, T. Moritz1, M. Weber1, B. Krauss1, T. Mang1, G. Euler1, F. Wolff1, C.J. Herold1, H. Ring1; 1 Vienna/AT, 2 Forchheim/DE (michael.toepfer@medunwien.ac.at)

Purpose: To evaluate the reliability of attenuation values in virtual non-contrast images (VNC) reconstructed from contrast-enhanced, dual energy scans performed on a second-generation dual energy CT, compared to single-energy, non-contrast images (TNC).

Methods and Materials: The institutional review board approved this research and waived informed consent. Sixteen phantoms containing a mixture of contrast agent and water at different attenuations (0-1400 HU) were investigated on a daily clinical routine, a safety margin of 10 HU should be applied.

Results: All cases, absolute differences between TNC and VNC were under 15 HU, and, in 10% for BF, BV and TTP and below 15% for MTT. For lower temporal samplings of 2 s, temporal sampling was 2 s, for full-scan reconstructions 4 s. On the clinical CT we performed scans at 1, 2, 3 and 4 s temporal sampling. We used a perfusion phantom which provides reproducible contrast curves. Three different water flow rates were utilised to simulate different functional behaviour. Scans were repeated three times and post-processed using the maximum slope method to assess the functional parameters blood volume (BV), blood flow (BF), mean transit time (MTT) and time to peak (TTP).

Conclusion: The assessment of functional parameters by C-arm CT shows promising results and may save valuable time in patient treatment, when no additional CT or MRI scan is required before or during therapeutic intervention.

B-0127 11:24

Characterisation of the biograph mMR
S. Fürst1, G. Delso1, B.W. Jakoby1, R. Ladebeck1, C. Gunter1, S.G. Nekolla1, E.J. Rummeny1, M. Schwager1, S.I. Ziegler1, 1 Munich/DE, 2 Khonkong/TH, 3 NUS/SG, 4 Erlangen/DE (sebastian.fuerst@tum.de)

Purpose: The physical performance of the first fully integrated whole body MR/PET scanner, the biograph mMR (mMR), was studied and compared to current MR and PET/CT systems, the Magnetom Verio 3 T and the biograph mCT (mCT), respectively. Simultaneous operation and its effects were also considered.

Methods and Materials: The key components of the mMR are a 3 T magnet and APD-LSO block detectors. Measurements were prepared and performed as described in the NEMA NU 2-2007 protocol (PET) and in the ACR quality control manual (MRI). PET sensitivity and spatial resolution were assessed both with and without an MRI VIBE sequence running.

Results: Based on its geometry, the mMR has an increased sensitivity of 15 kcps/MBq in and 14 kcps/MBq off the FOV centre (mCT: 10 kcps/MBq). The average spatial resolution values of the mMR and the mCT are comparable (4.3 mm/4.4 mm at the FOV centre). These findings were unaffected by parallel MRI scans. The noise equivalent count rate of the mMR peaks at 23.1 kcps/ml with 183.5 kcps (mCT: 180.3 kcps/28.3 kcps/ml). The scatter fraction was measured to be 36.7% (mCT: 33.2%). The image contrast increases from 32.5% to 70.8%, whereas the background variability decreases from 5.3% to 3.7% with increasing diameters of active spheres (4.1 mm/4.8 mm). Measurement of B0 homogeneity (< 1 ppm in a 22 cm sphere), B1 field distribution and RF noise showed no significant differences to the reference MR system. Simultaneous PET acquisitions had no effect.

Conclusion: Proper integration of APD-PET technology and 3 T MRI does not limit the performance of either component in comparison to state-of-the-art stand-alone instrumentation.

B-0128 11:33

Comparison of SPACE and 3D-TSE-MRCP regarding image quality and diagnostic certainty in patients in a routine clinical setting
P. Suchal1, C.Urgo1, G. Bongartz1, J. Hohmann1, 1 Basle/CH, 2 London/UK (suchalhttp@uhbs.ch)

Purpose: We compared 3D-SPACE (sampling perfection with application optimised contrast)-MRCP with conventional 3D-TSE-MRCP in a routine clinical setting. Aim was to evaluate whether or not the 3D-SPACE-MRCP allows better image quality in patients and if this translates also to a higher level of confidence regarding the diagnosis of choledocholithiasis.

Methods and Materials: 3D-TSE and 3D-SPACE sequences were consecutively obtained from 12 patients undergoing MRCP at our institution. For evaluation, the pancreaticobiliary tree was sub-divided into 10 segments which were scored separately for visibility and diagnostic certainty on a five-point-scale each by three experienced radiologists.

Results: In total, 104 segments were reviewed in both sequences. The average image quality was rated good in both sequences but higher for SPACE-MRCP than for 3D-TSE (4.59 versus 4.14 n=104, p=0.0025). In 36 of 104 segments, image quality in 3D-SPACE was superior to 3D-TSE while image quality in 3D-TSE was better in only 11 segments (57 segments where rated as equal). Diagnostic certainty was evaluated better for 3D-SPACE than 3D-TSE in 24 of 104 segments while 3D-TSE had a higher diagnostic certainty in only 6 segments (74 segments where rated as equal).

Conclusion: 3D-SPACE-MRCP allows superior image quality and offers a higher diagnostic certainty compared to conventional 3D-TSE-MRCP. It should be used as the MRCP-sequence of choice in a routine clinical setting.

B-0129 11:42

Development of a tissue-equivalent phantom for standardisation of diffusion-weighted MRI
G. Wolf, M. Laniado, N. Abolmaali, T. Paulus; Dresden/DE

Purpose: Wide-spread application of diffusion-weighted MRI (DWMRI) in oncology is currently impaired due to limited standardisation across instruments. Therefore, we propose to develop a phantom with tissue-equivalent MRI properties (ADC, R1, R2) for DWMRI standardisation.

Methods and Materials: The influences of individual phantom components agarose gel (concentration=0-4%), succrose (0-40%), Gd-DTPA (0-0.4mM), SPIO (0-1mM) and preservative sodium azide (0.05%) on MRI properties were systematically evaluated. Based on a linear combination model of single components effects, the tissue-equivalent phantom was composed to resemble in-vivo MRI properties of various normal and neoplastic tissues according to literature values. ADC, R1 and R2 of tissue-equivalents were measured by diffusion-weighted spin-echo EPI (9 b-values=0-1000s/mm2), multi-contrast inversion-recovery TSE (9 TI-values=25-2000 ms) and multi-contrast SE (10 TE-values=10-100 ms) using a 1.5 T scanner (Avanto; Siemens). Intra- and inter-series variability was evaluated across multiple acquisitions within the same and all imaging sessions, respectively.

Results: Individual components show inverse linear scaling with concentrations for ADC and linear scaling for R1 and R2. The tissue-equivalent phantom yielded stable MRI parameters over at least 216 days at room temperature storage. Experimental and reference ADC values of tissue-equivalents were significantly correlated (r=0.996, p=0.0003). However, R1 and R2 were less adequately imitated (p=0.05). Intra- and inter-series ADC variability was 1.4±0.7% and 3.4±1.4%, respectively.

Conclusion: The tissue-equivalent phantom permits repeated quantification of MRI parameters in combination with easy preparation and long-time stability as well as simple handling and positioning. It may be useful in quality assurance and system standardisation procedures. DWMRI shows excellent repeatability within the same scanner.
**B-0130** 10:51
Towards standardisation of diffusion-weighted MRI: status survey across instruments using a tissue-equivalent phantom
G. Wolf, F. De Keyzer, T. Paulus, R. Herman, N. Abolmaali; †Dresden/DE, ‡Leuven/BE

**Purpose:** Widespread application of oncologic diffusion-weighted MRI (DWMRI) is currently impaired due to limited standardisation across instruments and imaging parameters. We therefore aimed to perform a status survey of DWMRI at different scanners using a tissue-equivalent phantom.

**Methods and Materials:** The phantom was prepared from agarose gel, sucrose and Gd-DTPA to resemble in vivo MRI properties (ADC, R1, R2) of various normal and neoplastic tissues according to literature values. ADC of tissue-equivalents was measured by diffusion-weighted spin-echo EPI (9 b-values=0-1000s/mm2, TE=69-180 ms, TR=1000-10000 ms, parallel imaging factor (PIF)=1-4) on several scanners (1.5 T Avanto, 1.5 T Sonata and 3 T Trio; Siemens). Median intra- and inter-scanner variability was evaluated across multiple image acquisition sessions within the same and all scanners, respectively.

**Results:** With growing TE we observed a marked early ADC decrease for Sonata (down to 12% relative to TE=minimal) and moderate late decreases for Avanto and Trio (81% and 83%). Avanto-ADC was lower than on Trio (Δ=160µm2/s) independent of TE, whereas it was higher than on Sonata (Δ=220-1640µm2/s) increasing with TE. Correspondingly, inter-scanner variability increased with TE (15-143%). At our optimal settings (TE=minimal, TR=3000 ms, PIF=3), intra-scanner variabilities were 2.8% (Avanto), 3.2% (Sonata) and 5.7% (Trio), while inter-scanner variability was 15% (10-37%).

**Conclusion:** ADC quantification and variability strongly depend on imaging parameters. In general, DWMRI reveals substantial variability across scanners, which largely complicates setup of multi-centre studies and comparison of results. Nevertheless, at optimal settings, DWMRI provides excellent repeatability at the same scanner. However, future efforts are needed to bring standardisation into clinical practice.

**10:30 - 12:00**

**Room Q**

**Cardiac**

**SS 103**

Acute coronary syndromes: viability

**Moderators:** G. Hadjidekov, Sofia/BG
G. A. Krombach, Giessen/DE

**B-0131** 10:30
Sensitivity of cardiac magnetic resonance varies with clinical presentation of biopsy-proven acute myocarditis
G. Cannavale, M. Francone, I. lampieri, B. Conti, A. Frustaci, C. Catalano; Rome/IT

**Purpose:** Recently T2-weighted imaging allowed depiction of myocardial oedema as a specific marker of disease in acute clinical setting. Its sensitivity, however, varies in acute and chronic manifestations. We report good sensitivity variations of MR in acute myocarditis depending on clinical presentation.

**Methods and Materials:** We retrospectively evaluated MR sensitivity in comparison with clinical presentation in 70 patients who had in the last two years an endomyocardial biopsy diagnosis of active myocarditis and a clinical history ≤3 months. All subjects underwent at time of diagnosis a cardiac CMR (CMR) and invasive cardiac examination.

**Results:** Three types of clinical patterns of myocarditis were recognised: 1) infarct-like (feyer, chest pain, ST segment deflection at ECG and serum Troponin I elevation), 2) Cardiomyopathy (left ventricular dysfunction in absence of ECG, serologic or systemic abnormalities), 3) Arrhythmic (sudden occurrence of supraventricular and/or ventricular arrhythmias in absence of systemic evidence of inflammation). Delayed enhancement at CMR suggesting a myocarditis was documented in 72% of patients (n=18/25) of pattern 1, 57% (n=15/26) of pattern 2 and 47% (n=9/19) of pattern 3. Tissue oedema was observed in 80% (n=20/25) of pattern 1, 130% (n=8/26) in pattern 2 and 26% (n=5/19) in pattern 3. Early enhancement was positive in 71% (17/25) of the cases with pattern 1.6% (17/26) with pattern 2 and 52% (10/19) with pattern 3.

**Conclusion:** Sensitivity of cardiac MR is high for infarct-like myocarditis, low for cardiomyopathy and very low for arrhythmic pattern. A more extensive vascular involvement in pattern 1 compared with focal myocyte and conduction tissue damage of pattern 2 and 3, are the most likely explanation.

**B-0132** 10:39
Hybrid PET/MRI in the assessment of cardiac viability: added value compared to PET/CT
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**Purpose:** We evaluated the potential for hybrid PET/MRI devices to provide integrated metabolic, functional and anatomic characterisation of patients with suspected coronary artery disease.

**Methods and Materials:** Ten patients (5 with suspected hibernating myocardium and 5 healthy volunteers) performed an imaging study using a hybrid PET/MRI (Philips). Viability assessed by 18 F-FDG was performed in diseased patients along with MRI anatomic and functional study and reassessed within 30 minutes by conventional PET/CT. Non-contrast right coronary artery (RCA) targeted and whole heart 3D coronary angio-MRI using ECG-gating and respiratory navigator was performed in healthy volunteers using performed MPR and volume rendering. The extent of metabolic defect (MD) using PET/MRI and PET/CT was compared in patients and coronary territories (LAD, CX, RCA). Assesability of coronary lumen was judged as good, sub-optimal or non-assesable using a 16-segments coronary model.

**Results:** Metabolic assessment was successful in all patients with MD being 19.2% vs 18.3% using PET/MRI and PET/CT, respectively (P=n.s.). The MD was 10.2%, 6%, and 3% vs 9.3%, 6% and 3% for LAD, CX and RCA territories, respectively (P=n.s.). Coronary angio-MRI was successful in all volunteers with 68 coronary segments visualised overall. The RCA was fully visualised in 4/5 volunteers and the left coronary arteries in 4/5 volunteers. Assessability in visualised segments was good, sub-optimal and non-assesable in 88%, 2% and 10%, respectively.

**Conclusion:** Hybrid PET/MRI devices may enable metabolic evaluation comparable to PET/CT with additional value owing to accurate functional and anatomical information including coronary assessment.

**B-0133** 10:48
Is angiographic perfusion score assessed in patients with acute myocardial infarction correlated with cardiac magnetic resonance infarct size and N-terminal pro-brain natriuretic peptide in 6-month follow-up
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**Purpose:** Aim of the study was to analyse the correlation between APS and CMR infarct size and LVEF parameters in 6-month follow-up.

**Methods and Materials:** In a cohort of 68 patients with STEMI treated with PCI APS was calculated for infarct-related artery based on angiographic parameters and was defined as the sum of the TIMI flow grade (0-3 points) and the TIMI myocardial perfusion grade (0-3 points) before and after PCI (range of points from 0 to 12). Full perfusion was defined as APS ≥ 10. Bare metal stents were used during primary PCI. In patients with multivessel disease PCI was performed in the infarct-related artery. CMR parameters and NT pro-BNP were assessed at 6 months.

**Results:** Median APS was 7.5 points. APS ≥ 10 was present in 42% of patients. The significant correlation was found between APS and CMR infarct size (r = 0.47, P = 0.0001), CMR left ventricular (LV) ejection fraction (r = 0.5, P = 0.02), LV end-diastolic volume index (r = -0.37; P = 0.004), LV end-systolic volume index (r = -0.41; P = 0.001), NT pro-BNP (r = -0.5; P = 0.02). Patients with APS ≥ 10 had significantly lower infarct size, LV volumes, higher EF and lower NT pro-BNP.

**Conclusion:** APS assessed in patients with STEMI treated with PCI is a good predictor of infarct size and left ventricular function in 6-month follow-up. There was a significant correlation of APS and CMR parameters and NT pro-BNP after 6 months.

**B-0134** 10:57
In vivo MRI characterisation of the myocardium with a diffusion-weighted sequence in 3 T
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**Purpose:** Heart motion limits the use of MR diffusion-weighted (MR-DW) sequences in routinely cardiac examination due to the required time by the pair of gradient pulses. Our objective was to define an MR sequence, which could be used to quantitatively analyse in vivo myocardium tissue diffusion in humans.

**Methods and Materials:** In vivo cardiac MR diffusion images were acquired in a population of 10 healthy volunteers (age 35±12 years) using a 3 T MR system (Achieva-TX, Philips Healthcare) and a surface coil with 32 channels. The pulse sequence was a spin-echo echo-planar-imaging (SE-EPI) with a TE of 43 ms, the
B-0135  11:06
Acute coronary syndrome with normal coronary arteries and positive enzymes; differential diagnosis with cardiac-MRI

Purpose: To determine the role of cardiac MRI in the differential diagnosis of myocardial infarction with normal coronary arteries, and other forms of heart disease with infarct-like presentation (myocarditis, Tako-tsubo, etc.). Study design: prospective study performed in a single centre on patients admitted to our UTIC.

Methods and Materials: 65 consecutive patients with chest pain, electrocardiographic changes similar in type-infarct, elevated Troponin and coronary angiography with evidence of normal coronary arteries, were performed within one week of onset of symptoms, a cardiac magnetic resonance with contrast agent (INTERA 1.5 T, Philips Medical Systems, Best, The Netherlands).

Results: Magnetic resonance imaging showed in 56 patients the presence of significant morpho-functional alterations in terms of diagnostic; in 9 patients no pathological changes were observed. In 41 patients was found late-enhancement: in 13 patients the localisation was compatible with myocardial infarction, in 28 patients with myocarditis. In 15 patients, which was not present late-enhancement, there was a severe cardiac akinesia in the apical segments average, framework in patients with myocarditis. In 15 patients, which was not present late-enhancement, there was a severe cardiac akinesia in the apical segments average, framework.

Conclusion: The cardiac MRI may have key role in the differential diagnosis of acute coronary syndromes with normal coronary arteries and/ or other cardiomyopathies.

B-0136  11:15
Improved agreement between experienced and inexperienced observers using a standardised evaluation protocol for cardiac volumetry and infarct size measurement


Purpose: To study the agreement between experienced and inexperienced observers before and after training using a standardised evaluation protocol for cardiac volumes, mass and infarct size. Planimetric measurements were performed on short axis slices (Simpson’s method) using a heart analysis tool (HeAT). Subsequently, the inexperienced observers were trained using a standardised evaluation protocol. Thereafter, all observers analysed another 10 CMR studies. Agreement and variance was compared before and after training using Bland-Altman analysis.

Results: Before training the relative difference between experienced and inexperienced observers was -4.3 ± 8.2% for EDV, -13.3 ± 14.2% for ESV, 5.9 ± 8.2% for EF, -12.2 ± 10.9% for LV mass and -27.0 ± 29.0% for infarct size. After training, agreement significantly improved to 0.2 ± 8.0% for EDV (P < 0.05), -2.1 ± 10.9% for ESV (P < 0.01), 1.5 ± 9.9% for EF (P < 0.05), and -3.6 ± 17.1% for infarct size (P < 0.001). Slice-based analysis showed that inclusion of the most basal and apical slices were mainly responsible for the initial low agreement.

Conclusion: Training and adherence to the proposed evaluation protocol significantly improved the agreement between experienced and inexperienced observers for LV volumes, EF and infarct size. The proposed evaluation protocol can be used as a guideline for teaching of novel CMR examiners.

B-0137  11:24
Magnetic resonance T1-mapping in acute myocardial infarction: from core to periphery

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Purpose: To evaluate T1 characteristics of acute myocardial infarction (AMI) and to delineate AMI in pre- and postcontrast-enhanced myocardial T1-mapping.

Methods and Materials: 18 patients (mean age, 57±10; 4 females) with AMI (2-5 days) underwent cardiac MRI after acute percutaneous coronary intervention on a 1.5 T scanner (Magnetom Avanto) with 32-element coil. For T1 mapping purposes a modified Look-Locker inversion recovery (MOLLI) sequence was applied pre- and post-contrast injection (0.15 mmol/kg Gadobutrol) at three short axis slice positions. T1 evaluation was based on 11 measurements with different T1 times clustered in 3 groups during T1 relaxation. Pre- and post-contrast T1-maps were calculated and AMI was defined having a cut-off of > 3 standard deviations (SD) as compared to T1 values of normal myocardium (MYO). ROI-based measurements of T1-values of AMI, normal myocardium (MYO) and of myocardial-vascular-obstruction (if present) in the AMI core (MVO) were performed.

Results: The comparison of T1 values of AMI and MYO revealed significant differences in pre-contrast scans (1050±10 ms vs. 818±7 ms; p < 0.001). There was no significant difference of MVO (1015±176 ms) compared to AMI or MYO. Postcontrast T1-values of AMI, MYO and MVO dropped by 72%, 49% and 57%, respectively. The differences of T1 values in AMI and MYO were significant (284±64 ms vs. 449±51 ms; p < 0.001). T1 values of MVO were significantly higher compared to AMI (434±56 ms; p < 0.009); however, there was no significant difference between MVO and MYO.

Conclusion: T1 values of acute myocardial infarction are significantly different compared to normal myocardium in both, pre- and postcontrast imaging.

B-0138  11:33
Right ventricular involvement in acute left ventricular myocardial infarction: prognostic implications of cardiac MRI findings

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Purpose: The purpose of this study was to investigate the prevalence and prognostic importance of the cardiac MRI finding of right ventricular involvement in patients with acute ST-segment elevation myocardial infarction (MI).

Methods and Materials: Fifty patients with first-ST-segment elevation MI underwent 1.5 T cardiac MRI immediately after successful percutaneous coronary intervention. The MRI protocol included inversion recovery FLASH delayed enhancement sequences after contrast administration for the quantification of myocardial damage. The prevalence of right ventricular involvement detected with ECG and echocardiography was compared with the prevalence detected with cardiac MRI, which was the reference standard. Patients underwent follow-up for 32 ± 8 months.

Results: Right ventricular involvement was diagnosed with cardiac MRI in 27 patients (54%); 14 of 30 patients (47%) with inferior ST-segment elevation MI and 13 of 20 patients (65%) with anterior ST-segment elevation MI. Patients with right ventricular involvement in anterior ST-segment elevation MI had larger infarcts (diasnetal enhancement, 32.9 ± 14.5% vs. 11.4 ± 10.1% (p < 0.001), lower left ventricular ejection fraction (34.3 ± 8.2% vs. 45.2% ± 9.5% (p < 0.05)), and lower right ventricular ejection fraction (39.8% ± 6.6% vs. 54.9% ± 8.8% (p < 0.001)) than those without right ventricular involvement. In a multivariate logistic regression model, right ventricular involvement was a strong independent predictor (odds ratio, 15.8; 95% CI, 4-63) of major cardiac adverse events.

Conclusion: Right ventricular involvement in ST-segment elevation MI is detected more frequently with cardiac MRI than with ECG and echocardiography and is an independent prognostic indicator.

B-0139  11:42
Value of cardiac magnetic resonance imaging in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram

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Purpose: To assess the value of cardiac MRI in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram and analyse factors of influence on the accuracy of the diagnosis.

Methods and Materials: In a 39-month period, 126 patients from the chest pain unit could be included in this study. The MR imaging protocol was kept as simple as possible and consisted of cine, oedema sensitive and late gadolinium enhancement imaging. Clinical follow-up and the synopsis of all clinical, laboratory and imaging
data were the basis for establishing a consensus-based diagnosis. This diagnosis served as the standard of reference.

Results: Besides the five main diagnoses (ischaemic cardiomyopathy, dilative cardiomyopathy, myocarditis, Takotsubo cardiomyopathy and hypertensive cardio-
myopathy; n=111) there were miscellaneous cardiac diagnoses (e.g. hypertrophic cardiomyopathy, cardiac amyloidosis or non-compaction cardiomyopathy n = 15).

Compared with the final standard of reference diagnosis, CMRI enabled establishing the final diagnosis in 110/126 patients (87%). Only in 16 patients CMRI could not detect the final diagnosis. Further analysis showed no significant correlation be-
 tween age, sex and time to CMRI examination and the correctness of the diagnosis (p>0.05). The only important factor was the kind of diagnosis itself.

Conclusion: CMRI helps establishing the final diagnosis in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram in the vast majority of cases. Age, sex and time to examination had no influence on the accuracy of the diagnosis.

**B-0140** 11:51

**Partition coefficient for gadolinium chelates in the normal myocardium: comparison of gadopentetate dimeglumine and gadobenate dimeglumine**

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**Purpose:** To evaluate the influence of contrast agents with different relaxivity on the partition coefficient ($\lambda$) and timing of equilibration using a modified look-locker inversion recovery (MOLLI) sequence in cardiac MR.

**Methods and Materials:** MOLLI was acquired in healthy subjects (1.5 T) at mid-ventricular short axis pre-contrast and 5, 10, 20, 25, and 30 min after intrave-
nous administration of a bolus of either 0.15 mmol/kg Gadobenate dimeglumine (Gd-BOPTA) (n=10) or Gadopentetate dimeglumine (Gd-DTPA) (n=10) using the following parameters: TE/TR 1.06/2.5 ms; flip angle 35°; bandwidth 1002 Hz/Px; slice thickness 8 mm. T1 times were measured in myocardium and blood pool.

$\lambda$ was approximated by $1/T1Myocardium$ pre-contrast - $1/T1Myocardium$ post-contrast)/($1/T1Blood pool$ pre-contrast - $1/T1Blood pool$ post-contrast). Values for Gd-BOPTA and Gd-DTPA were compared (t-test). Inter-observer agreement was evaluated (intraclass correlation coefficient [ICCs]).

**Results:** Overall, 120 scans pre-contrast and at 5 time-points post-contrast administration in 20 subjects were evaluated. T1 times of myocardium and blood pool (p < 0.001) and $\lambda$ (0.42±0.03 and 0.47±0.04, respectively, p < 0.001; exclud-
ing 5 min for Gd-BOPTA) were significantly lower for Gd-BOPTA than Gd-DTPA.

$\lambda$(Gd-BOPTA) showed no significant variation between 5 and 30 min. $\lambda$(Gd-BOPTA) values were significantly lower at 5 min compared to other times (0.38 vs. 0.42; p < 0.05). Inter-observer agreement for $\lambda$ values was excellent with Gd-BOPTA (ICC=0.818) and good for Gd-DTPA (ICC=0.631).

**Conclusion:** $\lambda$(Gd-BOPTA) values are significantly lower compared to $\lambda$(Gd-DTPA) at the same administered dose. Using Gd-BOPTA, the equilibrium between myo-
cardium and blood pool is not achieved until 10 min post-contrast.

**Computer Applications**

**SS 105** Image processing (part 1)

**Moderators:** P. Badura; Gliwice/PL, E. Kotter; Freiburg/DE

**B-0141** 10:30

**Automated detection and volumetric segmentation of the spleen in CT scans of patients with malignant lymphoma**

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**Purpose:** We introduce an automated detection and volumetric segmentation of the spleen in spiral CT scans. Correlation analysis of automated volumetry (aV) and estimated volume determination (eV) and manual volume segmentation (mV) was performed.

**Methods and Materials:** We retrospectively evaluated the THESEUS-MEDICO CAD-system on spiral CT scans of 15 consecutive lymphoma patients at three different time points. Determination of the eV (spineous volume (cm³) = 30 cm³ + 0.58 (W x L x Th)) and mV as the gold standard were performed by an experi-
enced radiologist.

**Results:** The automated volumetry (aV) could be performed in all CT scans within approximately 15 seconds. The average spineous volume measured by aV was 268.21 cm³ compared to 281.58 cm³ in manual volume segmentation (mV) and 268.93 cm³ in estimated volume determination (eV). The correlation coefficient of aV and mV was 0.99, of mV and eV 0.91 and of aV and eV 0.91. There was an almost perfect correlation of the changes in spineous volume measured with the new aV and mV (0.95), mV and eV (0.95) and aV and eV (0.86) between two time points. All values are significant (p < 0.05).

**Conclusion:** Our automated detection and volumetric segmentation software rapid-
ly provides objective and reader-independent measurement of the spineous volume in CT scans. The automated volumetry is not as time consuming as manual vol-
umetry. Spineous volume changes can provide evidence of the course of lymphoma.

**B-0142** 10:39

**Assessment of a new 3D visualisation technique in CT colonography, the Funnel view, compared to standard interpretation strategies and other recent 3D rendering technologies**

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**Purpose:** The study objective is to assess the performance of a new 3D render-
ing technique applied to CT colonography (CTC), namely the Funnel view (FV). It aims at addressing current reviewing short-comings during uni- and bi-directional standard reviews (USV & BSV) such as limited colonic surface coverage de-

**Methods and Materials:** We designed a unique 3D virtual lens, arranging rays transmission based on the best ray-casting strategy optimising the respective field of view. It allows for distortion-limited visualisation of areas behind folds within a traditional perspective rendering. 20 endoscopy-validated CTC datasets with good colonic distensions were involved in this retrospective study, to compare USV, BSV and FV; 3D manual fly-through was deemed reference standard by manually assessing the complete colonic surface visible. Furthermore, FV will be involved in an academic protocol (McGill University, Quebec, Canada) to prospectively investigate its contribution to CTC reviews.

**Results:** A single fly-through with FV rendered 100% of the visible colonic mucosa, compared to 73% and 92%, respectively, for the USV and BSV. In addition, it significantly increased the display-time closer to the display periphery, required for quality assessment of potential lesions without inducing major distortion.

**Conclusion:** Funnel view for CTC provides a time-efficient interpretation strategy to assess the entire colonic mucosa with a single automatic fly-through, increasing potential lesion conspicuity and display-time. It has the potential to significantly reduce reviewing time, while maintaining sensitivity and specificity.

**B-0143** 10:48

**CT coronary angiography with 100 kV tube voltage and a low noise reconstruction filter in non-obese patients: evaluation of radiation dose and diagnostic quality of 2D and 3D image reconstructions using open source software (OsiriX)**

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**Purpose:** To evaluate the diagnostic quality of 2D and 3D image reconstructions from CT coronary angiography (CTCA) studies performed using a tube voltage of 100 kV and a low noise reconstruction filter.

**Methods and Materials:** Fifty non-obese patients with comparable body-mass index (BMI) underwent CTCA using a 64-row CT scanner. Out of them, 25 were imaged using a tube voltage of 100 kV and a low noise (Soft) reconstruction filter, while in the remaining 25 patients, a tube voltage of 120 kV and a standard recon-
struction kernel were selected. Maximum intensity projection (MIP), curved planar reformation (CPR), and volume rendering (VR) views were generated using open source software (OsiriX 3.9; www.osirix-viewer.com), and their diagnostic quality was assessed visually using a three-point score (poor, good, excellent).

**Results:** Effective dose was significantly lower with the 100 kV than with the 120 kV protocol (9.8±3.5mSv vs 18.3±5.8mSv, p < 0.0001). Image quality of all reconstructions was good to excellent both at 100 kV and 120 kV, with a statistical trend towards better quality of CPR views with the 100 kV, low noise filter protocol (MIP 2.83±0.55 vs 2.54±0.71, p=0.0323; VR 2.89±0.55 vs 2.40±0.81, p=0.2165; CPR 2.92±0.26 vs 2.34±0.83, p=0.0815, respectively).
**B-0144 10:57**

Image registration beyond PET/CT - advanced registration of x-ray - and MR-mammograms is feasible and provides morphological and functional information at a glance

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**Purpose:** Image registration of x-ray- and MR-mammograms (XM and MM) would allow combining morphological information of XM (e.g. microcalcification) with topographic and functional parameters of 3D MM (diffusion, perfusion, etc.). Yet, the few previous research on this topic investigated solely the topographic registration of XM with MM. Accordingly, we: [1] developed a software allowing both topographic matching of breast lesion as well as fusion of the corresponding functional MRI data and [2] evaluated overall radiological quality and accuracy of this approach.

**Methods and Materials:** Patients with visible masses-lesions both in XM and MM were enrolled. Based on the MM a “virtual XM” was calculated using our in-house developed software. Based on dynamic enhancement characteristics of the MM, a colour-coded overlay was calculated to characterise tumour vascularisation. This overlay was registered with the “virtual XM”. Overall image quality and accuracy of the registration and further tissue parameters were assessed by two experienced readers in consensus.

**Results:** 11 patients were enrolled (range: 43-73years; mean: 59years). In all patients fusion was performed successfully. Overall accuracy was defined as the placement of the centres of the lesion between XM and MM divided by the lesion size, it reached 0.82 (mean). The colour-coded overlay allowed identification and characterisation of all cases (n=11/11; 100%).

**Conclusion:** Clinical feasibility of advanced x-ray- and MR-mammograms registration could be demonstrated. As it allows combination of topographic, morphologic and functional data into one single image, it is a promising tool to further enhance diagnostic accuracy and clinical workflow in breast imaging.

**B-0145 11:06**

Trabecular direction and deformation distribution in lung transplant patients with severe osteoporosis risk

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**Purpose:** New onset osteoporosis or progression of a pre-existing disease with bone fractures within the first years after lung-transplantation (LuTX) is a severe but poorly understood problem. High-resolution peripheral quantitative computed tomography (HRpQCT) offers novel options for the assessment of disease progression. It provides volumetric BMD, detailed cortical bone geometry and trabecular microarchitecture. We propose and evaluate a novel optical-flow-based registration approach to capture trabecular reorganisation and observe significant differences between LuTX indications.

**Methods and Materials:** 13 patients (indication groups: (a) vascular diseases, (b) cystic fibrosis, (c) parenchymal diseases) were scanned with HR-pQCT at baseline and 3 months after LuTX. To capture trabecular reorganisation the volumes were rigidly registered. Subsequently trabecular deformation was measured using optical-flow. We obtained deformation-field-maps for each case and quantified the increase of trabecular thickness together with trabecular direction. Entropy was used to quantify directional dominance, Kullback-Leibler (KL) divergence between direction and change distribution to quantify the relationship of two measurements.

**Results:** No significant differences between LuTX indication groups were observed when comparing directional dominance at a single time point. However, when including multiple time points temporal changes becoming visible. Compared to baseline and follow-up, significant changes (p<0.05, fdr corrected) were found between indication groups (a)(b) and (b)(c) (mean KL (a) 0.4197, (b) 0.2991, (c) 0.4964).

**Conclusion:** Computer-based analysis of bone microarchitecture detected significant differences in osteoporosis progression among different LuTX groups, while trabecular microarchitecture assessment at a single time point does not. Trabecular reorganisation can be measured quantitatively in HR-pQCT data, and reveals disease-specific patterns.

**B-0146 11:15**

Does JPEG lossy compression disguise cranial fractures?

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**Purpose:** The current study aims to establish whether detection of cranial vault fractures is affected by JPEG2000 x30 and x60 lossy compression when compared to JPEG2000 lossless compression.

**Methods and Materials:** 55 CT images, with three levels of JPEG 2000 compression (lossless, x30 & x60) were presented to 14 senior radiologists. 32 images contained a single skull fracture while 23 were normal. Observers were asked to identify the presence or absence of a fracture and where a fracture was present to locate and rate their confidence in its presence. A JAFROC and ROC methodol-ogy was employed and the DBM MRMC method was used to explore differences between the lossless and lossy compressed images.

**Results:** The mean JAFROC FOM and ROC AUC scores with lossless JPEG2000 compression were 0.74, 0.78 compared to 0.74, 0.79 for x30 lossy and 0.66, 0.71 with x60 lossy. Significant differences were seen only between JPEG2000 Lossy x30 and x60 (p < 0.01). An overall trend of decreased performance with x60 lossy compression was seen while JPEG2000 lossless and JPEG2000 Lossy x30 were seen to perform equally (p < 0.41). A significant trend of increased confidence in true and false positive scores was seen with JPEG2000 Lossy x60 compression.

**Conclusion:** This work demonstrates that JPEG2000 x60 lossy compression degrades the detection of skull fractures significantly while increasing the confidence with which readers rate fractures. JPEG2000 lossy compression at x30 does not significantly change performance when compared to JPEG2000 lossless compression for the detection of skull fractures in CT.

**B-0147 11:24**

Intra-operator variability of liver segment volumetry using vessel-based and plane-based techniques

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**Purpose:** To measure the intra-operator variability of liver segment volumetry. Two approaches were compared in point of difficulty, variability and duration.

**Methods and Materials:** 14 patients with primary or metastatic liver tumour were selected from a public dataset (http://silver07.org). One radiologist separated the 8 Coinaud segments on portal-venous CT scans using a research prototype. Starting from gold-standard liver contour the radiologist applied two different techniques: In the vessel-based approach portal vein (PV) was segmented from manually defined root point. Then, non-PV structures were removed, and the 8 main PV branches were labelled in 3-dimensional view, manually. Finally, the vascular territory belonging to each labelled PV branch was computed. In the plane-based approach 2-dimensional views were used to draw 5 traces along the main vein branches: left-, middle-, and right hepatic vein; right PV, and branches of left PV feeding segments II and III. Using these traces 5 smooth surfaces were computed, which were used in a hierarchical order to separate the liver. All patients were processed 3 times with both methods, the standard deviation of volume for each segment was computed (in % of the total liver), and processing time was measured.

**Results:** The average standard deviation in segment volumetry was 1.8% and 2.0%, while the processing time was 398 and 201 seconds for vessel- and plane-based approach, respectively.

**Conclusion:** The intra-operator variability of segment volumetry did not prove to be significantly different for the 2 techniques. Vessel-based approach takes significantly longer due to difficulties of labelling the right PV.

**B-0148 11:33**

Fast automatic computation of path proposals for CT-guided radiofrequency (RF) ablation of malignant liver tumours: initial clinical experience

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**Purpose:** To demonstrate feasibility and effectiveness of a fast automatic physician-independent method that computes a list of path proposals for computer tomographic (CT)-guided radiofrequency ablation (RFA) of malignant liver tumours.

**Methods and Materials:** 26 CT datasets of patients with malignant liver tumours treated by CT-guided hepatic RFA were retrospectively evaluated. Optimal access paths were determined from three experienced interventional radiologists considering following parameters: distance tumour to skin, at risk structures (lung, epigastic...
Results: Automatic path proposal computation was successful in all 26 cases (100%). Image processing time was approximately 3.7 sec (±1.4 sec). The mean mark of the automatic path proposal was 1.77 demonstrating a clinical usability. The automatic method correlated well with the three expert proposals (r=0.79; r=0.81; r=0.80).

Conclusion: The automatic path proposal computation for CT-guided RFA of malignant liver tumours is feasible and effective with a good correlation to expert proposals used in clinical routine work.

B-0149 11:42
Evaluation of hepatic fatty infiltration with dual energy spectral CT
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Purpose: To investigate the accuracy and sensitivity of the dual energy spectral CT in the assessment and classification of fatty infiltration in liver.

Methods and Materials: This prospective study was institutional review board approved, and written informed consent was obtained from all patients. The authors examined 42 patients (13 men, 29 women) with dual energy spectral CT imaging during the plain CT scan. There were 29 hepatic patients with mild (18), moderate (6) and severe (5) fatty infiltration, respectively, as the study group; 13 normal hepatic patients as the control group. The degree of fatty infiltration was classified according to the measured liver-to-spleen attenuation ratio. Fat concentrations in the liver were derived from the base material decomposition spectral CT images. The quantitative parameter between the control and study group and among the three hepatic fatty infiltration groups were compared, respectively (two-sample t test, the analysis of variance).

Results: Fat concentrations in normal hepatic patients (1041.04 mg/mL ±7.25) differed significantly from those patients with hepatic fatty infiltrations (1024.83±10.00) (P <0.001) with the sensitivity of 92.3% and specificity of 72.4%. Significant differences were also found among the patients with mild (1029.62 mg/mL ±5.28), moderate (1024.19 mg/mL ±6.63) and severe (1008.38 mg/mL ±6.80) fatty infiltrations in liver, respectively (P <0.001).

Conclusion: The fat concentrations derived from the fat-based material-decomposition in the dual energy spectral CT were statistically different among patients with different degrees of fatty infiltration and may provide a quantitative method to assess and classify the hepatic fatty infiltration.

B-0150 11:51
Impact of robust image processing to reduce error in computational haemodynamics
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Purpose: Cardiovascular diseases are associated with a number of factors that include biochemistry, haemodynamics and genetic predisposition. These factors are specific to each individual and it is important to accurately represent patient-specific information in order to assess patient state at diagnosis and prognosis stages. Here, we focus on the effects of uncertainty in clinically acquired medical imaging to variability in the reconstructed vessel geometry, and this error propagates to the computational haemodynamics.

Methods and Materials: The effects of filtering, contrast enhancement and segmentation of medical images are examined with relation to changes in the reconstructed geometry. The images used include MRI and CT data sets, largely focused on the cerebral vasculature. Different image processing methods are chosen and tested, and the most suitable combination of approaches is discussed. Numerical simulations of the haemodynamics are performed and the impact of variability in the vessel geometry is considered with respect to flow parameters commonly associated with disease progression and stresses on the 4- vessel wall. The discussion is therefore with a clinical relevance.

Results: Results indicate that image preprocessing can substantially alter the quality of the image to improve vessel extraction. This removes a certain level of uncertainty in the segmentation process. Nevertheless, care must be taken to choose appropriate and robust schemes. Results of computational haemodynamics are presented with error bars.
Results showed that the two readers achieved more accurate results combining DWI, the readers correctly identified 25/26 of CR (spec 96%). Our preliminary 19/26 patients with complete response (specificity 73%), while after addition of were 1.43±0.25x10⁻³ mm²/sec. On T2W images both readers correctly identified MR1 examination was 0.86±0.22 x10⁻³ mm²/sec, whereas mean values after CRT were 0.25 (T2W).

Results:

Conclusion: The functional DW-MRI plays a crucial role in detecting the complete response in LARC patients, by adding information about changes in tumour pathophysiology useful for the assessment of viability of the tumour after CRT.

B-0155 Long-term outcome of MRI-based individualised treatment for rectal cancer: a multicentre study


Purpose: A differentiated treatment according to each individual risk profile in rectal cancer patients was introduced over the last decade. The purpose of this study was to evaluate whether MRI-based individualised treatment can improve long-term outcome of rectal cancer patients.

Methods and Materials: From 2003 until 2008 228 patients were included in a multicentre prospective cohort study with expert and non-expert rectal MRI readers. All underwent preoperative MRI using a lymph-node-specific contrast agent to predict CRM, T and N-stage. Based on the MRI, patients were stratified in different risk groups for local recurrence: (a) early tumour (wide CRM&NO), (b) locally advanced tumour and (c) locally advanced tumour (close/involved CRM, N2-status, distal tumours). Group (a) underwent surgery, (b) preoperative 5x5Gy followed by immediate surgery and (c) a long-course of chemoradiation with surgery after a 6-8 week interval. Kaplan-Meier curves were used to estimate long-term outcome. Results: After a median follow-up of 41 months the 3-year local recurrence, disease-free survival and overall survival are 2.2%, 80% and 84.5%, respectively.

Conclusion: MRI-based individualised treatment of rectal cancer leads to excellent long-term outcome, specifically regarding local control, both in expert and non-expert centres. The results compare favourably to other published reports. The results confirm that MRI is mandatory in the staging of rectal cancer and show that good local control is achieved, while now distant metastases determine overall survival. Therefore, radiologists should focus on early detection of metastases with the aim to improve overall survival.

B-0156 Diffusion-weighted MRI imaging for prediction of early response of locally advanced rectal cancer to chemoradiation therapy

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Purpose: To evaluate DWI for assessment of early treatment response of locally advanced rectal cancer (LARC) 2 weeks after chemoradiotherapy (CRT).

Methods and Materials: Twenty-eight patients with LARC underwent MRI prior to, and 2 and 8 weeks after CRT, including T2-weighted images and echo-planar DWI with 6 b-values (0 to 1000 sec/mm²); ADC values were measured. Imaging was correlated to post-surgical histopathological tumour regression grade, according to Mandard’s classification. Two- and 8-week post-treatment ADC changes were compared between responders (WHO 1) and non-responders (WHO 2-4). The median %ΔADC of CR group (47.5%) was significantly higher than that of non-CR group (-0.84%) (p=0.024). The best %ΔADC cut-off to differentiate CR from non-CR at 2 weeks was 25% (.p=0.001), which yielded a sensitivity of 91%, a specificity of 77%, and an Az value of 0.87. When comparing median %ΔADC obtained at 2 and 8 weeks after CRT, no significant differences were found either for CR or for non-CR group (p=0.13).

Conclusion: The median %ΔADC at 2 weeks after CRT represents an early and reliable predictor of preoperative treatment outcome.

B-0157 Vascular mapping using an MRI blood pool contrast agent reveals vascular asymmetry and chemoradiation-induced vascular remodelling in the mesorectum of rectal cancer patients

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Purpose: In rectal cancer patients, the tumour-surrounding mesorectum exhibits the enhanced vasculature and desmoplastic pattern. Our aim was to determine the vascular changes in the mesorectum related to the tumour growth and the influence of neoadjuvant chemoradiotherapy on the structure of mesorectal vasculature using MRI vascular mapping with a blood pool contrast agent.
Methods and Materials: The staging and restaging MRI was performed for six patients on a 1.5 T scanner using a phased-array coil. A routine imaging protocol was complemented with a dynamic T1-weighted scan (TE/TR=6/7.9 ms, α=30°, time resolution=8s, matrix=512x512). 0.03 mmol/kg of gadofosveset was administered during the acquisition. Maximal intensity projections were derived from the difference images, obtained by subtracting the pre-contrast baseline from 2 min post-contrast images. The number of vascular branches was determined in the tumour-neighbouring and tumour-distant mesorectum using the primary-staging data. The pre- and post-chemoradiotherapy vascular maps were compared with respect to the number of vascular branches, their length and diameter using OsiriX.

Results: A significantly higher number of vessels was found in the tumour-neighbouring mesorectum compared to tumour-distant mesorectum (p=0.003). The difference was between two- and eight-fold for different patients. The comparison of pre- and post-chemoradiotherapy maps revealed a 54% lower vessel branch difference was between two- and eight-fold for different patients. The comparison of pre- and post-chemoradiotherapy maps revealed a 54% lower vessel branch difference was between two- and eight-fold for different patients. The comparison of pre- and post-chemoradiotherapy maps revealed a 54% lower vessel branch difference was between two- and eight-fold for different patients.

Conclusion: Vascular mapping of the mesorectum of rectal cancer patients revealed the enhanced vasculature around the tumour and vascular remodelling after chemoradiotherapy.

B-0158 15:03
Assessment of preoperative radio-chemo therapy (pCRT): a novel numerical semi-quantitative DCE-MRI parameter compared with morphologic MRI (mMRI) and qualitative time intensity curves (IMRI)

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Purpose: mMRI evaluation is considered the best available tool for LARC staging after pCRT. To compare the accuracy of a novel semi-quantitative numerical parameter based on pattern analysis (SIS) with mMRI and DCE-MRI based on qualitative IMRI in patients with LARC who received CRT and TRG. The purpose of this study was to establish a reporting model to accurately distinguish histologically proven negative LN (N0) from positive (N1) CRC patients by CT.

Methods and Materials: 40 patients underwent DCE-MRI examination before and after pCRT. Pre and post-contrast T1w scans were acquired after Gd-DOTA injection. Regions of interest (ROI) were drawn inside the tumour, respectively. TIC evaluation and SIS analysis were computed for each ROI. mMRI, IMRI and SIS-based evaluations were performed.

Results: mMRI evaluation was 54.2% sensitivity (SE), 56.2% specificity (SP), 65.0% positive predictive value (PPV) and 45% negative predictive value (NPV). Performing IMRI evaluation 79.2% SE, 84.5% SP, 73.1% PPV and 61.4% NPV were obtained. Performing a SIS-based evaluation a relevant gain respect to mMRI alone (+30% and +14.1%) and IMRI (+7.2% and +37.2%) was obtained.

Conclusion: Standard number and index of shape (SIS) based on a numerical semi-quantitative DCE-MRI parameter, obtained through pattern analysis, results an accurate tool to predict tumour activity of pCRT in LARC patients through a well-defined cut-off (11.6%) to differentiate R by NR.

B-0159 15:12
Treatment monitoring in LARC: role of diffusion-weighted imaging and 18-FDG-PET-CT in evaluation of tumour regression grade during and after CRT

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Purpose: To assess the role of ADC values (DWMRI) in comparison with SUVmax values (18 FDG-PET-CT) before, during and after chemo-radiation therapy in patient with LARC, being the histologic examination as reference standard.

Methods and Materials: Three sequential 18 F-FDG PET/CT studies were performed in 35 patients with biopsy-proven primary rectal carcinoma as follows: before starting CRT (PET/CT1), during CRT (PET/CT2), and after completion of treatment (PET/CT3). MR scanning was performed before (MRI1) and after CRT (MRI2), on a 1.5 T scanner (Philips Achieva) and comprised T2SE multplanar sequences and DWI (b factor=0, 500 and 1000 mm/2sec). The percent decrease of SUV (ΔSUV 1 and 2) and ADC (ΔADC) values from baseline to presurgical scan was assessed and correlated with pathologic response classified as tumour regression grade (Mandard’s criteria; TRG 1= complete regression, TRG 5= no regression).

Results: Tumour was detected in all patients at both MR imaging and FDG PET/CT, and after CRT all patients were submitted to surgery. According to the Mandard’s criteria, 26 (74%) showed complete (TRG 1) or subtotal regression (TRG 2) and were classified as responders; nine (26%) were classified as non-responders (TRG 3, 4 and 5). In all patients the mean values of SUVmax in PET1 were higher than the mean values of SUVmax in PET2 and PET3 (p < 0.001), whereas the mean ADC values were lower in RM1 than RM2 (p < 0.001), with a significant percentage decrease of values after the treatment (p < 0.005). The best predictors for TRG response were SUV3 (threshold of 4.4) and ADC2 (1.28x10^-3 mm2/sec) with sensitivity, specificity, accuracy, negative predictive value, and positive predictive value of 77.3%, 88.9%, 80.3%, 61.5%, and 94.4%, respectively. A significant correlation (linear regression) between ADC values and TRG’s data was also found (p < 0.001).

Conclusion: DWMRI and FDG-PET/CT have a complementary diagnostic role in the follow-up of patients with LARC, by differentiating fibrosis from viable tumour tissue after CRT.

B-0160 15:21
Lymph node staging in colorectal cancer by contrast-enhanced CT: development of a new reporting model for higher diagnostic accuracy

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Purpose: Lymph node (LN) staging in patients with colorectal cancer (CRC) is important for optimal treatment planning. However, it is difficult by CT based on simple criteria. Purpose of this study was to establish a reporting model to accurately distinguish histologically proven negative LN (N0) from positive (N1) CRC patients by CT.

Methods and Materials: This retrospective study included 97 patients with proven CRC and preoperative contrast-enhanced CT from an interdisciplinary tumour-board database. In a blinded manner, the following LN features were evaluated: different metric traits, total LN count, form, structure/density, presence of a hilum, contrast-medium-enhancement. The accuracy of those criteria in combination was examined by logistic regression. All collected parameters were correlated with postoperative histopathological findings (N0 vs. N1/2).

Results: Some parameters reached significance for predicting LN-metastases; however, only intermediate accuracies: Largest LN > 9.05 mm (sens.: 66%; spec.: 81%, accuracy, 74%), SD of longest LN diameters > 1.4 mm (85%, 55%, 70%), ro> 6 locoregional LN< 3 mm (61%, 67%, 64%). The combination of the following criteria significantly predicted LN-metastases: Presence of amorphous LNs, SD of LN longitudinal diameters > 1.4 mm, mean of the LN cross-diameter ≥ 5 mm, and SD of the cross-diameter/longitudinal-diameter ratio > 0.136. If ≥2 of these four criteria were fulfilled, LN-metastases were predictable with a slightly higher accuracy (73%, 83%, 78%). A reporting model was developed for clinical decision making on LN malignancy.

Conclusion: The developed reporting model (decision tree) might facilitate and improve LN staging by contrast-enhanced CT in CRC patients. Prospective studies have to confirm this suggestion.

14:00 - 15:30 Room D1

Chest

SS 204
Pulmonary nodules

Moderators:
M. Das; Maastricht/NL
B. Feragalli; Chieft/IT

B-0161 14:00
Iodine uptake ratio (IUR): a novel approach to differentiate between malignant and benign lung lesions

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Purpose: To investigate the feasibility of iodine uptake ratio (IUR) for differentiating malignant and benign lung lesions using contrast-enhanced CT spectral imaging. Methods and Materials: 41 patients with known biopsy-proven lesions were prospectively evaluated. All CT examinations were performed on a high definition CT scanner (Discovery CT750 HD, GE). For each imaging session, 70 mL of iodinated contrast agent (300 mgI/mL) was injected intravenously at 1.5 mL/s. After a delay time of 70 s, spectral images were acquired with dual energy at 80/140 kVP. Material decomposition iodine images were reconstructed. Circular ROI were defined in the iodine density images over the lung lesion and normal lung parenchyma for iodine concentration measurements. IUR was defined as the ratio between iodine concentration of the lesion and that of normal lung parenchyma.

Conclusion: The developed reporting model (decision tree) might facilitate and improve LN staging by contrast-enhanced CT in CRC patients. Prospective studies have to confirm this suggestion.
Results: Pathological results showed that 30 lesions were malignant lesions, while 56 lesions were benign. IUR of malignant lesions (3.86 ± 1.94) was significantly higher (p < 0.05, two-tailed Mann-Whitney test) than that of benign lesions (2.47 ± 1.58). The area under receiver operating characteristic curve was 0.712, indicating the potential capability of IUR in differentiating malignant and benign lung lesions. An IUR threshold value of 2.36 was determined, allowing differentiation between malignant and benign lung lesions with sensitivity, specificity and accuracy of 90.0%, 63.6% and 82.9%, respectively.

Conclusion: IUR is first demonstrated as a novel approach to differentiate between malignant and benign lung lesions, suggesting its potential applications in monitoring disease progressions and therapeutic interventions.

B-0162 14:09
Newly developed mathematical model for perfusion CT using 320-detector row CT in patients with pulmonary nodules: comparison of diagnostic capability with previously utilised models for first-pass perfusion CT and FDG-PET/CT
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Purpose: To compare diagnostic capabilities among newly developed and previously used mathematical models on first-pass perfusion 320-detector row CT and FDG-PET/CT.

Methods and Materials: 52 consecutive patients with 86 nodules underwent first-pass perfusion CT using a 320-detector row CT, PET/CT, and microbacterial and/or pathological examinations. 86 nodules were classified into two groups based on the final diagnoses: malignant (n=56) and benign nodules (n=30). From perfusion CT data in each nodule, total blood flow (TF) was calculated from pulmonary arterial flow and bronchial arterial flow by dual-input maximum slope model. In addition, blood flow within the nodule (BF), ejection fraction (EF) and distribution volume (DV) were also calculated by single input maximum slope model. On PET/CT, SUVmax within each nodule was determined by ROI measurement. To compare diagnostic capability among all indexes, ROC tests were performed. Finally, sensitivity, specificity and accuracy were compared each other using McNemar’s test.

Results: Area under the curve of TF (Az=0.83, p < 0.05) was significantly larger than that of EF (Az=0.72), DV (Az=0.50, p < 0.05) and SUVmax (Az=0.72). When feasible cut-off values were adopted, specificity and accuracy of TF were significantly higher than those of BF (p < 0.05), EF (p < 0.05) and SUVmax (p < 0.05). In addition, sensitivity and accuracy of TF were significantly higher than those of DV (p < 0.05).

Conclusion: Newly developed model for first-pass perfusion CT on 320-detector row CT was more accurate than previously utilised models, and can play as more specific and accurate role for diagnosis of pulmonary nodule than PET/CT.

B-0163 14:18
Evaluation of adaptive iterative dose reduction (AIDR) for lung nodule detection in ultra-low-dose thoracic CT
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Purpose: To demonstrate the accuracy of ultra-low-dose CT (ULDCT) with AIDR image reconstruction for lung nodule detection compared to ULDCT and LDCT filtered back projection (FBP) images.

Methods and Materials: Raw data from 50 LDCT: 64x0.5 mm, 120 kVp, and 25 mAs (dose=1mSv) were selected so that 25 studies contained a single lung nodule mean diameter 6.7 mm (3-18 mm), mean density -250 HU (-570 HU to +170 HU) with variable location from apices to bases. LDCT images were reconstructed with FBP (group-A) and AIDR (group-B) at 52.5 mm. Two chest fellows (R1, R2) read all images in randomised blinded study and performed a 5-point ROC analysis for lung nodule detection and a 3-point scale for image quality (IQ); 1=poor, 2=good, 3=excellent.

Results: Qualitative analysis: IQ rating for groups A, B, and C for each reader were, R1:0.26, 1.22, and 1.98 and R2:2.1, 1.5 and 1.7. Quantitative analysis: nodule detection by (R1, R2) for all image sets were: group-A: sensitivity=95.8%, 100%; specificity=95.7%, 100%; accuracy=95.7%, 100%; AUC=0.9755, 1.000; group-B: sensitivity=95.8%, 91.7%; specificity=100%, 100%; accuracy=97.9%, 95.7%; AUC=0.9964, 0.9937; group-C: sensitivity=95.8%, 95.8%; specificity=100%, 100%; accuracy=97.9%, 97.9%; AUC=0.9964, 0.9982. Results of group-C (ULDCT/AIDR) were superior to group-B (ULDCT/FBP) and comparable to group-A (LDCT/ FBP).

Spearmans rank correlation coefficient between groups-C and A were: R1=0.838, and R2=0.954 (p < 0.001).

Conclusion: Ultra-low-dose CT with AIDR has comparable clinical performance to conventional LDCT for lung nodule detection and achieves 80% dose reduction.
B-0166 14:45

Which solitary ground-glass opacity pulmonary lesion necessitates invasive investigation?

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Purpose: To evaluate the histological significance of solitary ground-glass opacity (GGO) in order to determine the cases in which CT-guided FNA should be the next step in evaluation.

Methods and Materials: We retrospectively reviewed 891 CT-guidue FNA of pulmonary lesions as a primary diagnostic work up performed at our institution between 2007 and 2010. Our study included 56 patients that had a solitary GGO pulmonary lesion with a mean age of 66.7 years. The lesions were in the RUL in 33.9%, RML in 5.3%, RLL in 21.4%, LUL in 21.4% and LLL in 17.8% of patients. The mean diameter of the GGO lesion was 1.93 cm with a range from 0.7 to 4.7 cm. Each case was reviewed for diagnostic yield and complications.

Results: After cytological examination, malignancy was diagnosed in 73.2% of patients: in 55.4% adenocarcinoma, 8.9% NSCLC and 8.9% unspecified malignancy. A negative result was obtained in 15 patients, among them 3 cases revealed malignancy after surgical excision.

Conclusion: Most of the solitary GGO pulmonary lesions turned out to be malignant. Even though histologically most of them are slow growing adenocarcinomas, for those lesions with malignant appearance, surgical excision should follow the CT diagnostic. We recommend CT-guided FNA in cases of equivocal GGO lesions or in patients that are not able to undergo a surgical procedure and a diagnosis is mandatory for further treatment.

B-0167 14:54

Computer-aided detection of ground glass nodules in lung cancer screening: retrospective evaluation of potential benefit


Purpose: Ground glass nodules (GGNs) have a high probability of being malignant. We retrospectively investigated the usefulness of a dedicated computer-aided detection (CAD) system for GGNs in a clinical screening setting.

Methods and Materials: A set of 620 low-dose chest CT scans (16x0.75 mm, 120-140 kVP, 30 mAs) were randomly selected from a lung cancer screening trial. All scans were processed with a research prototype CAD system for GGNs (Diagnostic Image Analysis Group, Nijmegen, The Netherlands, Fraunhofer MEVIS, Bremen, Germany). Two chest radiologists inspected all CAD marks and classified them as GGN, other lesion, or false positive. Findings were compared with the annotations recorded in the screening trial database, which were obtained without the support of CAD.

Results: GGN CAD found 386 marks (0.62 per scan). Radiologist 1 classified 22 marks as GGN, 222 as other lesions and 142 as false positives. For radiologist 2 these numbers were 39, 107, and 240, respectively. Fifteen findings were considered to be GGNs by both radiologists. Of these 15, only 3 had been annotated in the screening trial database. CAD sensitivities for nodules with 80-100% concurrence were 71.4%, and it decreased to 52.1%, 43.4% and 27.6%, with 60-79%, 40-59% and 20-39% concurrence, respectively. The readers’ percentage concurrence and CAD sensitivity were highly correlated (R=0.99). The CAD false mark rate was 0.80, while the readers’ false mark rate ranged from 0.02 to 0.34 (mean of 0.11).

Conclusion: CXR CAD designed to mimic the performance of experts rather than to detect CT-confirmed nodules, should improve the usefulness of CAD in the clinical setting as it will increase the willingness of general radiologists to accept the CAD prompts on chest-radiographs.

B-0169 15:12

Computer-aided lung nodule volumetry: can MDCT be replaced by highfield MRI at 3 T?


Purpose: To determine the accuracy of computer-aided volumetry of artificial pulmonary nodules in highfield MRI at 3 T in an intraindividual comparison to MDCT.

Methods and Materials: We retrospectively analysed the clinical history of 75 patients affected by lung metastases and were excluded from further analysis. 72 nodules of diameters ranging 4-16 mm were implemented into 10 porcine lungs within a dedicated chest phantom. Signal on T1-weighted images and radiopacity were adjusted by adding 0.125 mmol/ l Gd-DTPA and 1.5 g/l of Iodine. A T1-weighted three-dimensional gradient echo sequence (T1-3D-GRE; TR/TE 3.3/1.1 ms, slice 4 mm, FOV/375 mm, matrix 256x256, Flip-angle 10°) was applied in axial orientation, followed by MDCT (16x0.5 mm; reconstructed slice thickness 1 mm; increment 0.5 mm) which served as the reference. Computer-aided volumetry was performed using a commercially available software tool (Oncotecrt, MeVis, Germany). After the experiments all specimens were harvested and true lesion size and shape were assessed for all nodules. Statistics included comparison of mean values and logistic regression analysis.

Results: Compared to the MDCT data, using MRI mean lesion volume was overestimated by 28%. Consequently, the slope of the regression line was 0.85 for the MRI data and was subordinate to the identity line.

Conclusion: Due to the lower spatial resolution the accuracy of computer-aided volumetry was lower for the MRI-based datasets than for MDCT data. Nevertheless, a variance in volume assessment of < 30% implies that MRI can sufficiently be used to monitor the volume of small pulmonary nodules and to detect doubling of nodule volume, indicating malignancy.

B-0170 15:21

Positron emission tomography and lung nodules: prognostic value of standard uptake value

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Purpose: Our aim was to investigate the prognostic value of standardised uptake value (SUV) in patients submitted to positron emission tomography (PET) for solitary lung nodule.

Methods and Materials: We retrospectively analysed the clinical history of 75 patients (44 males, 31 females, 70.3±11.2-year-old) who underwent PET/CT for lung nodules, in a single-centre experience. The analysis included evaluation of images and physicians’ reports of PET/CT exams, anamnesis of patients and subsequent diagnostic examinations in their follow-up (imaging, biopsy specimen and/or pathological analysis after surgical resection). Follow-up of all patients ended with survival control in September 2011. Receiver operating characteristic curves and Kaplan-Meier method were used.

Results: Mean follow-up was 26.1±19.3 months. Three out of 75 (4%) patients were affected by lung metastases and were excluded from further analysis. In 33/75 (44.0%) subjects a non-small cell lung cancer was diagnosed (20/33 adenocarcinomas and 13/33 squamous carcinomas); 173/51 (51.5%) patients underwent surgery. In all other patients (42/75-56%) lesions were classified as non-oncologic diseases or benign. The best combination to properly characterise the neoplastic nature of nodules found a SUVmax cut-off value of 3.1, resulting in 87.9% and 74.4%, sensitivity and specificity, respectively. Nodules with higher SUVmax value (>3.1) were associated with lower survival rate (p<0.05), independently from surgical/non-surgical approach. For SUV >3.1 and <3.1 the survival rates 1 year after PET imaging were 74.2% and 90.9%, while survival expectancies after 2 years were 54.5% and 78.1%, respectively.

Conclusion: In conclusion, prognostic value of SUVmax value was proved; a cut-off value of 3.1 seems to offer good reliability and accuracy.
In this study, there were 23 APA that showed biochemical cure of primary aldosteronism after RFA. Comparing post-RFA to pre-RFA CT scans, there was a significant drop in HU from pre-RFA to post-RFA measurements (4.4 versus 7.9, P=0.52). In contrast-enhanced CT scans, there was a significant drop in HU after RFA (from 48.3 to 14.7, P=0.03). None of the included cases showed residual uptake at 18 F-FDG PET with abnormal SUV. In 2 cases with either immediate or late complications, in 21/23 (91.3%) nodes complete ablation (lack of enhancement at CEUS, negative 18 F-FDG PET with normalisation of SUV and > 90% decrease of Tg serum levels) was achieved. In 2 cases residual uptake at 18 F-FDG PET with abnormal SUV was found and laser ablation was repeated. Overall intraprocedural CEUS led to a change in therapeutic management in 52-79 years, mean 64.1 ± 9.9 years) with 22 histologically confirmed hepatic malignancies (HCC: n = 10, liver metastases: n = 12) underwent RFA. Before RFA, conventional US, CEUS and contrast-enhanced CT (ceCT) of the liver were performed. During the CT-guided RFA procedure, CEUS was performed to assess the ablation defect. In case of partial ablation a subsequent ablation was performed with a corrected electrode position and evaluated again using CEUS. This procedure was repeated until a CA was achieved. The number of ablations per patient was recorded. Secondary efficacy parameters assessed were lesion detectability in the different imaging modalities and contrast phases.

Results: Overall intraprocedural CEUS led to a change in therapeutic management in 52-79 years, mean 64.1 ± 9.9 years) with 22 histologically confirmed hepatic malignancies (HCC: n = 10, liver metastases: n = 12) underwent RFA. Before RFA, conventional US, CEUS and contrast-enhanced CT (ceCT) of the liver were performed. During the CT-guided RFA procedure, CEUS was performed to assess the ablation defect. In case of partial ablation a subsequent ablation was performed with a corrected electrode position and evaluated again using CEUS. This procedure was repeated until a CA was achieved. The number of ablations per patient was recorded. Secondary efficacy parameters assessed were lesion detectability in the different imaging modalities and contrast phases.

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**B-0176** 14:45
The significance of persistent intra-lesional enhancement of renal tumours following percutaneous cryoablation

B. Shepherd, P. Kumar, T.J.C. Bryant, D.J. Breen; Southampton/UK

**Purpose:** We evaluated the occurrence of 'thread-like' intra-tumoral enhancement on initial cross-sectional imaging in renal tumours treated by percutaneous cryoablation.

**Methods and Materials:** We performed a retrospective review of the post-procedural imaging of all solid renal tumours treated with percutaneous cryoablation from May 2007 to June 2011. We recorded all patients with intra-tumoral enhancement seen on the initial CT or MR performed within 2 weeks.

**Results:** 139 tumours in 118 patients were identified, out of the 139 tumours 15 (10.8%) showed initial ‘thread-like’ intra-tumoral enhancement. Of these 15 tumours none had evidence of residual or recurrent disease at a mean radiological follow-up of 13.9 months. Of the 15 tumours, 11 were confirmed renal cell carcinoma, 2 oncocytomas and 2 were indeterminate. This was proportional with the pathological distribution of the larger cohort.

**Conclusion:** A small but significant minority of solid renal cell tumours demonstrate, seemingly benign, intra-lesional 'thread-like' enhancement post-cryoablation. It is important to be aware of this phenomenon as to avoid the sequelae of misreporting this as residual disease.

**B-0177** 14:54
Microwave ablation (MWA) versus radiofrequency ablation (RFA) for small liver malignancies: rates of technical success

G. Mauri, T. Tondolo, L. Cova, T. Ierace, L. Sobbiati; Busto Arsizio/IT (vanni.mauri@gmail.com)

**Purpose:** To compare primary technical success of MWA and RFA for the treatment of small liver tumours.

**Methods and Materials:** 388 liver malignancies (234 HCCs and 154 metastases) smaller than 2.5 cm in 240 patients undergone US-guided thermal ablation with MWA (n=162) or RFA (n=226) between January 2008 and June 2011 were retrospectively evaluated. A single needle insertion was preoperative planned. Primary technical success (complete coverage of the tumour after one ablation) achieved in the MWA group and in the RFA group was distinctly assessed by intraoperative contrast-enhanced US (CEUS). Further ablations were performed during the same session when CEUS showed residual lesional enhancement, until achievement of complete lack of enhancement. 24-hour CT or MRI were performed to assess the final technical success.

**Results:** Primary technical success was achieved in 134/162 (82.7%) tumours in the MWA group and in 153/226 (67.7%) in the RFA group (p=0.001), in 77/86 (89.5%) HCCs in the MWA group and 105/148 HCCs (70.9%) in the RFA group (p=0.001), in 57/76 metastases (75%) in the MWA group and in 48/78 metastases (61.5%) in the RFA group (p=0.084). Complete ablation at 24 hours was achieved in 378/388 tumours (96.9%); 156/162 (97.5%) tumours in the MWA group and 218/226 (96.4%) in the RFA group (p=0.797).

**Conclusion:** MWA provides a significantly higher primary technical success than RFA in liver tumours smaller than 2.5 cm, and particularly in HCCs. After multiple ablations technical effectiveness is similar between MWA and RFA. MWA should be considered the first choice treatment for small HCCs.
follow-up. Results were assessed after a minimum 6-month follow-up for a total of 124 malignancies (76 HCCs and 48 metastases, size range 0.5-5.5 cm, mean 2.2) in 74 patients. Results: Immediate complete ablation was achieved in 111/124 malignancies (89.5%); 67/76 (88.1%) of HCCs and 44/48 metastases (91.7%). Local tumour progression occurred in 13/124 malignancies (10.5%); 3/57 (5.3%) with sizes ≤1.9 cm, 6/46 (13%) for tumours ranging 2.0-2.9 cm; and 4/21 (19%) for tumours > 3 cm. All local progression was successfully re-treated within 4 months using the same method. Minor complications occurred in 21/148 (14.2%) patients. Only one delayed major complication was noted (0.6%). Conclusion: In our series, valuable local control of hepatic malignancies without significant complications was achieved. Even lesions bigger than 3 cm were successfully treated with few antenna insertions and in a short time.

14:00 - 15:30  Room E1
Musculoskeletal
SS 210  MRI of ligaments, tendons and muscles
Moderators: M. Reijnierse; Leiden/NL   V. Zuberi; Zurich/CH
B-0181  14:00
The use of diffusion-weighted and dynamic contrast-enhanced MRI for quantitative evaluation of the tibial tunnel after anterior cruciate ligament reconstruction with intraoperatively administered platelet-rich plasma gel
M. Ruprecht, M. Vogrin, M. Jevsek, I. Sersa, V. Jevlo; Maribor/Sl.
(Ljubljana/Sl [mitja.ruprecht@guest.arnes.si])

Purpose: To quantitatively evaluate the effect of platelet-rich plasma gel (PRPG), locally administered during the anterior cruciate ligament (ACL) reconstruction.

Methods and Materials: To compare the diagnostic accuracy of a dedicated MR system (0.31 T) with a whole body 1.5 T MR system in the diagnosis of meniscal lesions with arthroscopic correlation.

Dedicated 0.31 T MR was used in 74 patients. Fifteen patients were re-examined with a 1.5 T MR system. Thirty-two patients were examined for the presence of a linear signal intensity increase with the use of a contrast agent and dynamic MRI sequence (2 minutes, 200 mmol iodine per kg). In patients with a positive dynamic MRI, the lesion was confirmed with an arthroscopic examination. The sensitivity of the dedicated 0.31 T MR system for the diagnosis of a linear signal intensity increase was 94.2% (69/74) with a specificity of 66% (15/23). The sensitivity of the 1.5 T MR system was 100% (74/74) with a specificity of 86.9% (20/23). The overall accuracy of the dedicated 0.31 T and 1.5 T MR system was 95% and 98%, respectively. Conclusion: The dedicated 0.31 T MR system is highly accurate for the diagnosis of meniscal lesions. The 1.5 T MR system provided even higher accuracy.

B-0184  14:27
Ankle cartilage: correlation between T2 value and ligament injury
S. Lee, Y. Yoon; Seoul/KR (oddph@ gmail.com)

Purpose: To evaluate differences in T2 values in ankle cartilage at magnetic resonance imaging (MRI) imaging in patients with injury of anterior talofibular ligament (ATFL) compared with healthy subjects.

Methods and Materials: Ankle cartilage was evaluated in 51 subjects with ankle pain who were categorised as having normal ATFL (n = 23, mean age 39), partial tear (PT) (n = 21, mean age 39.7), or complete tear (CT) of ATFL (n = 8, mean age 34) using multiecho spin-echo T2-weighted sequences. Trochlear cartilage regions of the talus were divided into six compartments (anteromedial, medial, posteromedial, anterolateral, lateral centre, and posterolateral). Mean value of compartmental T2 measurements was obtained in three groups.

Results: Mean value of compartmental T2 measurements showed significant differences in the compartment of anteromedial, medial, and posteromedial regions.

Conclusion: MRI is a valuable tool for the assessment of ankle ligament injury and can help in the diagnosis of different grades of ligament pathology.
Rhabdomyolysis revisited: magnetic resonance (MR) imaging finding in detail

Purpose: To retrospectively evaluate magnetic resonance (MR) imaging finding of rhabdomyolysis in detail.

Methods and Materials: Eighteen patients (14 males and 4 women age range, 24 - 88 years; mean age, 49.4 years) were included in this study. Signal intensity on T1- and T2-weighted images, presence of intramuscular haemorrhage, presence of stipple sign, presence of non-enhancing portion in muscle, increased volume of muscle, abnormal signal intensity in subcutaneous fat layer and deep fascia are evaluated.

Results: On T1-weighted image, 11 patients (11/18, 61.1%) showed homogeneous iso signal intensity and 7 (11/18, 38.9%) patients showed heterogeneous mixed high and iso signal intensity. On T2-weighted image, 9 (9/18, 50%) patients showed heterogeneous signal intensity combined high and low signal intensity. Ten patients (10/18, 55.6%) had T1 high or T2 dark signal intensity in muscle representing haemorrhage. Twelve patients (12/18, 66.7%) had stipple sign. Seven patients (7/18, 38.9%) had focal or diffuse non-enhancing portion in involved muscle. Fifteen patients (15/18, 83.3%) showed increased volume of muscle. Nine patients (9/18, 50%) had T2 high signal intensity oedema in subcutaneous fat layer. T2 high signal intensity in facial plane is seen 11 patients (11/18, 61.1%).

Conclusion: Increased volume of muscle is most common imaging finding in rhabdomyolysis on MRI. Other common imaging findings were stipple sign, T2 high signal intensity in facial plane, intramuscular haemorrhage, T2 high signal intensity oedema in subcutaneous fat layer, and focal or diffuse non-enhancing portion in involved muscle.

Magnetic resonance quantitative monitoring of muscle healing through diffusion tensor imaging (DTI) and T2-mapping assessment
A. Esposito, F. De Cobelli, A. Palmisano, T. Canu, L. Campana, G. Pezzetti, A. Manfredi, P. Rovere-Querini, A. Del Maschio; Milan/IT (esposito.antonio@hsr.it)

Purpose: To prospectively evaluate a multiparametric MRI protocol as a non-invasive and quantitative tool for monitoring muscle damage/healing process, obtaining dynamic information about inflammatory infiltrate and fibres regeneration.

Methods and Materials: Acute muscle injury was obtained by cardiotomy (CTX) injection into tibialis-anterior (TA) of C57BL/6 mice. An MRI study including T2-mapping, diffusion-weighted imaging and diffusion-tensor imaging (DTI) was performed before and 1, 3, 5, 7, 10, 15 and 30 days after injury. At each time-point 3 animals underwent MRI and were sacrificed immediately after imaging to obtain tissue's samples for histological analysis.

Results: T2 relaxation time (T2t) significantly increased after injury reaching the top at 3 days; subsequently T2t progressively decrease from 3rd to 30th day, recovering a complete normalisation. A general increase of muscle diffusivity, associated with an important loss of fractional anisotropy (FA), was observed 24 hours after injury. After 15 days FA progressively increased from day 1 to day 5, up to values above the normal level. From day 5 forward FA showed a very slow progression towards basal level. Pearson test revealed good correlations of T2t with histological damage score (r=0.89; p < 0.005) and especially with number of infiltrating leucocytes (r=0.94; p < 0.005); FA correlated with the histological count of centra-nucleated regenerating fibres (r=0.89; p < 0.005).

Conclusion: MRI with T2-mapping and DTI could be considered an effective non-invasive tool to obtain panoramic monitoring of muscle damage and repair process with quantitative readout about leucocytes infiltration and the fibres regeneration.

Quantitative magnetic resonance imaging of the lower limb muscles in Duchenne muscular dystrophy: a new approach for monitoring the disease progression and response to therapy
C. Groi, S. Gerevini, S. Napolitano, F. Ciceri, G. Cosso, Y. Torrente, G. Scotti, L.S. Politi; Milan/IT (claudia.groi@collegiodimilano.it)

Purpose: 1) To determine through magnetic resonance imaging (MRI) the pattern of lower limb involvement in Duchenne muscular dystrophy (DMD); 2) to compare quantitative MRI parameters with functional measures in DMD patients.

Methods and Materials: Twenty-six (6- to 12-year-old) DMD patients and 4 matched healthy controls underwent 3 T MRI examinations of the lower limbs without sedation, at baseline and after nine months. Axial and coronal SE T1, multi-echo T2, STIR, TSE T2-weighted (w) and 3D THRIVE images of the legs and thighs were acquired. After threshold segmentation on T1 images, the muscle volumes (MV) were measured and normalised to the entire limb volume. Muscle signal intensity derived from T1 images was normalised to nearby fat intensity to obtain muscular signal intensity ratios (SIRs) as markers of fatty degeneration. MVs and SIRs were compared with clinical measures and tests, including muscle North Star Score and KinCom. Six patients underwent further MRI examinations every 6 months before being treated with intra-arterial injection of mesangioblasts.

Results: DMD patients' MV was lower than healthy subjects. Except for sartorius and gracilis, patients' SIRs were significantly higher than controls' ones. During follow-up, patients showed significant thigh-MV decrease and leg-MV increase, while SIRs were stable or increased over time. Significant Spearman correlations between SIRs, functional measures and thigh-MVs were found. In some patients with suspected bad compliance, MRI disconfirmed the poor clinical results. Follow-up after mesangioblast transplantation is ongoing.

Conclusion: MRI could provide reliable markers of muscle degeneration which correlate to neurological/functional performances and should be employed in clinical trials as outcome measures.

In vivo assessment of skeletal muscle ischaemia in diabetic rats by MR angiography, MRI imaging and proton MR spectroscopy
S. Dell'Pizzi, R. Madonina, A. Giammarini, G.L. Romani, R. De Caterina, A. Tartaro; Chieti/IT (sdeppizzi@gmail.com)

Purpose: To evaluate the feasibility of using MR techniques for in vivo investigating a rat diabetic model of hind limb ischaemia.

Methods and Materials: Experiments was approved by our Institutional Ethics Committee for animal research. Unilateral hind limb ischaemia was induced by ligation of the femoral artery in male streptozotocin (STZ)-treated (blood glucose ≥400 mg/dL) and healthy non-diabetic control rats. Four weeks after ligation, rats underwent 2D-time-of-flight (TOF) MRI angiography (MRA), T1-weighted (T1-W) and short time inversion recovery (STIR) sequences and muscle proton MR spectroscopy (1H-MRS) on both hind limbs. After MR examinations, immunoblotting and immunofluorescence analysis were performed.

Results: MRA showed a signal void due to flow discontinuation distal to the ligation of common iliac-femoral artery. MRI showed the presence of tissue swelling (p=0.028 for non-diabetic; p=0.028 for diabetic rats) and signal hyperintensity in tissue affected by occlusion. 1H-MRS showed a significant reduction of total creatine-water in occluded vs non-occluded limbs (p=0.028 for non-diabetic; p=0.018 for diabetic rats). MRI and 1H-MRS changes were more pronounced in diabetic than in non-diabetic occluded limbs (p=0.032). MR findings were confirmed using histological findings.

Conclusion: Combined MR techniques can be used to demonstrate the presence of structural and metabolic changes produced in a rat diabetic model of limb ischaemia. This MR-protocol coupled with an experimental rat model of peripheral arterial occlusion may be useful for evaluating in vivo the efficacy of novel pharmacological, as well as gene- and cell-based therapies.

Quantitative assessment of fat infiltration in the rotator cuff muscles using MRI

Purpose: To validate the established, qualitative, Goutallier's classification (GC) of fatty infiltration (FI) within the rotator cuff (RC) muscles using a novel chemical shift-based MRI technique (IDEAL) and to establish the reproducibility of IDEAL in the assessment of FI.

Methods and Materials: 31 patients with RC tear symptoms (22 males, 9 females, aged 23-64 years) was used and 6 of these patients were scanned twice. Shoulder MR examinations were performed at 3 Teslas with an 8-channel shoulder surface coil using sagittal plan PD-FSE and IDEAL (FOV=12, ST=4 mm for both). Fat fraction maps were reconstructed online with T2* correction and a multi-peak fat coil using sagittal plan PD-FSE and IDEAL (FOV=12; ST=4 mm for both). Fat fraction values with GC for each RC muscle; reproducibility of IDEAL technique with suspected bad compliance, MRI disconfirmed the poor clinical results. Follow-up after mesangioblast transplantation is ongoing.

Conclusion: MRI could provide reliable markers of muscle degeneration which correlate to neurological/functional performances and should be employed in clinical trials as outcome measures.
from 15.3 to 17.5% and for grade 4 from 18.3 to 27.3%. The precision error of the

**B-0190 14:09 Improving anorectal angle measurement reproducibility by a semi-
automated method**

M.A. Alkubeyyer1, B.J. Erickson2, J.G. Fletcher2; 1 Riyadh/SA, 2 Rochester, MN/US

**Purpose:** Much has been written about poor reproducibility of anorectal angle (ARA) measurement in defecography. ARA is often determined by estimating a straight line along the posterior border of the rectum and the anal canal. A semi-automated method for ARA measurement is introduced to enhance reproducibility.

**Methods and Materials:** 30 consecutive cases of magnetic resonance defecography with variable evacuatory disorders were recruited. After adding 150 mL of ultrasound gel to the rectum, 3 mid-sagittal images of the pelvis at rest, squeeze and strain were obtained using T2-weighted steady state free precession (SSFPE) sequence. Two readers (MR fellow, fellowship-trained radiologist and MD (MD-PhD stu-
dent) have measured ARA manually and semi-automatically in two sessions with one week interval. Manual measurement has been done by plotting a line through the anal axis and through the posterior aspect of the lower rectum. Semi-automated measurement has been done by clicking along the proximal and the distal end of the anal canal and then drawing the line to automatically estimate the ARA by thresholding the lower rectum then applying a convolution filter followed by oval-fitting to the largest filtered posterior segment of the rectum.

**Results:** Bland-Altman analysis showed high reproducibility of ARA measurements using the semi-automated method compared to manual method with bias, standard deviation, 95% limits of agreement of 0.91, 7.86, [-14.82,16.64] and -3.11, 14.08, [-31.26,25.05], respectively.

**Conclusion:** A semi-automated method can decrease the inter-observer variability of ARA measurement for which future defecography comparative studies become more feasible and reproducible.

**B-0193 14:18 Scattered radiation doses to operators performing fluoroscopic studies on bariatric patients**

M.A. Arshad, A. Sergot, D. Blunt, L. Morris; London/UK (mubank@doctors.org.uk)

**Purpose:** Fluoroscopy is frequently used for assessing post-operative complications and surveillance after bariatric surgery. In this study, the amount of scattered radiation encountered was measured.

**Methods and Materials:** A prospective study involving 20 post-operative bariatric surgery patients and 21 controls was undertaken. The scattered radiation was measured whilst performing upper gastrointestinal fluoroscopic studies using a badge dosimeter worn over the protective lead shielding. The body mass index (BMI), screening time and dose area product (DAP) were also measured.

**Results:** In the bariatric group, the mean BMI was 37.4 (31.4, 48.6) (95% CI), control group of 26.6 (22, 35.5), (p < 0.0001). For the bariatric group, the average screening time was 1:27 and for the control 1:17 (p=0.62). The DAP measured 7.56 Gy cm² (0, 23.9) in the bariatric group, control group 2.64 (0.35, 7.04) (p=0.068). The average deep dose scatter reading for each bariatric patient was 0.009 mSv compared with 0.006 for each control and the average surface reading dose for a bariatric patient was 0.012 compared with 0.006 for non-bariatric patients.

**Conclusion:** The screening times were similar due to a combination of careful collimation and using last image hold in the bariatric group. There was, however, a 1.5- to 2-time increase in the amount of scattered radiation whilst screening bariatric patients. This study highlights the increased radiation exposure to operators providing bariatric fluoroscopic services. The implications of this are discussed, with reference to the increasing volume of bariatric surgical procedures and their impact on radiology departments.
Multiple swallowing disorders of oro-oesophageal tract and gastro-oesophageal junction: role of MR-fluoroscopy with high-speed kinetic sequences

I. Sansoni, C.L. Piccolo, F. Pitocco, R.L. Alloni, R. Del Vescovo, R. Coppola, B. Beomonte Zobel; Rome/IT

Purpose: To define upper and lower swallowing disorders testing the feasibility of high-speed kinetic MR sequences.

Methods and Materials: 33 patients (10 male and 23 female) with oro-oesophageal and gastro-oesophageal disorders underwent MR examination on a 1.5 Tesla scanner. We acquired BH GRE unspoiled T1-w and HASTE T2-w sequences on multiple planes in order to define the anatomic details (i.e. Nissen fundoplication position above or below diaphragmatic plane). Visualisation of oesophageal bolus transit, bolus transit-time, peristalsis, gastro-oesophageal junction patency and competency during oral administration of contrasted yogurt were evaluated.

Results: MR-fluoroscopy revealed to be a reliable tool to evaluate bolus propulsion from oesophagus to stomach. MR-fluoroscopy showed swallowing abnormalities in 31/33 patients: 3 upper motility disorder, 8 achalasia, 1 megaoesophagus, 2 para-oesophageal Hiatial Hernia, 7 gastro-oesophageal reflux (2 of those with sliding Hiatial Hernia), 12 after Nissen-fundoplication, 1 after gastrectomy. MR findings well correlated with other different instrumental examination findings.

Conclusion: In symptomatic subjects, after Nissen fundoplication, MR-fluoroscopy can detect motility alterations, providing additional information for diagnostic work-up. Finally, MR-Fluoroscopy is a radiation-free and non-invasive tool, able to evidence swallowing disorder; it is simple, non-invasive, rapid and well-tolerated for diagnosing GE reflux or motility disorders.

MRI sinography/fistulography is a newer and less used technique for imaging patients with sinus/fistulas when compared to conventional sinograms/fistulography but more helpful and accurate without radiation

H.P. Parekh, N.U. Bahk, D.P. Vasavada, Jamnagar/IN

Purpose: MRI sinography/fistulography is considered a newer and less used technique for imaging patients with perianal sinus/fistulas. To evaluate sterile lignocaine jelly as a contrast agent for MRI, as a cheaper alternative to gadolinium-based contrast, for lesions where no vascular communication is probable.

Methods and Materials: 20 patients are studied to date to compare the information provided by conventional imaging versus MRI. 15 patients in whom the external opening was visible, 3% sterile lignocaine jelly was injected and MRI was done. 5 patients in whom the external opening was not visible. Heavily T2WI images were taken without injecting lignocaine. All the images studied for exact location, track, openings, both internal and external and any visceral communication. Results were analysed and compared with the findings of conventional study.

Results: In the 20 patients studied, 4 patients had the same findings on both modalities. 12 patients had additional information on MRI, inter-communicating or more tracks, 4 symptomatic patients had non-conclusive conventional study, where MRI delineated detailed pathology. Sterile lignocaine jelly provided adequate contrast along with heavily T2-weighted imaging provided diagnostic information and no adverse reactions were noted.

Conclusion: MR sinography, being a newer and advanced technique, should be applied in all symptomatic patients where the conventional imaging findings are not satisfactory. In addition, symptomatic patients without visible external opening, MRI is most useful for detection and surgical guidance. Sterile lignocaine jelly is cheaper, easily available and suitable contrast material for this study with good patient compliance.

Sandwich sign of Borrmann type 4 gastric cancer on diffusion-weighted magnetic resonance imaging

L. Tang, X.-P. Zhang, Y.-S. Sun, Z.-Y. Li, J.-F. Ji, X.-T. Li, Y.-Q. Liu, Q. Wu; Beijing/CH

Purpose: To assess the appearance of Borrmann type 4 (BT4) gastric cancer on diffusion-weighted magnetic resonance imaging (DWI) and to investigate the potential of qualitative and quantitative DW images analysis to differentiate BT4 gastric cancer from poorly distended normal stomach wall.

Methods and Materials: DWI was performed on 23 patients with BT4 gastric cancer and 23 healthy volunteers. The signal characteristics and correlated histopathological basis of the cancers on DWI were investigated. The contrast-to-noise ratio (CNR) of cancer were compared between DWI and T1W1/T2WI. The thickness and apparent diffusion coefficient (ADC) of cancer and normal stomach wall were compared.

Results: All of the gastric cancers displayed hyperintensity compared to the nearby normal gastric wall on DWI. A three-layer sandwich sign with demonstrated high signals in the inner and outer layer, and low signal in the intermediate layer was observed in 69.6% of cancers on DWI. The low signal represents the muscularis propria through the comparison with pathology, and it is postulated scattered distribution of the cancer cells in this layer causes less damage and subsequently less restriction of water movement, which causes the low signal on DWI. The mean ADC value of BT-4 gastric cancer was significantly lower than the poorly distended normal stomach wall (1.12±0.23 x 10^-3 mm2/s vs. 1.93±0.22x10^-3 mm2/s, P < 0.01).

Conclusion: DWI can highlight the signals of BT-4 gastric cancer which may present a characteristic three-layer sandwich sign, and ADC values are helpful in the discrimination of gastric cancer from poorly distended stomach wall.

Acute mesenteric ischaemia: do different findings suggest different aetiology? 7T-MRI on a rat model

D. Baccino, F. Somma, F. Iacobellis, M. Belfiore, S. Cappabianca, A. Rotondo, R. Grassi; Naples/IT (daniela.bertino@libero.it)

Purpose: The signs of acute mesenteric ischaemia (AMI) vary depending on the cause and underlying pathophysiology. Magnetic resonance (MR) findings, intestinal morphodynamics and histological appearance of AMI due to various primary causes are discussed.

Methods and Materials: Twelve SpragueDawley rats were divided into three groups (n=4). Two rats of each group underwent superior mesenteric artery (SMA) (groups 1 and 3) or vein (SMV) (group 2) ligation. Externised bowel underwent macroscopic monitoring. The remaining two rats of each group had a non-occluding loop tied around SMV or SMV and three days after surgery vessels were occluded by squeezing the tips tunneled to the posterior cervical area. Seven Tesla MR (Bruker-Biospec-70/16-US) scans were performed. All rats of groups 1 and 2 were monitored until 8 hour; in group 3 the ligation was loosened after 1 hour and reperfusion was observed until 7 hours. The bowel was removed for histological analysis at the end of observation.

Results: In all type of AMI the mesentery is the first to react. In the arterial ischaemia it appears the contraction of bowel wall followed by hypotony and a bowel wall thinning is distinctive. In case of SMV ligation the spasm is absent due to bowel wall congestion but thickening and early chromatic change of the intestinal wall, mesenteric ulcers and thumbprinting are typical. In case of reperfusion the appearance steer the course of SMV ligation.

Conclusion: This animal model detected morpho-functional alterations of ischaemic bowel and identify the specific pattern of lesions of AMI.
B-0200 15:12
Contrast-enhanced ultrasound for differential diagnosis of suspected GvHD in patients after allogeneic transplantation
L.M. Dendl, K. Landfried, E.M. Jung, N. Platz Batista da Silva, C. Friedrich, C. Stroszczyński, A.G. Schreyer; Regensburg/DE (lena_marie_dendl@yahoo.de)

Purpose: Early diagnosis of GvHD (graft versus host disease), after differentiation from other causes leading to the same symptoms, such as viral or bacterial enteritis, is important because the time needed for diagnosing GvHD is directly correlated to a worsening of the outcome. We evaluate the value of contrast-enhanced ultrasound (CEUS) for the differential diagnosis of GvHD.

Methods and Materials: We examined 23 patients presenting with the abdominal symptoms of GvHD. All patients underwent CEUS with particular attention to penetration of the intravenously applied microbubbles in the bowel lumen. In the patients having allo-SCT in their history we had histological confirmation of GvHD. 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. For microbubble penetration as a criterion for GvHD of the GI-Tract, this leads to a negative predictive value (NPV) of 67%, and a positive predicative value (PPV) of 100%.

Conclusion: Our study strengthens the hypothesis that transmural bubble penetration may be a highly specific and adequately sensitive non-invasive-diagnostic criterion for GvHD of the GI tract.

14:00 - 15:30 Room F1
Genitourinary

SS 207
Genitourinary CT
Moderators: O. Nikolic; Novi Sad/RS, J. Stoker; Amsterdam/NL

B-0201 14:00
Impact of 4th generation iterative reconstruction techniques on image quality in low-dose computed tomography of the upper urinary tract

Purpose: To intraindividually compare and evaluate the influence of the 4th generation iterative reconstruction (IR) technique iDoseTM on low-dose MDCT of the upper urinary tract with regard to anatomical delineation and artefact reduction.

Methods and Materials: In 26 consecutive patients suffering from urolithiasis the raw data of unenhanced MDCT scans (120 kV, mean CTDIvol: 5.9 mGy) were reconstructed using a 64-row and 256-row CT scanners. Scans parameters were: 0.9 mm slice thickness, 0.45 mm reconstruction interval, 120 kV and 50-200 mAs. A total volume of 20 ml iodine contrast dilution (3 ml of iodine contrast and 17 ml of saline solution) was administered into the ureteric cavity using a semi-rigid plastic cannula.

Results: In the cervical region CT-VHSG demonstrated: wall irregularities (23%), folds thickening (10%), cervical polyps (9%), diverticulae (6%), cervical stenosis (8%), cervical synchiae (1%). Uterine cavity findings were: polyps (40%), submucous myomas (9%), synchiae (11%). Uterine wall abnormalities included: intramural and subserous myomas (9%), uterine malformations (8%), adenomyosis (5%) and C-section scar (3%). Fallopian tubes findings included: unilateral hydroalpinx (8%) and bilateral hydroalpinx (2%), tubal obstruction (4%). The 7% of the fallopian tubes were partially visualised in the CT-VHSG studies. The scan time was 3.2 ± 1.1 sec. The effective radiation dose was 0.93 ± 0.08 mSv. The 86% of the patients referred only mild or no discomfort.

Conclusion: CT-VHSG allowed an adequate and accurate evaluation of the female internal genital organs, providing comprehensive diagnostic information in patients with infertility. This is minimally invasive low radiation dose technique, well tolerated for the vast majority of the patients.

B-0203 14:18
Detectability of small urinary stones on virtual nonenhanced images with different slice thickness, generated at ptyeograpic phase dual energy CT
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Purpose: To evaluate the detectabilities of small urinary stones by 1 mm, 3 mm, 5 mm slice thickness, virtual nonenhanced (VNE) images.

Methods and Materials: 45 patients who had undergone abdominopelvic CT scans, which consisted of true nonenhanced (TNE) and ptyeograpic-phase dual source dual energy CT scans, were enrolled. 40 patients who have urine stones less than 5 mm in diameter were enrolled randomly, and 5 patients who have no urinary stone were enrolled for control group. Total 50 stones were enrolled. Two radiologists independently evaluated the VNE images for the presence of stone, size and location. In addition, the image quality, artefacts, associated renal abnormalities, and radiation dose were also calculated. Sensitivities were calculated for stones with diameter of 2-2.9 mm, 3-4.9 mm and overall. Specificities, accuracies and positive predictive values were also calculated. The TNE image was considered the reference standard.

Results: The main overall sensitivities of two observers for detecting stones at 1 mm, 3 mm, 5 mm VNE images were 84%, 74%, 70%. The sensitivities for detecting 3-4.9 mm sized stones were 96.30%, 92.59%, 90.74%. The sensitivities for 2-2.9 mm sized stones were 71.74%, 52.18%, 45.66%. The overall specificities were 43.41%, 41.67%, 22.62%. Accuracies were 75.44%, 66.59%, 60.31%. PPV were 85.28%, 81.98%, 77.78%. Interobserver agreement showed good (k=0.613). 30.91% of total radiation dose could have been reduced if TNE images were not taken. Symptomatic ureteral and ureterovesical junction stones (21 of 50 stones) were detectable in 97.62%.

Conclusion: VNE image is useful even for detecting small urinary stones, and detectability of small stones can be enhanced with 1 mm slice thickness VNE image.

B-0204 14:27
CT in uroradiology: potential of dose reduction and impact on image quality using iterative reconstruction
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Purpose: To determine the potential of dose reduction and impact on image quality using iterative reconstruction for CT of uroradiology.

Methods and Materials: A 4.8×4.3 mm uic acid ureteral stone was placed inside an anthropomorphic Alderson phantom at the pelvic level. Measurements were performed on a 64-channel-MDCT-system using different kV (120, 100, 80 kV) and mAs (100, 70, 30, 15, 8) settings. For each kV and mAs settings 1 mm data sets were
reconstructed using standard filtered back projection and iterative reconstruction soft tissue kernels (B30 and D30). The resulting 30 scans were randomised into 6 groups and image quality was independently assessed by two blinded readers. The best two scans of each group were again randomised and pooled against each other until the best 8 scans were determined. Effective dose (ED) was estimated for each data set from dose length product and a conversion factor. Noise measurements were performed in an additional water phantom used with each scan.

Results: Low-dose images using a MAs setting of 8 were not diagnostic and could not visualise the stone. Among the 8 best data sets, 5 were based on iterative reconstructions. Image quality using iterative reconstruction at the highest dose were rated to have the best image quality (120kv, 100 mA, ED=2.53, Noise level=12.7). Lower dose settings (120 kv/30 mA, ED=0.75, Noise level=25.7) allowed for diagnostic image quality with a dose savings potential of 70%.

Conclusion: Iterative reconstruction allows for a potential dose saving of up to 70% while still yielding diagnostic image quality in CT of urolithiasis.

B-0205 14:36
Dual energy split-bolus CT for the detection of urinary stone disease.

One phase acquisition: threefold information
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Purpose: To prospectively evaluate image quality, diagnostic performance, and radiation dose of dual energy split-bolus CT for the evaluation of urinary stone disease.

Methods and Materials: Fifty consecutive patients (19 women; 45±15 yrs) referred for the evaluation of urinary stone disease and urinary tract obstruction underwent CT with a standard unenhanced and dual energy (dual source CT, 100-140 kVp/30 mA) contrast-enhanced phase. Contrast media (300 mg Iodine/ml) was administered in a split-bolus fashion (1st bolus 30 ml, 2nd bolus 50 ml after 9 min). Dual energy data were acquired 10 min after initiation of contrast injection. Virtual non-enhanced (VNC) images were reconstructed by iodine subtraction. Two blinded readers independently assessed image quality. Sensitivity, specificity and diagnostic accuracy for the detection of urinary stone disease were calculated using standard unenhanced images as the reference.

Results: Image quality of contrast-enhanced dual energy and VNC images were rated diagnostic in all 50 patients (100%). Image noise of VNC images was low (7±1 HU, 5-11 HU). Standard unenhanced CT revealed 39 urinary stones in 25/50 patients (50%); VNC demonstrated 37 uroliths in 24/50 patients (48%). The two blinded readers independently assessed image quality. Sensitivity, specificity, and diagnostic accuracy were 95%, 100%, and 97% on a per-urolith and 90%, 100%, and 98% on a per-patient basis, respectively. The effective dose of dual energy split-bolus CT was significantly (p < 0.001) lower than that of standard bi-phantom protocol (41%).

Conclusion: Split-bolus dual energy CT allows for the evaluation of urinary stones, nephrographic and excretory phases in a single acquisition, thus, it facilitates comprehensive CT evaluation of urinary stone disease at a considerably reduced radiation dose.

B-0206 14:45
Can virtual non-contrast images of dual energy CT replace true non-contrast images in evaluation of renal pathologies
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Purpose: To assess the efficacy of the virtual non-contrast CT (VNC) in evaluating the renal lesions compared to true non-contrast CT (TNC) and its capability to reduce the radiation dose.

Methods and Materials: 100 patients underwent triple bolus CT urography using DECT scanner. VNC images were obtained using commercial dual energy software. Two readers independently and retrospectively reviewed, rated and compared VNC images with TNC control images using mean HU value, signal-to-noise ratio (SNR), image quality, lesion detectability and radiation doses as parameters. Statistical analysis was performed.

Results: Of the 100 cases studied, 32 were normal, simple cysts (47), renal carcinoma (9), complicated cysts (2) and renal calculi (10). The mean HU values and SNR of these lesions were comparable in VNC images and corresponding TNC images. The image quality of VNC images was comparable and diagnostic VNC images were equally efficient as TNC images in detecting solid focal lesions and cysts. However, 8 of 10 (80 %) calculi were detected using VNC images, whereas all were visualised on TNC images. With this new technique, calculated radiation dose was 9.8 mGy vs. 18.2 mGy received using conventional technique.

Conclusion: Obtaining VNC images of the kidneys and the urinary tract using DECT software significantly reduces effective radiation dose without compromising SNR, image quality and lesion detectability. This can potentially obviate the need to obtain TNC images in CT urography.

B-0207 14:54
Triple bolus technique with dual energy MDCT: a new perspective in CT urography
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Purpose: To retrospectively evaluate and compare renal, vascular and urinary tract visualisation as well as radiation dose efficiency following triple bolus injections in a single acquisition with conventional triphasic CT urography technique.

Methods and Materials: 60 patients underwent triple bolus CT urography using dual source CT scanner. The protocol followed was: 30 mL of i.v. contrast at 2 mL/sec at 0 and 410 seconds and 40 mL at 3 mL/sec at 510 seconds, with total scanning time of 536 seconds. Virtual non-enhanced images were obtained using commercial dual energy software. Two readers independently and retrospectively reviewed and rated the images for contrast opacification of the renal parenchyma, vasculature and urinary tract distension and compared with conventional triphasic CT urography (cCTU) images.

Results: Complete opacification of the intrarenal collecting system and proximal ureter was achieved in 100% of segments, respectively (cCTU, 100% and 95%). The distal ureter and bladder was not opacified in 30% and 5% of cases, respectively (cCTU, 25% and 0%, p<0.05). Image quality of renal parenchymal enhancement was excellent in 73% cases (conventional CTU, 80%, p<0.05). Vascular image quality was excellent in 88% of cases (cCTU, 90%, p<0.05). With this new study, calculated unenhanced dose was 9.8 mGy, much less than the conventional triphasic CT urography (34.2 mGy).

Conclusion: Triple-bolus CT urography technique using dual energy CT is a dose-efficient protocol permitting comprehensive study of the urinary system in a single acquisition and can be potentially used as standard protocol for CT urography.

B-0208 15:03
The diagnostic accuracy of multidetector computed tomography with multiplanar reformatted imaging and virtual cystoscopy in the early detection and evaluation of bladder carcinoma
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Purpose: To evaluate the diagnostic accuracy of multi-detector computed tomography with multi-planar reformatted imaging and virtual cystoscopy in early detection and evaluation of bladder masses with comparison with conventional cystoscopic findings.

Methods and Materials: This prospective study included thirty-five patients with suspected bladder cancer were studied by (computed tomographic cystography (CTC) and virtual cystography (VC) in both the supine and prone positions after distending the bladder with air. The patient population was divided into three groups based on lesion size at conventional cystoscopy. Results of the CT study were compared with those of conventional cystoscopy (CC). Main outcome measures: sensitivity, specificity, positive and negative predictive value was used to study the association between VC and CC as regarding lesion detection.

Results: The size of the tumours varied from 2 mm to occupying more than three-quarters of the bladder. Of the 71 lesions detected on CC, 47 lesions were positive in histopathology, 28 were 4 mm were detected by VC and 24 of 28 < 4 mm. The locations of all were correctly described at VC when compared with CC. The overall sensitivity of VC versus CC was 94.36%, specificity 71.42%, PPV was 97.1% and NPV was 55.55.

Conclusion: Cystoscopy remains the standard of reference for the evaluation of the urinary bladder, but MDCT is indicated for examination of patients on whom conventional cystoscopy is contra-indicated, difficult to perform, unsatisfactory in interpretation, and as an adjuvant tool in the evaluation of areas difficult to assess with conventional cystoscopy.

B-0209 15:12
Evaluation of diagnostic strategies for diagnosing bladder cancer using CT urography, flexible cystoscopy and voided urine cytology: results for 778 patients

Purpose: To evaluate diagnostic strategies for diagnosing bladder cancer (BCa) using CT urography (CTU) as additional, replacement or triage tests.

Evaluation of diagnostic strategies for diagnosing bladder cancer using CT urography, flexible cystoscopy and voided urine cytology: results for 778 patients


Purpose: To evaluate diagnostic strategies for diagnosing bladder cancer (BCa) using CT urography (CTU) as additional, replacement or triage tests.
Methods and Materials: The clinical cohort was a consecutive series of 778 patients referred to a haemataura clinic with visible haemataura, age over 40 years with urinary tract infection excluded. All patients underwent CTU and flexible cystoscopy (FC), scored using 3-point systems and urine microscopy. Reference standard consisted of review of imaging, histopathology and medical notes. Follow-up was 21-66 months. Results: The prevalence of BCAs in the cohort = 20% (n=156/778). For CTU as an ‘additional-test’ to FC, sensitivity (Se) = 1.0 (95%CI, 0.98-1.00), specificity (Sp) = 0.94 (95%CI, 0.91-0.95), positive predictive value (PPV) = 0.80 (95%CI, 0.73-0.85) and negative predictive value (NPV) = 1.0 (95%CI, 0.99-1.00). For CTU as a ‘replacement-test’ for FC, Se = 0.95 (95%CI, 0.90-0.97), Sp = 0.83 (95%CI, 0.80-0.86), PPV = 0.58 (95%CI, 0.52-0.64), and NPV = 0.98 (95%CI, 0.97-0.99). For FC for diagnosing BCAs, Se = 0.98 (95%CI, 0.94-0.99), Sp = 0.94 (95%CI, 0.92-0.96), PPV = 0.80 (95%CI, 0.73-0.85) and NPV = 0.99 (95%CI, 0.99-1.0). For CTU and FC as a ‘triage-test’ for rigid cystoscopy (RC) and follow-up (normal and equivocal-scores referred for FC=option-1); Se=1.0 (95%CI, 0.98-1.0), Sp=0.94 (95%CI, 0.91-0.95), PPV=0.80 (95%CI, 0.73-0.85), NPV=1.0 (95%CI, 0.99-1.0). For CTU and FC as a ‘triage-test’ for RC and follow-up (normal-score referred for follow-up=option-2); Se=0.95 (95%CI, 0.90-0.97), Sp=0.98 (95%CI, 0.97-0.99), PPV=0.93 (95%CI, 0.87-0.96), NPV=0.99 (95%CI, 0.97-0.99).

Conclusion: The optimum ‘diagnostic-strategy’ for diagnosing BCAs uses CTU and FC as a ‘triage-test’ for RC and follow-up (option-1). Patients with positive CTU-scores for BCAs go direct for RC, and normal and equivocal scores undergo FC. Diagnostic accuracy is the same as the additional test strategy with the advantage of a 17% reduction of the number of FCs performed.
control (AEC) settings were modified, dosimetry proved a dose reduction of 29.87%. According to the ACR Breast Imaging Reporting and Data System (BI-RADS), the mammograms were category 1-3, breast tissue density was ACR level 1-4. The mammograms were read twice by 2 experienced radiologists with a 3-point score on diagnostic image quality and the visualisation of parenchyma, cutis, benign lesions as well as calcifications.

**Results:** NIP compared to PIP at standard dose showed a better over-all image quality at ACR 1-3 which was significantly better at ACR 2 (p < 0.038). At ACR 4 image quality was similar with standard and reduced dose on NIP and PIP. With 30% dose reduction we found no significant loss of image quality within the NIP examinations. The reading showed a good intra- and interobserver agreement (r=0.87/0.89).

**Conclusion:** With the new needle-based imaging plate (NIP) technology in digital mammography, dose reduction of 30% is possible without loss of diagnostic image quality.

**B-0214**

**14:36**

Mammographic texture resemblance generalises as an independent risk factor of breast cancer

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**Purpose:** Breast density is an established risk factor for breast cancer. Mammographic-texture-resemblance (MTR) was shown to be a density independent risk factor, but only on a single study. We show that MTR generalises across different cohorts.

**Methods and Materials:** MTR was computed from digitalised mammograms of a 4-year prospective study (S1). Dutch screening program, 245/05 cancers/matched-controls, cancers were ascertained years prior to diagnosis 1993-2006), and from an independent cohort study (S2). Mayo Mammography Health Study cohort, 226/442 cancer/age-matched-controls). Mammographic percentage-density (PD) and other major risk factors were ascertained in S2. Finally, S2 was MTR-scored based on textures from S1 and S2 in a leave-two-out fashion. Scores on S2 were related to future breast cancer incidence by analysing AUC and quartiles adjusted for BMI, menopause status, and postmenopausal hormone (PMH) use.

**Results:** MTR-scores on S1 showed a significant capability to separate cancers and matched controls in S2 were insignificant. S2 showed an AUC of 0.633, 0.613, and 0.600 based on percentage density, MTR-scores trained on S1 and S2, respectively. Adjusted for PD, MTR-scores of S2 trained on S1 showed OR in quartiles of ref: 1.0 (0.64-1.89), 0.93 (0.52-1.68); 1.96 (1.13-3.23), respectively, and a combined AUC of 0.654.

**Conclusion:** The heterogeneities that characterised breast cancer risk in S1 were also density independent risk factors in S2. Hence, the MTR-predicted risk persisted under differences in x-ray technology, population demographics and geography.

**B-0215**

**14:45**

Tomosynthesis elastography: evaluation of a novel elastography technique on simulated tumours in breast-mimicking phantoms

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**Purpose:** To evaluate whether measurement of strain under static compression in tomosynthesis of breast-mimicking phantoms can be used to distinguish tumour-simulating inclusions of different elasticities. To compare the results of this technique to ultrasound elastography as well as values predicted by rheometric analysis.

**Methods and Materials:** We prepared three soft breast-mimicking phantoms containing simulated tumours of different elasticities varying within a range typical for benign and malignant lesions. The phantoms were imaged using a wide angle tomosynthesis of breast-mimicking phantoms can be used to distinguish tumour-simulating inclusions in breast-mimicking phantoms by elasticity. The results are similar to ultrasound elastography and to the gold standard, rheometry. This technique may in future be useful for assessing elasticity of breast lesions. Initial results from clinical experiments appear promising; examples will be shown.

**B-0216**

**14:54**

Functional infrared imaging of the breast: automatic breast cancer detection using multiparametric computer analysis

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**Purpose:** A novel prototype system performing functional three-dimensional (3D) infrared imaging (RUTH), coupled with multi-parametric computer analysis (MIRA), was evaluated for non-invasive detection of breast cancer. The technique utilizes non-ionising radiation and automatically provides risk assessment based on parameters derived from a clinically known training set.

**Methods and Materials:** Following IRB approval, a prospective multicentre, two-armed blinded study, was performed on 118 women, which included 66 patients with histologically proven breast cancer and 52 women with a normal (BI-RADS 1) mammogram. RUTH Imaging (Real Imaging Ltd, Israel) was acquired on a continuous temporal timeline for 1 minute at 9 Hz. Acquired data were analysed using multiple computed algorithms (MIRA) which were combined to develop a master algorithm for risk assessment of breast cancer. Analysis was blinded to the pathological diagnosis and mammography. Performance was evaluated using ROC analysis.

**Results:** Fifty-eight of 66 cancers (87.8%) were identified using this technology. The sensitivity and specificity of RUTH imagers coupled with MIRA for detecting breast cancer were 87.8% and 73.1%, respectively. ROC-AUC was 0.872. Detected tumours ranged 5 mm-45 mm (mean 17.4 mm) in size.

**Conclusion:** This preliminary study shows high sensitivity and specificity of the novel technology examined for detecting breast cancer. Performance was better than the published sensitivity of mammography and comparable to the reported performance of new adjunctive breast imaging technologies. Our results warrant further evaluation of the RUTH imager in detecting and characterising breast cancer.

**B-0217**

**15:03**

Molecular breast imaging (MBI) dose lowered to match mammography: potential for screening dense breasts


**Purpose:** Molecular breast imaging (MBI) uses single gamma photons to visualise breast tumours that are often occult on mammography of radiographically dense breasts. Our purpose was to reduce the MBI dose and evaluate its potential for future screening of women with dense breasts.

**Methods and Materials:** We optimised the imaging physics for the LumaGEM MBI scanner (Gamma Medica) that uses two detector heads with pixelated CZT gamma detectors with 1.6 mm square pixels. We designed a low-dose collimator with tungsten septa and square holes that match the CZT detector pixels. We developed with a breast lesion phantom that facilitates measurement of contrast-recovery curves, useful for comparison of various MBI systems and for predicting lesion detectability.

**Results:** In clinical trials at Mayo Clinic we have demonstrated low-dose MBI with 99mTc-Sestamibi, at a whole body dose equivalent to screening mammography. We are conducting a clinical trial to evaluate MBI screening of about 1600 women with dense breasts. MBI has proven far more sensitive and specific at detecting biopsy proven cancers than mammography in dense breasts. The breast lesion phantom demonstrates that our 1.6 mm pixel size is optimal for MBI, enabling the lowest dose compared to systems using 2.5 mm or 3.2 mm pixels.

**Conclusion:** Dose has been effectively mitigated as an obstacle to MBI screening of radiographically dense breasts. An ongoing clinical trial suggests that MBI could be a very effective screening tool in the dense breast population (up to 40% of European and American women; more than 50% of Asian women).
Non-invasive differentiation of small breast lesions via 3D MT imaging

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Purpose: The 3D non-ionising diagnostic imaging technology of multimodal tomography (MT) was introduced in ECR 2011. MT was recently shown to differentiate breast lesions (down to 2 mm in size) in 103 BI-RADS-4 volunteers.

Methods and Materials: The MT clinical prototype performs 3D tomographic scan of the pendulant breast in water-bath using transmission ultrasound in a fixed-coordinate system. Design details were presented in the EIBIR Workshop of ECR2011. MT reconstructs multiple images for each coronal slice, using measurements of refactivity and frequency-dependent attenuation and dispersion. MT detects and differentiates lesions using fusion of these multimodal images. This year, MT results from 103 BI-RADS-4 female volunteers (ages 39-79, average: 54.7 years) were compared with histopathology results from biopsy of the suspicious lesions (sizes 2-28 mm, average: 7.1 mm) taken by minimally invasive core biopsy, FNA, Fischer Mammotome® and BLES®. The hypothesis that MT can detect and classify correctly malignant lesions down to 2 mm in size was tested.

Results: MT detected and correctly classified 33 out of 34 malignant lesions (97.1% sensitivity) in the biopsy samples. Among the 33 detected malignant lesions, 15 (45%) had maximum dimension <= 5 mm (mostly DCIS). The smallest detected malignant lesions (DCIS) had maximum dimension of 2 mm. There was only one false-positive MT result in the biopsied lesions (96.5% specificity).

Conclusion: Initial clinical results confirmed the ability of MT technology to detect and classify breast lesions (down to 2 mm in size) among 103 BI-RADS-4 female volunteers with 97.1% sensitivity and 98.5% specificity.

B-0219 15:21

Fusion of US and FDG-PET/CT image for evaluation of loco-regional recurrence of breast cancer using real-time virtual sonography (RVS): first experience

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Purpose: F18-fluorodeoxyglucose (FDG) positron emission tomography/CT (PET/CT) is more sensitive than conventional imaging in detecting metastatic or recurrent disease of the breast. When incidental FDG uptake with high standard uptake value (SUV) is detected in loco-regional lesion by FDG-PET/CT, sonographic confirmation needs to be done immediately. We recently developed a real-time virtual sonography (RVS) system that enables simultaneous display of both a US and the CT images of the same site in real-time using magnetic position tracking system. The aim of this study was to evaluate the role of RVS in the sonographic localisation of FDG activity.

Methods and Materials: Between March 2009 and June 2011, we performed FDG-PET/CT for suspected recurrent breast cancer in 22 patients. The sonographic detection rate was determined for FDG uptake in loco-regional recurrence, with or without RVS.

Results: Of the 22 patients, a total of 14 FDG uptake lesions in seven patients were detected as loco-regional recurrence. The median tumour size was 14 mm (range 5-54 mm). Of the 14 lesions, 7 (50%) could be identified in targeted US without RVS, but 13 (93%) were identified in targeted US with RVS (p<0.03). The RVS was able to correctly project FDG uptake information onto a body surface without operator’s skill, as we checked sonography form images.

Conclusion: Our results suggest that RVS can sonographically identify FDG uptake lesions with excellent accuracy.

B-0220 14:00

Influence of breast parenchyma density on malignant lesion detection with gadobenate dimeglumine-enhanced MRI compared to gadopentetate dimeglumine-enhanced MRI, mammography and ultrasound

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Purpose: To determine the influence of breast parenchyma density on malignant lesion detection in patients undergoing gadobenate dimeglumine-enhanced MRI, gadopentetate dimeglumine-enhanced MRI, mammography and ultrasound.

Methods and Materials: One hundred and eight women (52.7±12.7 years) that underwent mammography and who had BI-RADS 3/4/5 findings on mammography and/or ultrasound underwent two identical breast MRI exams in randomised order, one with gadobenate dimeglumine and the other with gadopentetate dimeglumine each at a dose of 0.1 mmol/kg BW. MRI was performed at 1.5 T using 32w and 3D spoiled T1w GRE sequences with a temporal resolution of ≤2 min. Images were evaluated independently by three, unaffiliated, blinded radiologists for cancer detection. Imaging findings were matched with histology data by a fourth independent, blinded, radiologist. Malignant lesion detection rates were compared (McNemar’s test) across different categories of breast tissue density.

Results: 122 malignant lesions were confirmed at histology in patients undergoing MRI and mammography/ultrasound. In predominantly fatty breasts (<50% glandular) each reader detected 74-76/81 (91.3-93.8%) malignant lesions on gadobenate dimeglumine-enhanced MRI compared with 35-39/41 (85.4-95.1%) lesions on gadopentetate dimeglumine-enhanced MRI and 38/41 (92.7%) lesions on mammography/ultrasound. In heterogeneously dense and extremely dense breasts (>51% glandular) the three readers detected 74-76/81 (91.3-93.8%) malignant lesions on gadobenate dimeglumine-enhanced MRI compared with 35-39/41 (85.4-95.1%) lesions on gadopentetate dimeglumine-enhanced MRI and 66/81 (81.5%) lesions on mammography/ultrasound. Gadobenate dimeglumine-enhanced MRI was significantly (p < 0.02) superior for malignant lesion detection particularly in heterogeneously dense breasts.

Conclusion: Gadobenate dimeglumine-enhanced breast MRI permits significantly improved cancer nodule detection regardless of breast tissue density.

B-0221 14:09

Intra-individual, randomised comparison of the MRI contrast agents Gadovist® 1.0 versus MultiHance® for pre-operative breast MR imaging, evaluated in a blinded read

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Purpose: To compare and validate the diagnostic performance of Gadovist® 1.0, 81.60% for 0.5M MultiHance®. Sensitivity in lesion characterisation across readers showed no difference between Gadovist® 1.0 (92.63%) and MultiHance® (90.53%). There was no difference between contrast agents in the
B-0222 14:18
Does preoperative MRI in breast cancer increase the rate of mastectomy?
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Purpose: To evaluate whether preoperative-MRI in female patients diagnosed with breast cancer increases the rate of mastectomy.

Methods and Materials: Two series of consecutive women surgically treated for breast cancer were retrospectively reviewed: Group 1: 300 patients with preoperative-MRI, Group 2: 300 patients without preoperative-MRI. Patient age, menopausal status, tumour size, staging, surgical treatment, neoadjuvant chemotherapy and reinterventions due to affected margins were evaluated. Statistical analysis was performed with Student’s t and Chi-square tests (SPSS 15.0).

Results: Both groups were similar in age (51.5±6.0 and 51.6±6.0 years; p=0.71) and menopausal status (150 and 158 women; p=0.41). The average pathological tumour size was smaller in group 1 (16.9±13.5 mm vs 22.3±15.3 mm; p<0.001). Multifocal/multicentric tumours were more frequent in group 1 (28.7% vs 15.7%; p<0.01). Bilateral tumours were diagnosed only in group 1 (5.3%). The rate of mastectomy was lower in group 1 (25% vs 49%; p<0.001). Oncoplastic (16.7%) and bilateral surgeries (5.2%) were only performed in group 1. The rate of neoadjuvant chemotherapy was higher in group 1 (30.7 vs 9.3%; p<0.001). Reinterventions due to margin infiltration were also more frequent in group 1 (7.3% vs 2.7%; p<0.01).

Conclusion: Despite diagnosing more multifocal/multicentric cases in group 1 (preoperative-MRI), our study shows a decrease in the rate of mastectomy (from 49% to 25%) when oncoplastic surgery and neoadjuvant chemotherapy are available. However, the increase of tumorectomies has led to more reinterventions due to affected margins (from 2.7% to 7.3%).

B-0223 14:27
The role of preoperative MRI in breast cancer: is the menopausal status of relevance?
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Purpose: To evaluate the role of MRI in the preoperative setting of breast cancer according to the premenopausal vs. menopausal status.

Methods and Materials: 300 breast-MRI exams of patients with breast cancer diagnosed by percutaneous biopsy were retrospectively evaluated. They were divided into two groups: 150 premenopausal (group1) and 150 menopausal (group2). Changes in surgical management induced by MRI findings, surgical treatment, MRI staging (size, bilaterality, multicentricity and multifocality), free tumoral margins and requirement of neoadjuvant chemotherapy (NAQ) were evaluated. Statistical analysis was performed with Student’s t and Chi-square tests (SPSS 15.0).

Results: Initially planned surgery was modified in 30.3% of the patients due to MRI findings, with no significant differences between groups (p=0.53). This additional information given by MRI was proved to be malignant in 95.6% of the cases. 16 bilateral surgeries, 75 mastectomies, 50 oncoplastic surgeries and 157 tumorectomies were performed with more mastectomies carried out in Group1 (30% vs 20%; p<0.05). MRI detected 16 bilateral cancers (5.3%) unsuspected with conventional techniques, 36 multicentric (12%) and 52 multifocality (17.3%), with no significant differences between groups (p=0.91). Mean size of the tumours was similar in both groups (p=0.11). Free margins were obtained in 91.7% with no significant differences (p=0.06). More women underwent NAQ in group1 (36.7% vs 26.4%; p<0.05).

Conclusion: MRI is more sensitive than conventional techniques for staging breast cancer, changing initial planned treatment in up to one-third of the patients. Both premenopausal and premenopausal patients may benefit from preoperative MRI. Premenopausal women undergo more mastectomies and NAQ.

B-0224 14:36
Impact of T-stage on lesion characteristics and overall diagnostic accuracy of breast MRI: does size really matter?

Purpose: Histopathological characteristics of breast tumours change during their course of growth. However, in radiological practice, lesion characteristics are applied irrespective of tumour stage. We aimed to identify morphologic and dynamic profiles of breast tumours in correlation to the T-stage and to evaluate the impact on overall diagnostic accuracy of breast-MRI (bMRI).

Methods and Materials: Basis of this investigation was a cross-sectional database of consecutive, histologically verified breast lesions imaged by bMRI (standardised protocols; ethical-board approval). All lesions were prospectively evaluated by two radiologist in consensus (>1000 bMRI-exams) using 17 standardised morphological and dynamic descriptors. According to the TNM-systems, size of each lesion was categorised as I: < 2 cm; II: 2-5 cm; II: 5 cm; n=50). Statistics addressed accuracy of individual descriptors in association with each size-subgroup (contingency-tables, Chi-square tests). Then, descriptors were combined into a multivariate model to identify overall accuracy of bMRI in association with the T-stage (logistic-regression; histology/target-variable: benign vs. malignant). Finally, results between each subgroup were compared (AUC-comparison [area under the receiver-operating-characteristics curve]).

Results: Majority (76%) of bMRI descriptors were associated with T-stage (P<0.05), resulting in different accuracy of such features according to tumour size. This contributed to the higher performance of bMRI in advanced T-Stages (II: AUC<0.97; III: AUC<0.99) compared to smaller tumours (I: AUC<0.90; P<0.05).

Conclusion: Our results suggest that lesions characteristics in bMRI change during the tumour’s course of growth. This causes characteristic morphologic and dynamic profiles in correlation with the T-Stage and further increases diagnostic accuracy of bMRI in larger lesions.

B-0225 14:45
Breast MRI and ductal carcinoma in situ: when can we expect to have no enhancement?
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Purpose: To evaluate the characteristics of ductal carcinoma in situ not identified on dynamic MRI examination performed for breast cancer staging.

Methods and Materials: Two experienced breast radiologists retrospectively evaluated images of 86 patients with ductal carcinoma in situ (DCIS) histopathologically proven on surgical specimen, who had also performed a dynamic breast MRI investigation before surgery in 54 months. We divided the patients with DCIS into two groups, depending on the result of dynamic MRI investigation: the absence of suspicious contrast enhancement, including in the late phase, was considered to be a false-negative examination. The presence of enhancement was considered positive. Fisher exact tests was used for statistical analysis (statistically significant: p-value<0.05).

Results: MRI correctly demonstrated the presence of 65/86 DCIS (sensibility: 75.6%). In 21 patients no enhancement was identified in the area of neoplasms. CDIS smaller than or equal to 15 mm on mammography did not present enhancement during MRI investigation more often than those over 15 mm (p<0.05). The absence of suspicious contrast enhancement at MRI was more frequently associated with low or intermediate histological grade compared with high grade (p<0.05). Mammographic presentation was not a significant predictor of absence of suspicious contrast enhancement at breast MRI.

Conclusion: MRI demonstrated high sensitivity in the identification of breast cancer, even without invasive features. Malignant lesions in situ that do not show enhancement are more often small and low grade.

B-0226 14:54
Validation of EUSOMA criteria for selecting to MRI preoperative staging patients eligible for conservative surgery at conventional staging S. Ciatto, O. Bernardi, M. Pellegrini; Trento/IT (stefano.ciatto@gmail.com)

Purpose: To verify the validity of EUSOMA criteria prompting MRI preoperative staging by magnetic resonance (MRI) in subjects eligible for breast conserving therapy (BCT): lobular histological type, size discrepancy > 1 cm between mammography and ultrasonography, high eredo-familial risk, and planned partial breast irradiation.

Methods and Material: We reviewed an unselected series of subjects eligible for BCT and consecutively undergoing MRI staging at Trento Breast Clinic. We...
Dynamic contrast enhancement MRI as a predictive and surrogate marker of pathological complete response of neoadjuvant treatment for locally advanced breast cancer

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Purpose: To evaluate the pharmacokinetic parameters of DCE-MRI as a predictive and surrogate marker for patients receiving neoadjuvant chemotherapy (NAC) for locally advanced breast cancer.

Methods and Materials: A retrospective study of 90 patients was performed where all patients underwent two DCE-MRI examinations, before (EX1) and during NAC (EX2). Maximum diameter (Dmax), and pharmacokinetic parameters from DCE-MRI such as Ktrans, Kep, Ve and Vp were concerned. Post-operative pathological examination was used as the gold standard with a binary response: responders, patients showing complete remission or “in situ” residual disease and non-responders for the rest of the patients. Wilcoxon test, ROC curves, comparison of ROC were employed for the statistical analysis.

Results: From the 90 patients 74 were non-responders (82.5%) and 16 (17.5%) showed complete pathological response. At EX1, a significant difference was found between the response groups only for the KtransEX1 (p=0.035) and at EX2 for Dmax (p < 0.001) and all pharmacokinetic parameters: Ktrans (p < 0.001), Kep (p=0.011), Ve (p= 0.003) and Vp (p = 0.043). Moreover, a significant difference was found between the response groups for the absolute changes of Ktrans, Ve and Vp and for the percentage changes of Dmax, Ktrans and Ve and Vp between EX1 and EX2. The ROC curve analysis showed the best performance for Ktrans at (EX1), for Dmax at EX2 and for % decrease of Ve between the two examinations: comparison of ROC employed for the statistical analysis.

Conclusion: DCE-MRI pharmacokinetic parameters could be a potential predictive and surrogate marker of neoadjuvant treatment in locally advanced breast cancer.
B-0231 14:09
Measurement of transplanted pancreatic volume by computed tomography: reliability by intra- and inter-observer variability
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Purpose: The aim of this study was to evaluate the reliability of measurement of pancreatic volume by CT in transplanted patients. Today there is no sufficient prognostic method for predicting failure of transplanted pancreas. The hypothesis is that measurement of pancreatic volume by CT volumetry could be a useful method for clinical purpose as a prognostic method and to follow the natural course of pancreatic transplants.

Methods and Materials: CT examination was performed on twenty-one consecutive patients that had undergone pancreas transplantation. Volume measurements were performed by two observers who traced the pancreatic contours in all slices. The corresponding volume was then automatically calculated. Observer 1 performed measurement for each patient twice. Observer 2 performed the measurements once for each patient. Differences in volume measurement were used to evaluate intra- and inter-observer variability.

Results: Intra-observer variability of pancreatic volume measurement, on CT, was found to have an almost perfect agreement with ICC 0.90. The inter-observer variability was also found to have an almost perfect agreement. ICC for the first measurements of observer 1 versus the measurements of observer 2 was found to be 0.90. ICC for the second measurements of observer 1 versus the measurements of observer 2 was found to be 0.96.

Conclusion: Intra- and inter-observer variabilities of transplanted pancreatic volume measurement have been evaluated concluding the method is reliable and reproducible with almost perfect intra- and inter-observer variability agreement. Thereby, CT volumetry could be considered a proper method for following and evaluating size/volume development of pancreatic transplants.

B-0232 14:18
Evaluation of quantitative perfusion map, with CT-perfusion technique, as an early predictor for tumour response to radiofrequency ablation in patients with HCC lesions: initial results
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Purpose: To assess the role of CT-perfusion (CT-P) technique in detection of blood flow changes related to the therapeutic effects in HCC lesion treated with RFA.

Methods and Materials: A total of 27 patients with known cirrhotic liver disease and biopsy-proven diagnosis of HCC lesion, that underwent RFA treatment, were prospectively enrolled in our study. Perfusion study of hepatic parenchyma and of treated lesion was performed about 1 month after treatment on a multidetector 16 slice-CT (Philips Brilliance, 16p, NL). Contrast medium-enhanced dynamic CT was performed with static table position acquiring 8 dynamic slice/scan for a total of 40 scans after intravenous injection of 50 ml of contrast medium. Treated lesion and surrounding parenchyma were evaluated using a dedicated perfusion software (CT Perfusion Philips 2.0). The following parameters were considered: hepatic perfusion (HP); arterial perfusion (AP); blood volume (BV); hepatic perfusion index (HPI) and time-to-peak (TTP). Univariate paired Wilcoxon signed rank test was used for statistical analysis.

Results: Perfusion parameters of treated lesions could be quantitative assessed using CT-P analysis. Seven out of 27 patients had a residual disease and values of perfusion parameters measured within tumour tissue were: HP 42.1±14.8 ml/sec/100 gr; AP 45.9±9.1 ml/min; TTP 19.06±3.7 sec; BV 19.08±4.9 ml/100 mg; HPI 52.1±31.8%. The corresponding perfusion values calculated in patients without residual tumour were: HP 10.3±6.1 ml/sec/100 gr; AP 10.7±7.8 ml/min; TTP 19.06±3.7 sec; BV 19.08±4.9 ml/100 mg; HPI 12.6±7.5%. A significant difference (p < 0.001) was observed in mean value of all parameters calculated between treatable and untreated tumours. Treatment with RFA and those successfully treated CT-P technique has demonstrated highly perfused areas related to the presence of residual arterial vessels within the viable portion of treated HCC lesions.

Conclusion: Perfusion-CT in patients with hepatocellular carcinoma enables assessment of tumour vascularity after RFA, by adding quantitative information about viable tumour tissue.
reconstructed using FBP as well as IRT with different iteration levels with a prototype image reconstruction system. Resulting images were analysed with objective noise measurements, defined as standard deviation of average density values in the liver as a homogenous organ.

**Results:** Absolute noise levels in image reconstructions with filter B were reduced from 14.19 (FBP) to 5.64 HU (highest level IRT). Relative noise in IRT images compared to FBP images was reduced by 60% with only minimal effects on subjective image quality.

**Conclusion:** By the use of a fourth generation IRT for CT examinations of the abdomen a reduction of image noise of up to 60% can be achieved.

**B-0236** 14:54

**Reducing x-ray dose for liver perfusion on an extended coverage multi-slice CT with a relaxed temporal resolution**

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**Purpose:** To investigate the feasibility of reducing CT x-ray dose in liver perfusion using a relaxed temporal resolution (TR) in axial scan mode.

**Methods and Materials:** 60 patients underwent CT perfusion scans for suspicion of tumours. The first 30 patients (group 1) underwent 40 mm perfusion scans with 2s TR for 16 samples, while the second 30 patients (group 2) underwent 80 mm perfusion scans with 3s TR for 10 samples. Tub current were 120 mAs and 96 mAs for groups 1 and 2, respectively. The regional cerebral blood flow (rCBF), regional cerebral blood volume (rCBV), mean transit time (MTT) and the radiation dose from the two groups were analysed by t-test. In addition, the detection rates for nodules with rich arterial blood supply were compared and verified by pathology.

**Results:** There were 95 hCC, 1 RN, 8 CH and 2 liver abscess patients. The 80 mm scans detected 7 more sHCC focuses and 8 more CH cases. The rCBF (ml·100 g-1·min-1), rCBV (ml·100 g-1) and MTT (s) for groups 1 and 2 were (191.9±20.36, 11.39±0.94, 6.18±0.69), and (160.3±20.29, 11.65±1.22, 4.52±1.21), respectively, with no statistical differences between these parameters (p=0.05). The radiation dose from group 2 with 80 mm coverage was similar to group 1 with 40 mm coverage.

**Conclusion:** With the use of an appropriate TR (up to 3s), the 80 mm coverage axial perfusion scans provided higher nodule detection rate without dose increase compared to conventional 40 mm coverage CT MDCT perfusion scans.

**B-0237** 15:03

**Abdominal CT with model based iterative reconstruction: comparison with adaptive statistical iterative and filtered back projection reconstruction**

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**Purpose:** To investigate if model-based iterative reconstruction (MBIR) can improve the quality of abdominal CT images and volume-rendered (VR) CT topography in comparison with adaptive statistical iterative reconstruction (ASIR) and filtered back projection (FBP).

**Methods and Materials:** Twenty patients (89±10.9 years) underwent three phase contrast-enhanced 64-slice CT of the liver. Images were reconstructed with MBIR (Veo), ASIR 50% and FBP. The contrast-to-noise ratio (CNR) relative to muscle was calculated for the liver and portal vein on 0.625-mm-thick images acquired in portal venous phase. The image quality of 4th branches of the portal vein on VR images was assessed by two observers using a 4-point scale (1: poor, 2: fair, 3: good, 4: excellent with clear delineation of 5th branches).

**Results:** MBIR showed significantly improved CNR of the liver (4.3±1.8) in comparison with those by ASIR (2.9±1.5), p=0.013 by Mann-Whitney U test and FBP (2.0±1.0, p=0.035). The CNR of portal vein was 12.1±3.4, being significantly higher than those by ASIR (7.4±1.9, p<0.001) and FBP (5.0±1.3, p<0.001). On qualitative analysis, the image quality of portal venous branches on VR topography was significantly improved using MBIR (3.7±0.6) as compared with those by ASIR (2.9±0.9, p<0.001 by Wilcoxon signed ranks test) and FBP (1.9±0.9, p<0.001).

**Conclusion:** The new MBIR algorithm significantly improves CNRs of abdominal CT, and can provide substantially improved visualisation of portal venous branches when compared with ASIR and FBP.

**B-0238** 15:12

**Is it available, by iodine concentration of the active part of renal mass, for differentiation between renal angiomyolipoma and renal cell carcinoma?**

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**Purpose:** To evaluate the potential of iodine concentration of the active part of the renal mass as a tool to differentiate angiomyolipoma (AML) and renal cell carcinoma (RCC).

**Methods and Materials:** Of these twenty-two patients with highly suspected renal disease who underwent single source dual energy CT scanning between July 2010 and April 2011, seventeen (eight patients had AML, nine RCC) underwent corticomedullary, nephrographic and excretory phase enhanced scans. The regions of interest (ROI) were manually placed on the active part of the renal mass and the abdominal aorta. The average iodine concentrations of (ROI)s and abdominal aorta were obtained. Repeated measure analysis was conducted with SPSS, and Bonferroni adjusted p was used for multiple comparisons.

**Results:** The average iodine concentrations of the active part of AML in three enhanced phases were 3.1±1.91 mg/cc, 2.65±1.49 mg/cc and 2.24±0.50 mg/cc, respectively. And those of RCC were 6.55±4.11 mg/cc, 4.71±2.32 mg/cc and 3.73±1.79 mg/cc. The average iodine concentrations were significantly different between AML and RCC in all enhanced phases (p=0.024, p=0.049, p=0.040), especially in corticomedullary phase. The iodine concentration change patterns of three phases between AML and RCC were also significantly different (p=0.024).

**Conclusion:** These preliminary results suggest that iodine concentration could provide another helpful method to differentiate AML and RCC in addition to conventional CT. If these results are confirmed, this approach could potentially differentiate AML and RCC with the active part of the mass no matter the fat in AML are minimal or much.

**B-0239** 15:21

**Low dose unenhanced MDCT with radiation dose equivalent to abdominal radiograph in evaluation of acute flank pain**

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**Purpose:** To determine the diagnostic efficacy of low dose unenhanced MDCT delivering radiation dose equivalent to abdominal radiograph in evaluation of patients with acute flank pain in comparison to standard dose CT.

**Methods and Materials:** A prospective study was conducted in 50 patients presenting with acute flank pain, after ethical committee clearance and informed consent. All patients underwent unenhanced low dose CT (LDCT) (effective mAs = 20) and followed by ultrasound and standard dose CT (SDCT) (effective mAs=165). Three reviewers, who were blinded to clinical findings independently reviewed LDCT, ultrasound and SDCT for pathology and image quality (graded as good, acceptable or poor).

**Results:** 58% of patients had calculus disease while 28% had non-calcular urological causes and 10% had extra-urinary causes responsible for pain. No cause was found in 4% patients. Calculus detection rate was 91.5% for LDCT, 100% for SDCT and 78% for ultrasound. The mean size of calculus missed on LDCT was 1.2 mm. Interobserver agreement in calculus detection amongst three reviewers was excellent. The sensitivity for detection of non-calculus causes was 66.6% for LDCT, 80.9% for SDCT and 85.7% for ultrasound. The mean radiation dose in LDCT and SDCT was 0.44 mSv and 6.00 mSv, respectively. Only 2-4% of low dose scans were rated as of poor quality.

**Conclusion:** Low dose unenhanced MDCT revealed a high sensitivity for urolithiasis and moderate sensitivity for diagnosing alternate causes of acute flank pain. Thus, it has potential to be used as a first line modality in evaluation of these patients.

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**European Congress of Radiology 2012**

**Scientific Session**

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**Thursday**

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Quantification of regional myocardial perfusion at different levels of coronary flow in a large animal model using dynamic perfusion CT


Purpose: To quantify regional changes of several myocardial perfusion parameters at different levels of coronary flow using ECG-triggered dynamic contrast-enhanced CT (DCE-CT).

Methods and Materials: In seven pigs, an adjustable hydraulic occluder was placed around the LAD to induce various degrees of coronary flow reduction. 28 scans were performed under maximum adenosine vasodilatation (no obstruction and flow reduced by 12% to 90%). Dynamic data were acquired for the whole heart after bolus injection using a dedicated ECG-triggered scan mode on a dual source CT. Using a two-compartment deconvolution technique 3D-maps of myocardial blood flow (MBF), first pass distribution volume (FPDV), perfused capillary blood volume (PCBV) and flow-extraction-product (FE) were calculated. All parameters were measured in the downstream LAD area and were correlated with relative input flow.

Results: MBF (baseline 257±27 ml/100 ml/min, r=0.78, slope=0.66), FPDV (baseline 24.6±2.8 ml/100 ml, r=0.84, slope=0.76) and PCBV (baseline 16.2±4.6 ml/100 ml, r=0.83) significantly decreased proportional to the reduction of coronary flow in the LAD (p < 0.001). FE (baseline 166±19 ml/100 ml/min), on the other hand, remained constant until coronary flow was reduced to less than 30%. FE values below 30% coronary flow were significantly lower than FE values above 30% (Mann-Whitney, p < 0.01). This agrees with the assumption that parenchymal flow does not decrease until the coronary flow reserve is exhausted.

Conclusion: DCE-CT is suitable for the assessment of regional myocardial perfusion parameters and can be used to study microcirculatory changes at various degrees of clinically relevant coronary flow reductions in a large animal model.

Quantification of myocardial ischaemia and infarcts by adenosine stress 128-high-pitch DSCT


Purpose: To evaluate quantification of adenosine myocardial stress/rest CTP using a combined high-pitch 128-source CTP/coronary CTA protocol with a new volumetric 3-D prototype software.

Methods and Materials: Adenosine stress high-pitch 128-slice dual source myocardial CTP (pitch, 3.4) and CMR (1.5 T)/DE was performed in 30 patients. Myocardial perfusion defects by CTP were classified as complete or partial reversible and fixed during stress and rest. A new prototype (SiemensTM) was used for quantification of CT-density (HU) of the myocardium based on automated 3-D volume segmentation into 16 AHA-myocardial segments. The total, subendo- and subepicardial HU were quantified. Image quality was evaluated (score 1-4).

Results: The total and subendocardial HU of myocardial segments with complete (n=49) and partial (n=58) reversible ischaemia were lower during stress as compared to rest (total: 88.5±100.2; subendocardial: 85±97 HU). For fixed perfusion defects, HU were total: 103.7±114 HU; subendocardial: 95.5±109.7 HU during stress and rest (n=55). As compared to CMR-DE, total and subendocardial HU of segments with myocardial infarcts were slightly lower during stress (98 and 101 HU) as compared to normal myocardium (111 and 115 HU). During stress, none of LAD and LM segments were non-diagnostic, whereas 4/169 of CX and 23/113 of RCA segments were nondiagnostic and rest CTA was needed for assessment. Radiation dose CTP was 0.93mSv±0.18.

Conclusion: Quantification of ischaemic myocardium during adenosine stress high-pitch 128-DSCT is possible at an ultra-low radiation dose of < 1mSv. Rest CTA is required to characterise myocardial perfusion defects and to ensure coronary CTA, and DE for viability.

Dynamic CT perfusion imaging of the myocardium using a wide detector CT scanner: first results


Purpose: To evaluate the feasibility of CT myocardial perfusion imaging (MPI) at a wide detector CT scanner.

Methods and Materials: 12 pigs underwent stress CT MPI at a 256-slice MDCT scanner. In 6 pigs a stenosis of a coronary artery (LAD n=4, LCX n=1, diagonal branch n=1) was induced by subcutal balloon occlusion (stenosis group), 6 pigs were examined without intervention (control group). The semiquantitative parameters time-to-peak (TTP), peak enhancement (PE), upslope (US), and the area-under-the-curve (AUC) were compared intra- and interindividually in post-stenotic and normal myocardium. Radiation dose was estimated by CTdose.

Results: The intra-individual evaluation showed significantly (p < 0.01) higher mean values for TTP (19.5±7.9 s) and lower mean values for PE (14.5±14.0 HU), US (1.1±0.9 HU) and AUC (119.3±114 HU*s) in the hypoperfused myocardium as compared to the remote myocardium in the septum and lateral wall (TTP: 13.5±6.4 s, PE: 75.3±24.3 HU, US: 8.4±3.7 HU/s and AUC: 467.9±198 HU*s/415.1±79 HU*S). The inter-individual evaluation showed significantly (p < 0.05) lower mean values for TTP (9.7±1.8 s) and higher mean values for PE (75.3±24.3 HU), US (8.4±3.7 HU) and AUC (362.0±71 HU*s) in the control group. CTdose was 88.5 mGy.

Conclusion: Dynamic stress CT perfusion imaging offers the potential assessment of the physiological significance of coronary artery stenosis, thereby overcoming one of the limitations of cardiac CT.

Dynamic CT perfusion imaging of the myocardium: comparison of reconstructions from 180° and 360°


Purpose: To compare the image quality and z-axis coverage using standard 180° and 360° reconstruction analysis for CT dynamic myocardial perfusion imaging (MPI).

Methods and Materials: In 8 pigs coronary artery stenosis was induced by balloon occlusion. CT dynamic MPI was performed using a 256-slice MDCT. Image noise and signal-to-noise-ratio (SNR) were assessed. The semiquantitative parameters time-to-peak (TTP), peak enhancement (PE), upslope (US), and the area-under-
Evaluation of myocardial CT perfusion in patients presenting with acute chest pain to the emergency department: comparison with SPECT-MPI

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Purpose: To evaluate the feasibility and diagnostic accuracy of adenosine-stress dual energy computed tomography (DECT) for detecting haemodynamically significant stenosis causing reversible myocardial perfusion defect (PD) compared with SPECT-MPI myocardial perfusion imaging (SPECT-MPI) and conventional coronary angiography (CCA).

Methods and Materials: Thirty-four patients with known coronary artery disease (CAD) detected by dual source CT (DSCT) were investigated by contrast-enhanced, stress DECT with high- and low-energy x-ray spectra settings during adenosine infusion. Dual source computed tomography (DSCT) was performed as follows: first) stress CT; contrast-enhanced scan during adenosine infusion; 2) rest CT; contrast-enhanced scan using prospective triggering.

Results: The DSCT protocol was successfully completed for 33 of 34 subjects. Stress DECT had 89% sensitivity, 78% specificity and 82% accuracy for detecting segments with reversible PDs as seen on SPECT-MPI (n = 28). Compared with CCA (n = 29), stress DECT had 89% sensitivity, 76% specificity and 83% accuracy for the detection of vascular territories with reversible myocardial PDs that had haemodynamically relevant CAD.

Conclusion: Adenosine stress CT can identify stress-induced myocardial perfusion defects with diagnostic accuracy comparable to SPECT, with similar radiation dose and with the advantage of providing information on coronary stenosis.

B-0247 15:03
Perfusion deficits of the myocardium: a comparison of dynamic CT perfusion imaging and coronary computed tomography angiography
B. Katzen2, R. Cury2; 1, 2

Purpose: To compare the potential of detection of myocardial perfusion deficits using CT dynamic myocardial perfusion imaging (MPI) and “single shot” coronary CT angiography (CCTA) for detection of hypoperfused myocardium in an animal model.

Methods and Materials: 8 pigs underwent rest CT MPI (100 kV, 150 mA) and retrospectively ECG-gated CCTA (120 kV, 210 mA) using a 256-slice multidetector computed tomography scanner (MDCT). Complete balloon occlusion of a coronary artery (LAD n=4, LCX=2, diagonal branch n=1) was induced. Attenuation values of post-stenotic and normal myocardium were compared individually for MPI and CTP (CCTA) myocardial perfusion imaging (MPI) and increase z-axis coverage of 3D imaging volumes using a 256-slice MDCT scanner.

B-0245 14:45
Association between myocardial blood flow as measured by dynamic adenosine-mediated stress perfusion computed tomography and coronary artery flow in a large animal model
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Purpose: To determine the association between myocardial blood flow (MBF) as measured by CT-based dynamic stress perfusion imaging and coronary artery flow by sensor-tipped flow-wire in a porcine model with variable degrees of induced coronary stenosis.

Methods and Materials: Seven domestic pigs received stents in the LAD, distal to first diagonal branch, in which a balloon catheter was inflated to simulate luminal narrowing (50% and 75% diameter stenosis). Intra-arterial flow measurements were performed at each perfusion state. All models underwent adenosine-mediated (140 μg/kg/min) dynamic stress and rest myocardial MBF imaging, using a dual source CT (shuttle-mode, 100 kV/300 mA, 20 cm/480 mm). MBF was calculated for each myocardial segment using a model-based parametric deconvolution method and correlated with results of coronary flow measurement.

Results: At rest, measured coronary flow in 50% and 75% coronary artery stenosis were 18.6±1.3 and 14.0±1.5 cm/sec, respectively. Under stress condition, coronary flow increased to 20.2±1.6 cm/sec at 50% stenosis and decreased at 75% coronary stenosis to 11.0±0.7 cm/sec, similar to MBF derived by CT (1.60.25 vs. 0.80±0.28 ml/g/min, p<0.001). The increase in coronary flow of 1.4 cm/sec at 50% stenosis under stress was associated with an increase of 0.7 ml/g/min in MBFCT; the decrease in coronary flow at 75% under stress (3.0 ml/sec) was associated with a decrease in MBF of 0.10 ml/g/min.

Conclusion: Our results indicate that CT-derived eMBF measurements at rest and stress with varying degrees of coronary stenosis associate well with results of coronary flow measurements in a large animal model.

B-0246 14:54
Evaluation of myocardial CT perfusion in patients presenting with acute chest pain to the emergency department: comparison with SPECT-MPI
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Purpose: To evaluate rest myocardial CT perfusion (CTP) from coronary CT angiography (CTA) datasets in patients presenting with chest pain (CP) to the ED, in comparison with myocardial SPECT.

Methods and Materials: 76 patients (mean age 54±13; 42% females; 13% prior coronary revascularisations and 16% with prior MI) presenting with CP to the ED underwent coronary 64-slice CT-angiography (CTA). Myocardial perfusion defects were evaluated for CTP employing a HAA 17-segment model. CTP results were compared to rest sestamibi SPECT myocardial perfusion imaging (MPI) per-patient and per-segment. CTA was assessed for ≥50% stenosis per vessel and compared to stress/rest SPECT. Combined CTA/CTP approach was tested using vessel territory-based method.

Results: CTP demonstrated an sensitivity of 92% and 89%, specificity of 95% and 99%, positive predictive value (PPV) of 80% and 82%, and negative predictive value (NPV) of 98% and 99% on a per-patient and per-segment basis, respectively. The intermodality agreement of CTP to SPECT-MPI was kappa=0.82 (p<0.001). CTA showed an accuracy of 92%, sensitivity of 70.4%, specificity of 95.5%, PPV of 67.8%, and NPV of 95% as compared to SPECT-MPI. Addition of CTP findings to CTA improved the PPV from 67% to 90.1%, primarily by reduced false positives.

Conclusion: In patients presenting to the ED with CP, the evaluation of coronary CTA demonstrates high diagnostic performance as compared to SPECT-MPI. Addition of CTP to CTA improves the diagnostic accuracy of CTA, primarily by reducing rates of false positive CTA.
B-0249 15:21
Benefit of combining quantitative cardiac CT parameters with troponin I for predicting right ventricular dysfunction and adverse clinical events in patients with acute pulmonary embolism


Purpose: To prospectively evaluate the diagnostic accuracy of quantitative cardiac CT parameters alone and in combination with troponin I for the assessment of right ventricular dysfunction (RVD) in patients with acute pulmonary embolism (PE).

Methods and Materials: This prospective study had institutional IRB approval and was HIPAA compliant. 598 consecutive patients with suspected PE underwent echocardiography and troponin I serum level measurements within 24 hours. Three established cardiac CT measurements for the assessment of RVD were obtained (RVL/Lvaxial, RVL/4-CH, and RVL/4volume). CT measurements and troponin I serum levels were correlated with RVD found on echocardiography and adverse clinical events according to MAPPET-3 criteria.

Results: 39 of 83 patients with PE had adverse clinical events and 31 of 83 patients had RVD on echocardiography. A RVL/4Volume ratio > 1.43 showed the highest area under the curve (AUC) (0.65) for the prediction of adverse clinical events when compared to RVL/Lvaxial, RVL/4CH and troponin I (0.57-0.61). Patients with RVD showed significantly (p=0.001-0.042) higher RVL/4 ratios and troponin I levels compared to those without RVD. The AUC of RVL/Lvaxial, RVL/4CH, RVL/4Volume and troponin I for the detection of RVD were 0.86, 0.86, 0.92, and 0.69, respectively. A combination of RVL/Lvaxial, RVL/4CH, RVL/4Volume with troponin I increased the AUC to 0.87, 0.87 and 0.93, respectively.

Conclusion: A combination of cardiac CT parameters and troponin I measurements improves the diagnostic accuracy for detecting RVD and predicting adverse clinical events if compared to either test alone.

B-0250 14:00
Estimated radiation dose reduction for prospective electrocardiography-triggered dual source CT angiography of the thoracic aorta using iterative reconstruction: a prospective study

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Purpose: To prospectively investigate image quality and radiation dose reduction for prospective ECG-triggered sequential dual source (DS) CTA using iterative reconstruction of the thoracic aorta in comparison to prospective ECG-triggered sequential dual source (DS) CTA with standard filtered back-projection (FBP).

Methods and Materials: Two-hundred and sixty consecutive patients referred for ECG-assisted DS CTA of the thoracic aorta were prospectively enrolled. Tube voltage was adjusted to body mass index (< 25.0 kg/m², 100 kV, n=95; 25.0 kg/m², 120 kV, n=165). Patients were randomly assigned to a CT-protocol with reduced reference tube current of either 100, 150 or 200 mA/s/rot employing iterative reconstruction and were compared to a reference cohort previously examined with our institutional standard protocol (250 mA/s/rot, FBP). Image noise and subjective image quality were assessed. Effective radiation dose was calculated from the dose-length-product.

Results: Mean estimated effective dose was significantly lower for protocols with reduced tube current (200, 150, 100 mA/s/rot) compared to the standard protocol with 250 mA/s/rot (100 kV, 1.8±0.4 mSv, 1.2±0.3 mSv, 0.8±0.3 mSv vs. 1.8±0.6 mSv, p < 0.001; 120 kV, 3.9±1.1 mSv, 2.9±0.9 mSv, 1.8±0.4 mSv vs. 4.7±1.1 mSv, p < 0.001). With decreasing tube current, image noise increased but did not reach level of the standard protocol. Subjective image quality decreased with decreasing tube current, but image quality of the 100 mA/s/rot subgroups was equivalent to the standard protocol (100 kV, 1.9 vs. 2.0; 120 kV, 2.0 vs. 2.0, p=n.s).

Conclusion: Iterative reconstruction allows for reduction of applied tube current and thereby for dose reduction of approximately 60% in CTA of the thoracic aorta while maintaining objective and subjective image quality when compared to a standard protocol with filtered back-projection.

B-0251 14:09
Clinical evaluation and potential radiation dose reduction of the novel sinogram-affirmed iterative reconstruction technique (SAFIRE) in abdominal computed tomography angiography


Purpose: To evaluate the novel sinogram-affirmed iterative reconstruction algorithm (SAFIRE) with respect to clinical usability and potential reduction of radiation exposure.

Methods and Materials: Forty-six patients underwent routine contrast-enhanced CT follow-up after endovascular aneurysm repair. The examination was performed with a dual source CT running both x-ray tube detector systems at the same volt- age. Raw data were reconstructed using the projections of both tubes (FD) with filtered back-projection (FBP) and using only the projections of one tube (HD) with FBP and SAFIRE, corresponding a synthetic half-dose acquisition. Image sets were objectively compared with regard to image noise and edge sharpness. Two independent radiologists assessed a set of subjective criteria.

Results: HD SAFIRE images showed significantly lower noise than FD FBP (p < 0.0001) and equal edge sharpness (p=0.56). Most of the subjectively assessed parameters, like diagnostic usability and depiction of contrasted vessels, were rated similar in HD SAFire and FD FBP images. FD FBP images depicted fine anatomic structures more clearly (p < 0.05) while HD SAFIRE datasets had subjectively less noise (p < 0.001). HD FBP images were significantly worse in every subjective and objective criterion (p < 0.001). The image texture of the HD SAFIRE reconstructed images was regarded equal to FD FBP datasets. Inter-rater agreement was found to be good (FD FBP k=0.74, HD FBP k=0.8, HD SAFIRE k=0.77).

Conclusion: Using the SAFIRE algorithm, the radiation dose of high-contrast abdominal CTA can be reduced from a routine clinical level by up to 50% while maintaining good image quality and diagnostic accuracy.

B-0252 14:18
Higher iodine concentration permits dose reduction while increasing contrast-to-noise-ratio in high-pitch, wide-range CT angiography

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Purpose: To compare contrast-to-noise-ratio (CNR) and effective dose at different iodine concentration in high-pitch, wide-range CT-angiography.

Methods and Materials: All scans were performed on a 128-slice CT-system using a high-pitch acquisition technique (p=3.2), A software algorithm optimising kV and mAs settings on the basis of adjustable reference values and attenuation on the initial topogram was applied. Two scan protocols were compared: Protocol A used 300 mg/ml contrast injected at 4.0 ml/sec and reference values for kV and mAs set to 120 and 330. Protocol B used 400 mg/ml contrast injected at 4.0 ml/sec and reference values for kV and mAs set to 120 and 275. 100 patients who had undergone CT-angiography of the chest, abdomen and pelvis using either protocol A (n=50) or protocol B (n=50) were included in this analysis. Two readers measured intravascular enhancement and standard deviation at 18 different points within the arterial system. For dose estimation, the dose-length-product (DLP) was recorded.

Results: There were no significant differences in sex-ratio or BMI (27.5 vs. 26.2, p=0.72) between both groups. Automatic kV selection used 100 kV, 120 kV and 140 kV in 5, 19 and 26 patients in group A and in 17, 30 and 3 patients in group B (p < 0.05). Overall, datasets of group B showed significantly higher levels of noise (27 HU vs. 20.6 HU, p=0.0001) but also of signal (334 HU vs. 208 HU, p=0.0001), resulting in higher CNR in group B (12.8 vs. 10.8, p < 0.05). Applied DLP was significantly lower in group B (370 vs. 595 mGycm, p=0.01).

Conclusion: In high-pitch, wide-range CT-angiography, higher iodine concentration permits significant dose reductions while increasing contrast-to-noise-ratio.

B-0253 14:27
Low-dose multidetector-row CT angiography in the evaluation of infrarenal aorta and peripheral arterial occlusive disease

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Purpose: To investigate the possibility to reduce x-ray exposure during CTA of peripheral arteries and to evaluate the impact of radiation dose on diagnostic accuracy. We also compared the diagnostic performance achieved by three CTA acquisition protocols using pre-treatment DSA as gold standard.

Methods and Materials: We performed a prospective, single-centre, randomised comparison of 3 different x-ray exposure CT-acquisition protocols enrolling 60
patients with PAOD referred to our department to undergo a lower limb 64-MDCT angiography (0.625 mm-collimation; 100 ml Iomeprol 400 mg/mL, 6 ml/s). Patients were randomised into three x-ray exposure acquisition protocols: (a) standard-dose: noise-index: 26 (SMARTmA); 120 KV; B (low-dose): noise-index: 26 (SMARTmA); 80 KV; C (ultra-low-dose): noise-index: 30 (SMARTmA); 80 KV. Axial and 3D-images were qualitatively and quantitatively compared. The three protocols were also compared in terms of diagnostic performance using pre-interventional DSA as gold standard.

**Results:** Statistically significantly higher attenuation values were measured in the low-dose and ultra-low-dose acquisition protocol. Qualitatively, image quality was judged slightly better with the standard protocol than with the low-dose and ultra-low-dose protocol without significant differences on 3D images. No significant differences were found between the three protocols in terms of contrast-to-noise ratio (CNR). No significant differences were also found among the three groups of patients concerning the diagnostic performance. An overall dose reduction of 48% and 64% was observed for the low-dose and ultra-low-dose protocol, respectively. Conclusion: Ultra-low-dose MDCT considerably reduced radiation exposure while maintaining a constant CNR, good image quality and an adequate diagnostic performance.

**Conclusion:** An ex-vivo tissue culture model was created that can maintain basic biromorphology and receptor status of human venous segments in vitro over 15 days. This model potentially allows for long-term investigation of human vessel segments including studying the effects of interventional procedures in a convenient, cost-effective, controlled environment.

**B-0256** 14:54

**Interobserver agreement of whole body MR angiography for the depiction of atherosclerosis**

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**Purpose:** To evaluate the interobserver agreement for the depiction of arteriosclerotic changes in different anatomical areas as a marker for the quality of MR angiography (MRA).

**Methods and Materials:** 25 patients were referred for whole body MRA either for screening purposes or for suspected atherosclerotic disease. Imaging was performed on a 1.5-T MR system (Magnetom Avanto, Siemens). For signal reception a combination of several surface coils was used. After the intravenous injection of Gadobutrol (Gadovist, Bayer; weight-adjusted dose of 0.1 mmol/kg) four to five overlapping 3D GRE T1W sagittal data sets were collected from head to calves. Images were evaluated by two readers independently for the presence of stenotic lesions in 40 arterial segments using a 5-point scale (0-no stenosis; 1-stenosis ≤ 50% of vessel diameter; 2-stenosis 50-90%; 3-stenosis 90-99%; 4-occlusion). Interobserver agreement was calculated using the Cohen's kappa value.

**Results:** 1000 arterial segments were assessed. Mean Kappa value amounted to 0.84. Lowest Kappa values were found for the assessment of the aortic arch (0.48) and the ascending aorta (0.61). Highest Kappa values (1.0) were found for the evaluation of the iliac and femoral arteries.

**Conclusion:** Interobserver agreement of MRA differs substantially within various anatomical segments. The only moderate values for the thoracic aorta may be explained by the complex depiction of the vessel wall due to (cardiac) motion artefacts. However, large arteries in the pelvic and femoral region proved best agreement probably because of an easy and robust delineation.

**B-0257** 15:03

**Intraindividual comparison of whole body MR angiography at 1.5 and 3 Tesla in high risk patients with hereditary hyperlipidaemia**

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**Purpose:** To prospectively and intraindividually compare image quality and detectability of stenoses in contrast-enhanced whole body MRA (WB-MRA) at 1.5 and 3 Tesla (T) in patients with hereditary hyperlipidaemia.

**Methods and Materials:** 27 patients with hereditary hyperlipidaemia received a 1.5 T (0.6 mmol/kg) and a 3 T (1.2 mmol/kg) contrast-enhanced WB-MRA. 43 defined arterial segments were analysed regarding depiction of target vessels, image quality according to a 5-point scale (“not evaluable” to “excellent”), degree of stenosis (0%, 1-49%, 50-99% and 100%) and level of stenosis. Intensity and spatial resolution were compared for an equal number of 24 patients from a distinct population subgroup.

**Results:** 1,410 arterial segments at 1.5 T and 3,150 segments at 3 T were evaluated. A significant increase in contrast medium amount was necessary for comparable image quality. Statistically significantly higher attenuation values were measured in 1.5 T compared to 3 T examinations (p = 0.001). Field inhomogeneity artefacts deteriorated image quality at 3 T. In 16 patients and venous overlay was described more often at 3 T (n=9) than at 1.5 T (n=3). All relevant stenoses (50-99%; n=5), occlusions (n=5) and aneurysms (n=3) were evaluated similarly at both field strengths.

**Conclusion:** WB-MRA can be performed at 1.5 T and 3 T with diagnostic image quality. Due to technical drawbacks observed at 3 T, overall image quality was rated only modestly higher for 3 T examinations. In order to effectively take advantage of the higher field strength, further optimisation of sequence parameters and injection protocols for WB-MRA at 3 T is necessary.

**B-0258** 15:12

**Pulse wave velocity measurements in 5-point velocity encoded radially undersampled 4D phase contrast MR data (PC-VIPR)**

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**Purpose:** Pulse wave velocity (PWV) is a non-invasive measure of vascular stiffness and biomarker of atherosclerosis. We compared four different measurements of
PWV based on radially undersampled 4-dimensional phase contrast (4D-PC) MRI using high-temporal-resolution 2D-PC as standard of reference.

**Materials and Methods:** In eighteen healthy volunteers (9men/9women; 38.4±14.8years; BMI<30) 5-point velocity-encoded 4D-PC-VIPPR data and 2D-PC-MRI were acquired at 3 T with a 32-channel body coil. Key parameters were (4D/2D) 26-34/63a13 time frames and 1.5x1.5x1.5 mm/1.6x1.6x7 mm spatial resolution. 2D slices were prescribed from a contrast-enhanced MRA using 0.03 mmol/kg gadofosveset trisodium. 2D and 4D-PC data were analysed with a MATLAB-based software. PWV was computed using time-to-peak (TPP), time-to-foot (TTF), cross-correlation (XCorr), and time-to-upstroke (TTU). Bland-Altman analysis was used to compare 2D and 4D results and intra- and inter-observer reproducibility (in 10/18 subjects). Data variability was assessed with a model of age-dependence. Residuals of data were compared with a Brown-Forsythe ANOVA test.

**Results:** Overall results (2D: 4.6-5.3m/s, 4D: 3.8-5.0m/s) were similar. Results based on different algorithms differed non-significantly with average bi-

**Purpose:** To compare the image quality and radiation dose of a peripheral CT-angiography (pCTA) performed with low-kVP and BMI-adjusted mAs to the standard protocol.

**Methods and Materials:** Retrospective and prospective gained data of 111 patients receiving 128-slice-CTA were analysed. 54 patients analysed retrospectively, received a standard pCTA (120 kV, 250 mAs and CareDose) of those 14 were assigned to BMI-group.i. < 25 kg/m2. 28 to BMI-group II 25-30 kg/m2 and 12 to BMI-group III > 30 kg/m2. 57 patients included prospectively were examined with a BMI-adjusted protocol; group.i. (n=16) using 80 kV/200 mAs, II (n=28) 80 kV/250 mAs and III (n=13) 100 kV/250 mAs, respectively. Contrast administra-

**Results:** The image quality of pCTA with low-kVP and BMI-adjusted tube cur-

**Purpose:** To compare the accuracy of cardiovascular CT (CVCT) and cardiovascular MR (CMR) for the morphological assessments of the aortic valve (AV) in patients with severe aortic stenosis (AS) and to assess accuracy of the CVCT features differentiating between bicusp AV (BAV) and tricuspid AV (TAV).

**Methods and Materials:** Ninety-four patients with severe AS underwent CVCT and CMR before surgery. Two radiologists assessed morphologic pattern as definite BAV, definite TAV, and borderline type. In borderline type on CVCT (BAV 11, TAV 4), only round-shaped opening, midline calcification, and length of cusp fusion were assessed. Diagnostic accuracy of CVCT and CMR for discriminating BAV and TAV was compared with surgical finding.

**Results:** At surgery, 46 patients had TAV and 48 patients had BAV. Define BAV, definite TAV or borderline type was present in 38, 41, and 15 patients on CVCT and 41, 40, and 13 patients on CMR. In borderline type on CVCT (BAV 11, TAV 4), only round-shaped opening was strongly associated with BAVs (P < 0.009). Sensitivity, specificity, positive and negative predictive values for assessment of AV morphology were 98%, 87%, 89%, 98%, respectively, on CVCT and 100%, 87%, 89%, and 100%, respectively, on CMR.

**Conclusion:** CVCT and CMR are accurate for differentiation between BAV and TAV in patients with severe AS. Further studies are needed for assessment of CVCT features differentiating between BAV and TAV in borderline AV type.
**B-0262** 14:18
Cardiac magnetic resonance for evaluation of bicuspid aortic valve morphology
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**Purpose:** The most common aortic valve abnormality is the bicuspid aortic valve (BAV) (1-2%). The role of CMR to evaluate aortic valve morphology, diameters of the ascending aorta and the arrangement of the sinuses of Valsalva was investigated.

**Methods and Materials:** Forty-two of 134 consecutive patients with aortic diseases who underwent CMR presented with BAV. BAV were presented with different phenotypes: BAV without raphe and BAV with raphe. Within these subgroups different phenotypes are identified: BAV without raphe is subdivided into AP (antero-posterior) and LA (lateral-anterior). In BAV with raphe we identified 3 phenotypes: RL (left and right cusp fusion), RN (fusion of right and non-coronary cusp) and LN (fusion of the left and non-coronary cusp). The results were compared with recent literature. We also evaluated the possible association between BAV and ascending aorta dilatation.

**Results:** We observed prevalence of BAV with raphe (71.43%), and within this group, the phenotype RL (76.67%). The results have shown partly in agreement with the study of Buchner and colleagues. Both studies showed the prevalence of the group with BAV with raphe (71.43% in our study, 85.71% for Buchner, p = 0.07) and the subgroup RL (76.67% vs 84.44%, p = 0.49). In our study prevalent AP phenotype (75%) vs LA (73.3%). There was no significant correlation (p = 0.66) within BAV and ascending aorta dilatation.

**Conclusion:** CMR is currently the most complete imaging technique for classification and characterisation of BAV.

**B-0263** 14:27
MR assessment of pulmonary (QP) to systemic (QS) flow using 4D phase contrast technique: comparison with conventional through-plane 2D phase contrast technique
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**Purpose:** To evaluate 4D phase contrast (PC) MRI in assessment of possible intracardiac shunts by simultaneous assessment of pulmonary (QP) and systemic (QS) flow.

**Methods and Materials:** 21 patients with suspicion of intracardiac shunts underwent cardiac MRI at 1.5 Tesla. Assessment of Qp and Qs was performed using free-breathing retro-gated 2D PC GRE (1.6x1.6x5 mm3; TR 40 ms) imaging with 1D through-plane velocity encoding gradient (venc=150 cm/s) in consecutive measurements for the main pulmonary artery (MPA) and ascending aorta (AA), respectively. In addition, a prospectively triggered 3D PC GRE technique (2.4x1.8x3 mm3; TR 46 ms) with three orthogonal venc directions was employed with volume coverage for MPA and AA. 2D PC GRE was post-processed using a commercially available software algorithm and 4D PC GRE was analysed using custom-built software. Both approaches were compared for absolute Qp and QS values and Qp/Qs ratio.

**Results:** Heart rates during 2D PC measurements for AA and MPA were 70±14.5 bpm and 66±15.5 bpm, respectively (p=0.146) while heart rate during 4D PC was significantly lower (65.5±10.7 bpm; P < 0.005). Qp assessed by 4D PC correlated highly with the 2D PC (R=0.92; P < 0.0001) but demonstrated a significant systematic and random error (−21.9±12.2 ml; P < 0.0001). 4D PC Qp values also demonstrated high correlation (R=0.67; P < 0.0001) with significant systemic and random error (−10.7±13.1 ml; P=0.0023). Resulting Qp/Qs ratios of 4D and 2D PC acquisitions showed high correlation (R=0.78; P < 0.0001) and no significant differences (1.19±0.51 vs. 1.28±0.51; P=0.14).

**Conclusion:** 4D volumetric PC flow assessment allows for accurate assessment of Qp/Qs ratios in the evaluation of possible intracardiac shunts. Further investigations of the accuracy of individual flow volumes are warranted.

**B-0264** 14:36
Computed tomography evaluation of possible intraprocedural obstruction of the coronary ostia by the aortic valve leaflets during transapical aortic valve implantation
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**Purpose:** To compare the distance of the coronary ostia from the basal attachment of the aortic valve leaflets and the length of the aortic valve leaflets prior to transapical valve implantation (TA-AVI) with focus on possible, intraprocedural obstruction of the coronary ostia using computed tomography (CT).

**Methods and Materials:** CT scans of 56 patients (40/16 m:w, mean age 81±6.8y) with severe AS, scheduled for TA-AVI were included retrospectively. Distances of the coronary ostia to the aortic annulus were measured in systolic and diastolic phase and compared to the leaflet length measured in diastolic phase. Possible overlap distance (POD) was calculated using pairwise analysis.

**Results:** The mean POD indicated the risk of a potential occlusion of parts of the right coronary artery (RCA) ostium by the right leaflet (POD 1.7 ±2.2 mm, P < 0.001) due to the TA-AVI procedure. The mean distance from the most basal attachment of the LCL to the left coronary ostium did not differ significantly (p=0.66) from the mean LCL length with a mean difference of 0.2 (±2.7) mm.

**Conclusion:** Right coronary leaflet may theoretically overlap and occlude a large part of the RCA ostium due to the TA-AVI procedure.

**B-0265** 14:45
Right ventricular hypertrophy after atrial switch operation and its role in a systemic RV: normal adaptation process or risk factor? A cardiovascular magnetic resonance study
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**Purpose:** Systemic RV hypertrophy and impaired systolic function occur after atrial switch (AS) in d-transposition of the great arteries (d-TGA). Echocardiography has limitation in the assessment of the right ventricle (RV). In this study, we sought to evaluate systemic RV myocardial mass and function after AS for d-TGA and to analyse the role of excessive hypertrophy for ventricular function under special consideration of the interventricular septal (IVS) movement.

**Methods and Materials:** Thirty-seven patients after AS were studied at a 1.5 T scanner (Intera CV, Philips) using a dedicated 5-chanel-phase-array surface cardiac-coil. Cine steady-state-free-precession sequences were acquired to obtain biventricular myocardial masses and function. The systolic movement of the IVS was defined as positive (PSM), when moving towards the centroid of the RV, or else as non-positive. Patient parameters were compared to age-matched controls. Significant systemic RV’s were significantly larger (p < 0.001) than LV’s of the control group, systolic function significantly impaired (p < 0.001) and myocardial mass index (MMI) was comparable (p=n.s.). RV-MMI and RV-EF demonstrated a quadratic correlation (r=0.6, P < 0.001), meaning that patients with RV-MMI below 29 g/m² and above 68 g/m² had a reduced systolic function. Patients with PSM had a better RV function compared with the non-PSM subgroup (p=0.024).

**Conclusion:** A certain amount of RV hypertrophy after AS is a normal adaptation process after AS and a sufficient RV-EF can be expected within a range of 29-68 g/m². PSM is probably the result of hypertrophic septal RV fibres, which is beneficial for RV function and might be regarded as the physiological contraction pattern.

**B-0266** 14:54
Cardiovascular MSCT angiography in newborns with known or suspected congenital heart disease applying mean effective doses of 0.36 mSv
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**Purpose:** To investigate the diagnostic capability of cardio-vascular 256-MSCT angiography in cardio-pulmonary compromised newborns and infants with suspected or known congenital heart disease, and to compare different scan protocols with regard to radiation doses.

**Methods and Materials:** Nine newborns and infants (mean weight, 3700 g ±1800; age range 7 days to 8 months) were included in this retrospective study. Clinically indicated, non-ECG-triggered, cardio-vascular CTA was performed utilising a 256-MSCT scanner. Vendor-specific preset scan protocols were initially used and progressively adapted. Images were acquired with helical or a single axial rotation scan and tube voltages of 120 kV or 80 kV, respectively. Two observers evaluated thoracic cardiovascular findings and image quality. Effective radiation doses were estimated from dose length product.

**Results:** All major cardiovascular defects could be detected, and all images were of diagnostic quality. Two small atrial septal defects and one persistent foramen ovale were seen on echocardiography only. Image quality of axial scan covers the entire heart and great thoracic vessels within a single rotation were superior to images acquired with a helical scanning protocol. Reducing the tube voltage from 120 kV to 80 kV resulted in a mean effective dose of 0.36mSv ±0.09.
Conclusion: Cardio-vascular CT examinations can be performed in cardio-pulmonary compromised newborns and infants with radiation doses as low as 0.36mSv and diagnostic image quality. A protocol utilising a single-shot, axial, non-ECG triggered 256-MSCT scan is most favourable. Tube voltage of 80 kV reduced radiation significantly without relevant degradation of image quality when studying the heart and great thoracic vasculature.

B-0267 15:03
In-vivo imaging characteristics of a transcatheter heart valve prostheses with multislice computed tomography

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Purpose: Transcatheter heart valve (THV) prostheses are explored as an alternative to conventional aortic valve replacement. Post-implant echocardiographic follow-up findings can be complemented by multislice computed tomography (MSCT). However, little is known on image quality (IQ) of these stented THV prostheses that may be hampered by metal induced artefacts. We assessed the CT image quality of the commonly implanted Edwards Sapien THV prostheses (with a cobalt-chromium stent) in patients after transcatheter aortic valve implantation (TAVI).

Methods and Materials: Twenty-two patients after TAVI underwent retrospectively ECG-gated cardiac CTA on a 256-slice CT-scanner (120 kV, 250-600 mAs). After reconstruction in three perpendicular planes, The general IQ and IQ of the supra-prosthetic, sub-prosthetic, peri-prosthetic, intra-prosthetic and valvular regions was scored on a four-point scale (1=non-diagnostic, 2=moderate, 3=good and 4=excellent) in the best systolic and diastolic phase.

Results: Twenty-two patients underwent a cardiac CTA (12 female patients, age 79±9 years). Mean heart rate during scanning was 74±12 beats per minute. The general IQ score was moderate (23%) and good (77%) during systole and moderate (23%), good (68%) and excellent (9%) during diastole (p=0.7). A significant difference between the systolic and diastolic IQ in the supra-prosthetic (diastolic better, p < 0.001), peri-prosthetic (systolic better, p=0.004) and intra-prosthetic region (systolic better, p=0.005) existed. A significant correlation between the heart rate and general systolic IQ was present (p=0.03).

Conclusion: The commonly implanted Edwards Sapien THV prostheses and the peri-prosthetic regions can be visualised with moderate to good image quality by MSCT, despite the presence of a cobalt-chromium stent frame.

B-0268 15:12
The diagnostic value of dual source CT in complex congenital heart disease

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Purpose: To discuss the diagnostic value of three-dimensional reconstructed technique with contrast enhancement of dual source CT (DSCT) in complex congenital heart disease (CCHD).

Methods and Materials: The MSCT data of 121 patients with CCHD confirmed by surgery were retrospectively analysed. All patients were performed with transthoracic echocardiograms (TTE) and 68 were compared with cineangiocardiograms (CAG) before surgery.

Results: A total of 425 cardiac deformities were found by operation. The accuracy of DSCT, TTE and CAG in detecting deformities was 96.6%, 71.3%, and 95.8%, respectively. There were 238 intracardiac deformities, 4 missed by DSCT, 3 missed by TTE, and 1 missed by AG. There was no significance difference in diagnosis accuracy with three methods (P > 0.05). There were 187 extracardiac anomalies. The definite diagnosis rate of MSCT, TTE and CAG for extracardiac anomalies were 97.5%, 56.2%, and 96.6%, respectively. MSCT and CAG were superior to TTE in the identification of extracardiac deformities (P < 0.01), and the diagnosis accuracy of MSCT and CAG showed no difference (P > 0.05). MSCT combined with TTE could increase the definite diagnosis rate to 98.3%.

Conclusion: MSCT may be used to clearly display the pathologic anatomy of CCHD, which is superior to TTE remarkably in the diagnosis of extracardiac anomalies. Therefore, as a non-invasive technique, MSCT has a very high diagnostic value in CCHD.

B-0269 15:21
X-ray-induced DNA double-strand breaks in lymphocytes of children undergoing cardiac flat-panel CT and angiography

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Purpose: Flat-panel CT (DynaCT®) enables CT-like cross-sectional imaging by creating 3D soft tissue data sets by rotation of the detector around the patient's body. Purpose of this study was to investigate the effect of cardiac flat-panel CT on x-ray-induced DNA double-strand breaks (DSBs) in blood lymphocytes in children.

Methods and Materials: Blood samples were obtained from thirteen children before and after flat-panel CT scan. Lymphocytes were isolated, stained against the phosphorylated histone variant H2 AX, and foci representing DSBs were visualised using fluorescence microscopy. Dose area product (DAP) was registered as provided by the patient protocol.

Results: DAP ranged from 50.5 to 1070.5 μGy·cm² (median 304.4 DSB/cell). DSB levels ranged from 0.06 to 0.29/10⁶ cell (median 0.11 DSB/cell) before, and from 0.08 to 0.36/10⁶ cell (median 0.15 DSB/cell) after flat-panel CT, the increase of DSBs was statistically significant (p=0.0002). A correlation was obtained between the induced DSB and the DAP (r=0.60).

Conclusion: In every patient a significant increase of DSBs was detectable after flat-panel CT. X-ray induced DSBs depend on the delivered dose. In conclusion, immunofluorescence microscopy is a valid method to detect distinct DNA damages even after rather low diagnostic doses and therefore it can be used as a measure of biological radiation effects.
Methods and Materials: CT pulmonary angiogram for detection of pulmonary embolism.

Purpose: To investigate the frequency of pseudo-embolic perfusion defects second-
ary to the underlying bronchopulmonary disease in COPD patients.

Methods and Materials: 170 patients with stable COPD and no history of acute and/or chronic pulmonary vascular disease, underwent DECT with reconstruction of diagnostic and perfusion scans. This volumetric acquisition at deep inspiration was completed by sequential expiratory scans. Two radiologists evaluated, by consensus, (1) the presence of pseudo-embolic perfusion defects (i.e., triangular, pleural-based and sharply marginalized hypodense areas) on lung perfusion scans; (2) with systematic depiction of morphological changes in the corresponding areas on inspiratory and expiratory diagnostic images.

Results: A total of 143 pseudo-embolic perfusion defects were depicted in 47 patients (27.6%) with (a) a predominant distribution in the lower lobes (89/143; 62.2%); (b) with the concurrent presence of small airways disease alone (120/143; 83.9%), emphysematous lesions alone (11/143; 7.7%), a variable association of small airways disease and emphysema (n=9; 6.3%) or the exclusive finding of central airways abnormalities (n=3; 2.1%) in the corresponding anatomical zones. The CT features of small airways disease depicted in the areas of pseudo-embolic perfusion defects included air trapping (81/120; 67.5%), focal hypoaattenuated area (67/120; 55.8%), mucoid impactions (59/120; 49.2%) and/or bronchiolitis (81/120; 6.7%). No statistically significant difference was found in the frequency of pseudo-embolic defects between the CT phenotypes of COPD (p>0.12).

Conclusion: Pseudo-embolic perfusion defects were identified in 27.6% of COPD patients, mainly seen in association with CT features of small airways disease.
Pulmonary embolism at dual source CT angiography: do we overdose?  

**Purpose:** To compare the radiation dose of dual source 128-multidetector CT (128-DSCT) with conventional 16-multidetector CT (16-MDCT) in pulmonary angiography for the diagnosis of pulmonary embolism (PE).

**Methods and Materials:** The local ethics committee approved this study. We retrospectively reviewed 100 patients with clinical suspicion of pulmonary embolism (PE). 50 underwent 128-DSCT and 50 underwent 16-MDCT. Effective doses were compared with estimates based on the most commonly used method in clinical literature: multiplying dose-length product (DLP) by a general conversion coefficient (0.014 mSv·mGy/cm).

**Results:** The two groups matched well for clinical characteristics (there were included 28 men and 72 women, with an average of age of 65±19 years). The average length of the MDCT protocol was 24.1±9 minutes. The mean scan length for full, limited and average scans were: 290±104, 169±32 and 201±58 mm, respectively.

**Conclusion:** If the protocol is optimized similarly, limited scans are less harmful.

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80-kV 16-MDCT to diagnose pulmonary embolism with minimised radiation dose  
**U. Nyman**, P. Bjorkdahl, B. Goldman, M.-L. Olsson, S. Wettmark; Trelleborg/SE

**Purpose:** To compare radiation dose and image quality of 80 kV 16-multidetector CT (16-MDCT) to diagnostic pulmonary angiography CT (DE-CTPA) with that of 100 and 120 kVp with all other scanning parameters being equal, while 350 instead of 300 mg I/kg were used at 80 kVp to compensate for the decreased CNR.

**Methods and Materials:** Two readers independently measured IN (R1-4). 11:51

**Results:** Median patient weight and BMI at 80/100/120 kVp were: 76/75/73 kg and 26/25/25 kg/m². Median pulmonary artery attenuation, image noise, CNR, CTDIvol, DLP and effective dose at 80/100/120 kVp were: 653/467/332 HU, 49/32/22 HU, 13/12/12, 2.7/1.8/1.5 HU, 78/138/234 mGy/cm and 1.3/2.3/4.0 mSv. At 80 kVp all examinations were adequate; 92% classified as excellent compared with 70% and 36% at 100 and 120 kVp.

**Conclusion:** Radiation dose to patients may be decreased to about one-third by reducing x-ray tube potential from 120 to 80 kVp without deterioration of diagnostic image quality if the decreased CNR is compensated with a slightly increased iodine dose. The protocol may be of special benefit in young individuals < 100 kg with adequate GFR.

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Dose reduction in CT pulmonary angiography: is it safe to limit scan coverage?  
**J. Halperin**, J. Rajchgot, D. Odedra, K. Hany, M. Hashemi, N.S. Paul; Toronto, ON/CA

**Purpose:** To determine if scan length restriction during CT pulmonary angiography (CTPA) results in non-detection of significant findings.

**Methods and Materials:** Retrospective reviews of 461 consecutive patients 253 F mean age 57.8y (17-99) having CTPA from 2010 to 2011. Two observers reviewed all images in each study (full scan) and then only images superior to the aortic arch and inferior to the heart (limited scan) to detect radiological abnormalities. It was determined whether the abnormalities would be missed on limited scans and if they were significant; indeterminate or insignificant based on imaging features, chart review and previous imaging. Dedicated on-line software (Radiometrics Inc, Toronto) calculated patient and organ-specific dose for full and limited scans.

**Results:** Mean radiation dose full: 290 mm, limited 169.3 mm, average change, 122 mm (p < 0.05). 43.8% (202/461) patients had abnormalities missed on limited CTPA, 16.3% (33/202) were significant but only 6% (2/233) were new. Overall, 0.4% (2/461) patients had new significant findings missed; renal carcinoma (1) and periosteal disease (1). Limited scan CTPA produces patient radiation dose reduction of 34.4%, from 11.1 to 7.2 mSv (ICP 103) and organ dose reduction >70%: kidneys (81.6%), colon (74.0%), thyroid (70.2%), >50%: testicles (69.3%), skin (68.7%), small intestine (55.8%), >30%: spleen (48.0%), stomach (48.4%), oesophagus (45.4%), red marrow (42.6%), brain (41.2%), eye lenses (32.8%) and breasts (30.1%).

**Conclusion:** Limited scan CTPA is a safe procedure in 99.6% of patients, results in 34% reduction in patient dose and significant reductions in organ dose to radiosensitive tissues.
thoracic aorta. Gp1: 30 consecutive patients (age 54.3±20.5, 19 F) scanned using 100 kVp and AEC determined mAs with matched target IN=40 HU. 480 measurements tested for normal distribution (Kolmogorov-Smirnov test) and reader agreements (paired Wilcoxon Test). IN R1-R4 and patient DLP (mGy/cm²) were compared between Gp1 and Gp2 using the Mann-Whitney test for IN agreement and Bartlett test for standard deviation (10%) agreement of IN.

Results: Mean ± 1 body weight [kg] Gp1: 67.3±13.0; Gp2: 67.2±13.3; [NHU] Gp1: R1=37.4±15.1, R2=32.2±14.1, R3=36.1±14.5, R4=46.2±18.8; Gp2: R1=38.6±7.7, R2=31.5±5.8, R3=38.6±7.5, R4=42.8±8.4, DLP [mGy/cm²] Gp1: 473.8±128.2 and Gp2: 474.7±164.4. No significant differences in patient bodyweight (p=0.894) and DLP (p=0.734), in inter-reader results of IN for R1-R4, (p=0.082-0.459) or in IN for R1-R4 (all p > 0.55). Significant differences in 1-standard deviation (p < 0.0005) for R1-R4 with 10% reduction of averaged R1-R4 values in Gp2.

Conclusion: High-resolution 100 kVp CTPA using AEC provides more uniform image quality adapted to patient body habitus across the entire chest with 49% reduction in standard deviation (10%) of image noise compared with a fixed mAs-technique at equivalent patient exposure.

10:30 - 12:00 Room D2

Interventional Radiology

SS 509 CT and MR-guided interventions

Moderators:
P. Almeida; Coimbra/PT
S. Nos; Baille/CH

B-0280 10:20

CT fluoroscopy-guided percutaneous vertebroplasty in spinal malignancy: technical results, PMMA leaks and complications in 202 patients

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Purpose: To retrospectively evaluate the incidence and clinical impact of local PMMA leakage rate was 58.6% (194 of 331 vertebrae). PCE (3 slices, 2.5/1.25 mm slice thickness/overlap; 3.75 mm coverage), Presence of posterior facet osteophytes overlying a direct joint access, needle direction for joint access (oblique ipsilateral, straight isplateral, oblique contralateral), and number of CT-guidance scans needed for final needle placement and dose length product (DLP) were recorded. Intra-articular needle placement was confirmed by joint space contrast opacification.

Results: FJB were technically successful in 79/84 cases. Access side and direction were as follows: 73/84 ipsilateral (53 straight, 20 oblique), 11/84 contralateral oblique (13%). 46 FJB were at L4/L5, 29 at L5/S1, 5 at L3/L4, and 4 at L2/L3. 40/84 facet joints presented posterior osteophytes. Average number of guiding scans needed to obtain final needle position was 4±2. Average DLP per FJB was estimated at 16 mGy-cm, corresponding to an effective dose of 0.2mSv.

Conclusion: FJB using CT-guidance is safe and rapid, ensures reliable needle guidance, individual to each facet joint’s anatomy, and allows precise intra-articular injection, with extremely high procedural accuracy. The effective dose is comparable to that of one minute of fluoroscopy guidance.

B-0282 10:48

Extrapleural paravertebral CT-guided fine needle biopsy of subcarnal lymph nodes

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Purpose: To report our experience in CT-guided extrapleural paravertebral subcarinal lymph biopsy using a thin 25-gauge (25G) thin needle without the need of injection of saline to widen the mediastinum.

Methods and Materials: Biopsy was performed using a 25G needle which was advanced lateral to the vertebral body between the endothoracic fascia and the parietal pleura to gain access to subcarinal lymph nodes. One hundred and forty-one patients were included in the study (74 females, 57 males). No artificial widening of the mediastinum using saline injection was required. The study was performed in the presence of a cytopathologist; sensitivity and specificity rates were calculated. Complications were documented for each case especially for pneumothorax and haemorrhage.

Results: Cytopathological diagnosis was reached in all cases. All re-aspirations were done in the same session to reach a primary diagnosis at the time of the biopsy. Immunophenotyping study was done in 94 cases to confirm the primary diagnosis and to classify the malignant lesions. No pneumothorax was encountered. Small haematomas were noted in 5 cases (3.5%). Cytopathology showed a sensitivity of 97.2% and specificity of 100%. By adding immunophenotyping a 100% sensitivity and specificity was achieved.

Conclusion: Fine needle aspiration cytology (FNAC) using a 25-gauge needle for subcarinal lymph nodes via a percutaneous extrapleural paravertebral CT-guided approach is a safe, minimally invasive, and tolerable procedure yielding a high sensitivity and specificity rates without the need of artificial widening.

B-0283 10:57

Initial experience of a novel CT fluoroscopy-guided percutaneous gastroscopy technique with loop gastropcy and peel-away sheath trocar technique in amyotrophic lateral sclerosis patients

M. de Bucourt, F. Collettini, C. Althoff, F. Streitparth, J. Greupner, B. Hamm, U. Teichgräber; Berlin/DE (mdb@charite.de)

Purpose: To report our initial experience of a novel CT fluoroscopy-guided percutaneous gastroscopy technique with loop gastropcy and peel-away sheath trocar technique.

Methods and Materials: A consecutive series of 31 amyotrophic lateral sclerosis patients in whom endoscopic gastroscopy was considered too dangerous or impossible underwent CT-guided percutaneous gastroscopy and gastropcy, and prospective follow-up. All procedures were performed with a 15 FR Freka® Pexad gastrostomy kit (Fresenius Kabi, Bad Homburg, Germany), 16-row scanner
B-0284 11:06
Sphenopalatine ganglion alcohol neurolysis under CT guidance in the management of craniofacial pain in 53 procedures
A. Kastler1, S. Aubry2, G. Cadet3, B. Kastler1, 1Clermont-Ferrand, FR, 2Besançon, FR
Purpose: The purpose of this study is to describe and evaluate the safety and effectiveness of alcohol neurolysis of the sphenopalatine ganglion under CT guidance in the management of craniofacial pain syndromes.
Methods and Materials: Thirty-eight patients were included in this retrospective study between December 1995 and June 2011. A total of 53 sphenopalatine neurolysis (SPN) were performed using absolute alcohol. The SPN was considered to be effective when pain relief was equal to or greater than 50% lasting for at least one week. The mean pain relief period following the procedure for each patient was noted. In case of recurring pain, both duration and intensity of pain were noted. All procedures were realised on an outpatient basis under local anaesthesia.
Results: Mean duration of facial pain before procedure was 6.1 years. Thirty six out of the 53 SPN (67.9%) procedures performed were successful. The overall mean duration of pain relief was 8.7 months after SPN procedure. In 26/36 successful SPN, recuring pain occurred with a mean duration of 5.4 months after initial procedure. Success rate of SPN depending of pain type are as follows: atypical facial pain 85.7% (p < 0.05); cluster headache: 83.3% (P < 0.05), trigeminal neuralgia 50% (p < 0.05), compression by neoplasm: 100% (p < 0.05).
Conclusion: CT-guided alcohol neurolysis of the sphenopalatine ganglion is a safe and effective treatment for refractory chronic craniofacial pain syndromes especially in cases of cluster headaches, atypical facial pain and trigeminal neuralgia.

B-0285 11:15
Tailored interactive sequences for continuous MR-image-guided freehand biopsies of different organs in an open system at 1.0 Tesla: preliminary results
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Purpose: To assess feasibility, image quality and accuracy of freehand biopsies of lung, liver, soft tissue and bone lesions using bFFE (gradient + spin echo), FFE (fast gradient echo) and TSE (fast spin echo) sequences for interactive continuous navigation in an open MRI system at 1.0 T.
Methods and Materials: 24 MR-guided biopsies (1 lung, 13 liver, 3 bone, 7 soft tissue and other organs) were performed in a 1.0-T open magnetic resonance (MR) scanner (Panorama HFO; Philips Healthcare, Best, The Netherlands). 14- to 18-gauge MR-compatible biopsy sets (Somatex Medical, Teltow, Germany) or 11-gauge MR-compatible bone marrow biopsy needles (Somatex Medical, Teltow, Germany) were employed. Complications and pathological biopsy reports as an indicator for lesions hit were recorded. Average patients’ age was 49 (min: 28; max: 70). 13 female and 11 male patients were included. The mean intervention time was 27 min.
Results: Our initial results indicate that bFFE is particularly suitable for fast moving organs (pulmonary, paracardial), moving organs are targeted better with T1W TSE, T1W FFE (liver) or T2W TSE (adrenal glands), and static organs are successfully approached with PD (spine) or T1W TSE (peripheral bones, musculoskeletal system). No major complications occurred. Average lesion size was 35 mm (min: 15; max: 65).
Conclusion: Applying tailored interactive dynamic imaging sequences for continuous navigation with arbitrary slice selection for maneuvering even to delicate locations improves interventional accuracy and feasibility of freehand MR-guided biopsies and may hence reduce the risk of complications.

B-0286 11:24
Percutaneous drainage under CT-guidance of deep abscess using a blunt-tip introducer
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Purpose: Deep abscess drainages under CT guidance are usually difficult to reach because of vital structures intervening in the needle pathway. Our purpose is to evaluate the efficacy and the safety of deep drainages under CT guidance using a blunt-tip introducer.
Methods and Materials: Two hundred and seven consecutive patients referred for CT-guided abscesses drainage were included in this retrospective study. In fifty patients, a blunt-tip introducer was used to reach the abscess and in 157 a standard needle was used (control group). Procedures were analysed in term of duration, irradiation, success and complications.
Results: The procedure duration was longer in the blunt-tip group (29 min vs 22 min, p < 0.0001). However, patient's dosimetry was not significantly higher in the blunt-tip group (950 vs 870 mGy.cm). No side effect was observed in the blunt-tip group whereas 2 haematomas and 2 bowel perforations were seen in the control group. During the follow-up, a second drainage was necessary in 17% in the blunt-tip group and 8% in the other group (p=0.04).
Conclusion: Blunt-tip introducers represent a viable a safe alternative to standard needles when performing CT-guided percutaneous drainages of deep abscess.

B-0287 11:33
Towards cardiovascular interventions guided by magnetic particle imaging (MPI): first instrument characterisation
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Purpose: Magnetic particle imaging (MPI) is a new tomographic imaging method and a very promising application for cardiovascular interventional radiology. We evaluated the MPI-performance of various commercially available instruments and a self-coated catheter using magnetic particle spectroscopy (MPS).
Methods and Materials: Seventeen commercially available interventional devices were selected: nine catheters (five braided (one nitinol), four stainless-steel) and four non-braided) and eight guide wires (four stainless-steel, three nitinol, one polyetheretherketone, PEEK). 2-mm-sized pieces were taken from the tip, the distal part (20-30 mm proximal the tip) and from the shaft of each device and evaluated using MPS. As a measure of performance the total harmonic distortion (THD) was determined. In a second step, one commercially available catheter without signal response in MPS was experimentally coated at the tip with MPI-spectro to evaluate the traceability of a SPIO-coating.
Results: Signal-generating and non-signal-generating devices could be distinguished reliably using MPS. The THD of signal-generating instruments was significantly higher than of non-signal-generating instruments (-41.03, SD 17.54 dB vs. -114.33, SD 7.62 dB, p < 0.0001). 7 of 8 stainless-steel containing devices generated a signal response whereas nitinol-containing (1 of 4) and metal-free instruments (0 of 5) did not. Furthermore, the MPI-coated catheter generated a signal of a certain contrast to the same uncoated catheter (+56.76 vs. -109.51 dB).
Conclusion: It is possible to reliably distinguish signal-generating and non-signal-generating instruments and to label instruments with MPI-spectro for a better traceability using MPI. This is a precondition for further development of suitable instruments.

B-0288 11:42
Percutaneous MR-guided cryoablation of prostate cancer: technical feasibility and preliminary results
G. Tsoumakidou, H. Lang, O. Abdelli, X. Buy, M. de Mathelin, D. Jacqmin, A. Gangu; Strasbourg/FR (gt Soumakidou@yahoo.com)
Purpose: We herein report our initial experience and technical feasibility of transperineal prostate cryoablation under magnetic resonance guidance.
Methods and Materials: From July 2009 till July 2011 percutaneous MR-guided cryoablation was performed in 11 patients with prostate adenocarcinoma contained for surgery (mean age: 72-years, mean Gleason-score: 6.45, mean PSA: 6.21 ng/ml, T1-2c/NO/M0, mean prostate-volume: 36.44 ml). Free-hand probe positioning was performed under real-time MR-imaging. Four to seven cryoprobes were inserted in the prostate, depending on the total gland volume. The ice-ball was monitored using real-time Trufi and high-resolution T2W-Blade multi-planar imaging. Patients were followed at 1, 3, 6, 9.12 months after the procedure with serum PSA-level and post-ablation MRI.
Results: Prostate cryoblation was technically feasible in 10 out of 11 patients. The ice-ball was clearly and sharply visualised in all cases as a signal-void area. Mean follow-up was 15 months (range: 1-25 months). Mean PSA-nadir was 0.33 ng/ml (range: 0.02-9.4 ng/ml). Mean hospitalization was 5 days (range: 3-13 days). Complications included a urethra-rectum fistula, urinary infection, transient dysuria and scrotal pain.

Conclusion: MR-guided prostate cryoblation is feasible and promising, with excellent monitoring of the ice-ball. Future perspectives could include the use of MR-guidance for the focal prostate cancer cryotherapy.

B-0289 11:51
Clinical importance of CT-assisted sympathetic ology in primary, focal planar and planar hyperhidrosis
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Purpose: The objective of this study was to evaluate the benefit of thoracic and lumbar computed tomographic-assisted sympatheticolysis (CTSY) in patients with primary, focal hyperhidrosis.

Methods and Materials: Thoracic and/or a lumbar CTSy was conducted on 101 patients (average age 37.5 ± 15.5 years) with primary, focal hyperhidrosis of the hands and/or feet, who experienced persistent symptoms after all conservative treatment options had been exhausted. The patients were divided into groups with palmar, palmoplantar and planar hyperhidrosis. The patients evaluated the severity of their symptoms prior to the intervention, 2 days, 6 months and 12 months after the intervention using a Dermatology Quality of Life Index (DLQI) and side effects experienced.

Results: The interventions performed led to a statistically significant decrease in the follow-up after CTSy in all groups (p < 0.01). The technical success rate of the CTSy was 100%. No major complications occurred. As the most common side effect, 39/101 of the patients reported compensatory perspiration after the course of treatment. Neurolgia experienced by 15/101 and paraesthesia by 13/101 of the patients subsided spontaneously in all of those affected after a period of 4 weeks at most. The differential assessment of the strength of perspiration of the hands and feet showed statistically significant differences between the foot and hand region, whereby the decrease in sweat secretion of the feet was stronger and more lasting (p < 0.02).

Conclusion: After conservative measures have been exhausted, CTSy represents a therapeutic option low in side effects for patients with primary, focal hyperhidrosis.

SS 510 Ultrasound
Moderators:
D. Miklic, Zagreb/HR, G. Turoczky, Budapest/HU

B-0290 10:30
Sonoelastography can help in the evaluation of supraspinatus tendon degeneration
C. Martini, E. Fabbro, G. Ferrero, D. Orlandi, E. Silvestri; Genoa/IT
(chiarapio@libero.it)

Purpose: To describe utility of sonoelastography in the evaluation of supraspinatus tendon (SSP) degeneration in two groups of young and elderly asymptomatic volunteers.

Methods and Materials: Sixty asymptomatic subjects were included in our evaluation (thirty young subjects, group A, mean age 26, range 18-32; thirty elderly subjects, group B, mean age 72, range 63-84). All subjects were screened by US (13-6 MHz probe, MyLab 70 XvG, Esaote, Italy). Two young shoulders were found to have partial-thickness tear of the SSP, while 21 elderly shoulders were found to have signs of tendon degeneration (fibre interruption, fragmentation, and calcifications). The median sonoelastography score in group A was 2 (1-3 [25th-75th percentile]) while it was 4 in group B (3-5 (p < 0.01). Group A tendons presented with a relatively homogenous colour pattern, while group B tendons presented with a relatively patchy colour pattern. Correlation between US and sonoelastography was high (r=0.8, p < 0.01).

Conclusion: Sonoelastography was able to detect degenerative changes of SSP tendons in elderly volunteers, with good correlation to US, so it could help in increasing US diagnostic accuracy in detection of SSP tendon degeneration.

Sonoelastography can help in the evaluation of supraspinatus tendon degeneration
C. Martini, E. Fabbro, G. Ferrero, D. Orlandi, E. Silvestri; Genoa/IT
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Conclusion: Sonoelastography was able to detect degenerative changes of SSP tendons in elderly volunteers, with good correlation to US, so it could help in increasing US diagnostic accuracy in detection of SSP tendon degeneration.

B-0291 10:39
Clinical indications for musculoskeletal ultrasound: consensus paper of the European Society of Musculoskeletal Radiology

Purpose: To develop clinical guidelines for musculoskeletal ultrasound (MSKUS) referral in Europe.

Methods and Materials: Sixteen musculoskeletal radiologists from seven European countries participated in a consensus-based interactive process (Delphi method) using consecutive questionnaires and consensus procedure at European meetings. First evidence validity was confirmed by literature research, followed by consensus on clinical utility in evaluation of musculoskeletal diseases in three consensus meetings. This involved a thorough, transparent, iterative approach, employing quantitative and qualitative research techniques including interview, questionnaire, Delphi and standard setting methodologies. All relevant stakeholders were engaged, including European MSK experts with special focus on MSKUS. Two different expert groups worked on a consensus in a first and second meeting, The third consensus meetings resolved questions that did not achieve consensus (limit 67%) by the first two questionnaires.

Results: On general consensus, musculoskeletal ultrasound is indicated to detect joint synovitis, fluid and septic effusion for potential aspiration and poorly indicated to detect loose bodies. Recommendations for most appropriate use of musculoskeletal ultrasound are reported in six areas relevant to musculoskeletal ultrasound: hand/wrist, elbow, shoulder, hip, knee, ankle/foot.

Conclusion: A comprehensive evidence-based, expert consensus-defined educational framework is presented. This should facilitate referrals for musculoskeletal ultrasound throughout Europe.

B-0292 10:48
Factors influencing quantitative values of contrast-enhanced ultrasound and correlations with clinical values in rheumatoid arthritis
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Purpose: To evaluate the reliability of quantitative parameters of the time/intensity curves in contrast-enhanced ultrasound (CEUS) for the assessment of synovial vascularisation in RA and their correlation with clinical and biological signs of inflammation during the follow-up of the disease.

Methods and Materials: 21 patients with active RA and 6 control patients were recruited. Two acquisitions of a selected joint with Doppler synovitis were performed at 1-hour interval for each patient by the same investigator after injection of microbubble contrast agent. In addition, in patients with RA a third acquisition was performed 3 months later. Synovial vascularisation was quantified using time/intensity curve parameters (maximum signal intensity; AUC: area under the curve; TTP: time-to-peak). Correlations of the curve parameters with the following variables: patient, acquisition, size and localisation of ROI, as well as with clinical and biological signs of inflammation were analysed using logistic regressions and Pearson test.

Results: RA patients presented the following features: median age 55: (16-80) years, median disease duration: 11.8 (0.25-31) years. No signal intensity increase was observed in control patients (median age 65 (58-75) years). The curve parameters were independent from the acquisition and the ROI localisation (p < 0.001). At the 3-month follow-up variation of AUC was correlated with DAS28 variation (r=0.74 [0.65-0.82]) and with CRP variation (r=0.69 [0.41-0.80]).

Conclusion: Our preliminary findings show that synovitis may be reliably followed using CEUS time/intensity curve parameters and suggest that AUC are correlated with the variation of the DAS28 in patients with RA.
B-0293 10:57
CEUS evaluation in the pseudarthrosis before and after treatment with autologous transplantation of bone marrow stem cells: preliminary results
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Purpose: To demonstrate the effectiveness of CEUS in evaluating the process of reparative bone regeneration by monitoring angiogenesis around the fracture site in patients with pseudarthrosis who were treated with transplantation of marrow-derived mesenchymal stem cells.

Methods and Materials: The method was used in 15 patients of the Traumatology Centre in Torino, Italy from February 2009 to May 2011. All patients were treated for delayed multifragmentary fracture evolved in pseudarthrosis. Autologous concentrate of bone marrow stem cells was applied into the area of bone defect. CEUS examination was performed before the gelatinous compound was applied and at one-, four- and twelve-week follow-up time points, in order to evaluate the physiological formation of new blood vessels. At the end of the study an X-ray confirms the presence of callus.

Results: Ecographic signs of neo-vascularisation were noted at one week in 13 of 15 patients; a steady increase in vascularity was demonstrated in 13 patients in subsequent tests; repeated measures ANOVA demonstrated statistically significant differences in the extent of vascularisation at subsequent follow-up time points (P < 0.0001). At the end of the study x-ray examination revealed initial attachment of calcified callus in those patients who demonstrated an increase in vascularity at CEUS. The other two patients showed no improvement because of the presence of haematoma.

Conclusion: Transplantation of stem cells is a new treatment of pseudarthrosis; our results demonstrate that CEUS has a good predictive value on the formation of callus in that it affords the monitoring of the reparative tissue vascularity.

B-0294 11:06
Visualisation of myofascial trigger points in low back muscles by real-time sonoelastography
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Purpose: Myofascial trigger points (MTPs) are a common source of pain and has been reported to vary from 30% to 93% in musculoskeletal pain. However, there is still a lack of objective means to either quantify or visualise their core features. Purpose is to examine the ability of vibration sonoelastography (E-colour mode) to visualise MTP; superficial as well as deep ones and to differentiate them from their immediate surrounding myofascial structure. Also, to compare between active and latent MTPs, in the quadrates lumborum, longissimus thoracis, iliocostalis lumborum, psoas and gluteus medius muscles.

Methods and Materials: Thirty eight (38) subjects with more than two (6) MTPs were randomly assigned to an active MTP group and a latent MTP group. MTP identification was based on their essential and confirmatory criteria; also, a handheld digital electronic algometer was used to measure MTPs tenderness, through pressure pain threshold value. A hand-held vibrator (50 Hz) was used over MTPs while sonoelastographic readings were taken. Outcome measures; percentage of tissue stiffness of MTP and their immediate surrounding myofascial structure, as well as their strain ratio.

Results: Vibration sonoelastography clearly differentiated with statistically significant difference between MTPs stiffness and their immediate surrounding myofascial structure stiffness with a P-Value = 0.009 (P-Value<0.05). However, there was no significant difference between tissue strain ratios of both active and latent MTPs with a P-Value = 0.929 (P-Value> 0.05).

Conclusion: These preliminary results indicate that vibration sonoelastography can actually visualise MTPs and can differentiate them from its surrounding myofascial structure through strain readings. However, it could not differentiate between active and latent MTPs where tissue strains yield similar values.

B-0295 11:15
Sonographic-guided treatment of rotator cuff delamination tears using autologous blood: a one-year follow-up study assessing radiological features, pain scores and shoulder function
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Purpose: To assess ultrasound-guided autologous blood injection (ABI) as an effective treatment for rotator cuff interstitial delamination tears which are difficult to diagnose by arthroscopy and are therefore problematic to treat. ABI offers a new alternative minimally invasive treatment that actually targets pathophysiology of rotator cuff tendon pathology that has failed traditional non-surgical remedies.

Methods and Materials: 35 patients with clinical suspicion of rotator cuff tear underwent MRI examination. When evidence of a supraspinatus longitudinal split tear was confirmed, the patient was prospectively enrolled in the study and had US assessment; diagnosis confirmed according to echotexture, interstitial tearing and neovascularity. Individuals randomised into 2 groups; first group (18 patients, age 18-39) received standard treatment with 5 mL Bupivacaine and 40 mg triamcinolone into the subacromial-subdeltoid bursa. The second group (18 patients, age 19-39) received the standard therapy as well as ABI into the site of interstitial tearing and fibrilar discontinuity. We performed two injections and monitored any changes in the tendon with ultrasound and assessed pain scores and functional improvement using the validated Oxford Shoulder Score (OSS).

Results: Pre-procedural OSS and those at 10 days, 6 weeks, 3 and 12 months post-procedure were compared. Differences in sonographic echogenicity, neovascularity, and interstitial tear size noted. Patients in the ABI group showed statistical and clinical long-term pain relief and functional improvement as assessed by the overall OSS.

Conclusion: Autologous blood injection appears to be a viable alternative and more clinically effective when compared to standard steroid injection therapy for rotator cuff delamination tears.

B-0296 11:24
Evaluation of echo-guided autologous platelet gel (APG) treatment in patients with tendinosis
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Purpose: Purpose of our study was to evaluate the effect of platelet gel treatment in patients with tendinosis, that today is not surgically treated. The evaluation was based on observation of clinical improvement and MRI-imaging. The platelet gel shows anti-inflammatory and regenerative effects which allow recovery of the functionality.

Methods and Materials: We evaluated 72 patients with tendinosis of supraspinatus (40 pts), Achilles’ (20 pts) and patellar tendons (12 pts). Clinical as well as functional evaluations of the patients were performed, using the visual analogue scale (VAS), for pain, and Constant Scale, VISA-A and VISA-P, for functionality. The instrumental evaluation was based on US and MRI. The protocol included three infiltrations performed at a distance of 21 days the one from the other. The control MRI was performed before treatment and 30 days after the last infiltration.

Results: The VAS mean value of the supraspinatus tendon at the end of treatment improved overall by 75%, and the Constant scale by 55.4%. In the patients with tendinosis of Achilles tendons, we found an improvement of 75% (VAS) and 43% (VISA-A). The patellar tendon VAS value increased of 71% and the VISA-P value of 50%. Compared with these good clinical results, the imaging findings were less significant.

Conclusion: Besides producing very satisfactory results in terms of symptoms and functionality in patients with tendinosis, the use of platelet gel also gives signs of morphological recovery. However, further investigations are needed to confirm consistency of these results.

B-0297 11:33
Combined ultrasound (US)-guided percutaneous treatment of epiphrochelitis: a randomised controlled trial
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Purpose: Epiphrochelitis is a common cause of elbow pain that could be treated with conservative or surgical intervention. The purpose of our work was to compare patients with clinical diagnoses of epiphrochelitis treated with a combined US-guided percutaneous approach (dry needling and steroid) and similar patients treated with either local steroid injection or dry needling.

Methods and Materials: 30 patients suffering from epiphrochelitis underwent to US-guided percutaneous treatment: 10 (7 males, age 38.7±7.4 [mean±std.dev]) were treated with dry needling and local steroid injection together, 10 (6 males; age 43.2±6.8) with dry needling only and 10 (3 males; age 35.2±9.4) with local steroid injection only. A visual analogue scale (VAS) from 0 to 10 was used to evaluate the degree of pain at baseline and at 2, 12, 24, 36, 48 weeks after the procedure; US scanning was performed at baseline, 24, 48 weeks and 18 patients.

Results: No immediate or delayed complications were observed. Patients who underwent steroid injection only had a prompt pain decrease but limited effects on long-term basis (baseline VAS=6.9±0.3; 2 weeks VAS=1.8±0.5; 12 VAS=4.0±0.3;
shown to be a feasible and effective therapy for patients with chronic symptoms. Cervical nerve root injection has been used to allow scrutiny of vascular flow and therefore the investigator can have greater confidence in avoiding intravascular injection. Ultrasound guidance allows accurate real-time visualisation with high resolution of local anatomy and needle trajectory. Needle tip position is seen clearly. Doppler ultrasound allows scrutiny of vascular flow and therefore the investigator can have greater confidence in avoiding intravascular injection. Cervical nerve root injection has been shown to be a feasible and effective therapy for patients with chronic symptoms as compared with historical controls treated by injection without ultrasound guidance.

Conclusion: Patients treated with US-guided cervical nerve root injection had a better outcome than other groups and pain relief was faster and more permanent.

**B-0298** 11:42

A new minimally invasive and reproducible technique for management of cervical radiculopathy: ultrasound-guided cervical transforaminal epidural nerve root injections

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**Purpose:** Cervical radiculopathy is a common problem leading to intolerable debilitating pain. In refractory cases invasive therapies include CT and fluoroscopic-guided anatomaphysic salivary gland injections (TF-ESIs) as well as surgery. Unfortunately there is increasing literature illustrating potential for brain and spinal cord infarction following injection. Ultrasound allows safe, accurate and real-time injection. Methods and Materials: This HIPPA compliant study was approved by our local Institutional Review Board; informed oral and written consent were obtained. Between 2008 and 2011 seventeen patients with symptoms of meralgia paresthetica results in more frequent long-term improvement and a new objective parameter to determine the suitability for MR-guided focused ultrasound surgery (MRgFUS).

**Conclusion:** Ultrasound TF-ESIs avoid the risks of ionising radiation. Sonographic guidance allows accurate real-time visualisation with high resolution of local anatomy and needle trajectory. Needle tip position is seen clearly. Doppler ultrasound allows scrutiny of vascular flow and therefore the investigator can have greater confidence in avoiding intravascular injection. Cervical nerve root injection has been shown to be a feasible and effective therapy for patients with chronic symptoms as compared with historical controls treated by injection without ultrasound guidance.

Conclusion: Patients treated with US-guided cervical nerve root injection had a better outcome than other groups and pain relief was faster and more permanent.

**B-0299** 11:51

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

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**Purpose:** To evaluate the efficacy of ultrasound-guided injections around the lateral femoral cutaneous nerve (LFCN) in patients complainting of meralgia paresthetica nocturna, and to document long-term results at 12 months. Methods and Materials: This HIPPA compliant study was approved by our local Institutional Review Board; informed oral and written consent were obtained. Between 2008 and 2011 seventeen patients with symptoms of meralgia paresthetica nocturna, including 8 men (mean age, 61.38 years; range 47-70 years, SD: 9.16) and 9 women (mean age 61.57 years; range 46-75 years, SD: 8.60) were treated between 2008 and 2011. Seventeen patients with symptoms of meralgia paresthetica nocturna, including 8 men and 9 women (mean age 61.57 years; range 46-75 years, SD: 8.60) were treated with US-guided injection of steroids along the LFCN in patients complaining of Meralgia paresthetica. Mean NPV ratio in uterine fibroid of SSI, less than 10 (n=13), was 63.5±14.9%. In the case of uterine fibroid of SSI more than 10 (n=11), mean NPV ratio was 53.5±19.3%. Uterine fibroids of SSI less than 10 in T2 weighted MR images as a new objective parameter to determine the suitability for MRgFUS. Methods and Materials: Twenty-four uterine fibroids in twenty premenopausal Asian patients were treated using MRgFUS. Treatments were performed from October 2008 to January 2010 and mean age of the patients was 37.9±6.1 years. SSI was measured at T2-weighted MR images by standardising its mean pixel intensity to a 0-100 scale, using reference intensities of muscle (0) and fat (100), respectively. SSI in each fibroid was retrospectively analysed, according to the non-perfusion volume (NPV) ratio.

Results: Mean NPV ratio in uterine fibroid of SSI, less than 10 (n=13), was 63.5±14.9%. In the case of uterine fibroid of SSI more than 10 (n=11), mean NPV ratio was 53.5±19.3%. Uterine fibroids of SSI less than 10 in T2 weighted MR images showed higher NPV ratio than uterine fibroids of SSI more than 10.

Conclusion: Scaled signal intensity of uterine fibroids in T2-weighted MR images can be suggested as a new objective parameter for the patient selection in MRgFUS. Uterine fibroids of SSI less than 10 is more eligible for MRgFUS.

**B-0300** 10:30

MR imaging of the normal endometrium: do apparent diffusion coefficient values change among the portions of the uterus and over the phases of the menstrual cycle?

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**Purpose:** To establish whether the apparent diffusion coefficient (ADC) measured with diffusion-weighted magnetic resonance imaging (DWI) in the endometrium of healthy women significantly varies between the fundus and the isthmus of the uterus and from the early proliferative to the periovulatory phase of the menstrual cycle. Methods and Materials: A series of healthy fertile women (minimum endometrial thickness: 4 mm; no endometrial fluid) underwent DWI (1.5 T; b values: 0 and 800 mm²/sec). In 81 women (5th through 18th menstrual day) the endometrial ADCs measured at the fundus (as high as possible) were compared to those taken at the isthmus (2-3 cm from the internal cervical os). The fundal endometrial ADCs were moreover calculated, in 17 women, both at the 5th day after the beginning of the cycle and at the 14th day before the subsequent cycle. Each ADC value was obtained through the average of three different measurements. The statistical significance of the differences (fundal vs. isthmic; proliferative vs. periovulatory phase ADCs) was determined using the Student’s t-test per paired data. Results: The ADCs at the fundus (mean: 1.132 mm²/sec; range: 0.68-1.80) were lower than at the isthmus (mean: 1.420; range: 0.83-1.96). The fundal ADCs in the proliferative phase (mean: 0.923; range: 0.68-1.16) were lower than in the periovulatory phase (mean: 1.256; range: 1.10-1.80). Both differences were highly significant at statistical analysis (p < 0.001).

Conclusion: The magnitude of the variations in endometrial ADCs occurring in normal women should make the radiologists cautious when interpreting DWI examinations in patients with disease.

**B-0301** 10:39

Scaled signal intensity of uterine fibroids in T2-weighted MR images; new objective parameter to determine the suitability for magnetic resonance-guided focused ultrasound surgery of uterine fibroids

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**Purpose:** MR-guided focused ultrasound surgery (MRgFUS) is a non-invasive treatment for symptomatic uterine fibroids. Patient selection is the most important step to achieve good result. The purpose of this study is to assess the initial efficacy of scaled signal intensity (SSI) of uterine fibroids in T2-weighted MR images as a new objective parameter to determine the suitability for MRgFUS. Methods and Materials: Twenty-four uterine fibroids in twenty premenopausal Asian patients were treated using MRgFUS. Treatments were performed from October 2008 to January 2010 and mean age of the patients was 37.9±6.1 years. SSI was measured at T2-weighted MR images by standardising its mean pixel intensity to a 0-100 scale, using reference intensities of muscle (0) and fat (100), respectively. SSI in each fibroid was retrospectively analysed, according to the non-perfusion volume (NPV) ratio.

Results: Mean NPV ratio in uterine fibroid of SSI, less than 10 (n=13), was 63.5±14.9%. In the case of uterine fibroid of SSI more than 10 (n=11), mean NPV ratio was 53.5±19.3%. Uterine fibroids of SSI less than 10 in T2 weighted MR images showed higher NPV ratio than uterine fibroids of SSI more than 10.

Conclusion: Scaled signal intensity of uterine fibroids in T2-weighted MR images can be suggested as a new objective parameter for the patient selection in MRgFUS. Uterine fibroids of SSI less than 10 is more eligible for MRgFUS.
**B-0302** 10:48

**Deeply infiltrating endometriosis: evaluation of retroperitoneal space on MRI after vaginal opacification**

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**Purpose:** To prospectively investigate diagnostic value and tolerability of MRI with intra-vaginal gel opacification for diagnosis and preoperative assessment of deeply infiltrating endometriosis.

**Methods and Materials:** One hundred and six women with clinical suspicion of deeply infiltrating endometriosis were previously examined with trans-vaginal ultrasound and MRI pre- and post-administration of vaginal gel. We evaluated the tolerance of this procedure with a scoring scale from 0 to 3. We also assessed with a score from 1 to 4 the visibility of four regions: Douglas-pouch, utero-sacral-ligaments, posterior-vaginal-fornix and recto-vaginal-septum. All patients underwent laparoscopic surgery after MRI.

**Results:** Nine patients considered procedure intolerable. Visibility of utero-sacral-ligaments and posterior-vaginal-fornix showed to be increased with gel (p < 0.001). Nine patients considered procedure intolerable.

**Conclusion:** MRI with gel opacification of vagina should be recommended for suspicion of deep infiltrating endometriosis, in particular, for the added value in evaluation of recto-vaginal septum, uterosacral ligaments and posterior vaginal fornix.

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**B-0304** 10:57

**MRgFUS treatment of uterine leiomyomas: results on quality of life, non-perfused volume ratio and size reduction over 12 months**

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**Purpose:** To investigate the efficacy of sonication in symptoms relief and volume reduction over time.

**Methods and Materials:** 36 leiomyomas in 30 women (average age 40 years, range 32-66) were treated with MRI-guided focused ultrasound (MRgFUS). The system (ExAblate2100,InSightec), equipped with a phased-array transducer, computer-controlled positioning system, radiofrequency amplifier system, operates in conjunction with a 3 T MR unit (GE). We scored severity of symptoms (as menorrhagia, urinary frequency, pelvic pain or bulk symptoms) using a 0- to 3-point scale before and after treatment. We also measured their impact on quality of life using a visual analog scale, the choice-based waiting trade-off and the time trade-off. Pre-treatment imaging set (T2-w,T1-w, pre- and post-Gd-BOPTA images) were obtained to measure leiomyoma volume. Immediately after treatment, T1-w contrast-enhanced MRI images in three planes were used to measure non-perfused volume (NPV). The average volume of treated fibroids was 63±53 (SD) cm³. Follow-up images were obtained 3, 6 and 12 months after treatment to determine leiomyoma shrinkage. Qualitative and quantitative relations between fibroid volume, NPV ratio at treatment, and 6-month shrinkage were measured.

**Results:** All patients showed a complete relief of symptoms and a reduced local recurrence. Uterine size reduction of 36.5% (±15%), volume decrease of 54±40 cm³ with an average volume reduction of 20%±15%. A linear regression method to obtain significant relief of symptoms, good NPV ratio and in mild shrinkage at 3, 6 and 12 months.

**Conclusion:** MRgFUS therapy of leiomyoma shows as a noninvasive and safe method to obtain significant relief of symptoms, good NPV ratio and in mild shrinkage at 3, 6 and 12 months.

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**B-0305** 11:06

**Combined diffusion-weighted magnetic resonance imaging and MR lymphography reliably detect and evaluate sentinel lymph node in cervical cancer**

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**Purpose:** To evaluate whether DWI and MR lymphography (MR-LG) reliably detect and evaluate sentinel lymph nodes (SLNS) metastasis in cervical cancer.

**Methods and Materials:** Thirty-eight patients with cervical cancer were preoperatively underwent interstitial MR-LG with Omniscan after completing the conventional MRI and DWI examinations, and the first lymph node in the lymphatic drainage pathway was defined as the SLN. Blue dye SLN biopsy was performed on all patients. The morphologic features of all the SLNs on MR lymphographic images were analysed. The relative apparent diffusion coefficient (rADC) of each SLN was measured. Diagnostic accuracies of the combined MR-LG and DWI approach compared with only MR-LG without DWI versus histopathology were evaluated.

**Results:** All localised SLNs corresponded well with SLNs identified on SLN biopsy. In patients with non-metastatic SLNs, the sensitivity of MR-LG was visualised by MR-LG. In patients with metastatic SLNs, the sensitivities were with or without filling defects in all patients except three in which SLNs were not enhanced. The sensitivity, specificity, accuracy, and positive and negative predictive values (PPV and NPV) for using filling defects on MR-LG as a diagnostic criterion were 78%, 72%, 90%, 65%, and 89%, respectively. Meanwhile, there were statistically significant differences between metastatic and non-metastatic SLNS in rADC (P < 0.01). With the addition of DWI, the diagnostic accuracies increased: sensitivity, 80%; specificity, 87%; accuracy, 91%; PPV, 78%; NPV, 94%.

**Conclusion:** The combination of DWI and MR-LG was useful in detecting the SLNs and in improving the diagnostic accuracy of SLN metastases in cervical cancer.

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**B-0306** 11:15

**Evaluation of therapeutic response to concurrent chemoradiotherapy in cervical cancer using blood oxygenation level-dependent MRI at 3 T: preliminary experience**

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**Purpose:** To investigate the changes in the rate of spin dephasing (R2*) values at blood oxygenation level-dependent (BOLD) MRI in cervical cancer patients receiving concurrent chemoradiotherapy (CCRT), and to assess the relationship between tumour R2* values and final tumour response.

**Methods and Materials:** 29 consecutive patients with biopsy-proven cervical cancer were examined by T2-weighted and BOLD MRI at 3 T. BOLD MRI was performed using a multiple fast field echo (mFFE) sequence to acquire T2-weighted images within a single breath-hold. All patients who treated with CCRT performed two MR examinations [i.e., prior to therapy (pre-Tx) and 1 month after the completion of therapy (post-Tx)]. At each therapeutic point, R2* value (1/sec) was calculated in the tumour and normal myometrium. Final tumour response as determined by changes in tumour size using MRI (pre-Tx - post-Tx)/pre-Tx) was correlated with tumour R2* values at pre-Tx.

**Results:** The final tumour size response was 69.9%. The mean R2* values of the tumours were 21±6.7 at pre-Tx and 39.4±8.6 at post-Tx, respectively, which showed a significant difference (P < 0.001). However, the mean R2* values of normal myometrium were 24.9±3.7 at pre-Tx and 24.1±2.8 at post-Tx, respectively, which did not show a significant difference (P = 0.36). At pre-Tx, tumour R2* values showed significantly negative correlation with final tumour size response (P = 0.028, Spearman’s coefficient = -0.416).

**Conclusion:** BOLD MRI at 3 T may be helpful to evaluate therapeutic response in cervical cancers. These possibilities await further studies.

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**B-0307** 11:24

**Preoperative staging of patients with cervical carcinoma: comparison of magnetic resonance imaging and histopathologic evaluation**

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**Purpose:** Magnetic resonance imaging (MRI) is recommended for preoperative assessment of local tumour extension in patients with FIGO stage IB or higher, after histological confirmation. The purpose of this study was to evaluate diagnostic value of MR in preoperative assessment of patients with cervical tumours and to optimise further therapeutic approach.

**Methods and Materials:** This prospective study included 43 patients, with preoperative MRI and cervical biopsy that confirmed cervical carcinoma. Therefore, the patients were divided into two groups: group 1, patients with FIGO ≤ Ib who under undergo surgery, and group 2, FIGO ≥ 2b, who did not have surgery. In addition, in patients who underwent surgery, MR findings were compared with the histopathological report of the hysterectomy specimen.

**Results:** According to MRI findings, 18 (42%) patients were classified as T1, 7 (16%) patients were classified as T2a, 7 patients (16%) as T2b, 6 (14%) as T3, and 5 patients (12%) as T4, while on pathohistological specimens after surgery 20 (47%) were classified as T1, 5 (12%) as T2a, 7 as T2b (16%), 8 (19%) as T3 and
B-0308 11:33

Dynamic contrast-enhanced imaging for evaluation of therapeutic response to concurrent chemoradiotherapy in cervical cancer

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Purpose: To evaluate the changes of quantitative parameters of dynamic contrast-enhanced imaging (DCEI) in cervical cancers before, during, and after concurrent chemoradiotherapy (CCRT), and to assess relationship between quantitative parameters of the tumours and final tumour responses to treatment.

Methods and Materials: 35 consecutive patients with biopsy-proven cervical cancer were enrolled. DCEI was obtained using T1-weighted 3D fast-field-echo sequence at 3 T. Pharmacokinetic analysis using an extended Kety model was performed. All patients who treated with CCRT performed three serial MR examinations [i.e., prior to therapy (pre-Tx), at the fourth week of therapy (mid-Tx), and 1 month after the completion of therapy (post-Tx)]. At each therapeutic point, quantitative parameters (i.e., kep, Ve and Ktrans) were calculated in the tumours and normal gluteus muscles. Final tumour responses as determined by changes in tumour size or volume using MRI (i.e., pre-Tx - post-Tx/pre-Tx) was correlated with quantitative parameters of the tumour.

Results: Between therapeutic points, all quantitative parameters of the tumours revealed a significant difference (P < 0.05), while those of normal gluteus muscles showed no significant difference (P = 0.05). The mean value of final tumour response for the size and volume was 82.1% and 97.9%, respectively. Quantitative parameters of the tumours at pre-Tx or mid-Tx were not statistically associated with final tumour size or volume responses.

Conclusion: Quantitative parameters of DCEI revealed the therapeutic changes to CCRT in cervical cancers, compared with normal gluteus muscles. However, the parameters in cervical cancers were not associated with final tumour size or volume responses.

B-0309 11:42

Correlation between tumour size and surveillance of lymph node metastasis for Ib and IIA cervical cancer by MRI

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Purpose: To assess the feasibility of preoperative MRI-based measurement of tumour size with regard to lymph node (LN) metastasis in early uterine cervical cancer.

Methods and Materials: A retrospective review of patients with FIGO stage IB-IIA cervical cancer who underwent lymphadenectomy was performed. Diagnostic accuracy of MRI in detecting LN metastasis and rate of LN recurrence in terms of tumour size (≤4 cm versus > 4 cm) were analysed. ROC curve analysis was used to determine LN size for differentiating LN metastasis in terms of tumour size. P < 0.05 was considered statistically significant.

Results: Of the 200 patients, 45 (22.3%) had LN metastasis. There was no statistical difference between patients-based and region-specific analysis. The patients with tumour size with > 4 cm revealed higher diagnostic accuracy of MRI in detecting LN metastasis and rate of LN recurrence in terms of tumour size (≤4 cm versus > 4 cm) were analysed. ROC curve analysis was used to determine LN size for differentiating LN metastasis in terms of tumour size.

Conclusion: MRI has limited sensitivity, but high specificity in predicting surveillance of LN metastasis in the preoperative early cervical cancer, especially useful tool for patients with tumour size with > 4 cm.
**B-0312 10:48**

Additional breast ultrasonography (US) in asymptomatic women with negative mammography: are there risk categories that benefit more than others?

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**Purpose:** To assess the cancer detection of US in addition to negative mammography in asymptomatic women and to correlate with age, risk factors, mammographic density.

**Methods and Materials:** During a 2-year period (2009-2011), a series of 23,508 self-referring women underwent to clinical examination, mammography and ultrasound. 22,118 asymptomatic women (no breast/axillary sign) with negative mammography constituted the population studied (age: 40 years in 9%, 40-49 years in 41%, ≥50 years in 49%; previous history of breast cancer in 10%). Cancers detected by US was assessed in the population, as well as in subpopulations grouped by age (<50 years; ≥50 years), breast density (BI-RADS ACR categories: fatty breasts D1-D2, dense breasts D3-D4), patient history (previous breast cancer, no previous cancer), hormonal status (fertile, menopausal), Fisher's exact test was used for statistical analysis (significant p value<0.05).

**Results:** Overall, 162 breast cancers were diagnosed. 134/162 cancers (83%) were identified by mammography. The remaining 28 cancers (17%) were diagnosed by US alone. The US detection rate for total population was 1.3% . In the subgroups it was: 1.45% in women ≤50 years vs 1.03% in women > 50 years (p=0.29); 1.47% in dense breasts vs 1.06% in fatty breasts (p=0.24); 5.04% in women with previous cancer vs 0.85% in women without previous cancer (p=0.03).

**Conclusion:** The addition of ultrasound to mammography resulted in an increase of breast cancer detection of 17%. The age and the breast density have no significant effect on US performance. Most US-detected cancers occurred in women with personal history of breast cancer.

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**B-0313 10:57**

Lesion detection in 3D-US automated breast volume scans (ABVS): correlation with breast MRI

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**Purpose:** To determine the diagnostic accuracy of 3D-US automated breast volume scanning (ABVS) related to MR breast imaging, using BI-RADS classification as discriminator.

**Methods and Materials:** During a 5-month period, all patients who underwent breast MRI were requested to have additional ABVS conducted of their breasts. Patients under 18 years of age, males, patients unable to undergo MRI, or give informed consent were excluded. Time between breast MRI and ABVS was < 7 days. Scan protocol depends on breast size: In cup A-C 3 scans and in size D and D+ 5 scans per breast are obtained. Resulting 3D-US data is evaluated on a dedicated workstation by an experienced radiologist, who is blinded for MRI findings. The 3D-US findings are evaluated using the BI-RADS classification for ultrasound. MR findings are used as gold standard and, when available, also histopathologic correlation was performed.

**Results:** Out of 281 consecutive scanned patients with MRI imaging of the breasts 201 patients participated in our study. In nearly all patients, ABVS was technically successful and breast tissue was visible from skin to thoracic wall. The axillary region could not sufficiently be visualised for evaluation in most patients. So far, 104 patients are evaluated: 3D-US evaluation of the breast shows a sensitivity of 88% and specificity of 97% as compared to MRI imaging findings. In coming months all 201 patients will be evaluated.

**Conclusion:** Compared to MRI, 3D-US shows high sensitivity and specificity in the detection of suspicious lesions. ABVS seems a promising new ultrasound technique in breast evaluation.

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**B-0314 11:06**

Automated whole breast ultrasound: radiologists’ detection performance and interobserver variability

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**Purpose:** To evaluate the detection performance of automated whole breast ultrasound (AWUS) in comparison with hand-held breast ultrasound (HHUS) and to evaluate the interobserver variability in the interpretation of AWUS.

**Methods and Materials:** From October of 2009 to March of 2010, bilateral automated whole breast ultrasound was performed in consecutive 38 breast cancer patients who were scheduled for breast MRI. Total 66 lesions were included: 38 index cancers, 12 additional malignancies, and 16 benign lesions. Three breast radiologists independently reviewed AWUS data and analysed the breast lesions according to the BI-RADS classification. Detection rate, sensitivity and specificity of benign and malignant lesion detections were calculated and interobserver variabilities were calculated using Cohen’s kappa statistics.

**Results:** Detection rate of index lesion and additional malignancy was 98.0% (45/45) in HHUS, 90.0% (45/45), 88.0% (44/44) and 96.0% (48/48) for three readers of AWUS. Sensitivity and specificity were 100% (50/50), 62.5% (10/16) in HHUS, 92.0% (46/45), 87.5% (14/16) in reader 1, 90.0% (45/45), 81.3% (13/16) in reader 2, and 96.0% (48/48), 93.8% (15/16) in reader 3. There was no significant difference in radiologists’ detection performance, sensitivity and specificity among HHUS and AWUS (p<0.05). The interobserver agreement was fair to almost perfect agreement for US features, categorisation, size and location of index masses.

**Conclusion:** AWUS is thought to be useful for detecting breast lesion. AWUS showed no significant difference of detection rate, sensitivity and specificity in comparison with HHUS and there were high degrees of interobserver agreement.
variables: elastography-shape, elastography-homogeneity/ 5 quantitative-variables: lesion dimension/maximum stiffness (kPa), median-elasticity-mean, lesion/fat ratio, mean-elasticity-diameter-ratio. All standard calculations of sensitivity/ specificity, negative and positive predictive value and p-value were performed.

**Results:** 650 (69.2%) lesions were benign, 289 (30.8%) malignant. 303 lesions were scored BI-RADS 2 < 0 and BI-RADS 3-5 < 0. There were no lesions in the BI-RADS 2 group. Therefore, the reliability of the lesions consisted only in downgrading BI-RADS 3 to a new BI-RADS 2-group when the SWE feature was not suspicious. BI-RADS alone had a sensitivity of 100%, specificity 16%, PPV 35%, NPV 100%. Round shape on SWE appears to be a helpful finding to alter clinical management (no malignant lesions/p < 0.001).

No malignancies were found with maximum-stiffness < 20kPa (gain of specificity 48%/p < 0.001)/median-elasticity-mean < 1.6kPa (gain of specificity 8%/p < 0.011)/ lesion/fat ratio < 0.5kPa (gain of specificity 14%/p < 0.001)/mean-elasticity-diameter ratio < 0.7kPa (gain of specificity 14%/p < 0.001).

**Conclusion:** All SWE-features taken separately increased specificity of breast ultrasound elastography for BI-RADS 3 findings and reclassification in BI-RADS 2, Best model with highest clinical impact: BI-RADS+SWE-maximum stiffness< 20kPa.

**B-0317** 11:33
Is shear wave elastography (acoustic radiation force impulse) able to improve the assessment of BI-RADS 4 breast solid lesions?

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**Purpose:** To evaluate the performance of shear wave elastography in breast lesions for the characterisation of BI-RADS 4 solid lesions.

**Methods and Materials:** Solid mass lesions categorised as BI-RADS 4 on ultrasound were prospectively included. B mode images and results of acoustic radiation force Impulse (ARFI) imaging - both qualitative (suspicious elastogram image or not) and quantitative (shear wave speed m/s) - were correlated with cytological results (FNA or biopsy). Values of the shear wave velocity were determined in both the solid masses and normal surrounding tissue with measurements performed at the same depth and with the same probe pressure. Percentage of speed increase was calculated, to limit the bias due to variable pressure, and correlated to pathology.

**Results:** 82 solid mass lesions were studied (39 benign, 43 malignant, mean size 13.7 mm) in 78 patients. The mean shear wave velocity in benign masses was statistically significantly lower than in malignant lesions (respectively, 2.105m/s and 3.279m/s (p < 0.0001)). Using the receiving operating characteristic curve, a cutoff level for shear wave speed of 2.93m/s predicted malignancy with 90% specificity and 56% sensitivity, with an area under the curve (AUC) of 0.834. A 100% speed increase had 85% specificity and 45% sensitivity with an AUC of 0.77. In addition, all cancer cases exhibited a suspicious appearance using ARFI qualitative imaging.

**Conclusion:** ARFI, in combination with B-mode imaging, can improve the assessment of breast lesions, especially for benign lesions misclassified as BI-RADS4 and might help decreasing the number of benign lesions referred for biopsy.

**B-0318** 11:42
Lesion characteristics and histopathological factors affecting diagnostic performance of breast ultrasound elastography

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**Purpose:** To identify factors affecting the diagnostic performance of breast ultrasound elastography.

**Methods and Materials:** 701 sonographically visible breast masses that were referred to our department for image-guided biopsy were evaluated with ultrasound elastography. Elastographic assessment interpreted as probably benign or malignant based on a combination of elastographic size ratios and grey-scale strain pattern assessment. Using histological diagnosis as the gold standard, the sensitivity and specificity for various lesions were assessed.

**Results:** There was no statistically significant difference in the sensitivities of well-defined vs ill-defined lesions, regular vs irregular shaped lesions and lesions with and without acoustic shadowing. Statistically significant difference was noted in the specificities of well-defined lesions (90.0%) vs ill-defined lesions (63.8%) (p < 0.0001), regular (90.3%) vs irregular shaped lesions (71.9%) (p < 0.0001), no acoustic shadowing (83.5%) vs posterior shadowing (66.7%) vs combined shadowing (100%) (p=0.003). Sensitivity and specificity of lesions measuring 10 mm or less were 84.3% and 78.6% vs 98.1% (p=0.001) and 87.1% (p=0.009), respectively, for lesions more than 10 mm. There was no statistically significant difference in sensitivity and specificity for lesions with and without calcifications, lesions of different echogenicity and lesions in mammographically dense or fatty breasts. Sensitivity of mucinous carcinomas (50.0%) and LCIS (33.3%) was lower than the other malignancies. Specificity of papillomata (64.9%) and fibrocystic change (77.4%) was lower than for other benign conditions.

**Conclusion:** Ill-defined lesions, irregular shaped lesions, lesions with posterior acoustic shadowing, small lesions, mucinous carcinomas, LCIS, papillomata and fibrocystic change appear to be related to poorer ultrasound elastographic diagnostic performance.
**Conclusion:** Widespread cortical thickness shows diversified distribution of cortical thickness among individual healthy persons. The normal ageing decline rates measured from AISL 3 T data using BSIM are higher than what has been previously reported.

**Methods and Materials:**
Fourteen aMCI patients and 11 HC underwent resting-state fMRI (rs-fMRI) and neurophysiological testing (CERAD battery) at baseline and on a follow-up examination after 13-16 months. Resting-state fMRI data were decomposed into independent components (ICs) using FSL’s temporal concatenation group ICA (TC-GICA) and dual regression. The within-group test-retest reliability was determined by calculating spatial normalised correlation coefficients (SNCCs) for the corresponding averaged group-level components deriving from both MRI examinations.

**Results:** Both groups remained cognitively stable over time. The TC-GICA approach produced 15 ICs considered as RSNs and 9 ICs considered as artefacts. Overall SNCCs were low/moderate to high ranging from 0.20 to 0.81. Highest test-retest reliability was observed in two sub-networks of the default-mode network, two sensorimotor networks, and a visual network.

**Conclusion:** The long-term test-retest reliability of RSNs is moderate to high in cognitively stable healthy elderly and aMCI patients. This finding is essential to establish rs-fMRI as a tool in the diagnosis and follow-up of neuropsychiatric and neurodegenerative disorders.

**Purpose:** We investigated whether the distribution of (11)C-Pittsburgh compound B (PIB) and (11)C-L-deprenyl (DEP) in dual-tracer PET early frames is flow-dependent and its potential clinical use.

**Methods and Materials:** Dual-tracer PET scans were performed in a group of 7 patients with clinical diagnosis of "probable AD" (mean age ± SD, 64, 1±6.1y; mean Mini-Mental State Examination [MMSE] score ± SD, 22.2±6.0) and a group of 7 age-matched controls (mean age ± SD, 60, 3±3.9; mean MMSE score ± SD, 28.7±1.0), both recruited from Karolinska University Hospital. Quantitative data were obtained by summing all early PIB and DEP frames and an iterative algorithm generated normalised perfusion images with standard uptake values for selected regions of interest (frontal, parietal, temporal and posterior cingulate cortex). We calculated Pearson’s correlation coefficient for the combined frames in all brain tissue voxels and group differences were analysed with two-tailed t-tests.

**Results:**
PET frames between minutes 1-3 produced the only voxelwise correlation found (R=0.78a±0.05) in both groups. In this 3-min window were the lowest PIB and DEP uptake values measured, but the binding/flow ratio was significantly higher (p<0.05) in most AD patients (n=6) than in the control group, suggesting that tracer distribution may be flow-dependent. No correlation was found in other frames studied (minutes 4-10). Brain regions of interest identified as significant discriminators (p<0.05) of AD disease were posterior cingulate and temporal cortex.

**Conclusion:** The distribution of PET tracers in the very early frames is likely flow-dependent, which may be useful to derive clinical estimates of cerebral blood flow and neuroinflammation from a single multi-tracer PET scan.
B-0326

11:24

Hipocampal malrotation: not everything is mesial sclerosis
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Purpose: Demonstrate the imaging finding in Magnetic Resonance Imaging (MRI) in patients with epilepsy and hippocampal malrotation using high-resolution volumetric sequences.

Methods and Materials: Review of studies of MRI brain patient’s with epilepsy of our hospital diagnosed with mesial sclerosis from January 2005 through December 2011. For now, we have obtained 78 patients. The studies were conducted on a high field 1.5 T and 3 T, according to the protocol of epilepsy include: sagittal T1, axial T1 and T2, coronal FLAIR, coronal T2 (high resolution) and 3D volumetric sequences IR (1.5 mm thick).

Results: We have followed 12 patients with hippocampal malrotation in which there had been a misdiagnosis. Common features found in hippocampal malrotation were hippocampus abnormally situated in a medial location, which has not rotated to the normal depth within the wall medial temporal lobe. The vertical diameter is similar or greater than the transverse. The temporal horn appears enlarged and choroidal fissure is not visible. The collateral sulcus is often verticalizes altering the angle, causing a temporary imprint on the pole known as temporal eminence. The internal structure of the hippocampal gyrus is blurred, keeping the size and normal internal signal and changes in surrounding structures appear as parahippocampal gyrus (decrease in its upper transverse), the subiculum, the fimbria and fornix (thinning and flow position), but all in a temporal lobe maintains its normal size.

Conclusion: Hippocampal malrotation built a malformation that should be consid- ered in the differential diagnosis of patients with epilepsy.

B-0327

11:33

Cerebellar changes in essential tremor patients detected by magnetic resonance spectroscopy
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Purpose: Essential tremor (ET) is one of the most common movement disorders in humans, characterised by a kinetic tremor of arms, head and even the voice. The prevalence of ET is dependent on the increasing age. The aim of our study was to find out, if the metabolite concentrations measured in cerebellum are also age-dependent.

Methods and Materials: Patients with ET (n=28, 20 M, 8 F, age=50±31) and healthy volunteers (n=23, 15 M, 8 F, age=50±31) were divided into 4 age-groups: ≤30 years (controls=4, patients=5), 30-50 years (≥7, p=9), 50-70 years (≤9, p=12), >70 years (≥3, p=5). We focused on the cerebellum and measured N-acetyl aspartate (NAA), creatine (Cr) and phosphocholine (Pch) concentrations. Spectroscopy was performed on 1.5 Siemens Avanto scanner using single-slice CSI sequence (TR=1500 ms, TE=135 ms) and processed using Sipro software package with LCModel. Only voxels with low fitting error were chosen. Double-tailed Welch two sample t-test was used for statistical analysis.

Results: We found NAA (controls=5.0345, patients=4.110, p-value=6.792E-4) and Pch (controls=1.0851, patients=0.9468, p-value=0.0038) reduction in ET patients, no Cr reduction was found. The greatest difference between controls and patients was found in the age-group 40-50 years. We found all concentration values with no drop in increasing age.

Conclusion: We found significant reduction of NAA and Pch concentrations in ET compared to healthy controls; however, these changes were not related to age. Supported from grants IGA MZ CR, NS9654-4/2006, NT11328-4/2010, MŠM 0021620849 and MŠM 0021620816, IGA MZ CR NS10336-3/2009.

B-0328

11:42

Diffusion tensor imaging and voxel-based morphometry in Parkinson disease
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Purpose: The purpose of this study was to find out if a microstructural damage to cerebral white matter correlates with grey matter volume changes and cognitive symptoms in idiopathic Parkinson disease (PD).

Methods and Materials: 36 patients with de novo PD were examined (Hoehn and Yahr stages I, III; two age subgroups, 41 to 60 (A) and 63 to 80 (B) years old; with and without cognitive impairments). T1- weighted images (gradient echo, voxel 1 mm3), diffusion tensor images (DTI) were obtained. Total brain, grey matter (GM), white matter (WM) volumes were defined from T1-weighted images, fractional anisotropy (FA) meanings were calculated using FSL.

Results: Patients of A age subgroup also did not show any significant difference with controls, despite that duration of illness was twice longer than in patients 63 to 80 years. Subgroup B had shown decreased volume in medium temporal gyrus, fronto-temporal area, pons, Putamen, thalamus, caudate nucleus, amygdala volumes did not demonstrate difference with controls. FA, measured in all patients was unaltered in the midbrain, lowered in the corticospinal tract, in splenium of corpus callosum, front lobes, centrum semiovale, pons (in projection of substantia nigra). There were lower FA meanings in corpus callosum and internal capsule in patients with cognitive impairments and III Hoehn and Yahr stage, not depending on age or duration of illness.

Conclusion: Correlation of FA decrease and worse cognitive state in patients of any age, without brain structure volume changes can be a proved that widespread neurodegeneration is already present at the time of clinical onset.

B-0329

11:51

The relation of neuroimaging findings in carbonic anhydrase type II deficiency syndrome to cognitive disturbance and visual loss
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Purpose: This work describes the neuroimaging findings in carbonic anhydrase type II deficiency syndrome (CADS) and the relation of these findings to cognitive disturbance and visual loss.

Methods and Materials: Retrospective analysis of serial neuroimaging studies performed in 18 individuals from 10 unrelated consanguineous families with CADS followed for 10 years was performed and correlated with visual loss and mental retardation.

Results: Brain calcification was present in patients as young as two years old, but absent in patients as old as nine years, and was generally progressive and followed a distinct distribution, involving predominantly basal ganglia and thalami and grey-white matter junction in frontal regions more than posterior regions. Patients with more severe cognitive disturbance had less profound brain calcification. In general, basal ganglia and thalami were spared in individuals with more severe mental retardation, although grey-white junction calcification still occurred. Progressive calcification was noted even in individuals with minimal or no cognitive disturbance. Small optic canal was always associated with very poor vision, while canal size greater than 3 mm was associated with normal optic disk appearance. Optic canal size was correlated with visual acuity (r = -0.578; p = 0.001) and with degree of optic atrophy (r = -0.477; p = 0.003).

Conclusion: Brain calcification in CADS may not be present during childhood. Worse mental retardation is associated with less brain calcification, especially in the deep grey matter. Variability of brain calcification and cognitive disturbance may imply additional genetic or epigenetic influences affecting the course of the disease.
To describe MRI findings of breast cancer liver metastasis using gadoxetic acid with an emphasis on the added value of the hepatobiliary phase (HBP).

Methods and Materials: Nine patients with 13 liver metastases were included in the study after reviewing the medical records of 29 breast cancer patients who underwent Gd-EOB-DTPA-enhanced MRI between February 2008 and June 2010. The diagnoses of liver metastasis were established by percutaneous liver biopsy or surgery and on the basis of image findings. Two radiologists retrospectively evaluated SI and sizes of metastases and patterns of enhancement in HBP. The SI ratio was calculated as the SI of the central hyperintense portion in “target” lesions divided by the SI of nearby normal liver parenchyma on HBP. We also measured ADC values from DWI.

Results: Liver metastases were all hypointense (100%) on T1WI, and many lesions had “target” appearances with central high SI and peripheral low SI rim (47%) on T2WI. Dynamic study showed rim enhancement on arterial phase (95%), and “target” appearance, consisting of central enhancing portion with peripheral wash-out or hypointense rim, on HBP (62%). The mean SI ratio was 0.7. The mean ADC value of “target” appearing metastases was 1.25 (×10⁻³mm²/s; 1.3-1.6), compared with a mean value of 0.8 (×10⁻³mm²/s; 0.8-1.4) in homogenous defect on HBP. There was statistically significant difference (p < 0.05).

Conclusion: Breast cancer liver metastases commonly demonstrated as peripheral ring enhancement on arterial dominant phase and target sign with central round enhancing portion and peripheral hypointense rim on HBP.

Detection of colorectal hepatic metastases using Gd-EOB-DTPA MR imaging and diffusion-weighted imaging (DWI) alone and in combination in patients after chemotherapeutic treatment

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Purpose: To compare the accuracy and sensitivity of Gd-EOB-DTPA MRI imaging and DWI, alone and in combination, for detecting colorectal liver metastases in patients with metastatic disease after chemotherapeutic treatment.

Methods and Materials: 32 consecutive patients, with a total of 166 lesions, underwent MR imaging. Out of 166 lesions, 144 (86.8%) were metastases on histopathology and/or intraoperative sonography. Three image sets (Gd-EOB-DTPA, DWI, and combined Gd-EOB-DTPA and DWI) were reviewed independently by two observers. Statistical analysis was performed on a per lesion basis.

Results: MRI scans evaluated by the image set 1 (unenhanced sequences and after intravenous administration of Gd-EOB-DTPA) correctly identified 127/166 lesions with accuracy of 76.5% (95% CI 69.3-82.7) and 106/144 metastases with a sensitivity of 73.6% (95% CI 65.6-80.6). MRI scans evaluated by the image set 2 (unenhanced sequences and after intravenous administration of Gd-EOB-DTPA and DWI) correctly identified 148/166 with accuracy of 89.2% (95% CI 83.4-93.4) and 131/144 metastases with a sensitivity of 91% (95% CI 85.1-95.1).

Conclusion: The sensitivity and accuracy of set 3 is significantly better than both sets 1 and 2 (p < 0.0001). The sensitivity and accuracy of set 1 is significantly better than set 2 (p=0.0001).

Kinetics of Gd-EOB-DTPA in liver lesions suspect for metastases: a systematic comparison of raw data with arterial-input-function corrected data

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Purpose: Gd-EOB-DTPA is a liver-specific contrast agent for differentiation of focal liver lesions. Herein, our aim is to compare Gd-EOB-DTPA kinetics among benign and malignant lesions and to assess the effect of arterial-input-function (AIF) correction on this comparison.

Methods and Materials: Two blinded observers retrospectively reviewed consecutively examinations of 40 patients and identified 116 focal liver lesions (49 benign, 67 malignant). Reference standard was established on the basis of histopathology and follow-up examinations. Signal intensities (SI) were obtained for all identified lesions, healthy liver parenchyma, aorta and noise. For each lesion, these signal intensities were measured in the precontrast images as well as in the arterial, portalvenous, venous and late phase. Lesion signals now were evaluated using two different approaches (M1 and M2). M1 employed the lesions’ absolute SI and was corrected for the AIF with the aorta’s SI. M2 employed the lesions’ contrast-to-noise ratio and was corrected for the AIF with the aorta’s signal-to-noise ratio. M1 and M2 were compared.

Results: In M1 there was a significant difference between benign and malignant focal liver lesions in the late phase (P < 0.01). In M2 there was a difference in the arterial phase (P < 0.01). No other significant differences occurred in M1 and M2. Visual comparison showed that correction leads to more streamlined kinetics among all lesions.

Conclusion: AIF-correction may lead to further information about focal liver lesions, depending on what kind of correction is performed. Whether this information is diagnostically relevant needs to be determined.
Detection of colorectal liver metastases: sensitivity of T2-weighted and diffusion-weighted imaging using pathological examination as method of reference in a rat model

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Purpose: To compare the sensitivity of T2-weighted and diffusion-weighted imaging (DWI) in detecting colorectal liver metastases in a rat model.

Methods and Materials: Eighteen BDIX rats had surgery with 4 injections of 0.5 million DHDK12 cells in the left liver. MR examination included RARE T2-weighted imaging and SE-DWI (b = 0, 20 and 150 s/mm2). Sacrifice was performed immediately after MRI procedure. Images were analysed by two independent readers. Pathological examination was performed after slicing the whole liver every 0.4 mm. Average diameter of each liver metastasis was computed. Cochran Q-test was used to compare the detection rates.

Results: A total of 166 liver metastases were identified on pathological examination. Mean average diameter was 1.05 ± 0.8 mm. For both readers, a significantly higher number of metastases was detected on DWI than on T2-weighted images (99/166 (60%) vs. 77/166 (46%), p < 0.001 for reader 1 and 92/166 (55%) vs. 77/166 (46%), p=0.001 for reader 2). After stratification according to metastasis average diameter, DWI had a significantly higher detection rate than T2-weighted imaging for metastases with an average diameter between 0.3 and 1.2 mm (42/78 (54%) vs. 24/78 (31%), p<0.001 for reader 1 and 36/78 (46%) vs. 24/78 (31%), p<0.001 for reader 2). No difference was found between the two imaging techniques for metastases larger than 1.2 mm or smaller than 0.3 mm.

Conclusion: This experimental study with MR and pathological correlations shows the better sensitivity of DWI relative to T2-weighted imaging for detecting liver metastases, especially those of small size.

Impact of contrast-enhanced intraoperative ultrasound on operation strategy in case of colorectal liver metastasis

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Purpose: To evaluate the current impact of contrast-enhanced intraoperative ultrasound (CE-IOUS) on the initial surgical strategy for resection of colorectal liver metastasis (CRLM).

Methods and Materials: Eighty-six consecutive patients undergoing open liver resection for CRLM were evaluated retrospectively over a 2.5 years period. The patients underwent 97 operations. Preoperative staging was performed with standardised examination technique. CRLM were identified in venous phase as hypoechogenic lesions. CE-IOUS findings were compared with pathological examination. CE-IOUS was performed immediately after MRI procedure. Images were analysed by two independent readers.

Results: Combined CT/MRI identified preoperative 328 CRLM. Seventy-two additional lesions were identified during the operation. Intraoperatively 41 additional CRLM were identified. Combined CT/MRI identified 328 CRLM. Seventy-two additional lesions were identified during the operation. Intraoperatively 41 additional CRLM were identified. Seventy patients (34-71 years) were prospectively enrolled. Intraoperatively 41 additional CRLM were identified.

Conclusion: CE-IOUS is still an essential tool to ensure optimal and complete tumour resection. In case of a solitary CRLM the additional value of CE-IOUS might be debatable.

Diffused-weighted MRI for quantification of liver fibrosis

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Purpose: To evaluate the accuracy of diffused-weighted (DW) MRI for assessing the different stages of liver fibrosis.

Methods and Materials: 103 consecutive patients suffering different chronic liver diseases were studied by liver biopsy and by MRI. Patients with decompensated liver diseases were excluded. Diffusion-weighted MRI sequence was performed.
In-inflow phase, 5) MRCP; 6) 3D and 2D FLASH. Total examination time was recorded. Chi-square test and U-test were used for statistical analysis.

Results: The mean image quality for the automated processed examinations was rated higher for all categories and showed statistical significant difference in assessment of image contrast (mean±standard deviation 4.5 vs mean±standard deviation 4.1) and presentation of target organ (mean±standard deviation 4.4 vs mean±standard deviation 4.1) (* p < 0.05). The diagnostic confidence was 4.5±0.4 (p < 0.05), respectively. Mean examination time was 25.01 min in the automatically and 20.48 min in the manually processed examinations.

Conclusion: The completely automated MR scanner interface shows an increase in image quality and diagnostic confidence. The examination time was higher in the automatically processed examination due to longer lasting MR sequences.

B-0339  11:51
Alveolar echinococcosis of the liver: diffusion-weighted MR imaging findings
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Purpose: To report the diffusion-weighted MR imaging (DWI) findings in hepatic alveolar echinococcosis (AE). To evaluate the usefulness of apparent diffusion coefficients (ADCs) for differentiating the 5 types of AE lesions (as reported by Kodama, Radiology, 2003).

Methods and Materials: We retrospectively included 17 patients (10 women, mean age 64.3±years) with 48 AE liver lesions (>1 cm) that had been investigated by 3-Tesla MR imaging between March 2008 and August 2011 performing our standard protocol including DWI (b-values: 0, 300 and 600seconds/mm²). In consensus, two radiologists assessed lesion characteristics such as diameter, cystic and/or fibrotic components including Kodama classification, signal intensity, contrast enhancement, calcifications (on CT), and measured the ADC of each lesion. AE formation was confirmed by serology, biopsy and/or surgery in all patients.

Results: Seventeen lesions of Kodama type 1, 10 of type 2, 19 of type 3, 1 of type 4 and 1 of type 5 were found. Mean±standard deviation (mean±SD) ADCs of all AE lesions was 1.75±0.45×10⁻³mm²/s. Mean±SD ADCs of Kodama type 1, 2, 3, 4 and 5 lesions were 1.74±0.55, 1.71±0.49, 1.82±0.36, 1.46±0.44 and 1.43±0.10×10⁻³mm²/s, respectively. No significant difference was noted between the different Kodama types (p=0.89). Presence of fibrotic (p=0.24) and/or calcified (p=0.56) components, or contrast enhancement (p=0.84) of AE lesions were not correlated with significant differences in ADCs.

Conclusion: ADCs of AE lesions are relatively low compared to other cystic liver lesions, which is helpful in suggesting the diagnosis. However, ADCs were not found to be useful for differentiating Kodama types of AE lesions.

B-0340  10:30
Impact of cardiovascular risk factors and vessel wall inflammation on atherosclerotic disease progression: a PET/CT study
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Purpose: We hypothesised that atherosclerotic risk factors and vessel wall inflammation are associated with an accelerated progression of atherosclerotic disease as assessed by [18 F]Fluorodeoxyglucose (FDG)-PET/CT.

Methods and Materials: 94 tumour patients underwent whole body FDG-PET and contrast-enhanced CT twice within 12 months. Clinical risk factors for atherosclerosis and medications were documented. Blood pool-correlated standardised uptake value (TBR) and calcified wall volume (CWV) were measured in the aorta and both iliac and carotid arteries. Furthermore, pericardial fat volume (PFV) and mean aortic lumen area in the thoracic aorta were measured. The one-sample t-test and both iliac and carotid arteries. Furthermore, pericardial fat volume (PFV) and uptake value (TBR) and calcified wall volume (CWV) were measured in the aorta.

Regression analysis demonstrated that i) higher TBR values (P=0.009) and higher

B-0341  10:39
Diagnosis of large vessel vasculitises with 18-F FDG PET/CT: single centre experience on 64 patients
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Purpose: This is a retrospective study that aims to assess the diagnostic performance of 18F-FDG PET/CT in large vessel vasculitises (LVV); comparing different standards of image evaluation and taking into account concomitant immunosuppressive therapy.

Materials and Methods: Consecutive patients (n=64; 28 male, 36 female, mean age 55±years, range 14-86±years) were included in our retrospective analysis. Diagnosis of LVV was obtained on clinical consensus in 31 of 64 patients. Four types of analyses were used and compared with McNemar test: 1) semiquantitative maximal standardised uptake value (SUVMax), 2-3) qualitative evaluation on maximum intensity projection (MIP) images with a four-grade scale (0 to 3) repeated with two different cut-offs, 4) quantitative evaluation with collegial clinico-radiological correlation (considering: concurrent vascular pathology, local distribution, aero-cardio-vascular risk factors).

Results: Quantitative analysis with SUVMax cutoff value≥2.5 (sens 74.19%, spec 78.78%, acc 76.56%) did not show statistical significant differences compared to semiquantitative evaluation with higher cut-off (grade ≥2) (sens 64.51%, spec 84.84%, acc 75.00%). Semiquantitative analysis with lower cut-off (grade ≥1) had superior sensitivity but reduced specificity (sens 93.54%, spec 75.75%, acc 84.37%). Evaluation with collegial clinico-radiological correlation showed increase specificity, without a decrease in sensitivity (sens 93.54%, spec 93.93%, acc 93.75%).

Conclusion: Interpretation of 18F-FDG PET/CT exams in LVV needs to be based on efficient integration of clinico-radiological data, customised for each patient.

B-0342  10:48
Contrast-enhanced magnetic resonance angiography in management of pulmonary arterio-venous malformations in patients with HHT (Osler disease)
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Purpose: To evaluate contrast-enhanced magnetic resonance angiography (CE-MRA) for management of pulmonary arterio-venous malformations (PAVM) in patients with hereditary haemorrhagic telangiectasia (HHT), as well as a screening procedure for the detection and for follow-up after embolisation therapy.

Methods and Materials: 286 patients (mean age 45.9±years, male 118, female 168) with confirmed HHT or their first degree relatives underwent screening pulmonary CE-MRA (Gadolinium-BOPTA-0.1 mmol/kg bodyweight) for the presence of PAVM. Patients with at least one PAVM > 5 mm or a feeding pulmonary artery diameter > 3 mm were referred for catheter angiography (DSA) for embolisation therapy and underwent follow-up MRA for detection of reperfused PAVMs.

Results: Overall, CE-MRA detected 329 PAVM in 97 of 286 patients (149 in 44 men, 174 in 53 women, 89 in 32 patients of childbearing age). Most PAVMs detected on CE-MRA were small (<10 mm). 74 of 97 patients with 263 PAVMs detected on CE-MRA underwent global or selective DSA. Significantly (p < 0.001) fewer PAVMs (205/263 [78%]) were demonstrated on global DSA of which 191 were embolised. Follow-up CE-MRA showed 57 newly developed PAVM in 14 patients (interval 1-6years), and 32 reperfused PAVM (due to recanalisation, insufficient packing) in 24 patients (interval 3 months-7 years) of which 5 patients were embolised elsewhere. All reperfused PAVMs were confirmed by DSA and reembolised successfully.

Conclusion: CE-MRA should be the method of choice for the management of PAVMs in HHT patients. Due to the high sensitivity and the lack of ionising radiation MR should be preferred to CT if available.
Evaluation of acute pulmonary embolism detection using non-linear blending in dual energy computed tomography

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Purpose: To compare non-linear blending with standard linear blending (virtual 120 kV) and low kV images of dual energy CT pulmonary angiography for improved diagnostic image quality.

Methods and Materials: We compared 35 dual energy CT datasets of central and peripheral acute pulmonary embolism. A non-linear blending method based on a modified sigmoid function was compared with the low kV image series and the standard linear blending method that simulates the attenuation of a 120 kV scan. For the non-linear blending method we evaluated 37 different parameter settings with different blending centre and width. Contrast-to-noise-ratio (CNR) was calculated. Two independent radiologists evaluated the totally 39 image sets for their visual preference. Overall subjective image quality was rated with a 6-point-scale (1 = excellent image, 6 = non-diagnostic).

Results: With either one of the non-linear blending settings, the CNR was significantly higher compared with the low kV (CNR=27.4 ±16.6 and 3.35 ± 0.88 subjective overall image quality) and linear blending series (CNR=28.5 ±16.1 and 2.55 ± 1.00 subjective overall image quality). The optimal blending centre and width for highest CNR (CNR=63.8 ±38.0 and 2.7 ± 1.08 subjective overall image quality) results strongly depended on the level of contrast enhancement in the pulmonary arteries. However, on subjective image quality rating, the image series with the highest CNR was rated in 21 of 35 cases (60%) as the best in terms of optimal image quality. Conclusion: Non-linear blending of dual energy pulmonary computed tomography allows significant increase of CNR and image quality.

Imaging findings in arterial stenosis and mural involvement in Takayasu arteritis on CEMRA

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Purpose: To assess vessel involvement and activity of Takayasu arteritis with whole body MRA.

Methods and Materials: 25 patients with diagnosis of TA were subjected to whole body MRA with Gadolinium dimeglumine. According to vasculitis activity score, 19 patients were classified as having active/persistent disease and 6 patients as having remissive disease. The arterial system was divided into 32 segments of 5 regions. The image quality, wall thickness and wall signal intensity were evaluated by three radiologists who were not knowing clinical data. Quality analysis was performed, statistically significant differences in SI values of AD and RD were tested on a per region basis.

Results: A total 750 arterial segments with good to excellent image quality were assessed. 5 extravalvular manifestation were identified. In 8 patients mononatous could not depict vessel involvement. The vessel wall thickness of the AD group was thicker than that of RD group. Post-contrast SI ratio was significantly different for both the groups. Per region analysis revealed higher signal intensity in carotid and subclavian regions in both groups.

Conclusion: Whole body MRA offers a complete and comprehensive documentation of the vessel involvement. MRA is very useful modality for Takayasu arteritis staging, whether disease is active or not and is also in follow-up for therapy management.

Usefulness of CT angiography of celiac axis prior to pancreaticoduodenectomy

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Purpose: To perform a CT angiography of the celiac axis (CA), to detect the presence of stenosis due to atherosclerosis (AS) or to the median arcuate ligament (MAL), and to correlate it with the prevalence of complication after surgery.

Methods and Materials: We revised retrospectively 46 patients who underwent to pancreaticoduodenectomy between 2006 and 2010 in the Surgery Department of our Institution. Each patient MRA allows to a CT angiography (within 2-18 days before the surgery) with a 64 slice (64 x 0.5 mm slices) scanner after administration of 90 ml of ioinlated contrast media to detect the presence of stenosis of CA (>50% of lumen reduction). The prevalence of pancreatic fistula (PF) was collected from the Patient's clinical history.

Results: Of the 46 patients included, 17 presented a CA stenosis (10 due to MAL, 7 due to AS). After the surgery 18 patients developed a PF, of this group 13 presented a stenosis of CA.

Conclusion: We observed a significant correlation (P <0.0001) between the presence of stenosis of CA and the development of PF that is a major complication of pancreaticoduodenectomy and is related to a mortality rate of 20-40%. A stenosis of CA is easily treated during the surgery and must be therefore included in the report of the pre-surgery CT exam.

Vascular anomalies in a population with Turner syndrome: real adjudicative diagnostic role and clinical impact of magnetic resonance angiography (MRA) vs echocardiography (ECHO)


Purpose: Turner syndrome (TS) is associated with congenital heart diseases (CHD), aortic dilation and dissection, but also with a high prevalence of vascular anomalies, not easily depicted by ECHO. We tested the adjudicative diagnostic value of MR versus ECHO to identify the prevalence of vascular anomalies in a TS population ecchocardiographically pre-selected for the absence of CHD, excepting bicuspid aortic valve (BAV).

Methods and Materials: Retrospective analysis of MR aortic study of 111 TS patients was performed to evaluate minor and major vascular anomalies. All MR studies included thorax, aorta and oblique sagittal spin-echo sequences, and 98/111 thoraco-abdominal MRA.

Results: MR showed vascular anomalies in 44 patients (39.6%): the most frequent is aortic arch elongation (32 patients, 29%). Among major anomalies misdiagnosed by ECHO, MR analysis identified 10 partial anomalous pulmonary venous returns (PAPVR) (9%), 3 inferior vena cava interruption, 5 peripheral arteries aneurysms (4.5%). The subgroup with BAV (20 patients) shows higher prevalence of malformations (55%; p <0.05), especially elongation and PAPVR (35%). Among patients not affected by BAV, comparative analysis between groups with and without vascular malformations (PAPVR excluded) showed higher aortic dilation prevalence in the malformation group (p <0.05). MR analysis identified 4 PAPVR not reported at first evaluation.

Conclusion: MR has an adjudicative diagnostic power versus ECHO, identifying several vascular malformations otherwise misdiagnosed and a potential clinical impact on TS natural history. MRA must always be performed in TS to integrate ECHO study. MR evaluation, especially in BAV patients, must be extended to all the thoracic vasculature.

3D reconstructed contrast-enhanced MR angiography: 1.5 Tesla vs 3 Tesla in detection of the different branches of the internal iliac artery in females scheduled for uterine artery embolisation

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Purpose: To compare the ability of the 1.5-Tesla (1.5 T) MRI versus the 3-Tesla (3 T) MRI in detecting the different branches of the internal iliac artery (IIA) before UAE using 3D-reconstructed contrast-enhanced MR-angiography (CE-MRA).

Methods and Materials: Pre-embolisation CE-MRA from 84 females (mean age: 44.9 years) were retrospectively evaluated by 2 radiologists in consensus. Studies were done using a 1.5 T (n=49, 98 IIA) and 3 T (n=35, 70 IIA) MRI and 3D-images were reconstructed using Syngo-VesselView. A scoring system of 3 Grades was used: score 0 means that the artery was not seen, interrupted or its origin was not identified, score 1 means that the artery was faintly seen but can be traced with no missing segments till it gives off its first branch, score 2 means that the artery was clearly seen. Differences between both systems were tested using Mantel-Haensel-Test.

Results: The superior-gluteal artery was detected in the 1.5 T in 98 arteries (sensitivity (S)=1), in the 3 T in 70 arteries (S=1), no statistically significant difference was noted between both systems (p=0.82). Inferior-gluteal: 1.5 T (n=98,S=1), 3 T (n=70,S=1) no difference (p=0.4). Internal-pudendal: 1.5 T (n=96,88,S=0.98), 3 T (n=70,S=1), no difference (p=0.055). Middle-rectal: 1.5 T (n=11,S=0.11), 3 T (n=17,S=0.24), no difference (p=0.12). Iliococcygeal: 1.5 T (n=84,S=0.86), 3 T (n=69,S=0.99), significant difference noted (p=0.0047). Lateral-sacral: 1.5 T (n=96,S=0.89), 3 T (n=76,S=1), significant difference noted (p=0.0079). Uterine: 1.5 T (n=95,S=0.97), 3 T (n=70,S=1), significant difference noted (p=0.017). Obturator: 1.5 T (n=81,S=0.83), 3 T (n=67,S=0.96), significant difference noted (p=0.0006). Superior-vesical: 1.5 T (n=21,S=0.21), 3 T (n=32,S=0.46), significant difference noted (p=0.0009).

Conclusion: The 3 T was superior to the 1.5 T in detecting all IIA branches except the internal pudendal, middle rectal, superior and inferior gluteal arteries in which both systems showed similar performance.
B-0348 11:42
Low dose contrast-enhanced time-resolved MR angiography at 3 T: diagnostic accuracy for treatment planning and follow-up of body vascular malformations
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Purpose: To assess the accuracy of low dose contrast-enhanced time-resolved 3 T MR-angiography (MRA) for the morphological and functional assessment of vascular malformations (VM) and to evaluate its diagnostic potential in planning treatment and for the depiction of treatment-induced changes.

Methods and Materials: Twenty-five patients with known VM underwent MRA to evaluate the location and extent of lesions and their haemodynamic characteristics. 3D T1-weighted time-resolved sequences were acquired following the administration of 0.05 mmol/kg of gadobenate dimeglumine (Bracco, Milan, Italy). VM were classified according to their morphology and haemodynamic characteristics (high flow or low-flow). This lead to the subsequent patient’s management: transcatheter embolisation for high flow VM, percutaneous sclerotherapy in case of low-flow VM, or combined approach for artero-venous VM. Follow-up MRA was performed 30 days after treatment to assess morphological and functional changes.

Results: Based on haemodynamic characteristics, VM were classified as predominantly arterial (4 [16%]), artero-venous (19 [76%]) or venous (2 [8%]). Twenty-three (92%) lesions were classified as high-flow VM and 2 (8%) as low-flow VM. Complete exclusion of the nidus was obtained in 20 patients (80%) of patients, leading to a dimensional reduction and regression of aesthetic impairment or symptoms.

Conclusion: Low dose contrast-enhanced time-resolved 3 T MRA can accurately define morphological and functional aspects of VM during treatment planning and follow-up, and can identify post-therapy changes that positively correlate with treatment outcome. Moreover, MRA can avoid radiation exposure considering the youth age of these patients.

B-0349 11:51
Automated Doppler angle correction in liver transplant ultrasound
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Purpose: To evaluate the clinical feasibility of automatically corrected Doppler angle in hepatic vessels.

Methods and Materials: This prospective study was approved by the institutional review board; all patients gave their written consent to participate. 150 hepatic vessels were evaluated in 15 patients (total of 10 arteries and veins per patient) after liver transplant with ultrasound using a curvilinear 5-1 MHz transducer; manual Doppler angle correction was performed as the gold standard, followed by automated Doppler angle correction, both performed by the same operator with 10 years of experience in abdominal Doppler ultrasound, blinded to the measurements of the competing method. Doppler angles and peak velocities using manual and automated correction of Doppler angle were recorded. Results were analysed using regression analysis and a Bland-Altman (Difference) plot. Case-by-case analysis was performed for Doppler angles discrepant by more than 9 degrees to evaluate for possible aetiologies.

Results: 141 vessels were successfully examined. A strong correlation was found between the manually adjusted and the automated angle correction. The mean discrepancy of Doppler angles was 1.67 degrees (SD=9.95 degrees, correlation coefficient = 0.88). The mean discrepancy of peak velocities was 0.72 cm/s (SD=14.1 cm/s, correlation coefficient = 0.95). Causes for discrepant angles above 9 degrees included curved and bifurcating vessels, low eccentricity merged vessels, user’s preference of Doppler gate placement and other. Discrepancies were deemed clinically non significant.

Conclusion: Automation of Doppler angle correction is clinically feasible in the evaluation of hepatic vasculature. It may enhance standardisation and reproducibility of Doppler measurements.

B-0350 10:30
Development of in-hospital x-ray radiographic system using rotating cerium anode for coronary and cerebral microangiography

Purpose: As conventional angiography cannot visualise small arteries with a diameter of < 500 μm, we developed an in-hospital microangiographic system and evaluated its performances in basic experiments.

Methods and Materials: The microangiographic system consists of a rotating cerium anode and a large heat unit (SMHU) x-ray generator. The quasi-monochromatic x-ray spectra has a peak at 54.6 KeV and have a narrow energy band of 20 KeV in half maximum, which can efficiently detect small amount of iodine-contrast in small vessel. The high x-ray photon flux generated by SMHU generator allows to maintain enough photon number at the surface of a flat panel detector of spatial resolution of 50 μm even after passing through the adult body. Canine heart and brain of which arterial beds are filled with iodine-containing microspheres with a diameter of 15 μm was used as the test samples.

Results: The angiographic system visualised intramural small coronary arteries entirely from their epicardial origin to subendocardial terminal portions in the excised heart, and the perforating branches of cerebral arteries arising from the middle cerebral arteries and reaching to the deep subcortical lesions in the brain model. Vascular diameter measurement revealed a step-wise narrowing with a fixed reduction ratio as branching in the range of 50-500 μm.

Conclusion: The present angiographic system will lead to better prediction of therapeutic effects of percutaneous coronary intervention and/ or coronary bypass surgery, and better understanding of cerebral white matter disease related to vascular cognitive impairment in clinical settings.

B-0351 10:39
4D Guidance in interventional radiology: prototype development and feasibility study
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Purpose: To allow for volumetric (3D+time) radiological guidance of interventions at the same low dose levels as conventional projection fluoroscopy (2D+time) guidance.

Methods and Material: Today, radiological guidance of interventions is limited to projection fluoroscopy and repetitive full-dose volumetric CT scans. The use of continuous CT imaging, allowing true 4D intervention guidance suffers from prohibitive radiation dose. To reduce its dose to acceptable levels a compressed sensing CT reconstruction algorithm using prior information was developed and implemented. Guided interventions were simulated in phantoms and pig models. During interventions, continuous rawdata acquisition using a prototype flat-panel CT system was performed. 4D datasets of the intervention process were reconstructed with various undersampling ratios corresponding to various dose levels. Image quality was evaluated for the use in 4D interventional guidance by visual inspection. X-ray doses were compared to biplane fluoroscopy.

Results: Reconstruction results showed sufficient image quality for high contrast materials allowing as few as 12 projections per reconstruction. Guidewires and stents were visible in a 3D setting, could be followed while moving and located clearly with respect to vessels and their surrounding. Radiation doses of 4D guidance (47µGy/s), albeit slightly higher, were still in the order of biplane fluoroscopy (24µGy/s).

Conclusion: 4D interventional guidance is possible without exceeding acceptable x-ray dose values. Using prior information and compressed sensing image reconstruction techniques, real-time 4D guidance approaches may become an attractive method for intervention guidance with a great potential to make interventions faster, safer and to make more complex interventions possible; with a significant benefit for patient health.
Scientific Session

**B-0352 10:48**

4D intervention guidance: a technical feasibility consideration

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**Purpose:** To investigate the overall feasibility of 4D intervention guidance using current flat-panel CT technology.

**Methods and Materials:** Recent research suggests that 4D intervention guidance may become feasible by the use of novel reconstruction algorithms and prior information. To this end, continuous 3D data acquisition using a circular trajectory might be the most straightforward solution. Total dose of update scans can be distributed among various amounts of projections. Mathematical simulations as well as real phantom scans were performed. FDK reconstructions were used for high-resolution prior images, temporal updates were reconstructed using compressed sensing algorithms (including PICCS and ASD-POCS). For temporal update reconstructions, various noise levels per projection and different undersampling ratios were used, while the overall dose for every reconstruction was kept constant. Electronic detector noise was not included into simulations. Image quality was evaluated automatically (e.g., by a modified universal quality index) and by visual inspection.

**Results:** Image quality varied largely between algorithms and reconstruction parameters. For the distribution of the total dose to various amounts of projections a maximum image quality was found to be reached at the order of 25 to 40 projections per update reconstruction in simulations of typical interventional situations (e.g., stent placement, 100 ASD-POCS iterations). Both, more and less projections suffered from larger noise and undersampling effects.

**Conclusion:** These data suggest that with current flat-panel technology (readout rates 30 to 60 fps) and gantries rotating at about one to two rotations per second a sufficient 4D intervention guidance with up to three updates per second can be realised.

**B-0353 10:57**

2D curvelet spatio-temporal filtering applied to x-ray digital flat panel detector imaging

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**Purpose:** x-ray intervention imaging is particularly challenging in terms of dose reduction and de-noising. Indeed, cardiac and respiratory motion coupled with dense anatomies are among the major reasons for low signal-to-noise ratio in fluoroscopic imaging. To improve significantly low dose fluoroscopic image quality, interventional devices and bone visibility is increased while the image background noise is decreased.

The 2D curvelet spatio-temporal filtering is applied on x-ray images representing guidewires and stents. Input contrast-to-noise ratio is between 0.5 and 2.5. We demonstrate that our method outperforms wavelet-based spatio-temporal filter. The proposed method removes most of the gaussian noise and leaves some minor spike noise induced by the temporal filtering.

**Conclusion:** Our work demonstrates that combined curvelet and temporal filtering improves significantly low dose fluoroscopic image quality. Interventional devices and bone visibility is increased while the image background noise is decreased.

**B-0354 11:06**

Radiation exposure in vascular angiographic procedures

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**Purpose:** To investigate the radiation exposure in vascular angiographic procedures and to search strategies for dose reduction.

**Methods and Materials:** 764 consecutive vascular interventional procedures performed over 1 year were analysed including diagnostic DSA, recanalisation and PTa/stent in the pelvis and leg. EVAR, embolisation of lumbar arteries, PTa/stent of renal arteries, embolisation of diverse bleedings and other rarely performed interventions. They were analysed with respect to the fluoroscopy time and the resulting fluoroscopy radiation dose, the radiation dose of the radiographic frames, and the overall dose. Additionally, the investigators experience on the total dose was investigated.

**Results:** Overall, 70% of the total radiation dose was due to the acquisition of radiographic frames leaving only 30% of the total dose being applied by fluoroscopy (p < 0.001). The investigators experience had no significant impact on the total dose applied, most likely since there was no stratification to intervention-complexity.

**Conclusion:** Image grabbing of fluoroscopy should be used for documentation whenever possible. Interventional radiologists should be aware of the radiation exposure of different procedure types. A registry of radiation exposure should not only comprise a sufficiently large number of interventions but also different intervention types in order to develop reference levels.

**B-0355 11:15**

A new method of real time skin dose visualisation: clinical evaluation of fluoroscopy-guided interventions

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**Purpose:** The radiation exposure in fluoroscopy-guided interventions (FGI) is a major issue for the Public Health. The increasing complexity of FGI enhances the risk of creating side effects for patient such a radiation induced skin injuries. Currently dose area product (DAP) estimate the patient skin dose. This study evaluated an innovative awareness tool that displays directly the real time peak skin dose information.

**Methods and Materials:** We have tested during 6 months a new machine parameter-based dose calculations method (MAPDOC) on 50 patients population scheduled for head and neck, thoracic and abdominal FGI. Currently, angiographic system provides a basic cumulative air kerma value. MAPDOC method provides a real time air kerma mapping on a sphere patient model. It takes into account all relevant acquisition parameters (table height, angulation, collimation). This method is prospectively compared to radiocromatic films for every patient, for monoplane and biplane angiographic systems.

**Results:** Findings between MAPDOC and radiochromic films are closely correlated with a constant correction factor depending on procedure type (average ratio 1.30 for monoplane thoracic and abdominal procedures, 0.95 for monoplane cerebral procedures and 1.65 for biplane cerebral procedures) and procedure parameters (patient weight, C-arm angulations, collimation, ...). Mapping on a sphere patient model is closely correlated to radiocromatic films dose mapping and allow to optimise skin dose repartition during FGI.

**Conclusion:** MAPDOC provides a reliable real time feedback on patient skin dose and mapping during FGI. This innovative tool allows physician to optimise FGI procedures and prevents skin injuries.

**B-0356 11:24**

Study of a real-time dosimetry system and its impact on current practices in an angiography room

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**Purpose:** The radiation exposure in fluoroscopy-guided interventions (FGI) is a major issue for the Public Health. In our institution, we studied the impact of a new real-time dosimetry system (Philips DoseAware) on operators' exposure.

**Methods and Materials:** The Dose Aware System allows operators to see their personal dose-rate at a glance, during a procedure. Each Personal Dose-Meter (PDM) measures Hp (10) which is send wirelessly to a Base Station, a screen mounted next to the radiology monitors. The study consisted on the comparison of two measurements periods. First, the blinded phase, consisting radiation measurements by core lab with the screen off for operators. Then a regular stage, consisting measurements with the screen on.

**Results:** More than 21.000 elements of information have been treated during 6 months. The interpretation on cerebral angiography procedures showed a dose reduction for all operators: 45% for physicians, 25% for technicians and 8% for nurses.

**Conclusion:** The Philips DoseAware is an interesting optimisation tool for the operators’ exposure during cerebral angiography procedures. We intend to study this system on others FGI procedures. However, this system could be used also to estimate operators eye lens exposure, especially in the context of new recommendations project of Ionising Radiations Protection (ICRP) to reduce the eye lens’ exposure limit (150 to 20 mSv per year).
Purpose: Many studies proved that radiological breast density can be a predictive element of cancer risk. Radiologists evaluate breast density according to a visual analysis of the images, using BIRADS classification. A dedicated software, Quantra 1.3, can reduce errors associated with this qualitative method. The software makes a numeric measure, on mammography views, of breast and fibroglandular tissue volume, then it calculates the volumetric percentage of fibroglandular tissue of breast. The aim of this work is to provide a calibration in order to correlate the numerical result of Quantra with the BIRADS scale and then with the real breast density.

Methods and Materials: Four compressible phantoms were made, filled with substances of known density between 0.79 and 1.0 g/cm3, to simulate typical densities of real breasts. Mammographic images of phantoms were processed by the software. Finally digital mammograms of 24 patients was submitted to Quantra and then to radiologists in order to derive estimations of breast density according to BIRAD system.

Results: The numerical evaluation provided by Quantra on phantom breasts has been related with known densities (R=0.96). Using this calibration, the breast densities of 24 were calculated. These values show a correlation with the radiologists evaluations based on BIRADS scale (R=0.97).

Conclusion: Quantra help radiologists to estimate volumetric percentage of the fibroglandular tissue of breast, but it is necessary a proper calibration of this software to obtain the correct relation between Quantra results and real breast densities. This method enables to relate Quantra numbers with quantitative evaluations with BIRADS scale.
software (TeraRecon, CA, USA) in comparison with MR and Echo, both performed on the same day. During all the examinations HR has been recorded. MDCT interobserver-agreement was also assessed.

Results: HR recorded during the examinations resulted lower for MDCT (74.2±8.0) (p <.01). EF resulted lower for MDCT (MDCCT:57.1±7.5, MR:61.3±10.0, Echo:60.7±6.6) (NS). In comparison with MR for the assessment of LV volumes, MDCT showed higher EDV (MDCT:159.2±22.9 mL, MR:135.0±31.2 mL, p <.01), ESV (MDCT:70.4±17.9 mL, MR:59.7±22.7 mL, p <.01) and SV (MDCT:88.8±16.7 mL; RM: 76.1±16.0 mL, p <.01), but with moderate-to-good correlation (r=0.647, r=0.565, r=0.815, respectively) (p <.05 to 0.1). Slightly higher CO for MDCT was found (MDCCT:6.6±1.3L, MR:6.3±1.3L, p <.01), with a high correlation coefficient value (0.959, p <.01). MDCT showed slightly higher values of Mass (MDCT:120.6±25.9 g/ m2, MR:105.7±23.4 g/m2) (p <.01), but with a high correlation (r=0.795, p <.01).

Excellent was the MDCT interobserver-agreement (CCC<e>0.95).

Conclusion: MDCT allows the evaluation of heart-transplanted patients, obtaining diagnostic images with a relatively good agreement and correlation with MR for LVF assessment. It seems sufficiently reproducible to consider its application in the F/U and to support therapeutic strategies, with the advantage to perform LVF assessment within a global diagnostic approach including coronary arteries evaluation in one single very fast acquisition.

B-0362 10:48
Can segmented 3D images be used for stenosis evaluation in coronary CT angiography?

Purpose: To retrospectively evaluate the diagnostic accuracy of coronary CT angiography (CCTA) using segmented 3D data for the detection of significant stenoses.

Methods and Materials: CCTA datasets from 30 patients were acquired with a 64-slice CT scanner and segmented using the region growing (RG) method and the “virtual contrast injection” (VC) method. Three types of images of each patient were reviewed by different reviewers for the presence of stenoses with diameter reduction of 50% or more. For the original series, the reviewer was allowed to use all the 2D and 3D visualisation tools available (conventional method). For the segmented results (from RG and VC), only maximum intensity projection was used. Evaluation results were compared with catheter angiography (CA) for each artery in a blinded fashion.

Results: Thirty-four arteries with significant stenosis were identified by CA. The percentage of evaluable arteries, accuracy and negative predictive value for detecting stenosis were, respectively, 86%, 74% and 93% for the conventional method, 83%, 71% and 92% for VC, and 64%, 56% and 93% for RG. Accuracy was significantly lower for the RG method than for the other two methods (p <0.01), whereas there was no significant difference in accuracy between the VC method and the conventional method (p = 0.22).

Conclusion: Diagnostic accuracy for RG-segmented 3D data was lower than with access to 2D images. However, as a screening step, 3D methods may be useful complement to 2D reviewing. The VC-based method is more promising for this purpose than the RG-based method.

B-0363 10:57
Diagnostic accuracy of coronary CT angiography for stenosis detection according to calcium score: systematic review and meta-analysis
M.A.M. den Dekker1, A. Hidalgo, M. Descalzo, R. Leta-Petracca, L. Segura, S. Pujadas, F. Carreras, G. Pons-Llado; Barcelona/ES (alhidalgop@gmail.com)

Purpose: The purpose of this study is to assess the accuracy of coronary computed tomography angiography (CTA) for detecting significant coronary artery disease (CAD; ≥70% lumen reduction) and evaluate the impact in the risk stratification of middle aged asymptomatic patients.

Methods and Materials: A total of 310 consecutive middle aged asymptomatic individuals (87 men; mean age 55.9 years) underwent CTA (320-slice multidetector row computed tomography) as part of a general health screening. Median follow-up was 3.8±2 years (1-7.5 years).

Results: Atherosclerotic plaques (AP) were identified in 163 (55.3%) individuals. 19 individuals (6.4%), luminal stenosis was significant (≥70%). Aged (decade), male gender (p<0.005), diabetes (p=0.025), serum cholesterol, smoking and hypertension (p=0.0001) were related with the presence of atherosclerosis. The patient group with AP had a medium of cardiovascular risks greater (2.1±1.1 vs 1.2±1.1, p<0.001). In the midterm follow-up 1 patient died because of a cardiovascular cause, 1 patient had myocardial acute infarct and required stent implantation. Both had non-obstructive AP at CTA. 3 patients had atypical chest pain.

Conclusion: The prevalence of subclinical atherosclerosis showed by CTA in an asymptomatic population is high and it was related with a higher number of cardiovascular risks. Nevertheless, the number of major events in the midterm follow-up was low.

B-0366 11:24
Utility of computed tomography coronary angiography (CTCA) in diagnosis of cardiac allograft vasculopathy (CAV)
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Purpose: To evaluate the diagnostic accuracy of dual source computed tomography coronary angiography (CTCA) compared to invasive coronary angiography (ICA) and intravascular ultrasound (IVUS) for detection and quantification of in-stent restenosis.

Methods and Materials: Fifty-one patients with percutaneous coronary intervention of the LM were prospectively evaluated. Thirty-four of them underwent 56 complete follow-up examinations (median 6 months after intervention; CTCA, ICA and IVUS as gold standard examination) that focused on detection and quantification of restenosis.

Results: Sensitivity, specificity, positive and negative predictive values of ICA and CTCA were 100%, 94%, 50% and 100% and 74%, 18%, 100%, respectively. There was a moderate correlation between the minimal luminal areas (MLA) measured by CTCA and IVUS (r=0.63; p <0.01). A Bland-Altman analysis showed that the MLA measured by CTCA was underestimated (mean difference 2.1±2.2 mm2).

Conclusion: These results suggested that dual source CTCA has a high negative predictive value and might be considered a less invasive alternative to ICA for exclusion of LM in-stent restenosis. However, there was only a moderate correlation between the measurements of MLAs by IVUS and CTCA in the stented LMs. Therefore, finding of any restenosis according to CTCA should be re-evaluated by ICA or, better, by subsequent IVUS.

B-0365 11:15
Coronary computed tomography angiography for detection of occult coronary artery disease in asymptomatic patients
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Purpose: The purpose of this study is to assess the accuracy of coronary computed tomography angiography (CTA) for detecting significant coronary artery disease (CAD; ≥70% lumen reduction) and evaluate the impact in the risk stratification of middle aged asymptomatic patients.

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Conclusion: The prevalence of subclinical atherosclerosis showed by CTA in an asymptomatic population is high and it was related with a higher number of cardiovascular risks. Nevertheless, the number of major events in the midterm follow-up was low.
Impact of different levels of coronary calcium score on the prevalence of coronary artery stenosis in patients with an intermediate pre-test likelihood of coronary artery disease

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Purpose: To investigate the prevalence of significant coronary artery stenosis on coronary catheterization in patients with an intermediate pre-test likelihood of coronary artery disease at different levels of coronary calcium score (CCS).

Methods and Materials: 87 patients (33 females, 66 ± 10 years) with an intermediate pre-test likelihood of coronary artery disease underwent CCS-CT prior to coronary catheterization. The prevalence of significant coronary artery stenosis (>50%) on coronary catheterization was correlated to 5 different CCS levels using the Agatston score (AS): >0; AS >10; AS >100; AS >200; AS >400).

Results: Mean AS was 571 ± 599. Coronary catheterization revealed stenosis >50% in 87% of 87 patients. Mean AS of patients with confirmed stenosis >50% was 637 ± 484; range 3 - 1775. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) to predict significant stenosis on coronary catheterization was 100%, 15.6%, 67.1% and 100% using an AS cut-off value >0; 96.4%, 25%, 68.8%, 80% using an AS cut-off value > 10; 87.3%, 40.6%, 71.6%, 65% using an AS cut-off value > 100; 83.6%, 50%, 74.2%, 64% using an AS cut-off value >200 and 60%, 65.5%, 75% and 48.8% using an AS cut-off value > 400, respectively.

Conclusion: In patients with an intermediate pre-test likelihood of coronary artery disease an AS between 0-10 makes a significant coronary artery stenosis very unlikely. Thus, CCS-CT provides additional information in combination with traditional clinical risk factors e.g. Framingham score to accurately predict the risk of those patients.

B-0368 11:42
Influence of intracoronal enhancement on performance of second generation dual source CT coronary angiography

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Purpose: To assess the effect of intracoronal enhancement on diagnostic accuracy using second generation dual source computed tomography coronary angiography (CCT). The developed method is able to identify those which need a treatment.

Methods and Materials: 142 patients with suspected coronary artery disease who underwent conventional coronary angiography (CA) and CCT were evaluated. CCT was performed with collimation 64x2x0.6 mm and rotation time 280 ms using 100 ml of high concentration contrast material (Iomeprol 400; 400 mgI/ml) administered at 6 ml/s. The study population was divided into two groups of 71 patients based on median (332 HU) vascular attenuation measured at the origin of the coronary arteries (group 1 = mean attenuation <median value; group 2 = attenuation >median value). Image quality and diagnostic accuracy for the detection of significant coronary artery stenosis was determined and compared for both groups.

Results: No significant differences between groups 1 and 2 were noted in terms of age, gender, heart rate, coronary calcium score and body mass index. Overall, 528 significant stenoses (134 in group 1 and 124 in group 2) were detected in 1709 assessable coronary artery segments. The average intra-coronal attenuation was significantly (p < 0.05) higher for group 2 (396±46 HU) compared to group 1 (298±33 HU). Image quality and corresponding sensitivity/specificity values were higher for group 2 (99.2% and 97.8%, respectively) than for group 1 (85.1% and 93.0%, respectively).

Conclusion: Higher intra-coronary attenuation results in higher image quality and diagnostic accuracy for detection of coronary artery stenosis using second generation dual source computed tomography coronary angiography.
B-0371 10:39
Automated detection and measurement of uterine peristalsis in cine MR images
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Purpose: Changes in direction and incidence of uterine peristalsis, namely wavy conduction of subendometrial myometrium (junctional zone), are supposed to strongly affect conditions such as infertility and dysmenorrhoea. In this study, we have developed and evaluated software to detect and quantify the peristalsis in cine MR images.
Methods and Materials: A total of 60 serial HASTE images in a midsagittal plane of the uterus of 11 healthy females were obtained every 3 seconds. Uterine peristalsis was defined as rhythmic changes of signal intensities and their propagations in junctional zones. Our software first calculated cross-correlation between time courses of pixel intensities in a section of junctional zone and those of neighbouring sections. The cross-correlation was high with appropriate time-lag when travelling wave was present. For the sections where the travelling waves were detected, the software calculated auto-correlation of time course of the signal intensities and obtained wave periods from peak intervals of the auto-correlation. Two radiologists, meanwhile, visually assessed uterine peristalsis using the same image series.
Results: The results from the automated method were consistent with those of visual assessments from 20 out of 60 cine MR images, including 13 cases of peristalsis. Two radiologists, meanwhile, detected uterine peristalsis in 27 cine MR images, including 13 cases of peristalsis. For the sections where the travelling waves were detected, the software calculated auto-correlation of time course of the signal intensities and obtained wave periods from peak intervals of the auto-correlation. Two radiologists, meanwhile, visually assessed uterine peristalsis using the same image series.
Conclusion: Uterine peristalsis can be detected and counted by automated evaluations. Our method may be used for a routine functional assessment of uterus.

B-0372 10:48
Digital perfusion phantoms and their use in perfusion validation
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Purpose: Despite the increasingly broad use of perfusion applications, we still have no generally accessible means for their objective validation. To solve this problem, we introduce digital perfusion phantoms (DPP) - simulated DICOM image sequences, specifically designed to have known perfusion maps with simple visual patterns.
Methods and Materials: Let S be a temporal perfusion image sequence S={I0, I1, In-1, In, In+1}. We define digital perfusion phantom (DPP) as a computer-simulated image sequence S, where each temporal pixel value In (x,y)=In (x,y;tn) is generated to have predefined visual perfusion map patterns. That is, given blood flow FB, blood volume VB and mean transit time TM maps, we build DPP image sequence S to produce these maps. While any perfusion algorithm works a numerical solver for perfusion convolution equation, DPP becomes a known solution to it, which can be used to verify the algorithm correctness.
Results: We developed a 45-image DPP where FB, VB and TM maps consist of simple linear patterns. We then processed our DPP with several perfusion packages, comparing the resulting maps to the expected. This comparison provided an instantaneous and objective visualisation of algorithms’ deficiencies, as well as their sensitivity to noise and small details. DPP, used with different perfusion software and protocols, can clearly visualise processing errors and discrepancies.
Conclusion: Processing DPP perfusion sequence with any perfusion algorithm/ software of choice, and comparing the results to the expected DPP patterns provides a robust and straightforward way to control the quality of perfusion analyses, software, and protocols.

B-0373 10:57
Automated semantic navigation and synchronised alignment in baseline and follow-up full body CT scans: clinical feasibility and accuracy
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Purpose: Comparing findings from initial and follow-up examinations in increasing full body CT data is a challenging and time-consuming task for radiologists. We evaluated practicability and performance of automated semantic navigation and synchronised alignment in routine clinical follow-up CT data.
Methods and Materials: Initial and follow-up CT studies from 16 oncological patients undergoing routine CT staging were retrospectively incorporated into THESEUS-MEDICO-software (German federal project-number 01MQ0702U), which automatically detects organs and anatomical landmarks, used for automatic semantic alignment and prediction of findings locations in follow-up data from baseline findings locations. 205 relevant reported findings, e.g. lymph nodes or vessel junctions, were evaluated. Manual navigation by two experienced radiologists to corresponding findings in follow-up data was taken as gold standard and compared to system-based navigation. Error in mm between manual and automatic navigation was documented as cranio-caudal-, ventro-dorsal-, lateral-left or lateral-right deviation. Mean deviations and intra-class correlation coefficient (ICC) were evaluated.
Results: The mean deviation of the reported 205 lesions for reader 1 was 9.6 mm with similar deviations in all directions (4.4 mm cranial; 5.7 mm caudal; 5.1 mm ventral; 5.2 mm dorsal; 4.5 mm lateral-left; 4.0 mm lateral-right), and 9.2 mm for reader 2 (4.1 mm cranial; 5.4 mm caudal; 5.1 mm ventral; 4.8 mm dorsal; 4.4 mm lateral-left; 4.2 mm lateral-right). ICC was 0.9. For both readers there was no deviation bias in a particular direction.
Conclusion: Automated semantic navigation in CT follow-up data provides clinically sufficient accuracy and reproducibility allowing automated side-by-side viewing of corresponding locations in baseline and follow-up data. It should improve handling large datasets and speed up radiological reading.

B-0374 11:06
An automated method for visualising changes in vessel wall dynamics
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Purpose: The study of effects of vascular interventions is today mostly limited to static vessel models. This represents an over-simplification in the case of the thoracic aorta, which is strongly influenced by the motion of the myocardium.
Methods and Materials: In this paper, we propose a framework enabling the quantification and visualisation of the motion of the thoracic aorta from ECG-gated CTA sequences during the cardiac cycle. The vessel is segmented and tracked automatically through a heartbeat. The extracted motion of the aorta is deconstructed in measures of pulsation, bending and stretching. We further generate a novel 2D representation of the vessel dynamics for quick visual assessment.
Results: We used the proposed method to evaluate the effects of stent-grafting in the aortic arch after supra-aortic rerouting in 5 cases. The obtained measurements and their visual representation give detailed insight into patterns of movement in the thoracic aorta as well as changes induced by stent-grafting of the aortic arch. Elevated strain due to diffuse motion at the beginning of the prosthesis could be observed in all cases. The influence of stent-length and placement could also be quantified using the proposed method.
Conclusion: We developed an automated method to aid the visual inspection of the effects of vascular interventions in the aortic arch. As a first example of the application of the proposed method, we could describe the influences of the length and location of a stent graft in the aortic arch in 5 cases.

B-0375 11:15
Towards efficient simultaneous multi-patient annotation of 3D imaging data
W. Lang, R. Donner; Vienna/AT
Purpose: Manual segmentations of medical data are tedious and time intensive - multiple segmentations quickly become prohibitively expensive (especially on 3D data). We develop an interactive, incremental annotation tool for generic medical image data, focusing on simultaneous, weakly supervised classification based, multi-patient segmentations.
Methods and Materials: We use an initial over-segmentation methods such as Superpixels to cluster spatially coherente, homogeneous structures while retaining edge information. User-guided brush strokes mark representatives for each label class within the image, which are passed to a random forest, learning implemen- tation. Resulting priors combined with local descriptors and optimised by a MRF solver, give a first estimation of desired appearances in all multi-patient views. Suc- cessive interactions refine the annotation, making maximal use of each user input. Results: The resulting framework provides a multi-patient view, allowing to interact with all individual annotation simultaneously. We evaluate the segmentation results on 25 left-hand CTS, we calculate the Dice coefficient between our ground truth and segmentation results. We reach an overlap of 92.1% in metacarpals, 91.7% in proximal phalanges and 86.0% in intermediate phalanges on 800x500 pixel sized images with approximately 500 oversegmentation primitives per CT.
Conclusion: Using over-segmentation trough Superpixels combined with local descriptors makes the labelling problem in multi-patient segmentations tractable. Consistent with our goal of providing whole image labelling annotations, not individual object delineations, by lowering accuracy (due to the Superpixels) the annotation time for a whole set of patient data (e.g. hand CTS) is a fraction of the time required using current annotation tools.
B-0376 11:24
Retrieving positive findings in radiological images with the aid of textual hints in reports
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Purpose: To build and evaluate a retrieval system for German radiology reports enabling improved access to radiological image and free-text data.

Methods and Materials: A scalable text analysis platform is used to extract relevant information from German radiology reports and to create semantic links between images and textual descriptions. The platform consists of domain-specific analysis components dealing with different aspects of medical language such as negations, abbreviations, dimensions, proper names and the morphological analysis of word compounds. Additionally, it contains an image reference and context recognition component allowing the creation of semantic links between text and image data. Given an explicit picture reference mentioned in a report, e.g. ‘IMA 12-15’, and its surrounding description this component tries to deduce the corresponding DICOM component allowing the creation of semantic links between text and image data.

Results: On a corpus of 113,325 radiology reports the system was able to identify 32,533 image references and successfully retrieve 32,157 images from the local PACS server. Randomised validations of identified image references showed an average precision of P:0.97. On a corpus of 113,325 radiology reports the system was able to identify 32,533 image references and successfully retrieve 32,157 images from the local PACS server. Finally, key images and relevant text passages are automatically aligned of magnetic resonance imaging (MRI) and single photon emission computed tomography (SPECT), this project proposes the implementation of a hybrid routine using the combination of the Shannon and the Tsallis entropies in the Statistical Parametric Mapping co-registration.

Conclusion: The initial results showed strong evidences that the hybrid routine using Shannon and Tsallis entropies jointly performed most reliable inter-modality co-registration using statistical parametric mapping and therefore could be a new available cost function approach in the image processing tools.

B-0379 11:51
Integration of diffusion and perfusion images of human breast cancer by registration and dissimilarity-based clustering
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Purpose: To introduce a new patient-specific pipeline for the integration of breast diffusion and perfusion MRI for surgical planning.

Methods and Materials: We propose a two-step process for the integration of information derived from DW-MRI and DW-MRI modalities. First, voxel-wise dissimilarity-based clustering is performed on DCE images to identify different tumoral subregions, which are then projected to the DW-MRI following a patient-specific registration protocol consisting of a preliminary multiresolution rigid transformation followed by an elastic B-Spline deformation focused on the lesion area. The probability density functions in the ADC map of the subregions are then extracted and compared through non-parametric testing (Wilcoxon-signed-rank test, p<0.05). The pipeline was demonstrated using DCE-MRI and DW-MRI acquired from 7 patients, ranging in age 42-70 (median 48 years), affected by primary ductal carcinoma.

Results: Non-parametric tests show that ADC values from the subregions corresponding to different clusters in the DCE volume have statistically different characteristics, which indicates the consistency of the information obtained from the two modalities while providing a posterior validation of the registration method.

Conclusion: In this work we have employed dissimilarity-based representations instead of classic features to integrate the information provided by both diffusion and perfusion MRI images of the breast. Preliminary results are quite promising and suggest the exploitation in future works of this combined information in the registration process through the definition of an ad-hoc objective function. Moreover, after spatial registration, the diffusion information can be incorporated into the classification process yielding a truly multimodality integration of imaging data.

B-0377 11:33
Rapid semiautomatic liver segmentation using a new user-friendly, prototypic software tool: initial experience
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Purpose: To evaluate the accuracy of a new software-tool for semiautomatic liver segmentation in the analysis of liver segments, vessels and tumour lesions and to assess its user-friendliness.

Methods and Materials: In 10 healthy liver donors and 20 patients suffering from hepatic tumours thin-sliced MDCTs (256-iCT, Philips; 1 mm slice-thickness) were acquired. Based on a level set method for automatic contour identification the segmentation was performed following Couinaud's anatomical classification. The volume of segments, vessels and lesions was assessed automatically using a 2D-based voxel classification algorithm with propagational learning and, afterwards, manual correction was performed. The time necessitated for segmentation and manual correction was recorded. The time to execute all measurements and corrections was quantified.

Results: The semiautomatic segmentation rapidly performed precise determination of all segments with averaging correctness of 97.4% in healthy donors. In tumour patients the correctness for all segments was 95.5%. The mean time for semiautomatic liver segmentation and manual correction was 6:31 min and 5:48 min, respectively. Rapid assessment of tumour volume was achieved with correctness of 92%. The accuracy was limited if prior resection or large necrotic areas were present. The recognition of liver vessels was highly precise (> 90%) using a standard contrast injection protocol.

Conclusion: The new semiautomatic software tool evaluated allows for the segmentation of the liver, vessels and tumour lesions with remarkably high precision and efficiency. Furthermore, due to its easy-to-handle approach and the rather short time for manual correction this tool might meet the broad demands of modern clinical routine.

B-0378 11:42
Image registration in a hybrid routine using Shannon-Tsallis entropy for the statistical parametric mapping (SPM)
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Purpose: The automatic co-registration of medical images based on similarity measures have been suggested in several studies using different cost function approaches; which have presented relevant results for many kind of biomedical images. Based on previous results showing the contribution of the Tsallis entropy on the alignment of magnetic resonance imaging (MRI) and single photon emission computed tomography (SPECT), this project proposes the implementation of a hybrid routine using the combination of the Shannon and the Tsallis entropies in the Statistical Parametric Mapping co-registration.

Methods and Materials: MRI and SPECT of 1 morphologically normal patient were used for the construction of simulators which were co-registered with the original images using the proposed hybrid routine and the individual ones. The comparative analysis between the routines reliability was performed based on the root mean square (RMS) error of the rotation and translation parameters.

Results: Preliminary results showed that the hybrid routine led to a more reliable inter-modality co-registration for simulators with small transformations based on the RMS error, as expected. More co-registrations are being performed to confirm these results for the simulators with larger transformations.

Conclusion: The initial results showed strong evidences that the hybrid routine using Shannon and Tsallis entropies jointly performed most reliable inter-modality co-registration using statistical parametric mapping and therefore could be a new available cost function approach in the image processing tools.

SS 611a Interventional neuroradiology

Moderators: B. Gómez-Ansón; Barcelona/ES
S. Puchner; Vienna/AT

B-0380 14:00
Single centre experience of intracerebral artery thrombectomy using TREVO device in 60 patients with acute ischaemic stroke
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Purpose: To describe the effectiveness and safety of a mechanical stent-like device TREVO in the endovascular treatment of acute ischaemic stroke.

Methods and Materials: Prospective, single-centre study of 60 patients with an acute ischaemic stroke attributable to a large cerebral artery occlusion. Median National Institutes of Health Stroke Scale, 17. Arterial occlusion was in the anterior circulation in 86% of cases and in verteobasilar territory 14%. Mean time from symptom onset to endovascular treatment was 263 minutes. Endovascular treatment was ruled out when established ischaemic lesions were greater than
one-third of the middle cerebral artery territory, measured by multimodal computed tomography (CT) or magnetic resonance (MR). Results: 46% of patients were deemed to show good outcome (modified Rankin Scale score 0-2) at 90 days. Of the 49 patients treated using Trevo as the sole treatment technique, 76% showed complete thrombolysis in cerebral infarction score (TICI, grade 3) or partial (TICI 2b) reperfusion, and this increased to 86% if additional treatments were used. The mean time from groin puncture to recanalisation was 78 min. Symptomatic intracranial haemorrhage was found in 8 (13%) patients and 16 (28%) patients died within the 90-day follow-up period. There were 4 distal embolisations of a previous uninvolved territory. No arterial rupture or other major complications occurred.

Conclusion: Our findings indicate that mechanical intracranial thrombus extraction using TREVO is effective and has a reasonable morbidity and mortality rate in the treatment of acute ischaemic stroke.

B-0381  14:09
Endovascular reperfusion for acute ischaemic stroke (AIS).

Purpose: Aim of this preliminary study was to assess the safety/efficacy of the multiple endovascular modalities (pharmacologic/mechanical) that can be used in the reperfusion therapy for AIS to improve the rates of recanalisation.

Methods and Materials: 52 consecutive patients with AIS (mean age 57y, from April 2009 to September 2011), on-set less than 8 hours for the anterior circulation and 12 for the vertebro-basilar one, underwent to intra-arterial pharmacologic or mechanical therapy with recanalisation (CT/CT-perfusion/MRA/DSA) were used for the assessment of ischaemic area and causes. Patient’s age, sex, aetiology of occlusion, symptom before/after mechanical/pharmacologic treatments with modified Rankin Scale (mRS), recanalisation rates evaluated with TICI (thrombolysis in cerebral ischaemia): grade 0 (no-flow) grade 3 (normal-flow), and haemorrhagic transformations (HT) were recorded and correlated using a multiple logistic regression analysis.

Results: The sites of arterial occlusion before treatment were: M1=28 patients (53.84%), intracranial carotid=4 (7.69%), M2=7 (13.46%), tandem occlusion=3 (5.76%), extracranial internal carotid isolated occlusion=5 (9.61%), P1=2 (3.84%), basilar trunk=3 (5.76%). Therapeutic interventions included: multimodal therapy=28 (54.84%), pharmacologic cheap with tissue-plasminogen activator (t-PA)=11 (21.15%), mechanical therapy with embolectomy using solitaire (ev3-TM)=13 (25.00%). The recanalisation rate with multimodal therapy was significantly higher TICI 2-3 recanalisation rate (23 patients [82.14%]) compared to pharmacologic therapy only (6 patients [54.54%]) or mechanical one (8 patients[61.53%]), p<0.001. Haemorrhagic perfusion occurred in one patient with M1 occlusion that spontaneously resolved.

Conclusion: Multimodal therapy showed significantly higher recanalisation rates vs pharmacologic or mechanical ones while the prevalence of haemorrhage does not exceed that which occurs in the natural history. These preliminary results show potential for the endovascular management of AIS.

B-0382  14:18
Results of mechanical thrombolysis for acute ischaemic stroke: comparison with intra-arterial urokinase infusion

A. Im, S. Jeon, S. Choi; IlsanKR

Purpose: To evaluate the efficacy and safety of mechanical thrombolysis in acute ischaemic stroke compared with results of intra-arterial (IA) pharmacologic thrombolysis.

Methods and Materials: We retrospectively reviewed patients who were performed IA thrombolysis for acute thromboembolic occlusion of major vessels. Total patients were 101 and divided in to 3 groups: group 1 (pure urokinase [UK] infusion, n=31), group 2 (endovascular modalities [pharmacologic/mechanical] that can be used in the reperfusion for AIS to improve the rates of recanalisation) were compared. Group 3 (pure urokinase [UK] infusion with additional treatment). The mean time from groin puncture to recanalisation was 84 (range 26 - 199) minutes. One significant procedural event occurred. These results suggest that with the Trevo device, clots can be safely and effectively removed from intracranial large vessel occlusions in acute ischaemic stroke.

B-0384  14:36
Cerebral vasospasm (CV) after aneurysmal subarachnoid haemorrhage (A-SAHA): intra-arterial management

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Purpose: The purpose of this work is to evaluate predictors of recanalisation and a favourable neurologocal outcome in patients with CV after acute A-SAHA.

Methods and Materials: From May 2004 to September 2011, we embolised 149 aneurysm in 145 patients (age ranged from 19 to 87 years, mean age 57) with A-SAHA, using metal detachable coils/stenting; in 55 (36.91%) of these patients we report clinical and/or angiographic signs of CV. MRA, CT and DSA have been used to evaluate SAH. We discuss the use of neuroendovascular techniques and the recent advances in the local therapy of CV following A-SAHA. Patient’s age, sex, aetiology, perfusion, recanalisation and symptom pre- and post-treatment with modified Rankin Scale (mRS) were analysed using a multiple logistic regression analysis.

Results: In 21 (36.18%) of the 55 patients we have observed regularisation of the narrowed vessel using local i.a. infusion of papaverine (4 cases) or nimodipine (17 cases) at the 3 weeks control. In 25 (45.45%) patients we report the use of local i.a. nimodipine before and after large vessel percutaneous transluminal balloon angioplasty (PTA) with recanalisation after procedure and improvement of clinical condition at the 3-6 months of follow-up. Recanalisation favoured a better outcome with a pre- and post-treatment mRS improvement at 6- to 9-month follow-up (p<0.005), especially in those who received early treatment.

Conclusion: Earlier treatment is usually associated with better patient survival and outcome but continued efforts are necessary to improve and refine endovascular strategies as well as develop new treatment modalities.

B-0385  14:45
Angiographic outcome after endovascular treatment of intracranial aneurysms with the silk flow diverter

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Purpose: Wide-necked and fusiform aneurysms are technically challenging for EVT. FD may occlude the aneurysms by endoluminal reconstruction of the parent
artery and reducing the blood flow into the aneurysms. The purpose of this study was to assess the rate of intervention-associated complications and the midterm outcome after Silk stent implantation.

**Methods and Materials:** We retrospectively analysed 17 patients with unruptured aneurysms treated with 21 Silk FD between 05/2008 and 12/2010. Treatment indications were fusiform aneurysms, circumferential aneurysms, and giant aneurysms presented with embolic events or a progressive mass effect.

**Results:** Technical success was reached in 17/17 patients. Three aneurysms were immediately occluded, one of these with additional coiling. All aneurysms showed immediately inflow reduction. After three months, occlusion was observed in all cases except one aneurysm of the ICA. The overall complication rate including technical, thromboembolic complication or in-stent thrombosis was 6 of 21 FD (29%). Clinical outcome in 17 patients included one with not severe and 2 with severe neurological deficits. 1-year follow-up did not show any reperfusion of the aneurysm.

**Conclusion:** Despite a not low complication rate the FD treatment of complex aneurysms is effective with a high occlusion rate of the aneurysm also in the midterm follow-up. The overall complication rate may be higher than in conventional stent-assisted coiling but we have to consider that the aneurysms were difficult to treat with conventional endovascular methods, had recurred after previous treatments, or showed a disease progression.

**B-0387** 14:54

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**Purpose:** Flow-diverter devices have been demonstrated to be of high efficacy in treatment of intracranial aneurysms, especially those with wide necks. This project attempts to identify if pre-treatment flow characteristics are of assistance in predicting whether a specific aneurysm is more prone to thrombose, and if there are any haemodynamic indices that correlate with the regions which thrombose first.

**Methods and Materials:** Two cavernous aneurysms were modelled from 3D pre-treatment angiographic studies. Patients were treated using flow-diverter devices and were followed over the subsequent 2 to 12 months with contrast-enhanced 3D time of flight magnetic resonance angiography. Images were segmented using @neuFuse 7.3 TS software. @neuFuse was also used to virtually deploy a flow-diverter in both aneurysms. Flow with/without the flow-diverter was simulated using ANSYS CFX 13.0 software.

**Results:** Computational fluid dynamic (CFD) analysis and 3D angiographic follow-up studies enabled us to observe that thrombus formation within the aneurysm sacs initiated in regions of significant flow reversal; indicated by high Oscillatory Shear Index (reaching values near 0.5) and negative values of minimum aneurysm formation index (close to -1).

**Conclusion:** In this study, CFD analysis was performed on pre-treatment aneurysms geometries before and after the virtual deployment of a flow-diverter device. It was observed that thrombosis is more prone to occur in regions of significant flow reversal. We conclude that CFD may prove useful in predicting which regions of an aneurysm treated with a flow diverter will thrombose first.

**B-0388** 15:03

*M. Hahnenmann, M. Ho, M. Schliamann, S. Goericke, I. Wanke, C. Moeninghoff, M. Forsting, A. Ringelstein, Essen/DE (mariahahnenmann@gmx.de)*

**Purpose:** Stent-assisted coiling has improved the ability to treat difficult and complicated aneurysms. The present study aims to investigate the rate of silent embolic lesions after stent-assisted coiling and to define associated predictors.

**Methods and Materials:** The study includes a total of 69 patients treated with 70 stent-assisted coilings. DWI MR imaging of the brain was performed after stent-assisted coiling to detect intervention-associated silent ischaemic lesions. Demographic data, aneurysm characteristics and angiographic parameters were correlated with the frequency, the distribution, and the size of the ischaemic lesions.

**Results:** After 70 stent-assisted coilings 40 DWI MRI analyses after intervention revealed 161 bright lesions in a pattern consistent with embolic events. 147 lesions were smaller than 10 mm in diameter, whereas 14 lesions were larger than 10 mm. More than the half of the treated patients (54%) displayed embolic events without new neurological deficit. We assume a correlation of these ischaemic lesions with the duration of the procedure and with the patient’s age. Furthermore, higher DWI rates tend to appear in the anterior brain circulation.

**Conclusion:** Silent embolic events are much more frequent than the apparent neurological complication rate after stent-assisted coiling. However, individual and aneurysm-specific parameters may predict the safety of the intervention and presumably, the subsequent rate of neurological complications.

**B-0389** 15:12

**New ischaemic brain lesions on diffusion-weighted MRI after carotid artery stenting with protection: a single-centre study**

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**Purpose:** Carotid artery stenting (CAS) with distal protection is now considered an alternative to carotid endarterectomy. Despite cerebral protection, the risk of cerebral embolisation still persist during the procedure. Diffusion-weighted imaging (DWI) is considered the most sensitive tool for early detection of cerebral ischaemia. The purpose of this study was to evaluate the appearance of new ischaemic cerebral lesions by DWI after protected CAS in patients with severe internal carotid artery (ICA) stenosis.

**Methods and Materials:** Fifty CASs were performed with the use of distal protection. Mean age of the patients was 65.13±7.08 years and 74.5% were symptomatic. In 8.51% patients procedure was done on an emergency basis. All patients were unsuitable for CAE. DWI was performed immediately before CAS and within 24 hours after the procedure.

**Results:** There were 15 new lesions in 7 patients (14.89%) (mean 2.14±1.12 per patient). In 3 of them (42.86%) there were single lesions, and in 4 (57.14%) patients multiple lesions. Four patients (57.14%) developed ipsilateral new lesions, two patients (28.57%) developed contralateral new lesions and one patient (14.28%) developed bilateral new lesions. Patients with fibrinoid plaques had a significantly higher number of new lesions compared to patients with fibrocalkififi plaques (p=0.025).

**Conclusion:** New ischaemic lesions were observed in 14.89% of our patients. There was a significant relationship between plaque characteristics and the appearance of new lesions. The low percentage of new lesion suggests that CAS with protection is safe and effective in patients with severe ICA stenosis.

**B-0390** 14:00

**Reconstructions with identical filling (RIF) of the heart: a physiological approach to image reconstruction in coronary CT angiography**

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**Purpose:** The aim of the study was the comparison of image quality in coronary CT angiography (cCTA) between routine reconstructions with automated phase detection and Reconstructions computed with Identical Filling of the heart (RIF). The timing is provided RIF-formula, which is deduced from cardiac physiology.

**Methods and Materials:** From November 2009 until July 2010, 74 patients undergoing ECG-gated DSCT were included in the study for suspected coronary heart disease (n=40) or planning of interventional aortic valve replacement (n=34). RIF formula and the manufacturer’s software (BestDiastole) were used for calculating the datasets. Two radiologists assessed in consensus coronary artery segments according to the 15 segments AHA model. Image quality was stratified using a 5 grade Likert scale. Continuous variables were expressed as mean ± standard deviation, categorical variables additionally as frequencies or percentages. Differences in categorical data were analysed using the Wilcoxon test for paired variables.

**Results:** 31 men and 43 women with an average age of 71.86±13.1 years and with a mean heart rate of 69.2±14.8 were examined. In the BestDiastole group 590 segments achieved diagnostic quality compared to 693 segments in the RIF group. In corresponding AHA segments RIF was superior in 342 segments (30.8%), BestDiastole scored higher in 155 cases (14.0%). In the arrhythmic subgroup the mean RIF images scored 2.40±0.53 in comparison to BestDiastole with 1.84±0.41.
Conclusion: RIR reconstruction is superior to standard reconstruction, especially in patients with atrial fibrillation. Furthermore, RIR provides a theory for the optimal image reconstruction point.

B-0391 14:09
CT coronary artery calcium scoring and iterative image reconstruction techniques: reproducibility, accuracy, and potential for radiation dose reduction
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Purpose: The effect of iterative-reconstruction on CT coronary calcium scoring (CCS) has not been investigated. We evaluated in-vivo and in-vitro the reproducibility of CCS across different reconstruction methods and the potential for radiation-dose reduction.

Methods and Materials: 33 consecutive patients (17 men: 65.8±9.5 years) underwent CCS studies on a 2nd generation dual source CT (DSCT) system. In-vivo data were obtained using a moving anthropomorphic cardiac phantom containing calcium inserts of different sizes. Full-dose reconstructions were based on projections from two CT tube-detector series (FBP) and half-dose reconstructions were based on projections from one CT tube-detector series (IRIS). S1 was calculated using the Wilcoxon-Mann-Whitney testing. No significant differences in overall CCS were found between full-dose FBP, half-dose IRIS (S26) and half-dose SAFIRE (S96 [0/63]) were also not significant (p>0.05). In two patients with a calcium score of zero, the standard deviation of the Agatston score (FBP) was 1.7±0.8 (I26-100%) was also observed for I26 and 45±14% for I36 (p<0.001). An equivalent increase of CNR from 1.9±0.7 (B26) to 2.6±0.7 (I26-100%) and 2.8±1.0 (I36-100%) was also observed (p<0.05). The overall image quality and the diagnostic confidence significantly improved using IR.

Conclusion: The use of IR reduces image noise, improving CNR of the infarcted myocardium thus providing better image quality and having the potential to decrease radiation dose.

B-0392 14:18
How different levels of 4th generation iterative reconstruction influence image quality in low-dose cardiac CT
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Purpose: To investigate effects of an advanced 4th generation iterative reconstruction (IR) technique on subjective and objective image quality (IQ) in low dose coronary calcium CTA.

Methods and Materials: Five datasets of prospectively triggered coronary CTA in "step-and-shoot" mode were acquired on a 256-slice CT-scanner with optimised exposure settings. Each dataset was processed 16 times resulting in n=80 image reconstructions. Image noise was measured in the contrast-enhanced ascending aorta. Contrast-to-noise and signal-to-noise ratios (CNR, SNR) were compared at 9 coronary locations in all image stacks. Subjective IQ was rated on a 3-point scale with "natural" image appearance and noise-related artefacts as main criteria.

Results: Mean effective dose of cardiac CTA was 1.5mSv. Mean CNR and SNR were significantly improved with IR when compared to FBP and with every increasing level of IR (range CNR: 9.8-19.8; range SNR: 7.7-15.2; p<0.0001) with best objective IQ at highest level of IR (Dose level 7). Subjective IQ, however, was rated best at medium level of IR (Dose level 4) with fewer artefacts when compared to FBP and medium "natural" image appearance compared to higher levels of IR.

Conclusion: Objective IQ (CNR, SNR) improves with increasing level of IR in low dose cardiac CTA. Best subjective IQ, however, is reached at medium levels of IR with minimal artefacts and "natural" image appearance.

B-0393 14:27
Iterative reconstruction (IR) improves image quality and diagnostic confidence of CT delayed enhancement imaging for the detection of myocardial infarction: preliminary results
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Purpose: To determine the effect of iterative reconstruction (IR) on CT image quality and diagnostic confidence of myocardial infarction detection on delayed enhancement scans.

Methods and Materials: Nineteen patients with prior history of myocardial infarction were enrolled in the study. Prospectively triggered CT-delayed enhancement imaging was performed eight minutes after CT coronary angiography using dual source CT scanner. Scans were reconstructed using filtered back projection (FBP) with a smooth-medium kernel (B26) and Sinogram Affirmed IR (SAFIRE, Siemens Healthcare) at strength 60% and 100% with kernel 126 and 366. Signal and noise were measured in the descending aorta. Attenuation within the infarcted myocardium was measured and the contrast-to-noise ratio (CNR) was calculated. Two blinded readers graded the images in terms of image quality and diagnostic confidence in infarction detection using a four point scale (1: poor and 4: excellent).

Results: In comparison with FBP, the use of IR (strength 60%) resulted in a significant reduction of image noise of 25±4% for 126 and 20±7% for 136 (p<0.001). Increasing the strength to 100% a further decrease of noise was observed: 39±9% for 126 and 45±14% for 136 (p<0.001). An equivalent increase of CNR from 1.5±0.7 (B26) to 2.6±0.7 (I26-100%) and 2.6±1.0 (I36-100%) was also observed (p<0.05). The overall image quality and the diagnostic confidence significantly increased using IR.

Conclusion: The use of IR reduces image noise, improving CNR of the infarcted myocardium thus providing better image quality and having the potential to decrease radiation dose.

B-0394 14:36
The effect of iterative reconstruction on computed tomography coronary artery calcium score
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Purpose: Iterative reconstruction enables the reduction of radiation dose with maintained image quality in computed tomography (CT). We aimed to test the effect of iterative reconstruction on the calculation of coronary artery calcium score (CACS).

Methods and Materials: One hundred patients underwent electrocardiogram-gated CT coronary calcium scans as part of the SCOTHEART study using a 320-multi-detector scanner. Tube voltage was 120 kV and tube current was selected based on body mass index. Images were reconstructed using standard reconstruction and an iterative reconstruction algorithm (AIDR). Both Agatston score and calcium volume were calculated. The estimated percentile for a particular CACS based on age, sex and ethnicity was calculated using the MESA CACs reference values.

Results: Thirty-seven patients had a calcium score of zero and were excluded from further analysis. There was a small but significant difference in median Agatston score and calcium volume between standard and iterative reconstructions (179 vs 171, p=0.008 and 157 vs 155, p=0.044, respectively). Image noise was significantly reduced with iterative reconstruction (26 HU (95% CI 23 to 29) vs 21 HU (19 to 24), p<0.001). There was no significant difference in estimated percentile with iterative reconstruction (85.5 vs 86, p=0.84).

Conclusion: Iterative reconstruction reduces image noise in CT coronary calcium scans. The application of AIDR could lead to significant reduction in radiation dose. The absolute values of both Agatston score and calcium volume are slightly reduced using iterative reconstruction. However, the estimated percentile for the individual patient is not altered.

B-0395 14:45
Coronary CT angiography: comparison of a novel iterative reconstruction with filtered back projection for reconstruction of low-dose CT
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Purpose: To compare image noise between a novel iterative reconstruction algorithm (SAFIRE) and traditional filtered back projection (FBP).

Methods and Materials: Thirty-seven patients had a calcium score of zero and were excluded from further analysis. There was a small but significant difference in median Agatston score and calcium volume between standard and iterative reconstructions (179 vs 171, p=0.008 and 157 vs 155, p=0.044, respectively). Image noise was significantly reduced with iterative reconstruction (26 HU (95% CI 23 to 29) vs 21 HU (19 to 24), p<0.001). There was no significant difference in estimated percentile with iterative reconstruction (85.5 vs 86, p=0.84).

Conclusion: Iterative reconstruction reduces image noise in CT coronary calcium scans. The application of AIDR could lead to significant reduction in radiation dose. The absolute values of both Agatston score and calcium volume are slightly reduced using iterative reconstruction. However, the estimated percentile for the individual patient is not altered.
Methods and Materials: Twenty consecutive patients underwent coronary CT angiograms (cCTA) using dual-source CT (Siemens) with a protocol adapted from Rotterdam/NL P.J. de Feyter, N.R. Mollet; \( ^{1}\)Neuss/DE (ali.ursani@uhn.on.ca)

**A-0397** 14:54

Stenosis quantification using different kV: a phantom study comparing volume CT to micro-CT

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**Purpose:** To determine the impact of in-stenosis contrast on accurate lumen assessment in calcified coronary plaques comparing two-resolution CT, a phantom study.

**Methods and Materials:** A 10x10 cm static coronary artery phantom with tissue equivalent (40 HU) material contained 6 vessels of 3.5 mm (G1) and 5 mm (G2) diameter each. Circumferential lumen stenosis 0, 30, 50, 70, and 90% were created using 800 mg/cc Hydroxyapatite (HA). The lumen contained diluted iodinated contrast 350 mg/ml (Visipaque) reaching 400 HU. CT scans performed using 200μm (MicroCT, mCT) and 350μm (VolumeCT, mCT) spatial resolution with 0.5 mm slice reconstruction at 80 and 135 kVp. Varied tube current maintained image noise of 30 HU. The maximum HU value of the plaque and the minimum value of the vessel lumen were measured by in-line histogram (HU) and contrast (C [HU]) was calculated.

**Results:** Contrast (HU) for vCT/mCT at 80 kV in G1: C30%: 894/705; C50%: 910/650; G2: C30%: 915/600; C50%: 919/550.

**Conclusion:** Iterative reconstruction enabled significant reduction in image noise without loss in subjective image quality and holds potential to improve image quality in low-dose functional CCTA and possibly reduce radiation dose even further.

**B-0399** 15:12

Computed tomography coronary angiography (CTCA) radiation dose: a systematic review of the application of conversion factors

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**Purpose:** Tissue weighting factors used to calculate effective dose (E) were updated by ICRP in 2007. Recent work suggests that, due to the increased weighting factor for breast tissue, conversion factors should be increased when calculating E from dose length product (DLP) in CTCA. We aimed to assess the application of conversion factors in CTCA literature.

**Methods and Materials:** Peer-reviewed articles on CTCA in English or with an available translation were identified on MEDLINE using an online search tool (PubMed). Articles were included if they commented on radiation dose in title or abstract. Reviews, editorials, phantom and paediatric studies were excluded. Between 1979 and September 2011 there were 205 suitable papers.

**Results:** Conversion factor was not stated in 24 papers (12%), with 6 of these being published in the first half of 2011. There is a non-significant trend towards presenting DLP and conversion factors in abstracts (2010 16% vs 2008 13%, 0.777 and 2010 14% vs 2008 5%, p 0.223, respectively). The most frequent conversion factors are 0.017 (61%) and 0.014 (37%). However, the use of 0.017 is decreasing (2007 90% vs 2010 56%) and 0.014 is increasing (2008 10% vs 2010 40%, p<0.013). The use of scanner-specific conversion factors has recently emerged but currently accounts for only 2% of papers.

**Conclusion:** The use of the lower 0.014 conversion factor is increasing despite the change in ICRP recommendations. A significant proportion of current literature does not report the conversion factor making it impossible to compare radiation doses between studies.

**Neuro**

**SS 611b**

Functional MRI, resting state and DTI

Moderators: N. Bargallò, Barcelona/ES; M. Smits; Rotterdam/NL

**B-0400** 14:00

Target map individualisation for thalamus neurosurgery: possible applications of diffusion tensor tractography and statistical shape models

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**Purpose:** Neurosurgical interventions of the thalamus rely on transferring stereotactic 3D coordinates from an anatomical atlas onto the patient’s MR brain images. We aimed to develop a software application for thalamus target map individualization that fuses information from patient-specific thalamus geometry and diffusion tensor tractography.

**Methods and Materials:** Previously, our workshop developed a thalamus atlas by fusing anatomical information from 7 histologically processed thalami. The atlas was transferred to a standard neuroimaging space and DTI scans of 40 healthy subjects were accessed; thalamo-cortical connectivity maps were generated using a previously described procedure. Visible outlines and connectivity-based internal landmarks were incorporated in a statistical shape model respecting the inherent variability of the individual examples. This information was used to deform the atlas to individual images. Postmortem MRI scans were used to quantify the geometric accuracy of nuclei predictions.

**Results:** Reliable tractography-based markers were located in the ventro-lateral thalamus, with the somatosenory connections coinciding with the VPL and VPLP nuclei, and motor/prefrontal connections with VLP and VL nuclei, the uncertainty of localisation was less than 2 mm. The error of predicting geometry, expressed in surface-to-surface distances, was 0.56 mm for the visible thalamus outlines and significantly different using a SAS or RS protocol. The estimated radiation dose was significantly lower with the SAS than with the RS protocol (4.05±1.46 vs. 5.62±3.0mSv, p<0.001).

**Conclusion:** A step-and-shoot CTCA scan protocol is the preferred protocol in patients with regular heart rates using 128-slice dual source CT, providing optimal diagnostic accuracy with an “as-low-as-reasonably-achievable” radiation dose.
varied from 0.5 to 1.5 mm depending on the information utilised during predictions (e.g. connectivity-based landmarks or thalamus outlines).

Conclusion: Previous studies have already applied DTI to the thalamus. As a further step in this direction we demonstrate a hybrid approach using statistical shape models that has the potential to cope with variations in individual thalamus geometry.

B-0401 14:09
DTI tract-specific evaluation of the corpus callosum in patients with diagnosed systemic lupus erythematosus
P. Podgorski, A. Zimny, P. Szewczyk, J. Bladowska, M. Szymyka-Kaczmarek, M. Sasiadek, Wroclaw/PL (p.podgorski@onet.pl)

Purpose: Assessment of the potential white matter damage in patients with diagnosed systemic lupus erythematosus (SLE) using diffusion tensor imaging (DTI) and tract-specific morphometry.

Methods and Materials: Thirty-one patients (mean age 35.8 yrs) with diagnosed SLE and normal appearing brain in conventional MRI were included in this study. The study also included a control group composed of 12 age- and sex-matched healthy volunteers. All subjects underwent conventional brain MRI with typical protocol consisting of T1, T2, FLAIR and DWI images performed on a 1.5 T MR scanner. All subjects also underwent DTI examination with the following parameters (25 diffusion directions, b=1000s/mm2, slice thickness 4 mm, no gap). Obtained DTI images were preprocessed by applying 12-parameter affine transformation using AIR (http://bishopw.loni.ucla.edu) and then analysed in DiSTudio (https://www.mristudio.org). Multiple ROI approach was applied to select: genu, splenium and entire corpus callosum tracts. Obtained minimal, maximal and mean values of fractional anisotropy (FA) were then compared in patients and controls by using Mann-Whitney U and t-test.

Results: Compared to controls, SLE patients showed significantly (p < 0.05) lower mean FA values within genu and splenium tracts of the corpus callosum. FA mean values within entire corpus callosum showed lower values in SLE patients compared to the control group but did not reach the statistical significance.

Conclusion: Tract-specific DTI study showed statistically significant reduction of FA value in the corpus callosum suggesting white matter damage in patients with SLE.

B-0402 14:18
New non-linear colour look-up table to visualise fractional anisotropy changes: demonstrated on multiple system atrophy
J. Keller, A.M. Rulseh, A. Komarek, I. Latnerova, R. Rusina, K. Zarubova, H. Brozova, J. Vymazal; Prague/CZ (jiri.keller@homolka.cz)

Purpose: To facilitate the assessment of fractional anisotropy (FA) in daily clinical practice by defining a new, non-linear color look-up table (LUT).

Methods and Materials: FA was calculated for 76 healthy volunteers (age 44.4 years±18 SD, range 15-80.1 1.5 T, 2.2 mm isotropic voxel, 12 motion probing gradients (MPG)). A subset of 59 subjects was additionally scanned using 30 MPG. FA in the corpus callosum, frontal grey matter, thalamus, and in the basal ganglia was measured and analysed using the random intercept linear mixed model to calculate the population means and 95% prediction intervals, which were used to create a non-linear colour LUT. Unique colours were assigned to inflection points and continuous ramps were generated to create a colour transition between them. The LUT was applied to groups of 17 patients with multiple system atrophy (MSA) and matching volunteers. Four blinded radiologists classified subjects as norms/MSA. Thirteen patients with Parkinson disease were then added to anonymised cohort.

Results: The LUT generated from 12 MPG data is comparable with that from 30 MPG, and provides 82% sensitivity and specificity in differentiating MSA subjects from healthy volunteers. MSA patients can be separated from parkinsonians and norms with 76% sensitivity and 86% specificity.

Conclusion: Our LUT, based on the normative data, can accentuate abnormal FA values as well as anatomy. The radiologist can differentiate between MSA and norms just using LUT information. The new LUT can be potentially useful as a screening method for other neurological disorders. Supported by grants IGA-NT11328-4/2010, NS9654-4/2008, MSM0021620816 and MSM0021620839

B-0403 14:27
Assessment of the degradation of the selected projectile, comminual and association white matter tracts in asymptomatic HIV-positive nontreated, HIV-positive HAART-treated and HIV-HCV-positive patients using diffusion tensor MR imaging
J. Bladowska, A. Kołtowska, P. Szewczyk, A. Zimny, B. Hendrich, B. Knyz, M. Sasiadek; Wroclaw/PL (mbladow@wp.pl)

Purpose: HIV infection may affect cerebral white matter. The aim of the study was to evaluate the selected white matter tracts in asymptomatic HIV-positive patients using diffusion tensor imaging (DTI).

Methods and Materials: Forty-eight HIV-positive asymptomatic patients: 21 HIV-positive nontreated (mean age 33 yrs), 18 HIV-positive HAART-treated (mean age 39.3 yrs), 9 HIV-HCV-positive (mean age 36.6 yrs), and 17 normal control subject (mean age 34.6 yrs) were enrolled in the study. DTI examinations were performed on a 1.5 T MR scanner. Fractional anisotropy (FA) and average diffusion coefficient (average DC) values were obtained with a small ROI method in middle cerebellar peduncles (MCP), inferior longitudinal fasciculi (ILF), inferior frontoocipital fasciculi (IOF), genu (GCC) and splenium (SCC) of the corpus callosum, posterior limits of the internal capsules (PLIC), superior longitudinal fasciculi (SLF) and posterior cingula (CG).

Results: Significant decrease of FA (p < 0.05) compared to the normal subjects was found in all HIV-positive patients in the left MCP, both ILF, both IF0, GCC, SCC and both SLF, while there were no such differences in the right MCP and both CG. Significant reductions of FA in both PLIC were observed only in HIV-positive HAART-treated patients (p=0.001). Significant increase of average DC (p < 0.05) was found only in GCC and right SLF in HIV-negative nontreated and HIV-HCV-positive subjects.

Conclusion: The FA value could be a noninvasive neuroimaging biomarker for assessing the microstructural changes within the white matter tracts in asymptomatic HIV-positive patients. HIV-positive HAART-treated patients seem to present the most significant changes.

B-0404 14:36
Passive range-of-motion functional MRI paradigms are useful in the pre-surgical workout of childhood epilepsies
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Purpose: Performing pre-surgical functional MRI (fMRI) in epileptic children poses challenges due to the relatively young age of the patients and/or their possible mental retardation or paresis. Passive range-of-motion (RoM) paradigms were suggested for sensory-motor cortex mapping in this population, as these paradigms do not require patient cooperation. Retrospective analysis of our passive RoM examinations is presented to evaluate the utility of the method in the paediatric epilepsy population.

Methods and Materials: Nine fMRI examinations of seven children (mean age 9.2 yrs, range: 3-15; 6 boys: 2 cases of cortical dysgenesis, 2 of tumour, and 3 of porencephalic cysts) performed at 3 T (Philips Achieva 3 T, Philips Healthcare, Best, The Netherlands) in our institute is reviewed. Four patients were scanned in intravenous propofol sedation using passive RoM, one of them was scanned without sedation, as well. The remaining three patients were examined without sedation both with active and passive RoM paradigms.

Results: We were able to clearly identify the main sensory-motor foci in all cases. Moreover, we could show variable amount of functional reorganization to the healthy hemisphere in three cases. Nevertheless, the distribution of activations obtained with and without sedation, and with passive and active RoM differed to some extent, and in one case ongoing epileptic activity interfered with fMRI.

Conclusion: Passive RoM fMRI paradigms are useful for the evaluation of sensory-motor cortex in paediatric epilepsy patients. Moreover, our results show that these paradigms are able to describe cortical reorganisation, thus they have clear prognostic value in a pre-operative setting.

B-0405 14:45
F-MRI study of smell: perceptual, cognitive and semantic component of cortical elaboration of four familiar aromas
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Purpose: To investigate the changes in cortical activation during the administration of four familiar aromas.

Methods and Materials: Eleven volunteers have been enrolled in the study. All the examinations have been performed on a 1.5 T magnet using an 8-channel EPI sequence (TR/TE= 2171/45, 25 slices, 288 dynamics, session duration=10.51 min). Four
stimuli were chosen: citrus fruit, chocolate, coffee, flower plus neutral one (air). The experiment consisted of 3 sessions and each session consisted of 24 trials (3 stimulations for each aroma and 12 for pure air). Timing, amount and order of presentation were controlled by an MRI compatibleolfactometer. The data were analysed using SPM5 package. The analysis were conducted for each aroma compared to the neutral during the timing in which the subjects received the aroma and the few seconds immediately after.

**Results:** Each aroma seems to stimulate different cerebral regions. In particular, citrus is characterised by the perceptual aspect, especially visual (BA 17-18 bilaterally); chocolate involves mainly the cingulate and frontal cortex; coffee seems to be the most recognisable odor (orbital gyrus, medial cingulated cortex, left inferior frontal gyrus); flower seems to be the most difficult stimulus to recognise and describe, involving areas implicated in the recollection of autobiographical memory.

**Conclusion:** This study shows that odours can affect a variety of perceptual, motor and cognitive functions. The evaluation of olfactory system in order to demonstrate olfactory dysfunction could be used to assess the possible risk of developing neurodegenerative disorders in healthy individuals.

### B-0407 14:54

**Functional MRI for neurosurgical intervention planning: retrospective analysis of 87 examinations performed with our standardised language task panel**

L. R. Kozak, A. Szabó, V. Toth, C. Borbely, P. Barai, G. Rudas; Budapest/HU (lkozak@mrkk.sote.hu)

**Purpose:** Functional MRI (fMRI) gained importance in the neurosurgical assessment of brain tumour and epilepsy patients despite the ongoing debate regarding its clinical usefulness. A retrospective analysis of our pre-surgical language-mapping protocol is presented.

**Methods and Materials:** Blood-oxygenation level-dependent fMRI with picture naming, synonym decision, speech comprehension, and auditory word/non-word decision tasks was analysed from 87 sessions of 83 epilepsy and brain tumour patients (36 females; 47 lesions near eloquent areas) using SPM8. Spatial normalisation was performed with the lesions masked for analysing all patients in a common framework. First- and second-level results and probabilistic maps were calculated from general linear model fits. Lateralisations indices were calculated for Broca, Wernicke and whole-hemisphere regions of interest (ROIs), in threshold-independent and thresholded manners.

**Results:** The paradigms probed different aspects of language processing, therefore their perceived difficulty, and mapping performance varied across subjects. Generally, picture naming resulted in widespread bilateral activations not restricted to core language areas, while synonym task was the most lateralised in the Broca and Wernicke regions. Auditory tasks showed the expected preference for temporal structures and the Wernicke area. Lateralisation differences were significant at the Broca, Wernicke and whole-hemisphere regions of interest (ROIs), in threshold-independent and thresholded manners.

**Conclusions:** The paradigms probed different aspects of language processing, therefore their perceived difficulty, and mapping performance varied across subjects. Generally, picture naming resulted in widespread bilateral activations not restricted to core language areas, while synonym task was the most lateralised in the Broca and Wernicke regions. Auditory tasks showed the expected preference for temporal structures and the Wernicke area. Lateralisation differences were significant at the Broca, Wernicke and whole-hemisphere regions of interest (ROIs), in threshold-independent and thresholded manners.

**Purpose:** To evaluate left atrial (LA) volume in smokers according to the severity of emphysema and total lung volume (TLV).

**Methods and Materials:** 121 consecutive smokers, free of clinical cardiovascular disease, underwent a high-pitch and high-temporal resolution CT angiographic examination of the chest with dual source, single energy CT enabling quantification of emphysema, lung volumes and LA volume measurements normalised to body surface area.

**Results:** The CT phenotypes of the studied population were as follows: emphysema-predominant (Group 1; n=57); airway-predominant (Group 2; n=30); a mixed pattern of emphysema and total lung volume (TLV).

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were found in Group 2 (p=0.44; r=0.15) and group 3 (p=0.52; r=0.17) nor when gathering patients from groups 1 and 3 (p=0.14; r=-0.17).

Conclusion: The LA volume, impacting left ventricular preload, is significantly reduced in patients with severe emphysema.

B-0411 14:09

Krypton ventilation imaging using dual energy CT in COPD patients: initial experience
A.-L. Hachulla, S. Khung, L. Wemeau, J.-F. Cazaubon, J. Remy, M. Remy-Jardin, Lille/FR (anne-lise.hachulla@chu-lille.fr)

Purpose: To evaluate the level of lung ventilation enhanced after inhalation of stable krypton whose atomic number (36) and lack of anaesthetic properties make it eligible for ventilation imaging using dual energy CT.

Methods and Materials: 32 patients with severe emphysematous lesions were included in this study aimed at comparing the attenuation within normal lung (presumed to be normally ventilated) with that of emphysema (presumed to be poorly or not ventilated) after inhalation of a mixture of krypton (80%) and oxygen (20%). They underwent a dual source, dual energy chest CT examination with reconstruction of diagnostic and ventilation images. The statistical analysis was defined on the following assumption: the level of attenuation within the emphysematous lung was expected to be reduced in comparison to the Intervention within the normal lung; when present, this result was defined as a “success”.

Results: All studies were successfully performed, without adverse effects. Analysis of ventilation images showed differences in lung attenuation between normal lung and emphysematous areas in 26 patients (87.5%; 95% CI=71%-96.5%), thus demonstrating the feasibility of lung ventilation with krypton. The maximal level of attenuation within normal lung was 18.5 HU. Krypton attenuation difference between normal and emphysematous lung was statistically significant with a median value of 51.8% (p < 0.001). The mean (+SD) DLP value of this protocol was 387.1 ± 32.15 mGy.cm.

Conclusion: Dual energy CT of the lungs after inhalation of stable krypton was found to be technically feasible and well tolerated by all patients.

B-0412 14:18

A genome-wide association study of COPD with lung volumetry and airway measurement using MDCT
L.K.Y. Lee1, K. Kim1, J. Lee1, E. Kang1, Y. Oh1, B. Je1, J. Choo1; 1AsanKH/KR, 1Guro/KR, 1Ansan/KR (myneef@myneef.co.kr)

Purpose: The ratio of forced expiratory volume in one second to forced vital capacity (FEV1/FVC) is a measure used to diagnose airflow obstruction and is highly heritable. The aim of this study is to investigate genetic association of SNPs (single nucleotide polymorphism) in COPD genes for association with 3D-CT lung volumetry and airway measurement.

Methods and Materials: We have the GWAS results for 4,530 participants for lung function-related genes. FAM13A SNPs (single nucleotide polymorphism) on chromosome 4 including rs2609264 were associated with FEV1/FVC value. On the 3D-MDCT images, the software semi-automatically calculates total lung volume (TLV) and emphysema volume (EV), emphysema percentage (EP), mean lung density (MLD) including bronchial wall area (WA%), and we will compare the CT parameters between minor (TTCA) and major (CCTG) alleles. We did CT scans targeting 200 adults (aged 40-69 years) representative of T and C alleles for the acquisition of TLV, EV, MLD and bronchial WA%.

Results: The subjects with T allele had significantly smaller emphysema volume and emphysema volume % than those with C allele. However, total lung volume, mean lung density and bronchial WA% showed no significant difference between subjects with T and C allele.

Conclusion: The subjects with T allele were associated with emphysema volume and emphysema volume %. This might be important implication concerning the prevention of chronic lung function impairment caused by intervententions directed at risk factors such as ongoing COPD, smoking, infection, and socioeconomic factors.

B-0413 14:27

The performance of CT severity scores determined from paired expiratory/inspiratory high-resolution CT in predicting the severity of airflow obstruction
T Suwatanasophonpong, P. Pomorsuriyask, S. Sukkasem, S. Rattanasiri; Bangkok/TH (ratspoom@yahoo.com)

Purpose: To assess the performance of CT severity scores from paired expiratory/inspiratory high-resolution CT (HRCT) in predicting the severity of airflow obstruction (AFO).

Methods and Materials: We retrospectively assessed paired expiratory/inspiratory HRCT scans of 28 patients (6 men and 20 women; mean age (SD), 59.3 (11.0) years) having AFO from pulmonary function testing at the six chosen levels (i.e. five vessels, aortic arch, tracheal carina, 1 cm below the right bronchus intermedius origin, right inferior pulmonary vein, and 1 cm below the right hemidiaphragm dome). The severity grading of expiratory air-trapping (AT, 0-4), bronchial wall thickening (0-3) and bronchial dilatation (0-3) multiplied by its extent (k = 25%; lξ25-50%; lξ50-75%; and lξ75%) of involvement were considered as AT, bronchial wall thickening, and bronchial dilatation scores, respectively. The sums of all scores were considered as AT-Br scores. Receiver-operating-characteristic (ROC) analysis was applied to assess the performance of AT and AT-Br scores in discriminating patients with mild AFO (FEV1<65% predicted) from those with moderate to severe AFO (FEV1<65% predicted).

Results: The areas under ROC curves of AT and AT-Br scores were 0.74 (95% CI: 0.53, 0.94) and 0.79 (95% CI: 0.59, 0.99), respectively. The cut-off values of AT and AT-Br scores of 101 and 104 had a power to discriminate patients with mild AFO from those with moderate to severe AFO with a sensitivity of 85.7% and 85.7% and specificity of 57.9% and 57.9%, respectively.

Conclusion: The AT and AT-Br scores determined by our methods had the ability to predict the severity of AFO in most cases.

B-0414 14:36

Reproducibility of automatic airway measurements with multidetector computed tomography (MDCT) in inspiratory and expiratory scans
M. Amato, A. Larici, A. del Ciello, E. Devicenzi, G. Corso, S. Valente, L Bonomo; Rome/IT (michele.amato@tiscali.it)

Purpose: Software for post-processing MDCT images allow to obtain automatic measurement of airway parameters using an automated commercial software.

Methods and Materials: Forty patients with functional diagnosis of chronic obstructive disease (21 males, 19 females; age range: 48-85 years) were prospectively included. All the patients underwent two consecutive 64-rows CT scans of the chest (slice thickness/interval 0.625 mm; pitch 1.375) at full inspiration and at the end of forced expiration, respectively. Datasets were independently analysed by two chest radiologists in two distinct sessions (30 days apart) using an automated commercial software for the airways analysis (Lung VCAR, GE Healthcare). Operators reported for both acquisitions the values of lumen area (LA), automatically calculated on axial images reformatted along the perpendicular axis of the airway from the lobar (second generation) to the sub-branchional bronchi (fifth generation). The inter- and intra-operator differences were expressed as percentages over means (Bland-Altman). Mean values of differences (Δ) and standard deviations (SD) were assessed.

Results: Automatic measurements of LA has shown high reproducibility (mean±SD) on both inspiratory and expiratory scans. For LA we observed: Δinter-insp±SDinter-insp = -3.71/6.4±14/; Δinter-insp±SDinter-insp = 1.4/2.6±0.9/2.7; Δinter-expi±SDinter-expi = -2.7/1.8±5/11; Δinter-expi±SDinter-expi = -1.3/0.6±1.4/9.

Conclusion: Automatic measurement of lumen area on MDCT demonstrated high inter- and intra-operator reproducibility in both inspiratory and expiratory scans. Thus, it has the potential of being used as a complementary tool in the assessment of obstructive airways disease.

B-0415 14:49

Automatic airway analysis on MDCT in cystic fibrosis: correlation with pulmonary function testing
M.O. Wiepuezt1, M. Puderbach1, M. Eichinger1, O. Weinheimer1, S. Ley1, M.A. Malli1, A. Bischoff1, H.-U. Kauczor1, C.-P. Heussel1; 1Heidelberg/DE, *Mainz/DE (mark.wiepuezt@web.de)

Purpose: Software tools allow for quantitative airway analysis on multi-detector computed tomography (MDCT) of the chest. Aim of this study was to evaluate generation-based airway parameters in patients suffering from cystic fibrosis (CF) lung disease in correlation with predicted forced expiratory capacity in 1s (FEV1%).

Methods and Materials: MDCT acquired in parallel to FEV1% (median gap 0d, range 0-10d) from n=14 infant (CFInfant) and n=16 adult (CFAdult) CF patients were subjected to fully automatic airway analysis. N=4 infants and n=22 adults with normal airways and FEV1% served as controls (NORMALInfant, NORMALAdult). Total diameter (TD), lumen area (LA), and wall thickness (WT) of proximal to distal airways were separately correlated with FEV1%.
Contrast-enhanced MRI (CE-MRI) is more sensitive to detect small airways disease than proton-MRI (MRI): a comparative study in cystic fibrosis (CF) lung disease

P. Ciet1, P. Wielopolski2, E. van der Wiel3, M.H. Lequin4, M. Morena5, H.A.M.W. Tiddens6,7; 1RotterdamNL, 2TeviseffIT (p.ciet@erasmusmc.nl)

Purpose: Chest-CT is the most sensitive technique to monitor progression of CF-related bronchiectasis and trapped-air (TA) reflecting small airways disease. Chest-MRI is a radiation-free alternative for CT, but its sensitivity for TA is poor. Hyperpulsation (HP) often coincides with TA and thus CE-MRI might be more sensitive to identify TA. Aims: 1) to compare volume of HP on CE-MRI with volume of AT on MRI, 2) to compare volume of HP and TA to spirometry parameters sensitive to small airway disease.

Methods and Materials: 26 stable CF patients (13 M, mean age 14 yrs, range 8-18 yrs). Spirometry and CE-MRI were done on the same day. 1.5 T Scanner (Signa, GE). Protocol: SSFP-2D PD-weighted axial, coronal and sagittal (TR/TE=5595/10; 0.1 mmol/kg). Images were anonymised and scored in random order with CF-MRI score (expressed as % of max). Descriptive statistics, T-test and Spearman correlation (r) were used.

Results: Mean (SD) HP and TA scores were, respectively: 4.4 (3.94) and 3.3 (2.75). Correlations: TA vs HP (r=-0.413; p=0.045), HP vs FEV25 (r=-0.0, p=0.0001), HP vs FEF75 (r=-0.45; p=0.02), HP vs FEV1/FVC (r=-0.51; p=0.01), TA vs FEV25 (r=0.48; p=0.016), TA vs FEV25 (ns) or FEV1/FVC (ns).

Conclusion: HP but not TA showed highly significant negative correlations with spirometry parameters sensitive to small airway disease. HP areas did not always match TA areas. CE-MRI seems to improve the diagnostic value of MRI to detect small airways disease.

B-0417 15:03
A scoring system for tomosynthesis in pulmonary cystic fibrosis

K. Vult von Steyern1, I. Bjorkman-Burtscher2, P. Hoglund3, G. Bozovic4, M. Wiklund5, M. Geijer6, Lund/SE; 1RotterdamNL, 2RotterdamNL, 3VeniseffIT (kristina.vult_von_steyern@med.lu.se)

Purpose: No scoring system for tomosynthesis (digital tomography) in pulmonary cystic fibrosis (CF) has been published. The purpose was to introduce and validate such a system.

Methods and Materials: 88 paired chest radiography and tomosynthesis examinations on 69 patients with CF (33 children and 36 adults) and 7 paediatric oncology patients were scored independently by three radiologists. Tomosynthesis studies were scored for overinflation, bronchial wall thickening, atelectasis or consolidation, number and severity of bronchiectases, and large and small mucus plugs with a maximum score of 100. The Brasfield scoring system was used for radiographs.

Results: Correlation between the score for tomosynthesis and Brasfield score was good (Kendall’s rank correlation tau 0.68, 0.77 and 0.78 for the three raters). Tomosynthesis was generally scored higher in percentage of maximum score. Observer agreements for total scores were high in both systems (weighted kappa > 0.90 for the three pairs of radiologist raters for the tomosynthesis score, and 0.80, 0.81 and 0.85 for the Brasfield score). 29 patients (33%) were scored normal for nodular-cystic lesions on radiographs by all raters, but were scored positive for bronchiectases or mucus plugging with tomosynthesis.

Conclusion: The proposed tomosynthesis scoring system, with good observer agreements for the total score. Tomosynthesis is more sensitive to CF changes, in particular bronchiectases and mucus plugging, and shows them in more detail than radiography. Therefore, the new scoring system, having a higher maximum score, offers the possibility for a more accurate scoring of disease severity.
B-0420 14:00
Directional atherectomy of calcified stenotic lesions of the lower limb in segments with high biomechanical stress: 3-year results
P. Minko, S. Jaeger, A. Buecker, M. Katoh; Homburg a.d. Saar/DE (peterminko@yahoo.com)

Purpose: To evaluate the long-term outcomes (3 years) of patients with peripheral occlusive disease (POD) and calcified stenotic lesions in segments with high biomechanical stress after atherectomy.

Methods and Materials: Patients suffering from POD (Rutherford 2 to 6) were treated with the Silverhawk atherectomy device (ev3 Endovascular, MN, USA) if calcified stenotic lesions in the most proximal or distal 3 cm of the superficial femoral artery and/or popliteal artery were present. Overall 42 patients with 46 lesions (15 females, 27 males; mean age: 69±8.8) were included into this prospective study. Patients underwent clinical re-evaluation every 6 months for 36 months including the measurement of the maximum walking distance and the ankle brachial index (ABI). In addition, duplex sonography was performed.

Results: The primary success rate of the procedure was 89%. In five cases additional PTA and/or stenting was necessary. Procedure-related complications namely peripheral embolism occurred in 5 cases (6%). The mean Rutherford score decreased significantly from 4.1 to 0.75, while the mean ABI increased from 0.62 to 0.85 after 36 months. The primary and assisted primary patency rate was 66% and 79%, respectively. Target lesion revascularisation was performed in five patients.

Conclusion: Directional atherectomy should be considered as an alternative for treatment of calcified stenotic lesions in segments with high biomechanical stress as in most cases stenting can be avoided. Results after three years demonstrated a significant decrease of the Rutherford score and an increase of the ABI and a reasonable patency rate.

B-0421 14:09
Intra-arterial infusion of allogenic mesenchymal stem cells for critical limb ischaemia and foot ulcers safety and efficacy
B.J.J. Abdullah, S.S. Dhillon, A. Das, A.C. Roslani; Kuala Lumpur/My (basrij@ummc.edu.my)

Purpose: To determine safety, technical feasibility and clinical efficacy of intra-arterial allogenic mesenchymal stem cells (AMSC) for critical limb ischaemia (CLI) and foot ulcers.

Methods and Materials: A prospective single arm Phase II non-randomised study was carried out in 8 patients with untreatable lower limb peripheral arterial disease (surgical bypass or angioplasty) diagnosed by CE MRI. Uncontrolled DM, renal/hepatic failure or any previous malignancy was cause for exclusion. Only single injection of 100 million cells into the common femoral artery under US guidance. No repeat injections allowed. AMSC isolated from unrelated healthy donors analysed using flow cytometry. AMSC up-scaled according to cGMP. The type of adverse events (AEs), number of AEs and percentage AEs were noted. Primary endpoints were rest pain and ulcer healing at end 6 months while secondary endpoints were increased transcutaneous partial oxygen saturation (TcPO2), ankle brachial pressure index (ABPI), vasculogenesis (CE MRI) and limb preservation. Approval obtained from hospital ethical review board.

Results: To date, a total of 10 limbs treated. 1 patient each (1 limb) did not respond to treatment (pain persistent) with 1 patient having BKA. 2 patients died from unrelated causes (1 limb at 10 months; 2 limbs at 2months). At 6 months, 4 patients (5 limbs) have limb preservation (improved TcPO2 and ABPI within 1 month) and peaking at 3 months. No increased vasculogenesis seen on CE MRI. No AEs documented during the FU period.

Conclusion: These preliminary data show intra-arterial AMSC is a safe, technically feasible and efficacious in untreatable CLI.

B-0422 14:18
DEB vs PTA for multilevel lower limb revascularisation: 6-month results from a randomised trial
A. Cannavale, F. Fanelli, A. Bruni, M. Allegretti, E. Boatta, R. Passariello; Rome/IT (alessandro.cannavale@hotmail.com)

Purpose: Drug-eluting balloons have shown promising results in recent trials improving the patency rate in steno-oblstructive disease of the femoro-popliteal region. We would like to evaluate mid-term patency of peripheral angioplasty with paclitaxel-coated balloons (DEB) in comparison with conventional balloons (PTA).

Methods and Materials: Fifty consecutive patients (mean age 68±4 years), with stenosis or occlusion of a femoro-popliteal artery were enrolled and randomly assigned to treatment with DEB (25 pts, 50%; IN.PACT Amphirion, Invatec, Italy) and to treatment with uncoated balloons (25 pts, 50%; control group). Patients’ characteristics were similar in both groups: 28% smokers, 45% diabetes and 59% hypercholesterolemia. Thirty-eight% were TASC B while 34% were C and 10% D. The primary end point was late lumen loss at 6 months.

Results: Twenty-two percent of the lesions were total occlusions, and 36% were stenotic lesions. The mean lesion length was 5.5±3.5 cm. There were no adverse events correlated with the paclitaxel-coated balloons. At 6 months, USCD follow-up showed neointimal thickness of 1.6±1.7 mm in the control group, as compared with 0.5±1.4 mm (P<0.001) in the group treated with DEB. The rate of revascularisation of target lesions at 6 months was 9 of 25 (36%) in the control group, 2 of 25 (8%) in the DEB group (P=0.001 vs. control group). Thrombosis rate was 12% (PTA) vs 7% (DEB) p < 0.01. Amputation rate was 8% (PTA) vs 3% (DEB) p < 0.01.

Conclusion: Use of DEB in femoropopliteal disease is associated with significant reductions in late lumen loss and target-lesion revascularisation.

B-0423 14:27
Concomitant use of endovenous laser and foamed sclerant in treatment of lower limb varicosities: 3-year follow-up results
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Purpose: To report mid-term results (upto 3 years) of concomitant use of two modes of treating varicose veins - endovenous laser treatment for great saphenous vein (GSV) reflux and sclerotherapy for incompetent perforators and accessory venous channels.

Methods and Materials: 253 lower limbs (76 left, 43 right,134 bilateral) of 186 patients (66 women,120 men; mean age 45.5 yrs) were treated with concomitant use of endovenous laser and sclerotherapy. 5 patients (18 legs; 7%) had ulcers. GSV was mapped using 10MHz linear Ultrasound (US) probe. Following local anaesthesia, 0.035 inch J-Guidewire was introduced in GSV from lowest point of reflux. A 5 F sheath and 610µm laser fibre was used. Laser energy was delivered intraluminally at 14 W continuous mode. Fibre was uniformly withdrawn. Sclerosant mixed with air to produce foam was introduced through needle in perforators and additional venous channels under US guidance. All patients were advised to keep legs elevated and class II stockings. Follow-up was done at 1 week, 3,6,12, 24 and 36 months.

Results: 98% laser-treated GSV remained ablated at 3-year follow-up. 7% limbs in first year and additional 3% limbs in next 2 years (i.e., 10 % limbs in 3 years) required one more sclerotherapy session for new incompetent perforators. No complications were noted. 90% patients complained of lightness along the course of treated GSV. Patients resumed routine activities immediately.

Conclusion: Laser has already proven its use in treating GSV. Sclerotherapy is effective in dealing with perforators and provides rapid healing of chronic venous ulcers. Concomitant use of both modes limits the need of subsequent procedure.

B-0424 14:36
PTA the other way: US-guided SAFARI technique
I. Kogan, M. Leiderman, R. Rozenberg, A. Engel, A. Ofer; Haifa/IL (raduosenberg@yahoo.com)

Purpose: To describe the benefits of ultrasound (US)-guided subintimal arterial flossing antegrade-retrograde intervention (SAFARI).

Methods and Materials: We retrospectively analysed patients who were treated with the SAFARI technique due to failure of classical antegrade PTA to recanalise occluded femoral or tibial arteries. Between 2009 and 2011, 226 patients underwent 263 PTA procedures in our hospital for treatment of limb ischaemia. We used the SAFARI technique on 16 patients in whom antegrade PTA failed to provide direct flow to the ischaemic site. In all patients the retrograde puncture was performed under US guidance. In 93.7% of patients the ensuing puncture site was in the dorsalis pedis artery and in one patient we punctured the tibialis anterior artery. The guide wire was pushed in a retrograde manner through the previously inserted antegrade catheter. The balloon dilatation was performed using both puncture sites.
Results: In all patients the US-guided puncture of a distal artery was successful. Combined antegrade and retrograde (SAFARI technique) PTA was successful in 87.5% of the patients in which the antegrade PTA alone did not provide satisfactory recanalisation and was considered failed. As a minor complication, temporary DP artery spasm was seen in 12.5% of the cases.

Conclusion: SAFARI technique is usually used when the classic antegrade PTA fails. This procedure necessitates a hollow distal artery, angiographers with ultrasonographic skills and it is time consuming. However, it provides a good last alternative in patients in which the antegrade PTA has failed.

B-0425 14:45
Silverhawk directional atherectomy in the treatment of de novo femoropopliteal atherosclerotic steno-obstructive disease: single centre experience
M. Citone, M. Rossi, L. Greco, G.M. Varano, A. Zolotovins, V. David; Rome/IT (mi.citone@inwind.it)

Purpose: To evaluate the role of percutaneous directional atherectomy (DA) in the treatment of femoropopliteal atherosclerotic lesions, in symptomatic PAD patients.

Methods and Materials: Between 2008 and 2011, 62 patients (42 males, ma72) with symptomatic PAD (intermittent claudication 23 cases, rest pain 17, tissue loss 22) underwent DA with SilverHawk catheter for 62 atheromasic lesions (38 obstructions: 26 SFA, 12 popliteal artery; 24 stenoses: 4 CFA, 12 SFA and 8 popliteal artery). Average angiographic lesion length was 7.5 cm (3.-11) occlusion and 4 cm (2.5-8) stenoses. Pre-procedural lesions were measured in defined groups and also according to different stent graft devices. Additionally, reintervention and death rates were evaluated.

Results: Mean follow-up was 68.1 ±23.8 months. In the type-II-EL group sac diameters increased significantly in comparison to the first postoperative CT. In the nEL there was a not significant tendency to decreasing sac diameters. In progradient and equal type-II ELs the mean difference of sac diameter increase was significant in comparison to the nEL (p < 0.005). By means of the overall type-II-EL group there was no significant difference in sac diameter change in comparison to the nEL. Also, the difference of diameter change was not significant comparing the EL subgroups according to their vessel origin. Regarding different stent graft devices, the Excluder endoprosthesis showed a significant mean difference of sac diameter increase in comparison to the Talent and Zenith endoprosthesis (p < 0.005). Reinterventions were performed in 18.3% (n=20) of patients and there were 6.3% (n=2) aneurysm-related deaths.

Conclusion: Progradient and equal type-II ELs result in significant aneurysm sac enlargement during long-term follow-up. Based on our results, routinely follow-up of patients with type-II ELs remains mandatory.

B-0428 15:12
Excimer laser atherectomy in arteries of the lower limb with TASC C and D lesions
C. Wissgott, P. Kamusella, C. Luedtke, R. Andresen; Heide/DE (c.wissgott@gmx.de)

Purpose: The study objective was to examine the application of excimer laser atherectomy (ELA) in patients with refractory occlusions in femoropopliteal arteries, where previous conventional recanalisation attempts, using percutaneous transluminal angioplasty (PTA), were unsuccessful.

Methods and Materials: The average age of the 40 patients (32 men, 8 women) included in this study was 65.4 years. The average lesion length was 17.5 cm (range: 12-25 cm). The initial recanalisation attempts were performed with stiff Terumo guidewires (curved or straight) supported by various catheters (straight/multipurpose/Cobra). After the unsuccessful attempt, an excimer laser catheter (catheter diameters from 1.7 to 2.5 mm) was used for recanalisation using the step-by-step method of crossing. After successful crossing, balloon dilatation was performed in all cases. Stent implant was required in 10% (4/40) of procedures.

Patients were followed for 12 months with CCDS.

Results: The initial technical success rate of 90% (36/40) resulted in primary, primary-assisted and secondary-assisted patency rates of 58.9%, 67.8% and 83.2%, respectively, after 12 months. No serious complications occurred that were attributable to the intervention.

Conclusion: According to these results, ELA recanalisation provides a low stent rate alternative to surgical procedures for refractory occlusions. This would offer patients, with increased operative risks, a promising and low-risk therapeutic procedure. The option of a subsequent vascular operation would not be compromised.

B-0429 15:21
Long-term volumetric follow-up of abdominal aortic aneurysm repair to determine the effect of endoleaks on aneurysm volume
W.H. Sommer, M. Haack, R. Weidenhagen, F. Meinel, M.F. Reiser; Munich/DE (wieland.sommer@med.uni-muenchen.de)

Purpose: To determine the effect of different types of endoleaks on long-term changes in aneurysm volume in patients after abdominal endovascular aneurysm repair (EVAR).

Methods and Materials: We determined the volume of the abdominal aneurysm size in 103 patients who underwent EVAR between 2002 and 2009 in all pre-therapeutic and follow-up CTs using the software OsiriX 3.8. Mean increase of the aneurysm volume was determined for patients without endoleaks and with different types of endoleaks at different time points (3 months, 12M, and 36M after
EVAR). Patients with low-flow (type II) and high-flow (type II/III) endoleaks were separated solely to determine the effect of endoleaks on aneurysm volume.

Results: Overall 276 CT-datasets were evaluated by volumetry (patient age 69±14 y; no. of follow-up CTs: 5.6±1.6; mean follow-up time: 43±9 months). Among these patients, there were 6 type I, 19 type II and 5 type III endoleaks. The aneurysm volume in patients without endoleaks after 3M, 12M and 36M was 95±10%, 86±9% and 76±8% of the initial aneurysm volume, respectively. Low-flow (type II) endoleaks showed the following volumes: 110±5% (3M), 107±7% (12M) and 106±11% (36M). High-flow (type III) endoleaks showed the following volumetries, compared to the initial volumetry: 108±8% (3M), 113±12% (12M) and 121±14% (36M) (p < 0.05).

Conclusion: Both low- and high-flow endoleaks have a significant impact on regression of aneurysm volume in patients after EVAR. Type II endoleaks rather lead to stable volumes over years, type I and III endoleaks continuously increase aneurysm size.

14:00 - 15:30 Room E1

Musculoskeletal

SS 610

Cartilage and osteoarthritis

Moderators:
A. Platkajis; Riga/LV
G. Scheurecker; Linz/AT

B-0431 14:00

Biomechanics of human knee cartilage-loading of knee during 3 T MRI
T. Shiono, P. Szomolanyi, J. Jurus, S. Zbyn, S. Trattnig; Vienna/AT
(t-shiono@ka2.so-net.ne.jp)

Purpose: As reported previously, MRI measurements of knee cartilage morphology are not sensitive to changes associated with early stage of osteoarthritis development. Biochemical MRI provides information on cartilage composition, dominantly on proteoglycan content and collagen matrix. We hypothesise that changes in T2 values of human knee cartilage observed during biochemical MRI correlate with cartilage functionality.

Methods and Materials: Multi-slice multi-echo was performed on 10 volunteers. After load-free measurements, load of half body weight was applied with the MRI compatible custom-made pneumatic controlled compression device for 3 T. At the end, load-free measurement was repeated. Offline post-processing was used to evaluate T2 maps. ROIs were drawn manually by experienced radiologist in deep and superficial zone of the weight-bearing area. Mean, standard deviation and pixel count were recorded and statistically analysed by T-test.

Results: T2 values of human knee cartilage exhibit significant decrease in loading phase (57.04 ms -> 52.45 ms, p= 0.00045), and significant increase in unloading phase (51.86 ms -> 56.58 ms, p= 0.00004). T2 values exhibit nonlinear dynamic change over time and reached stable values after 20 minutes of loading/unloading. Changes of T2 values were more obvious in superficial layer.

Conclusion: Loading of knee during MRI can provide biomechanical characteristics of human knee cartilage. Statistically significant change of cartilage T2 in loading and unloading phase provides insight into cartilage function. This can help in diagnostics of early stages of osteoarthritis development, when morphological changes and degenerations are not visible. Next step will be application of loading MRI to the patients after cartilage surgery.

B-0431 14:09

Knee joint configuration: the implication of severe osteoarthritis and ACL injury
E. Vassalou, P. Matailliotaki, K. Spanakis, P. Maida, E. Magkanas, A. Karantanas; Iraklion/GR (vassalou.e@hotmail.com)

Purpose: To assess the effect of severe osteoarthritis (OA) and ACL injury on the knee joint configuration.

Methods and Materials: MR images for 206 patients were reviewed. Group I consisted of 101 patients (11-71y) with MRI diagnosis other than severe OA (chondral defects ≤ stage II) and ACL injury. Group IIa included 40 patients (14-67y) with complete, chronic or recent, ACL tear and IIb 25 patients (14-76y) with partial, chronic or recent ACL tear. Group III encompassed 40 patients (39-93y) with severe OA (chondral defects > stage II). The femoral angle was defined in the axial plane, by drawing a horizontal line and a line tangent to the posterior aspect of the cortex of the femoral condyles at their maximum anteroposterior diameter. The tibial angle was measured similarly one slice above the head of the fibula. The femorotibial angle (FTA) was defined as the femoral angle minus the tibial angle. All patients’ ages were recorded.

Results: There was significant difference regarding the FTA between group I and groups IIa, IIb and III (independent samples, t-test, p < 0.005). 91% and 22% of the patients in group I and IIa respectively, had an FTA < 4.4o. No significant correlation between the FTA and patients’ ages was observed, in any of the groups.

Conclusion: ACL injury and severe OA induce alteration in the femorotibial anatomical relationship by means of rotation of the femur in relation to the tibia. The above finding could be of value in assessing ACL tears with equivocal direct signs on MRI.

B-0432 14:18

Multi-parametric MRI of talar and tibial cartilage in cadaver ankles at 7T: correlation with immuno-histological findings
S. Zbyn, S. Apprich, J. Jurus, P. Szomolanyi, S. Domayer, S. Trattnig; Vienna/AT
(stefan.zbyn@medunivwien.ac.at)

Purpose: To evaluate biochemical MRI techniques at 7 Tesla, such as sodium imaging and T2 mapping, as potential markers for biochemical composition of talar and tibial cartilage in upper ankle-joint, by correlating MRI parameters with immuno-histologically assessed glycosaminoglycan and water content of cartilage in cadaver ankles.

Methods and Materials: Seven fresh cadaver ankles from a local anatomy department were used in this study. Sodium MRI was performed with gradient echo sequence optimised for articular cartilage using sodium-only 15-channel transmit/receive knee coil. The T2-relaxation times were obtained using a multi-echo spin echo technique with 28-channel transmit/receive knee coil. Talar and tibial cartilage of each ankle was divided into lateral, central and medial part and region-of-interest analyses were performed on corresponding MR images. Resultant sodium signal-to-noise ratio (SNR) and T2-relaxation times were correlated with each other, as well as with immuno-histologically assessed glycosaminoglycan and water content of talar and tibial cartilage.

Results: Strong Pearson correlation coefficient was found between sodium SNR and glycosaminoglycan content in talar (r= 0.716) and tibial (r= 0.780) cartilage as well as between T2-relaxation times and water content in tibial cartilage (r= 0.761). Low correlation was observed between T2-relaxation times and water content in talar cartilage (r= 0.434).

Conclusion: Obtained high correlation between MRI parameters and immuno-histological results validates the findings of progressive MRI methods at 7T. A contrast-free, glycosaminoglycan-specific sodium imaging, as well as water- and collagen-sensitive T2 mapping, are feasible for the noninvasive biochemical evaluation of the talar and tibial cartilage in reasonable scan times.

B-0433 14:27

UCSF score: a novel quantitative assessment score for cartilage lesions in early osteoarthritis - data from the osteoarthritis initiative
(hamzaalzari@gmail.com)

Purpose: In this study, we describe a quantitative scoring system for cartilage lesions, test its reliability and validity and compare it with established semiquantitative scoring systems.

Methods and Materials: Forty-seven individuals with and 27 without risk factors for knee OA were randomly selected from the osteoarthritis initiative cohort. Inclusion criteria were age 45-55, BMI 19-27 kg/m², no knee pain and no radiographic OA at baseline. Baseline and 24-month follow-up right knee 3 T MR images were analysed using WORMS, BLOKS and UCSF-Score with an interval of 3 weeks between each analysis. Progression of cartilage lesions using each scoring system was calculated and compared using multilevel, mixed-effect linear-regression models. Weighted Kappa values were calculated to determine reliability.

Results: The UCSF-Score assesses 5 features of cartilage defects: diameter, number of sections, section thickness, depth and shape, in 6 knee compartments. The inter- and intra-observer reliability for the total UCSF-Score were calculated as 0.80 and 0.84. Inter-observer Kappa for individual features ranged from 0.87 to 0.94. UCSF-Score had a significantly higher rate for detecting cartilage lesion progression than WORMS and BLOKS (p < 0.0001): 43%, 18% and 15% of the lesions progressed when analysed with UCSF-Score, WORMS and BLOKS, respectively. Using UCSF-Score, the subjects with OA risk factors had higher odds of progression than subjects without risk factors (OR 2.78, p=0.005).

Conclusion: The UCSF-Score is a novel reproducible and valid quantitative scoring system for cartilage lesions, which provides an improved detection rate for monitoring early OA progression compared to the semi-quantitative WORMS and BLOKS.
B-0435 14:36
T2 relaxation time measurements are limited in monitoring advanced cartilage degeneration of the knee - longitudinal data from the osteoarthritis initiative

Purpose: To analyse the natural two-year development of knee cartilage T2 relaxation time measurements in relation to the extent of morphological cartilage abnormalities, assessed with 3 Tesla MRI images from the osteoarthritis initiative incidence cohort.

Methods and Materials: Right knee MRIs of 245, 45 - 60 year old individuals (122 males, 123 females) with risk factors for osteoarthritis (OA) but without radiographic OA or knee pain at baseline were included in this study. Cartilage was segmented and T2 maps were generated in five compartments (patella, medial and lateral femoral condyle, medial and lateral tibia plateau) at baseline and two-year follow-up. T2 changes over 2 years were correlated with baseline T2 values as well as cartilage degenerative changes assessed with whole organ MRI scoring systems (WORMS).

Statistical analysis was performed with ANOVA and two-sided Students t-tests.

Results: Baseline mean and heterogeneity of MR knee cartilage T2 were associated with morphologic degeneration of cartilage, meniscus, and bone marrow over three years: data from the osteoarthritis initiative. Baseline mean and heterogeneity of knee cartilage T2 at baseline were associated with morphologic degeneration of these tissues over three years in subjects with risk factors for knee osteoarthritis (OA).

Methods and Materials: Subjects with risk factors for knee OA (n=289) with an age range of 45-55 years were selected from the osteoarthritis initiative (OAI) database. 3.0 Tesla MRI images of the right knee at baseline and 3-year follow-up were analysed using morphological gradings of cartilage, meniscus, and bone marrow (WORMS scoring). A T2 mapping sequence was used to assess baseline mean and heterogeneity of cartilage T2 (grey level co-occurrence matrix (GLCM) texture analysis). Regression models were used to assess the relationship between baseline T2 parameters and changes in morphologic knee WORMS scores over three years.

Results: The prevalence of knee abnormalities in the cartilage, meniscus, and bone marrow significantly (p < 0.05) increased from baseline to 3 years in all compartments combined. The mean and heterogeneity of baseline cartilage T2 was significantly (p < 0.05) elevated in subjects whose cartilage, meniscus, and bone marrow WORMS scores increased over three years compared to subjects whose scores did not change.

Conclusion: The prevalence of knee abnormalities significantly increased over three years; increased cartilage T2 at baseline is associated with longitudinal morphologic degeneration in the cartilage, meniscus, and bone marrow over three years in subjects with risk factors for OA.

B-0437 14:54
MRI-based baseline T2 relaxation time predicts progression of knee osteoarthritis
L. Nardo, A. Prasad, J. Schooler, H. Liebl, T.M. Link; San Francisco, CA/US

Purpose: To evaluate whether T2 relaxation times of knee cartilage determined with 3 T MRI at baseline predicted longitudinal progression of cartilage degenera-tive changes.

Methods: Quantitative analysis of cartilage was performed using 3 T MRI with both T2 mapping techniques in 55 individuals with mild OA (Kellgren-Lawrence [KL] score of 1-2), divided into two groups of progressors (27 subjects) and non-progressors (28 subjects). Morphological abnormalities of cartilage, menisci, ligaments and bone marrow were analysed on sagittal fat-saturated T2-weighted fast spin echo (FSE) sequences and progression of degenerative disease was assessed over a period of two years. Differences between T2 relaxation time in progression and non-progression cohorts were compared using one-way analysis of variance (ANOVA) and t tests.

Results: Significant differences in baseline T2 values were found between progression and non-progression cohorts in all compartments (p < 0.05) except the lateral tibia: medial femur (p=0.0171), lateral tibia (p=0.0179), and patella (p=0.01).

Conclusion: T2 mapping techniques differentiated individuals with and without progression of degenerative abnormalities and may therefore be used as predictors for progression of knee OA.

B-0438 15:03
MRI-based and clinical long-term results of isolated osteochondral transplantation (OATS) of the knee joint
J.S. Bauer, L. Kohn, J. Penzel, P.U. Brucker, A. Imhoff, E. Rummney, K. Woertler, M. Sauerenschlag; Munich/DE (jab@iro.med.tum.de)

Purpose: OATS is an established therapy for osteochondral lesions at the knee joint. However, long-term results regarding clinical and morphological outcome do not exist in a uniform patient set so far.

Results: Comparing pre-surgery with follow-up, significant improvement was found in case of VAS, WOMAC- and Lysholm-score. The Tegner-score did not show differences (p> 0.9). BLOK-score increased in OA-associated findings like osteophytes. Average T2-relaxation times of the OATS cylinders (48.5±8.0) did not show significant differences to normal cartilage (47.1±5.2). However, the adjacent cartilage next to the cylinder demonstrated significantly higher T2-values (50.9±7.6, p < 0.01). A T2 mapping sequence was used to assess baseline mean and heterogeneity of knee cartilage T2 at baseline predicted longitudinal progression of cartilage degeneration.

Conclusion: Isolated OATS therapy shows good long-term results, both clinically and morphologically. The elevation of the surrounding cartilage may suggest a preexisting defect in cartilage ultrastructure, larger than the replaced area, not visible for the surgeon.
A correlation between MRI parameters and clinical scores was only found between T2 ratios and modified Lysylom (p = 0.001, p = 0.04).

Conclusion: Our results imply that the hyaline character of AOT grafts seems to degenerate in the long term. AOT can still be recommended as an option for the treatment of limited sized cartilage defects due to few correlations found between MRI and clinical scores.

14:00 - 15:30 Room F1
Abdominal Viscera

SS 601
MRI (high field)
Moderators:
K. Holzapfel, Munich/DE
O. Lucidamme, Paris/FR

B-0440 14:00
Optimisation of liver intravoxel incoherent motion imaging protocol at 3.0 T for chronic liver diseases assessment
B. Lecrom, F. Filipeu, O. Beuf; Villeurbanne/FR (benjamin.leporq@creatis.insa-lyon.fr)

Purpose: To optimise a 3 T acquisition protocol for liver intravoxel-incoherent-motion (IVIM) imaging to be included in a clinical study focused on chronic liver diseases. Four set of parameters were evaluated on fifteen healthy volunteers.

Methods: Invariant parameters were: eDWI sequence with 11 b-values (0-20-40-60-80-100-200-300-600-800-mm-2); 2000 ms TR; 21 axial slices; 400×300 mm² F OV; 128×96 matrix; 8 mm slice thickness, 250KHz bandwidth. Variable parameters according to the four settings were: a) respiratory-triggering, 6NEX, 48 ms TE, 3 perpendicular diffusion gradients applied simultaneously (option “3-in-1”) and 6 or 7 scan duration. b) Free-breathing, 9NEX, 48 ms TE, 3-n or 1 option and 5 or 3.5 scan duration. c) Free-breathing, 9NEX, 55 ms TE, 3 perpendicular diffusion gradients applied sequentially (“all” option) and 9 or 40 scan duration. d) Variable NEX according to b-values (2-2-2-3-3-3-4-5-6-7-8-9-8-9-8-9) from 0 to 800s.mm-2; additional 10 ms.n-2-b value, 55 ms TE. “all” diffusion option and 5 or 26 scan duration. Pure molecular diffusion coefficient (Dslow), perfusion-related coefficient (Dfast) and perfusion fraction (f) were obtained by a non-linear least-square fit to the IVIM model.

Results: Mean IVIM parameters were: I=21.0±6.0, 16.9±6.2, 17.9±5.0 and 22.4±10.6%; Dslow=1.03±0.14, 1.12±0.10, 1.09±0.08, 1.09±0.08×10⁻³ mm².sec⁻¹; Dfast=56.4±22.2, 71.6±26.3, 80.6±26.6, 75.8±44.7×10⁻³  mm².sec⁻¹ for protocol a), b), c), and d), respectively. Bland-Altman plots were not shown significant differences between settings.

Conclusion: High signal averaging restricted motion artefacts caused by free-breathing imaging and allowed free-breathing technique. The smart-averaging procedure reduces significantly the scan duration with similar SNR for the highest numbers of b-values and three perpendicular diffusion gradients sequentially applied. This setting is a suitable compromise to be added in a clinical protocol between acquisition time, modelling reliability, reproducibility and patient acceptance.

B-0441 14:09
Can we differentiate infiltrative hepatocellular carcinoma and confluent fibrosis in background liver cirrhosis with Gd-EOB-DTPA-enhanced 3 T MRI?
Y. Park, C. Lee, K. Kim, J. Choi, J. Lee, C. Park; Seoul/KR (jips1408@naver.com)

Purpose: To retrospectively determine the significant MRI features for the differentiation of infiltrative hepatocellular carcinoma (HCC) from confluent fibrosis in liver cirrhosis.

Methods and Materials: After search of pathologic and radiologic databases, 16 of infiltrative HCC and 8 of confluent fibrosis evaluated with Gd-EOB-DTPA-enhanced 3 T MRI from 2008 to 2010 were reviewed. Two radiologists retrospectively reviewed MR images in consensus for morphologic change, signal intensity, enhancement pattern, apparent diffusion coefficient (ADC) value, and presence of portal vein thrombosis, duct dilatation, and metastatic lymph node. Clinical findings such as tumour marker and symptom also were recorded. Univariate analyses were used to differentiate these entities.

Results: All infiltrative HCC showed preservation of contour or contour-bulging and all confluent fibrosis showed capsular retraction. Infiltrative HCC manifested arterial enhancement (9/16) and portal vein thrombosis (14/16). Confluent fibrosis appeared delayed enhancement (6/8). ADC was significantly lower in infiltrative HCC than in confluent fibrosis (0.96±0.14 x 10⁻³ mm²/s and 1.47±0.17 x 10⁻³ mm²/s, p=0.0001). Compared with T2-weighted image, hepatobiliary phase showed more discrete margin and nodular configuration in infiltrative HCC and more indistinct and wedge shape in confluent fibrosis.

Conclusion: Preservation of liver contour or contour-bulging, portal vein thrombosis, and low ADC value were found to be highly suggestive MR findings for differentiation of infiltrative HCC from confluent fibrosis in liver cirrhosis. Hepatobiliary phase improves characterisation and determination of extent and margin of the lesion to distinguish these two entities.

B-0442 14:18
Gd-EOB-DTPA-enhanced 3.0 T MRI for the evaluation of hepatic metastasis from colorectal cancer: Is metastasis always seen as a “defect” on the hepatobiliary phase?
A. Kim, C. Lee, K. Kim, J. Choi, J. Lee, Y. Park, C. Park; Seoul/KR (arkim.rad@gmail.com)

Purpose: To determine specific imaging features of hepatic metastasis from colorectal cancer, focusing on the hepatobiliary phase (HBP) of Gd-EOB-DTPA-enhanced MRI.

Methods and Materials: Over a 2-year period, 79 hepatic metastatic lesions were identified from 32 patients (22 men and 10 women) who proven colorectal cancer and underwent Gd-EOB-DTPA-enhanced 3.0 T MRI. Hepatic metastases were proven pathologically in 16 patients: by surgical liver resection (n=14) and by US-guided biopsy (n=2). The remaining 16 patients were considered to have hepatic metastasis based on imaging studies and clinical information. Two radiologists evaluated the imaging features of each MRI sequence, including high-resolution T2WI, dynamic contrast enhancement study with hepatobiliary phase, and diffusion-weighted image. We also compared SI of the lesions on T2WI and HBP.

Results: T2WI showed homogeneous high SI (n=25; 31.7%), target appearance (n=3; 3.8%), reversed target appearance (n=2; 2.6%), and heterogeneous high SI (n=15; 19.2%). On HBP, homogeneous defect was seen in 22 lesions (27.9%), target appearance in five lesions (6.4%), reversed target appearance in two lesions (2.5%), and heterogeneous defect in 50 lesions (63.3%); including reticular (70%), partially globular (26%), and diffuse GGO-like (4%) patterns. According to the imaging features on HBP, the homogeneous defect and heterogeneous defect groups had a mean ADC value of 0.99±0.3 and 1.07±0.3 mm²/sec, respectively, without statistically significant difference.

Conclusion: Hepatic metastasis from colorectal cancer usually showed as a heterogeneous defect on HBP and a homogeneous high SI on T2WI. The generally accepted “true defect” was not a common finding in hepatic metastasis from colorectal cancer.

B-0444 14:27
Quantification of liver fat content by 3 Tesla spectroscopy magnetic resonance (3 T SRM) in nonalcoholic fatty liver disease: correlation with serum levels of alanine aminotransferase (ALT)

Serum levels of ALT is a biomarker nonalcoholic fatty liver disease (NAFLD). Only a proportion of patients with NAFLD have elevated serum ALT levels. Purpose: To know if there is a relationship between liver fat content and serum levels of ALT, as well as to study if there is a threshold within de current normal ALT values, from which we could suggest the presence of NAFLD.

Methods and Materials: This is a community, prospective, cross-sectional, random study. Group A: 22 subjects with elevated serum ALT levels (> 40 U/L) without any known cause: alcohol, viral hepatitis, autoimmune, drugs and others were excluded. Group B: 23 subjects with serum ALT levels between 20 and 40 U/L. Group C: 11 subjects with serum ALT < 20 U/L. Quantification of liver fat by spectroscopy 1H MR 3 T. We used a cut off value > 5% of liver fat content for the diagnosis of hepatic steatosis.

Results: The proportion with hepatic steatosis was: group A: 88%; group B: 87%. Group C: 0% (< 0.001 for group B or C vs. group A). A significant positive correlation was observed between liver fat content and ALT serum levels (r: 0.576; p < 0.001).

Conclusion: Our study shows that there is a positive significant correlation between liver fat content and serum ALT levels in subjects with NAFLD. 87% of subjects with “normal” ALT levels (20-40 U/L) had hepatic steatosis. We suggest that serum ALT could be a useful biomarker of NAFLD if the normal threshold is established at ALT levels < 20 U/L.
**B-0045 14:36**

Liver intra-voxel incoherent motion imaging at 3.0 T: comparison with conventional dual b-values method

**Purpose:** To report our experience about intra-voxel incoherent motion (IVIM) imaging on human liver and phantom to compare the bi-exponential diffusion pattern with the conventional dual b-values ADC method.

**Methods and Materials:** Acquisitions were performed at 3 T, in free breathing, on fifteen healthy volunteers then on a doped 2.5% agar gel phantom using eDWI sequence (GEHC). Parameters were: 11 b-values (0-20-40-60-80-100-200-300-400-600-800 s/mm²-2); 2000 ms TR; 48 ms TE; 21 axial slices; 400×300 mm² FOV; 128x96 matrix; 8 mm slice thickness, 9NEX, 250 kHz bandwidth. Three perpendicu- lar diffusion gradients were applied simultaneously. Pure molecular diffusion coefficient (Dslow), perfusion-related coefficient (Dfast) and perfusion fraction (f) were obtained by a non-linear least-square fit to the bi-exponential IVIM model. ADC was computed using conventional mono-exponential method with two pair of b-values: 0/600 and 40/600.

**Results:** Mean IVIM parameters were Dslow=1.12±0.10×10⁻³ mm.s⁻²; ADC was computed using conventional mono-exponential method with two pair were obtained by a non-linear least-square fit to the bi-exponential IVIM model.

**Conclusion:** The mean organ signal from 1.5 T to 3 T of 1.45, and 1.19 from 3 T to 7T. Conclusion: Our results demonstrate the benefits and the limitations of an increase of the magnetic field strength, offering improved and highly detailed delineation of anatomical and vascular structures in T1w imaging.

**B-0046 14:45**

Apparent diffusion coefficient values of healthy pancreas from diffusion-weighted imaging of upper abdomen at 3.0 T

**Purpose:** To clarify the apparent diffusion coefficient (ADC) values in different anatomical regions (head, neck, body) of normal pancreas.

**Methods and Materials:** The study subjects comprised 183 patients with confirmed healthy pancreas. Echo-planar diffusion-weighted imaging (DWI) of upper abdomen was performed by applying two b-values of 0 and 500 s/mm² at a 3.0 T magnetic resonance imaging (MRI) system. ADC values were obtained in 1532 various regions of pancreas. Dependency of ADC on the anatomical regions was analysed using Kruskal-Wallis test and Wilcoxon sign rank test.

**Results:** The mean ADC value of the whole healthy pancreas is 1.60±0.33×10⁻³ mm²/s. The results of Kruskal-Wallis test showed the significant difference of the ADC values among the different anatomical regions. The lowest values were obtained in the pancreatic head (head.1.52±0.29, neck.1.64±0.34, body.1.67±0.35, and tail 1.58±0.31 x10⁻³ mm²/s2). Chi-square = 44.874, DF = 3, P < 0.0001. The results of Wilcoxon sign rank test showed the mean ADCs differed remarkably between head and neck (P < 0.0001), head and body (P < 0.0001), head and tail (P < 0.0008) and body and tail (P < 0.0001). Also, the mean ADCs of neck and body (P < 0.1851) showed no significant difference.

**Conclusion:** The mean ADC values of normal pancreas varied significantly within the different anatomical regions. Therefore, it is necessary to utilise these results in related studies or clinical applications for differentiating between different pancreatic diseases.

**B-0047 14:54**

1.5 Tesla vs 3 Tesla versus 7 Tesla abdominal MRI: the more Tesla, the better?

**Purpose:** The aim of our study was to investigate and compare the diagnostic ability of 1.5 T, 3 T and 7 Tesla abdominal MRI.

**Methods and Materials:** 12 healthy volunteers were each examined on a 1.5 T (Magnetom Aera), a 3 T (Magnetom Skyra) and a 7 T MRI system (Magnetom 7T, Siemens). The following sequences were obtained: 1) T1w Is 2D FLASH, 2) T1w}
Conclusion: At 9.4 T liver relaxation characteristics in rat liver vary with the age of the animal as a consequence of tissue transformation and have to be considered in experimental settings.

**B-0450** 14:00

**SS 602** Tomosynthesis and FFDM

**Moderators:** M. Michell, London/UK E. Siopis; Bologna/IT

**Purpose:** To analyse the impact of breast tomosynthesis (DBT) on specificity compared to standard digital mammography (MX).

**Results:** Overall, mean specificity was significantly higher with DBT than MX (86.9% vs. 83.1%, p = 0.025), while the combined protocol led to higher specificity (not significantly) than MX, but slightly lower than DBT alone (86.9% vs. 87.6%, p = 0.723), with or with the addition of MXCC, which was significantly higher than standard mammography (36.8% MX, 43.4% DBT, 45.6% DBT+MXCC; p-value (DBT vs. MX) = 0.017; p-value (DBT+MXCC vs. MX) = 0.002). The proportion of normal breasts correctly assessed was similar with MX and DBT (87.6% vs. 86.7%, p-value = 0.723), with a small decrease with the combined protocol (84.3%).

**Conclusion:** Tomosynthesis significantly increased specificity compared to digital mammography. More in detail, DBT significantly improved characterisation of benign lesions, reducing the number of false positives.

**B-0451** 14:09

**MRI in the pre-operative breast cancer staging before and after the introduction of digital breast tomosynthesis (DBT): has anything changed?** J. Giglio, G. Ghione, E. Regini, M. Durando, A. Luparia, M.C. Eandi, P.P. Campanino, G. Marisottti, G. Gandini; Tunin/IT (jacopo.giglio@gmail.com)

**Purpose:** To compare the diagnostic accuracy of MRI and conventional imaging techniques (digital mammography [DM] and ultrasound [US]) combined or not with DBT in pre-operative breast cancer assessment and to determine the effects on surgical treatment.

**Methods and Materials:** We retrospectively reviewed 132 newly diagnosed breast cancer patients (146 operated breasts), who underwent pre-operative conventional imaging modalities and MRI between January 2009 and June 2011. The patients were divided into two groups: those who had DBT in addition to DM and US (group-1:76/132, 88 operated breasts) and those who did not undergo DBT (group-2:56/132, 58 operated breasts). Statistical analyses were performed to compare the diagnostic accuracy of imaging techniques and to evaluate MRI impact on surgical management in the two groups.

**Results:** In group-1 MRI overall sensitivity was 94.1% (DM+DBT:80.6%, DM:63.6%, DM+US:73.6%; p < 0.05) and in group-2 93.6% (DM:69.3%, DM+US:73.6%; p < 0.05); for multifocal/multicentric lesions was, respectively, 80% (DM+DBT:55%, DM+DBT+US:70%; p > 0.05) and 73.3% (DM:46.7%, DM+US:46.7%; p < 0.05); for controlateral lesions was 100% in both groups (group-1:DM+DBT:57%, DM+DBT+US:57%; p < 0.05; Group-2:DM+50%, DM+US:50%; p < 0.05). In group-1 MRI specificity was 72.2% (DM+DBT:77.7%, DM+DBT+US:83.3%; p < 0.05) and in group-2 72.7% (DM:81.8%, DM+US:81.8%; p < 0.05). Pre-operative MRI changed surgical treatment in 12/88 (14.7%) in group-1 and in 25/58 (20.6%) in group-2, with a conversion from breast conservatory surgery into mastectomy, respectively.

in 7/88 (9.0%) and 10/58 (17.2%) (p < 0.05). Overall pathologic confirmation of malignancy was, respectively, 8/12 (66.7%) and 8/12 (75%) in surgical specimens.

**Conclusion:** DBT combined with DM and US improved conventional imaging accuracy, but MRI still showed the highest sensitivity in detecting and staging breast cancer.

**B-0452** 14:18

The role of breast tomosynthesis combined with digital mammography and ultrasound in breast cancer staging before and after the introduction of digital breast tomosynthesis and not seen on standard mammograms: 6 cases on ACR 2 (the detection rate was increased 0.75 %), 11 cases in ACR 3 (0.87 %) and 14 cases in ACR 4 (1.18 %). No statistical differences were found in the detection rate among the three patterns (p=0.62). Tomosynthesis increased the detection rate 0.94 %, so the total detection rate using the combo studies was 2.57 %.

**Conclusion:** The addition of digital tomosynthesis increases the detection rate from 1.63% to 2.57%. There are not significant differences among the three ACR density patterns, so tomosynthesis can be useful not only in dense patterns but also in pattern 2.

**B-0453** 14:27

Role of breast tomosynthesis in the morphological analysis of breast lesions

B. Raghsavan, M. Rajmohan, G. Sivararamalingam; Chennai/IN (drbagyam@gmail.com)

**Purpose:** To assess the role of breast tomosynthesis (by 3D combo view) versus 2D full field digital mammogram alone in the morphological analysis of breast lesions. To evaluate the potential role of tomosynthesis in BIRADS categorisation and final histopathology.

**Methods and Materials:** Patients who were referred to our department for mammogram from May 2011 (900 patients) underwent full field digital mammogram and 3D tomosynthesis (combined view). Cranio-caudal and mediolateral oblique views of both breasts were acquired for all patients. Of these our study population includes 100 patients with abnormal 2D digital mammogram. 2D digital mammogram and 3D tomosynthesis were analysed for the following features: mass, margins, calcification, asymmetry density, focal asymmetry and architectural distortion. Following the mammogram all patients were subjected to ultrasound and image-guided trucut or trucut core tissue biopsy for correlation. Statistical analysis was done to evaluate the performance of tomosynthesis versus 2D digital mammogram in terms of morphology, BIRADS categorisation and histopathology.

**Results:** There was significant difference between 2D and tomo for feature analysis (p < 0.05) and for BIRADS significant difference (p < 0.05) was found between 2D and USG/final and no significant difference (p > 0.05) was found between 2D and USG/final.

**Conclusion:** Tomosynthesis was useful in majority of patients in terms of lesion conspicuity and feature analysis. It approximated the final BIRADS after ultrasound and HPE better than 2D digital mammogram alone.

**B-0454** 14:36

Does combining 3D breast tomosynthesis with digital mammography improve diagnostic accuracy?

N.H. Said, H. Abd Magd, M. Mokhtar, L. Bassam, S. Waheed, D. Salem, A. Selim; Cairo/EG (nonrhussen@yahoo.com)

**Purpose:** To assess the value of adding 3D breast tomosynthesis (BT) to full field digital mammography (DM), for improving lesion visibility and BIRADS assessment in relation to pathological outcomes.

**Methods and Materials:** 929 cases were evaluated with DM and BT in a dedicated breast imaging unit with diagnostic and screening services. Both DM and BT were performed in cranio-caudal and mediolateral oblique views in different exposures using a siemens mammatom inspiration unit. Evaluation and BIRADS scoring was
given to DM followed by BT. A final BI-RADS score considering both interpretations and any additional information by ultrasound was later decided.

Results: 70.8% of cases were screening and 29.2% were diagnostic. According to the final assessment categories: 25.3%, 53.3%, 11.2%, 5.5%, 4.7% of cases were given a BI-RADS score of 1, 2, 3, 4, 5, respectively. Accuracy, +PP and -PP of DM alone were 96.77, 89.71, 97.33%. On adding BT results were 98.06, 87.5, 99.17%, respectively. Agreement between BT BI-RADS and Final BI-RADS score was 91.8% (kappa 0.872). Between DM and Final BI-RADS was 81.1% (kappa 0.710). Between BT and DM BI-RADS was 84.8% (kappa 0.764). Regarding the cancers detected in very dense breasts (more than 75% glandular tissue) DBT could diagnose 76.4%, while only 5.8% were diagnosed by DM. BT added new information in 20% of cases by visualisation of margins, analysis of focal asymmetry and detecting multifocality/multicentricity of cancers.

Conclusion: Adding BT to DM improves accuracy of BI-RADS categorisation and radiologic-pathologic correlation.

B-0455 14:45
Dutch digital breast cancer screening: implications for breast cancer care
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Purpose: In comparison to other European population-based breast cancer screening programmes, the Dutch programme has a low referral rate, similar breast cancer detection and a high breast cancer mortality reduction. The referral rate in the Netherlands has increased over time and is expected to rise further, mainly following nationwide introduction of digital mammography. This study explores the consequences of the introduction of digital mammography on the balance between referral rate, detection of breast cancer, diagnostic work-up, and associated costs.

Methods and Materials: Detailed information on diagnostic work-up (chart review) was obtained from referred women (n=988) in 2000-2006 (100% analogue mammography) and 2007 (75% digital mammography) in Nijmegen, the Netherlands.

Results: The average referral rate increased from 15 (2000-2006) to 34 (2007) per 1000 women screened. The number of breast cancers detected increased from 5.5 to 7.8 per 1000 screens, whereas the positive predictive value fell from 37% to 23%. A sharp rise in diagnostic work-up procedures and total diagnostic costs was seen. On the other hand, costs of a single work-up slightly decreased, as less surgical biopsies were performed.

Conclusion: Our study shows that a low referral rate in combination with the introduction of digital mammography affects the balance between referral rate and detection rate and can substantially influence breast cancer care and associated costs. Referral rates in the Netherlands are now more comparable to other countries. This effect is therefore of value in countries where implementation of digital breast cancer screening has just started or is still under discussion.

B-0456 14:54
Dramatic increase in stereotactic core needle biopsy rate and ductal carcinoma in-situ detection after conversion from analogue to digital screening mammography
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Purpose: To determine the impact of implementation of digital screening mammography on stereotactic core needle biopsy (SCNB) rate and ductal carcinoma in-situ (DCIS) detection.

Methods and Materials: We included a consecutive series of 47,737 analogue and 49,946 digital screening mammograms, obtained at a Dutch breast screening region between, respectively, January 2008-July 2009 and July 2009-January 2011. Tumour stage and biology characteristics were determined for screen-detected cancers. Results. The overall cancer detection rate was 6.9 (343/49,946) per 1,000 screened women at digital screening (255 invasive cancers and 88 ductal carcinomas in-situ (DCIS)) compared to 4.6 (222/49,249) per 1,000 screened women at analogue screening (197 invasive cancers and 36 DCIS, p<0.001). The proportion of advanced cancers (defined as T2+ and/or lymph node positive cancers) was significantly lower at digital screening (20.4% versus 34.8%, p<0.001), but tumour size (either T1a-c or T2+) of invasive cancers was comparable to those detected at analogue screening (p=0.7). At digital screening, over-diagnosis of invasive cancers showed lymph node metastasis (18.8% (48/255) versus 32.0% (63/197), p=0.002). Tumour histology of invasive cancers (either ductal or lobular cancer) was comparable (p=0.6), but invasive cancers detected at digital screening showed a more favourable Nottingham gradation (72.9% (186/255) versus 61.9% (122/197), p=0.01).

Conclusion: Replacement of analogue screening mammography by digital screening mammography had a favourable impact on both breast tumour stage and biology of screen-detected cancers.

B-0458 15:12
What do we gain by changing from screen film to full field digital mammographic screening?
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Purpose: To analyse the effect of prior and current use of screen film mammography (SFM) and full field digital mammography (FFDM) on early outcome measures in screening mammography.

Methods and Materials: Data from women aged 50-69 years screened in the Norwegian Breast Cancer Screening Programme between 1996 and 2009 were included in the study. Recall and detection rate, and positive predictive value from 525,092 initial SFM, 74,420 initial FFDM, 964,853 SFM after a prior SFM, and 197,426 FFDM after a prior SFM, and 168,410 FFDM after a prior FFDM were included in the study. Recall and detection rate, and positive predictive value were analysed using two-sided Chi-square tests.

Results: The recall rate was 5.5% for initial FFDM (p<0.001) and 4.6% for initial SFM (p<0.001). Either the detection rate of DCIS or DCIS and invasive differ (72.9% (186/255) versus 61.9% (122/197), p=0.01). Proportions of estrogen receptor positive or Her2Neu receptor positive invasive cancers were similar (p=0.2 and p=0.2, respectively), but the proportion of progesteron receptor positive invasive cancers was larger at digital screening (72.9% (186/255) versus 61.9% (122/197), p=0.01).

Conclusion: Conversion from analogue to digital screening mammography resulted in a dramatically increased SCNB rate, with a concomitant increased DCIS detection. Over-diagnosis of breast cancer is more profound at digital than at analogue screening mammography.

B-0457 15:03
Conversion from analogue to digital screening mammogram results in a more favorable tumour stage and tumour biology of screen-detected cancers
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Purpose: To determine the impact of conversion from analogue to digital screening mammography on tumour stage and tumour biology of screen-detected cancers.

Methods and Materials: We included a consecutive series of 47,737 analogue and 49,946 digital screening mammograms, obtained at a Dutch breast screening region between, respectively, January 2008-July 2009 and July 2009-January 2011. Tumour stage and biology characteristics were determined for screen-detected cancers. Results. The overall cancer detection rate was 6.9 (343/49,946) per 1,000 screened women at digital screening (255 invasive cancers and 88 ductal carcinomas in-situ (DCIS)) compared to 4.6 (222/49,249) per 1,000 screened women at analogue screening (197 invasive cancers and 36 DCIS, p<0.001). The proportion of advanced cancers (defined as T2+ and/or lymph node positive cancers) was significantly lower at digital screening (20.4% versus 34.8%, p<0.001), but tumour size (either T1a-c or T2+) of invasive cancers was comparable to those detected at analogue screening (p=0.7). At digital screening, over-diagnosis of invasive cancers showed lymph node metastasis (18.8% (48/255) versus 32.0% (63/197), p=0.002). Tumour histology of invasive cancers (either ductal or lobular cancer) was comparable (p=0.6), but invasive cancers detected at digital screening showed a more favourable Nottingham gradation (72.9% (186/255) versus 61.9% (122/197), p=0.01).

Conclusion: Conversion from analogue to digital screening mammography resulted in a more favorable tumour stage and tumour biology of screen-detected cancers.
**B-0459** 15:21

**Improving detection rates of DCIS with digital DR mammography**

C.S. Mierer*, J. Mierer Filho*, A.C.P. Nazario*; São Paulo/BR

**Purpose:** To evaluate detection rates of pure ductal carcinoma in situ (DCIS) by film screen mammography and by digital radiographic (DR) mammography in women submitted to annual screening for breast cancer.

**Methods and Materials:** Prospective study of 17,606 asymptomatic women submitted to annual mammographic screening in two centres. Ten thousand two hundred and ninety-four women in the first group had film screen mammograms and 7,312 women in the second group had digital DR mammograms. All exams were read by the same radiologists. All women on first screening examination were excluded. Biopsy was recommended for lesions suspicious for malignancy, in accordance with BI-RADS® categorisation, and was submitted to pathological examination.

**Results:** Mean age was 54.3 years in the first group and 52.5 years in the second group. Dense breasts were present in 44.8% of women in the first group and in 46.2% of those in the second group. In the film screen group, 49 of 175 women recommended for biopsy were diagnosed with breast cancer (positive predict value [PPV] = 28%), 9 of 49 with pure DCIS (18%). In the digital group, 51 of 152 women recommended for biopsy were diagnosed with breast cancer (PPV=33.5%), 13 of 51 had pure DCIS (25.5%), which was significantly higher than with film screen mammography.

**Conclusion:** In women undergoing annual screening for breast cancer, digital DR mammography improves detection rates of preinvasive stage compared to that achieved by film screen mammography.

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**B-0461** 14:09

**SPECT-CT for the depiction of sentinel lymph nodes in cutaneous head and neck tumours**

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**Purpose:** The value of sentinel lymph node excision (SLNE) in patients with cutaneous head and neck malignancies has been controversially discussed. We aimed to assess the diagnostic impact of preoperative SPECT-CT in direct comparison to standard SLNE without SPECT-CT.

**Methods and Materials:** Data of 48 clinically lymph node-negative patients (age range: 12-96 years) were analysed. Primary tumours included malignant melanoma (n=27) and high risk cutaneous squamous cell carcinoma (n=21). In group A (n=10) a lymphoscintigraphy was performed with either 16 MBq or 80 MBq of Tc-99m-nanocolloid depending on the schedule of the surgical procedure. In group B (n=38) an additional SPECT-CT scan (matrix: 128x128, 128 frames, 256 per frame) of the head and neck region was obtained immediately after lymphoscintigraphy. SLNE was performed during surgery according to the previous imaging results. Operating times for both groups were compared.

**Results:** 78 SLN were removed in 44/48 patients. The operating time in group B was significantly shorter (median 40 min) than in group A (median 108.6 min; P<.0001). Due to the exact anatomical localisation of the SLN determined by SPECT-CT, the surgical approach was changed in 9 of 34 patients (26.5%).

**Conclusion:** SPECT-CT is an innovative imaging technique providing additional information to detect and to excise SLN in patients with head and neck malignancies.

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**B-0462** 14:19

**Dose and image quality of high-pitch dual source CT for the evaluation of cervical lymph node status: comparison to regular 128-slice single source CT**

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**Purpose:** Patients with malignant lymphoma regularly undergo CT of the neck for the evaluation of lymph node status with relevant dose exposure. We compared a novel high-pitch dual source CT (DSCT) protocol with our standard single-source CT protocol in terms of dose and conspicuity of cervical lymph node levels.

**Methods and Materials:** Each 30 patients underwent either contrast-enhanced high-pitch DSCT (group 1; pitch 3.0) or regular single-source CT (group 2; pitch 0.8) of the neck on the same CT device (Definition Flash, Siemens) at 120 kV/180 mAs. Automated exposure control was used in both groups. Images were reconstructed at 2-mm thickness with a medium soft kernel (B30f). CTDIvol, DLP and background noise (BN) were compared. Two radiologists rated diagnostic image quality and artefact burden (1 = excellent image quality/no artefacts, 5 = no reliable diagnosis possible/heavy artefacts).

**Results:** Mean CTDIvol (5.6±0.9 vs. 12.9±1.1 mGy) and DLP (182±34 vs. 357±39 mGy/cm) were significantly (p = 0.003) lower in group 1, while BN was significantly higher (6.7±1.4 vs. 4.2±0.4 HU; p = 0.001). This did not affect diagnostic image quality, since subjective image quality (1.2±0.4 vs. 1.1±0.3) and artefact burden (1.7±0.7 vs. 1.3±0.5) were not rated significantly different between both groups (p = 0.54 and 0.29).

**Conclusion:** High-pitch DSCT of the neck allows for a significant reduction of dose while maintaining image quality and artefact burden. This is important in patients undergoing cervical lymph node staging for malignant lymphoma. Especially in young adults radiation delivered to the thyroid gland and eye lens is of important matter.

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**B-0463** 14:27

**Management of head and neck carcinoma of unknown primary: the diagnostic accuracy of F-18 FDG-PET/CT in detection of the clinically occult tumour**

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**Purpose:** Carcinoma of unknown primary (CUP) represents 3-7% of all head and neck malignancies and poses significant demands on otorhinolaryngology departments. Squamous cell carcinomas account for 70-90%. Traditional evaluation of metastatic cervical lymphadenopathy includes clinical examination, fibroptic-laryngoscopy/nasopharyngoscopy, cross-sectional imaging (CT/MRI) and panendoscopy with directed biopsies ± tonsillectomy. The disease follows an aggressive course with median survival of 2-10 months. Our aim was to review the diagnostic accuracy of FDG-PET/CT in cases of CUP in the West of Scotland.

**Methods and Materials:** Clinical records and imaging reports of 63 consecutive patients with metastatic cervical lymphadenopathy and occult primary tumour...
Results: FDG-PET/CT correctly detected 26 occult primary tumours in 63 patients (detection rate 41.3%). There were 17 true negatives, in which no extranodal malignancy was proven. There were 11 false negatives in which an underlying primary tumour was established by other methods despite negative PET/CT. There were 9 false positives in which directed search established no histological diagnosis at the site of concern on FDG-PET/CT. Sensitivity and specificity were 70.3% and 85.4%, respectively. Positive predictive value 74% and negative predictive value 81%. Overall accuracy 68%.

Conclusion: For a majority in this challenging subgroup of patients, FDG-PET/CT contributes positively when conventional diagnostic pathways have failed to establish a primary tumour.

B-0464 14:36
Comparison of contrast-enhanced PET-CT and MRI in patients with head and neck cancer
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Purpose: To retrospectively compare combined 18F-fluorodeoxyglucose positron-emission-tomography/computed-tomography (18F-FDG PET-CT) to contrast-enhanced magnetic-resonance-imaging (MRI) in the diagnosis of head and neck cancer regarding diagnostic accuracy and tumour volumetry.

Methods and Materials: Within 13 days 18F-FDG PET-CT and MRI were performed in oral cavity SCC (n=41,23 primaries/18 recurrent tumours) and within 5 days in Hodgkin lymphoma (n=12,10 primaries/2 recurrent tumours). Evaluated parameters were tumour localisation, tumour diameter, tumour volume, lymph nodes, distant metastases.

Results: In oral cavity SCC diagnostic accuracy was as follows: accordance of MRI/PET-CT: 78%; MRI-positive/PET-CT-negative: 9.8%; MRI-negative/PET-CT-positive:0.0%; MRI-positive/PET-CT-unclear:4.9%; MRI-negative/PET-CT-unclear:2.4%; PET-CT-positive/MRI-unclear:2.4%; PET-CT-negative/MRI-unclear:2.4%. Average maximum standardised uptake-values (SUV-max) in PET-CT findings were measured to be 6.43. In tumour volume and expansion PET-CT vs. MRI showed larger volume in 39%, MRI vs. PET-CT larger volume in 39%, PET-CT equaled MRI in 19.5%. In 2.4% no evaluation was possible. Regarding lymph node evaluation MRI equaled PET-CT. In 19.5% distant metastases were detected via 18F-FDG PET/CT. In Hodgkin lymphoma there was no statistically significant difference between the two modalities regarding pathological findings. Concerning lymphoma expansion PET-CT was superior to MRI in 13.9%, MRI was superior to PET-CT in 19.4% and in other patients MRI equaled PET-CT. Concerning lymph node numbers MRI equaled PET-CT in size and morphology. In 8.3% suspect extra-cervical findings were revealed by 18F-FDG PET/CT.

Conclusion: In summary, MRI was equal to PET-CT regarding accuracy. Concerning volumetry MRI had some advantages vs. PET-CT. 18F-FDG PET/CT easily identified distant lymph node metastases. Maximum standardised uptake-values (SUV max=2.5) in PET-CT is reliable for evaluating lymph node metastases.

B-0465 14:45
Pre- and intraoperative determination of tumour extent and bone infiltration in the head-and-neck region: a comparison of multislice computed tomography (MSCT), high-resolution flat-panel volumetric CT (VCT), and histopathologic methods
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Purpose: To assess if VCT, as a high-resolution bone imaging modality, can in- tracorporatively supplement frozen-section analysis to establish the depth of tumour infiltration. To validate the VCT-approach, we compared CT, VCT, and histopathology results for tumour-extent.

Methods and Materials: Head-and-neck tumours of 92 patients were preoperatively staged with CT. Perioperative VCT of the resected specimen was used to supplement frozen-section analysis. Bone destruction was compared for the VCT, CT, and frozen-section methods before the results were relayed to the surgeon, who adjusted the resection procedure as necessary. Staging-CT and final histopathology results were compared postoperatively. 51 patients were not included in the final evaluation because either histopathology or CT results were incomplete.

Results: CT determined a larger tumour size than histology in 13 cases (mean difference 7 mm), a smaller size in 14 cases (mean difference 10 mm), and approximately equal sizes in 25 cases. In a comparison of tumour extent with CT, VCT, and histopathologic methods, results were approximately equal in 34 cases, although VCT best visualised the extent of bone destruction. In 18 cases, the CT results differed from the CT determined by VCT and histology.

Conclusion: Computed tomography is a sound method for determining tumour extent. VCT can accurately determine bony infiltration. It is thus a valid intraoperative supplement to frozen section analysis and can aid the resection and reconstruction strategy. Secondary reconstructive surgery can be avoided, thereby increasing patients' quality of life and decreasing total therapy costs.

B-0466 14:54
Radiochemotherapy-induced changes of local tumour blood supply estimated by DCE-CT in head and neck tumours
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Purpose: Radiochemotherapy (RCT) is considered standard treatment for non-operable head and neck tumours (HNT). Primary aim of our study was to investigate RCT-induced changes of local tumour blood supply parameters relative tumour blood volume (rTBV) and transfer coefficient (Ktrans) derived from DCE-CT in HNT.

Methods and Materials: Patients with non-operable HNT (Stages III-IV) scheduled for RCT were included. Chemotherapy consisted of cisplatin during all (Pmax) and (2) time to peak (TTP) were analysed during first week only. DCE-CT was performed before RCT, in two weeks (20Gy) and five weeks (50Gy) using Biograph 16 (Siemens). rTBV and Ktrans were determined by modified Patlak analysis using pixel-based software (VPCT, Siemens). Dynamics of rTBV and Ktrans were analysed during RCT and in 12 months follow-up.

Results: In 11 patients an increase of rTBV and/or Ktrans after 20Gy, followed by a decrease of both parameters after 50 Gy was noted. Except for one patient with local recurrence, complete tumour response during follow-up was diagnosed in 10 patients. In 3 patients an increase of rTBV with concomitant drop of Ktrans under RCT was detected. Morphologically, in all 3 patients a partial tumour response was established. In 1 patient showing a elevation of both rTBV and Ktrans during RCT local tumour progress was detected during follow-up.

Conclusion: Estimated by DCE-CT radiochemotherapy-induced changes of rTBV and Ktrans may represent a modification of local tumour blood supply as a function of intratumoral oxygen distribution and, consequently, reveal clinical impact allowing individualisation of RCT strategy in patients with HNT.

B-0467 15:03
Dynamic contrast-enhanced T1-weighted MR imaging to distinguish tumour recurrence from scar after treatment in patients with head and neck neoplasms: a pilot study
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Purpose: In follow-up imaging of patients with head and neck neoplasms it is often difficult to distinguish tumour recurrence from scar after treatment. Aim of this study is to analyse if perfusion curve-patterns help to differentiate tumour from scar.

Methods and Materials: MRI-perfusion data of 31 patients (17 men; mean age 64 years) with suspicious enhancing lesions of the oropharynx or the oral cavity were analysed. In 17 patients primary or recurrent squamous-cell carcinoma was diagnosed histologically, in 14 patients scar was diagnosed histologically (n=4) or by long-term radiological follow-up (> 6 months). Dynamic contrast-enhanced MRI were performed on a 3-Tesla-scanner (Tim-Trio, Siemens, Erlangen/Germany) using a volumetric interpolated breath-hold examination (VIBE) T1-weighted sequence (TR/TE 4.66/1.53 msec; slice 3 mm; FOV 220 mm; 38 measurements of 7.8s; flow 3.5 ml/s). Perfusion data were post-processed on a region-of-interest (ROI) basis using the mean-curve software (Siemens, Erlangen/Germany) obtaining signal-intensity-time (S(t)) curves. In each suspection four ROIs were positioned in consensus of two radiologists. For each S(t)-curve (1) maximal intensity value (Pmax) and (2) time to peak (TTP) were analysed.

Results: Mean S(t)-curves of the two groups were significantly different. Tumour showed a fast wash-in (TTP=22.5±17s) with a high Pmax (1.83±0.80; range 0.73-3.48); scar had a slower wash-in (TTP=98.1±76s; p < 0.001) with a lower Pmax (0.77±0.57; range 0.3-1.81; p < 0.001).

Conclusion: Perfusion S(t)-curve pattern of head and neck squamous-cell carcinomas is significant different to perfusion S(t)-curve pattern of scar following treatment. Dynamic contrast-enhanced MRI could be helpful in follow-up of patients with head and neck tumours.
**B-0468  15:12**

**Do apparent diffusion coefficient and histological characteristics of squamous cell carcinoma of the oral cavity correlate?**

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**Purpose:** To correlate apparent diffusion coefficient (ADC) with histological characteristics of squamous cell carcinoma of the oral cavity.

**Methods and Materials:** 66 patients with untreated histologically proven squamous cell carcinoma underwent conventional (including T2-weighted and T1 pre- and post-contrast) and diffusion-weighted MRI (b-values 0, 50, 250, 500 and 900s/mm²). The ADC for oral cavity tumours were calculated from regions of interest drawn manually on the highest b-value images using the ImageJ (ImageJ, NIH) and tsl (t 4, University of Oxford) image processing packages. The ADC for the tumour volume obtained was correlated with histological characteristics (TNM, Grading).

**Results:** Of the eligible patients, 53 (35 males, 18 females, mean age 56.0, range 26-77 years) were suitable for ADC calculation. Nine patients were excluded due to the presence of artefacts, and 4 due to inability to visualise the tumour on the diffusion-weighted sequences. The mean ADC value was 1123 ± 163 mm²/s, and mean size 33.5 ± 13.3 mm. ADC did not correlate with tumour stage or grade. ADC was significantly lower (p<0.025) for N2 (n=28) stage tumours when compared to N1 (n=8) stage. No other differences were observed between T stages, N stages or tumour Grading.

**Conclusion:** In our cohort we did not observe clinically relevant differences in ADC values in squamous cell carcinoma of the oral cavity.

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**B-0469  15:21**

**Macrobiopsies for head and neck cancers**

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**Purpose:** Contemporary medical treatments for head and neck (H&N) cancers increasingly use targeted therapies that are selected by molecular biomarkers. To allow these personalised diagnostics macrobiopsies are preferred. This study evaluates the use of the Spirotome macrobiopsy system in H&N cancers for providing high-quality tissue specimens.

**Methods and Materials:** 49 patients with a mass in the H&N region were selected for biopsy in 3 regional hospitals. Mild anticoagulation was allowed. The biopsy site was studied with regard to access route and critical organs by ultrasound, CT and/or MRI. The Spirotome (Medinvent NV, Belgium) was used as macrobiopsy system. Sample quality was evaluated with regard to volume, length, diameter and histological/immunohistochemical diagnosis and molecular biology. Patient tolerance and both early and late complications were recorded.

**Results:** In all 49 patients the anticipated procedure could be performed without complications or major side effects. Tolerance was good with only minimal pain in 6 patients. In all cases minimal bleeding could be stopped during the procedure. No hospitalisation or prolonged stay was necessary. Where appropriate (n=34) complete histological, immunohistochemical and molecular biology could be performed. In 9 patients only benign reactive lymph node tissue could be harvested. In 1 patient an abscess was recorded. In 8 patients an incomplete pathological protocol was given due to reimbursement restrictions.

**Conclusion:** The Spirotome macrobiopsy provides sufficient and high-quality tissue volume in H&N cancers to allow all molecular biology and histological tests for optimal diagnosis without hospitalisation or major side effects.
B-0472 14:18

Early bone marrow (BM) metastases: metabolic data using 18 F-fluorodeoxyglucose (FDG) PET/CT versus CT imaging
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Purpose: To assess the diagnostic role of FDG-PET/CT vs. CT in early metastatic deposit in BM.

Methods and Materials: 196 patients, 33% with lung cancer, 33% with breast cancer, 29% with lymphoma and 5% with multiple myeloma were retrospectively examined. All patients underwent FDG-PET/CT and CT for disease evaluation. At the time of PET/CT none of the patients were receiving cytotoxic therapy. All scans were reviewed by a radiologist and a nuclear medicine physician. BM metastases were confirmed by sequential PET/CT or MRI when available. The images of PET/CT and CT were compared. A patient-based analysis was performed.

Results: 94 (48%) patients had positive and 104 (52%) negative CT scan, whereas 110 (56%) had positive and 88 (44%) negative PET/CT for bone lesions. The imaging findings were concordant in 178/198 (90%) patients, while 20/198 (10%) had discordant imaging results (Chi-square test; p < 0.001). 21/178 (12%) concordant patients had BM lesions at PET/CT, whereas 9 out of 20 (45%) patients had BM involvement. Therefore, PET/CT was able to identify 27/198 (14%) patients with confirmed BM lesions. In these latter patients, the standardised uptake value for BM metastases was 7.9±4.5 (range: 3.1-19.0), resulting weakerly higher in patients with negative than positive CT scan (8.3±4.1 vs. 7.8±4.3, respectively; Student's t-test p=0.79).

Conclusion: PET/CT is more accurate than CT in detection of BM metastases; its inclusion in diagnostic algorithms changed the staging in about 15% of patients. PET/CT detects BM lesions directly based on their degree on metabolic activity either than by altered anatomy.

B-0473 14:27

CT protocols in [18F]FDG-PET/CT examinations: is there an additional benefit of contrast-enhanced CT in the differentiation of incidental gastrointestinal FDG uptake?
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Purpose: Evaluation of the possible benefit of contrast-enhanced (CE) CT in correlation to low dose (LD) CT in [18F]FDG-PET/CT for the further evaluation of incidental gastrointestinal FDG uptake.

Methods and Materials: From a database of 5045 patients with FDG-PET/CT, a subgroup of 60 patients with incidentally detected gastrointestinal PET lesions and a PET/CT scan including a multiphase (LD for AC + CE) CT protocol was retrospectively analysed. The PET lesions were categorised concerning their CT patterns (mass/inflammation/unspecific/normal) separately for both CT protocols. The imaging findings were correlated with the results of endoscopy or surgery.

Results: 62 incidental gastrointestinal PET lesions were found in the group of 60 patients. The PPV for a corresponding endoscopic pathology in these lesions was 81% for CECT and CECT-only. The positive predictive value of FDG uptake was 81% in the CECT group and 41% in the CECT-only group. The false positive rate in CECT was higher than in CECT (69% vs. 83%). False positive results due to physiological FDG uptake were diagnosed in 44% by CECT and 6% by IDCT. The false negative rate in IDCT was higher than in CECT (74%) and false positive in 5/18 (26%). The false positive rate in IDCT was significantly higher than in CECT (Student's t-test, p<0.05).

Conclusion: CECT is more accurate than LDCT in the differentiation of incidental gastrointestinal FDG uptake.

B-0474 14:36

Additional value of “dual phase” 18 F-FDG PET-CT in recurrent gynaecological malignancies
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Purpose: To prospectively evaluate the usefulness of “dual phase” PET-CT in suspected recurrences from gynaecological malignancies.

Methods and Materials: 45 patients with suspected recurrences from previously treated gynaecological cancer underwent both whole body PET-CT at 1 h after 18 F-FDG injection (standard PET-CT) and delayed PET-CT of the abnormal area at 3 hrs post-18 F-FDG injection (dual phase PET-CT). Besides qualitative evaluation, semiquantitative criteria were used standardised uptake value of early and delayed images, and retention index of the lesions.

Results: Per-patient analysis: 32/45 patients were confirmed to have recurrence and 13 to have benign lesions. Standard PET-CT detected recurrent tumour in 27/32 patients (84%), whereas delayed scan was true positive in 32/32 (100%). Standard PET-CT correctly excluded malignancy in 6/13 patients (46%) and was false positive in 7/13 (54%), whereas delayed scan was true negative in 10/13 (77%) and false positive in 3/13 (23%). Per-analysis: lesions were confirmed to be malignant and 18 benign. Standard PET-CT correctly identified 39/49 tumour lesions (79%) whereas at delayed scan all 49 lesions were true positive (100%). Standard PET-CT correctly excluded malignancy in 7/18 (39%) and was false positive in 11/18 (61%), whereas delayed scan was true negative in 13/18 lesions (74%) and false positive in 5/18 (26%). The standard deviation of the mean RI was ±104% in malignant lesions and -7.03% (range -77.8% - +80%) in benign lesions.

Conclusion: Dual phase PET-CT is a valuable tool in patients with suspected recurrence of gynaecological cancer and may impact on patient management.

B-0475 14:45

Whole body PET/CT compared to whole body MRI in the diagnosis of sclerotic bone metastases
S.M. Shaikh; Hyderabad/IN

Purpose: Aim of the study was to evaluate the diagnostic value of contrast-enhanced PET/CT using F-18 FDG compared to whole body MRI (WB-MRI) in the diagnosis of sclerotic bone metastases.

Methods and Materials: In a retrospective blinded study 58 patients with suspected sclerotic skeletal metastases underwent PET/CT as well as WB-MRI with the use of parallel imaging. PET/CT was acquired after administration of F-18 FDG, which followed by with a MR by 1.5 T MRI system coronal T1-weighted- and STIR- sequences of the entire body and sagittal imaging of the spine were performed.

Results: Sclerotic bone metastases were confirmed in 46 patients WB-MRI, but was missed in 2 patient during initial PET/CT reading. WB-MRI rated 102 lesions as suspicious for malignancy, out of them 96 lesions turned out to be metastatic. PET/CT described a number of 84 lesions as metastatic, which was lower as compared to WB-MRI. Most malignant lesions missed by PET/CT were located in the extremities. PET/CT was more sensitive in detecting malignant lesions than the abdominal (WB-MRI: n=8 vs. PET/CT n=10). The lesions missed by WB-MRI were located in the spine (n=8) and rib cage (n=4). 25 lesions were identified as benign during follow-up. PET/CT rated 20 of these 25 lesions correctly as probably benign, WB-MRI only 19. WB-MRI falsely diagnosed metastatic bone disease in one healthy patient.

Conclusion: WB-MRI delineates more sclerotic bone metastases compared to PET/CT.

B-0476 14:54

Diagnostic accuracy of virtual FDG-PET/CT bronchoscopy for the detection of lymph node metastases in non-small cell lung cancer patients
T.A. Heusner1, J. Treffert2, B. Geiger3, V. Hartung4, M. Herbrik4, M. Forsting4, C. Pfannenberg1; Essen/DE (heusner@med.uni-duesseldorf.de)

Purpose: The aim was to determine: (a) the diagnostic accuracy of the FDG-PET/CT bronchoscopy for the detection of mediastinal, hilar, interlobar and lobar lymph node metastases in non-small cell lung cancer (NSCLC) patients; (b) the smallest bronchus diameter accessible by virtual FDG-PET/CT bronchoscopy; (c) the time duration from starting the viewing tool until virtual FDG-PET/CT images were displayed.

Methods and Materials: 61 NSCLC patients underwent FDG-PET/CT. From these source data virtual FDG-PET/CT bronchoscopies were reconstructed. The time duration from starting the tool till the display of virtual bronchoscopy images for the detection of regional lymph node metastases was evaluated. The diagnostic accuracy of FDG-PET/CT bronchoscopy for the detection of regional lymph node metastases was evaluated on a lesion basis. Axial FDG-PET/CT scans served as the standard of reference. The smallest bronchus diameter accessible by FDG-PET/CT bronchoscopy was measured.

Results: The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of virtual FDG-PET/CT bronchoscopy for the detection of lymph node metastases was 76%, 87%, 75% and 81%. The mean smallest diameter of accessible bronchi by FDG-PET/CT bronchoscopy was 3 mm. The mean time duration from starting the virtual FDG-PET/CT bronchoscopy tool till the display of the images was 22±7 seconds.

Conclusion: Virtual ‘fly-through’ 3D FDG-PET/CT bronchoscopy is feasible in clinical routine, yields a relatively high diagnostic accuracy for the detection of regional lymph node metastases and has access to bronchi even in the periphery of the lung.
Molecular imaging of breast tumours with MR-PET


Purpose: To prove that molecular imaging of breast tumours with proton MR spectroscopy, diffusion-weighted imaging, contrast-enhanced MRI and positron-emission tomography improves diagnostic accuracy, sensitivity and specificity in cancer diagnosis.

Methods and Materials: 49 patients with a suspicious breast were included in this IRB approved prospective study. All patients were examined with dedicated 18 FDG-PET-CT and 3 T multiparametric MRI of the breast. MRI protocol included: a diffusion-weighted sequence (DWI), a T2-weighted and a contrast-enhanced 3D-T1-weighted sequence (CE-MRI) before and after application of a standard dose Gd-DOTA. After injection of approx. 300 MBq 18 F-FDG based on the patients weight PET-CT was acquired in the prone position allowing the same patient geometry in breast MRI. CT data were used for attenuation correction. Co-registration of imaging data and image fusion were performed. MR-PET was assessed for lesion morphology and EH-signals according to BIRADS, restricted diffusion, increased Choline (Cho)-levels and 18 F-FDG avidity. An ADC threshold 1.25 x10^-3 mm²/s and a signal-to-noise ratio of the Cho resonance peak > 2.55 were defined as a marker of malignancy. Lesions classified as positive for 18 F-FDG-uptake were defined as a marker of malignancy. Lesions classified as positive when 18 F-FDG-uptake was greater than blood pool activity. All lesions were histopathologically verified. Conclusion: In single cases PET-CT shows large deviations of the whole data set. The simultaneous data acquisition of hybrid MR-PET leads to a significantly improved alignment of metabolic and morphologic datasets in the liver and urinary bladder and can reduce anatomical deviations due to breathing and patient movement as well as different filling states of the urinary bladder.

Conclusion: Molecular imaging of breast lesions with MR-PET increases sensitivity as well as specificity of diagnostic accuracy in the diagnosis of breast cancer and lymphnode metastases.
underwent an immediate TBCT from vertex to pubic symphysis. For the first 50 patients during day time several clinical important time points were registered.

Results: In total, 159 patients were included, of which 112 were males, 152 had blunt trauma. Median age was 42 years, median Injury Severity Score was 19.5. After TBCT 93 patients received additional imaging and 84 underwent radiological or surgical intervention. Median time to imaging was 11.7 min (acquisition time 7.4 min). All diagnoses were known 29.6 min after admission. Mortality in the 159 patients was 16.4%.

Conclusion: With the use of immediate TBCT in severe trauma patients complete diagnoses can be achieved within 30 minutes.

B-0482 14:18 Ultrasound follow-up of polytrauma patients after initial computed tomography: an analysis of role and costs
M.H. Maurer, A. Winkler, M. Poverski, F. Elgeti, B. Hamm, R. Roetgen,
T. Marnitz; Berlin/DE (maurer.m.harald@charite.de)

Purpose: To assess the costs and diagnostic gain of abdominal ultrasound follow-up of polytrauma patients initially examined by whole body computed tomography (CT).

Methods and Materials: A total of 176 polytrauma patients (126 men, 50 women; age 43.5±17.4 years) were retrospectively analysed with regard to supplementary management and outcome. A total of 142 (2.8 %) cases, compared with the results of the measured volume (B/C; p > 0.05). However, patients with history of cocaine abuse had a higher prevalence of mixed plaque (18 (26.5%) vs. 6 (8.8%), p=0.02).

Conclusion: Higher risk for ACS in patients with a history of cocaine abuse might be associated with a higher prevalence of mixed coronary atherosclerotic plaque. This association may be explained by the mechanical properties of mixed plaque, which may predispose to rupture during cocaine-induced vasospasm.

B-0486 14:54 Standard vs high-pitch CT of the chest in ventilated patients: comparison of motion artefacts, image noise and effective dose
F. Schwarz, T. Goelz, A. Arnoldi, K. Nikolaou, M.F. Reiser, C.H. Becker;
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Purpose: To compare motion artefacts, image noise and effective dose between a high-pitch and a routine chest CT protocol in ventilated patients.

Methods and Materials: All analysed studies were performed on a 128-slice CT-system. 35 consecutive ventilated patients who underwent high-pitch chest CT (p=3.2) were included in this analysis. As control group, 35 ventilated patients matched for sex and body mass index (BMI) who had undergone routine chest CT
A compound-motion-score was significantly lower in the high-pitch group (0.9 vs. 3.3, p=0.004). The highest motion scores observed in the high-pitch group and control group were 5 and 11, respectively. High-pitch datasets had a tendency towards higher image noise (24 HU vs. 20 HU, p=0.7) and lower DLP (445 vs. 507 mGy/cm, p=0.6).

Conclusion: For CT scans of the chest in ventilated patients, a high-pitch acquisition technique significantly reduces motion artefacts while maintaining similar degrees of image noise. This has considerable potential to improve detection of pulmonary infarcts without increases in applied dose.

**B-0487** 15:03  High-pitch dual source CT pulmonary angiography with 30 cc of contrast material

J.M. Kerl, B. Schell, M. Larsson, T. Lehnert, T.J. Vogl, R.W. Bauer; Frankfurt a. Main/DE (matthias.kerl@kgu.de)

**Purpose:** To compare different low contrast material injection protocols using high-pitch dual source CT pulmonary angiography in patients with suspected pulmonary embolism.

**Methods and Materials:** Data of 60 consecutive patients referred for CTPA for exclusion of PE were evaluated. All scans were performed on a 128-channel dual source CT scanner with a high-pitch protocol (pitch 3.0, 100 kV, 180 mAs). In group 2 (n=20) contrast enhancement was achieved by injecting 50 cc CM followed by a saline chaser of 50 cc, in group 2 (n=20) contrast enhancement was achieved by 40 cc of CM followed by a saline chaser of 50 cc and in group 3 (n=20) contrast enhancement was achieved by 30 cc of CM followed by a saline chaser of 50 cc. In all studies iomeprol (400 mgI/cc) was used injected at a rate of 4 cc/s. Attenuation profiles in the pulmonary trunk and on segmental level were measured to evaluate the enhancement within the pulmonary arteries.

**Results:** In all patients an adequate and homogeneous contrast enhancement of more than 250 HU was achieved in the pulmonary arteries. However, a significant different level of enhancement within the pulmonary system between group 1 and group 2 versus group 3 was observed (p<0.05). No statistically significant difference between groups 1 and 2 was found regarding attenuation of the pulmonary arteries.

**Conclusion:** A homogeneous opacification of the pulmonary arteries and sufficient image quality can be achieved with 30 cc of contrast material in high-pitch DSCT pulmonary angiography.

**B-0488** 15:12  Accuracy of multidetector computed tomography to evaluate acute aortic syndromes: 5-year experience in a cardiovascular center

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**Purpose:** To assess the accuracy of multidetector computed tomography (MDCT) performed in acute patients with clinical diagnosis of aortic syndrome.

**Methods and Materials:** Emergency MDCT was performed in 72 patients suspected of having acute aortic syndrome. From these patients 51 met inclusion criteria and were enrolled for this study. From 21 refused patients, 5 had previously known and treated aortic disorders and 16 did not undergo surgery or second comparative method. MDCT was compared with surgery (n=22). In patients without surgery, second method was ultrasound (n=20), digital angiography (n=8), both (n=1). In all patients not only second comparison method but also clinical follow-up was considered.

**Results:** MDCT was positive for acute aortic syndrome in 31 of 51 patients. Diagnosis included type A dissection (n=9), type B dissection (n=6), aortic rupture (n=4), type A intramural haematoma (n=4), ulcer (n=3), type A dissection and intramural haematoma (n=3), type B dissection and rupture (n=1), type B intramural haematoma and ulcer (n=1). MDCT was negative for acute aortic syndrome in 20 patients. 11 patients with normal aorta, 9 patients had unknown aneurysm without complication. Sensitivity, specificity, positive predictive value and negative predictive value for detection of acute aortic syndrome and correct characterisation for each subtype was 100% in all cases.

**Conclusion:** MDCT depicts an excellent imaging method to evaluate acute aortic diseases and represents a fundamental tool to properly stratify patients in this critical situation.
**B-0491** 14:09
Impact of a radiographic positioning doll on developing skills in skeletal radiology: a study on radiography students

**R. Girometti, C. Zuliani, S. Da Dalt, A. Moretti, R. Fazzini, M. Bazzocchi; Udine/IT (rgirometti@sism.org)**

**Purpose:** To investigate the subjective impact of a radiographic positioning doll (RPD) in developing main skeletal radiology (SR) skills in radiography students.

**Methods and Materials:** Before starting the clinical internship in skeletal radiology, 30 radiography students were involved in a preliminary 100-hours training program using an anthropomorphic RPD. The training was supervised by two expert radiographers in order to develop 7 main skills in performing a SK examination. After completing the clinical internship, students were asked to subjectively quantify how the use of RPD impacted on developing each of the established skills using a 1 to 3 score (1=no impact; 2=moderate impact; 3=high impact). We calculated the proportion of 2-3 scores for each skill, by testing statistical significance with the Chi-square test.

**Results:** Regardless of the specific skill, the large majority of the students subjectively attributed a 2-3 impact score to the use of the RPD (p < 0.0015). RPD was found more impacting in developing capabilities in post-processing procedures (100%; 95%C.I. 86.7-100), patient positioning (92.9%; 95%C.I. 79.7-99.9), and individualization of radiographic reference points (92.9%; 95%C.I. 75.7-99.0). RPD was found less useful in training to perform radiographic projections (73.0%; 95%C.I. 52.2-88.4), patient preparation (71.4%; 95%C.I. 51.3-86.7), and exposure regulation (62.9%; 95%C.I. 42.3-80.6). High proportion of students found the use of RPD of value in preparing for clinical practice (61.4%; 95%C.I. 61.9-83.7).

**Conclusion:** A training with a RPD is subjectively of value in developing main SR skills of radiography students before the clinical internship.

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**B-0492** 14:18
Image quality system for radiographers

S. Geers-van Gemeren; Utrecht/NL (s.geers@umcut.nl)

**Purpose:** The Dutch Society of Medical Imaging and Radiotherapy has developed in cooperation with Rogan Delft a system to analyse rejected images, retakes, image quality and radiation dose. The aim of the Image Quality System (IQS) is to evaluate, improve and audit patient positioning and radiographic exposure conditions in a digital radiology department.

**Methods and Materials:** In 1998 a instrument is implemented for radiographers to analyse and evaluate retakes in the department. In 2004 a first step was made to investigate the possibilities to change the instrument from conventional images to digital images. In 2009 the Dutch Society started with a inventory of the requirements for the Image Quality System. A questionnaire was constructed and sent out to all the radiology departments in the Netherlands.

**Results:** With the outcome of the survey the Dutch Society developed requirements for the Image Quality Tool. The IQS is tested in different hospitals and is available on a licence base agreement between the department and the Dutch Society.

**Conclusion:** It is possible in a full digital environment to use the IQS to evaluate, improve and audit patient positioning and radiographic exposure conditions. International agreements should be made for standardisation of the information in the IQS to enable a high cross-country service. The IQS can be used in quality assurance programme in the department, as a benchmark tool between departments and for clinical audits performed by the radiographer society.

**B-0493** 14:27
The evaluation of patient’s anxiety levels undergoing magnetic resonance imaging examination


**Purpose:** To analyse possible differences between the anxiety levels of patients who receive additional information about the MRI scan, and patients who receive only basic instructions from the hospital, and to verify if there is variation in anxiety levels of patients before and after the examination, and relate it to their gender, age, education level, and previous MRI examination.

**Methods and Materials:** The total sample of 60 patients was divided into a control group and an experimental group, and each one divided into two subgroups before and after the exam, and then it was applied STAI form Y-1 to both, after the sociodemographic questions.

**Results:** At a 95% confidence interval, the mean difference between the control group, before and after, ranged from 7.210 and 20.624. The value of the Student’s t test was 4.153 (df=58 and 2-tail sig=0.000). The mean difference between the experimental group before and after, ranged from 6.112 and 19.305. The value of the Student’s t test was 3.856 (df=58 and 2-tail sig=0.000). Using Spearman’s Ro, there are some correlations between the sociodemographic variables and their levels of anxiety. The level of anxiety can be changed by many reasons, one and the most important is when the patient has already performed a MRI scan.

**Conclusion:** The main results suggest a significant difference in both groups, among the subgroup before and after, that let us concluded that after the MRI exam patients are less anxious. We also conclude that who has previously performed an MRI scan has smaller values of anxiety.

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**B-0494** 14:36
Children’s and parents’ perception of a MRI examination

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**Purpose:** To describe children’s and parents’ perception of a MRI examination.

**Methods and Materials:** Children and parents were selected consecutively. Inclusion criteria were that they could understand and speak Swedish. The children should be of both genders and aged 6-10 years. It should be children who did a MRI examination for the first time and they would be able to carry out an interview of 30-40 minutes. The parents who followed were also interviewed. Semi-structured interviews with 8 children, 5 girls and 3 boys, and their parents were carried out. The interviews were analysed using a phenomenographic analysis approach to better to determine the categories were critically reviewed and revised to improve the reliability of the analysis. A follow-up focus group was created to validate, clarify and refine the collected data.

**Results:** The children perceived security through preparation/information, parental presence and that it was a light inside the MRI. The parents perceived security through information about the procedure and being present while their child was examined. Both children and parents felt a sense of security by the positive behaviour from health professionals. They had a need to be involved verbally and practically in examination of their children. Participants who did not receive adequate information showed signs of stress.

**Conclusion:** An information leaflet before an MRI examination that is produced for children could contribute to reduced anxiety, greater understanding of what they are going through and lead to improved quality of the examination.

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**B-0495** 14:45
Information to the parents in connection with their child’s diagnostic examination

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**Purpose:** To identify parents’ need for information in connection with their child’s diagnostic examination, and to prepare radiographers better to communicate to satisfy those needs.

**Methods and Materials:** A qualitative approach was applied, and the data were collected from twenty parents who participated in a semi-structured face to face or focus group interviews. Constant comparative technique was utilised to analyse the data, where answers and conclusions were categorised and then compared and related to one another. The categories were critically reviewed and revised to improve the reliability of the analysis. A follow-up focus group was created to validate, clarify and refine the collected data.

**Results:** Parents’ knowledge about diagnostic examinations and the risk connected to them are very limited. Most of them have prejudices and their thoughts about radiation are very confused. Information about the risk their children are exposed to is highlighted as the most important need parents have. They have a need to be involved verbally and practically in examination of their children. Participants who did not receive adequate information showed signs of stress.

**Conclusion:** Radiographer should involve the parents in examination using clear instructive information, as their resources can be very useful as psychological support to the child and practical help. The risk of radiation should be explained in a way parents can relate. More detailed and accurate information about the actual radiation procedure understanding and concerns will be eliminated. By defining and standardising information some minimum quality should be guaranteed to the parents.

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**B-0496** 14:54
Hypnosis in the management of claustrophobic MRI patients

N. Alexandre1, M.A. Fontaine1, B. Suarez1, D. Mompoint2, J. Becchio3; 1Villejuif/FR, 2Hvidovre/DK (mamontain@student.univ-paris13.fr)

**Purpose:** Hypnosis is a suitable alternative to manage claustrophobic patients undergoing MRI. We present our experience to manage patients who had been previously trained to perform hypnosis.

**Methods and Materials:** To identify parents’ need for information in connection with their child’s diagnostic examination, and to prepare radiographers better to communicate to satisfy those needs.

**Results:** The main results suggest a significant difference in both groups, among the subgroup before and after, that let us concluded that after the MRI exam patients are less anxious. We also conclude that who has previously performed an MRI scan has smaller values of anxiety.

**Conclusion:** The main results suggest a significant difference in both groups, among the subgroup before and after, that let us concluded that after the MRI exam patients are less anxious. We also conclude that who has previously performed an MRI scan has smaller values of anxiety.
Methods and Materials: Two MRI technicians and a radiologist learned eriksonian hypnosis. Over a period of twenty months, 3920 patients were explored by MRI. Fifty-two patients were identified as claustrophobic, refusing the scheduled MRI. Seven patients experienced a panic attack. A brief single session of hypnosis was proposed.

Results: Among the 52 identified claustrophobic patients, 48 accepted hypnosis and underwent MRI. Four patients declined the proposed treatment and were unable to withstand the MRI procedure.

Conclusion: Hypnosis appears to be a safe, efficient, rapid and inexpensive tool for the care of patients suffering from claustrophobia during MRI. With this drug-free method, MRI of claustrophobic patients may be performed in the best conditions.

B-0497 15:03
Practices to control infection related to chest radiography in intensive care unit
M.M.C.P. Ribeiro1, A.L. Resendes1, F.P. Rodrigues1, J.E.G. O’Neill1, J.C. Mauricio2; 1Lisbon/PT, 2Oulu/FL (margarida.ribeiro@estesl.ipl.pt)

Purpose: To analyse the process of carrying out chest radiography at the intensive care unit (ICU), regarding the control infection practices applied by radiographers.

Methods and Materials: The study took place in a public hospital which carries out chest radiography in the ICU and all patients admitted there. Fifteen radiographers were observed (observational empirical component) and compiled by the researchers, one check-list with eleven items. Thirteen different radiographers filled one survey with eight questions (exploratory empirical component).

Results: Most of radiographers gave only three correct answers. 15.2% of the radiographers presented practices suspicious to conduct to an infection process; 1.9% led to practices of an effective infection while the remaining (82.9%) did not present any risk behaviour related to the development of infection. Most of radiographers had more than 5 years of work experience and 20-29 years. Disinfection procedures were not carried out on the image plates (Ip’s) or portable equipment in the Imaging Department, before to arrive on the ICU. Most of the radiographers (71.4%) used gloves, did not use any personal utensils (94.3%) or did not come into contact with the patient or the bed without disinfect first (62.9%), during the procedures; the Ip’s protection was used in 57.1% of the cases. The following procedures never were applied by half sample: wearing of a white coat/impermeable apron or mask, and disinfection of the Ip’s at the end.

Conclusion: The results, far from following the recommendations or guidelines, suggested that the matter about prevention and control infection among radiographers should be improved through theoretical and training initiatives.

B-0498 15:12
Are UK radiographers more emotionally intelligent than a normative comparison group? An age- and gender-matched analysis
S.J. Mackay1, P. Hogg1, G.T. Cooke1, R.D. Baker1, T. Dawkes1; 1Salford/UK, 2Chester/UK (s.mackay@salford.ac.uk)

Purpose: Emotional intelligence (EI) has been identified as a beneficial phenomenon in medicine, nursing, radiography and has been shown to be positively associated with a greater amount of compassionate and empathic patient care. This paper will compare EI data from a UK wide survey of radiographers with a normative sample group to determine whether radiographers have higher emotional intelligence than a normative group.

Methods and Materials: In 2010, a UK-wide survey of radiographer trait emotional intelligence (n=1997) was undertaken to determine the global and four factor EI levels of radiographers. This data were compared with a normative group (n=866) from the national Trait EI database. The mean, age range and gender proportion of these two datasets differed so age and gender matching by group was undertaken followed by ANOVA with post hoc Tukey tests.

Results: Statistically significant difference was observed for age group between datasets on global trait EI and all factors. Post hoc tests indicated differences lay mainly with 18-29 age group. Radiographers scored more highly than normative group for all but the emotionality factor. Highly statistically significant differences were observed in gender between data sets for global and all factors. Post hoc tests indicated differences between females across global and all factors but for males this was limited to global trait EI, well being and self-control.

Conclusion: The UK radiographer sample scored more highly in emotional intelligence than a normative sample group.
Saturday, March 3
**Methods and Materials:**

CTA detects more collaterals than standard CTA due to its insensitivity to delayed contrast arrival.

**Conclusion:**

Poor collaterals status on TI-CTA is a strong predictor of poor clinical outcome in acute stroke patients with large vessel occlusion.

**Purpose:**

Acute stroke patients with intracranial vessel occlusion may demonstrate subocclusive thrombus, typically characterised by antegrade opacification distal to an occlusion on catheter angiography. This finding has been associated with higher rates of vessel recanalisation. We sought to determine whether antegrade flow can be demonstrated on near-whole-brain time-resolved four-dimensional CT angiography (4D-CTA) and whether it can be distinguished from retrograde collateral flow.

**Methods and Materials:**

Thin-section 4D-CTA data from 43 consecutive stroke patients with acute terminal internal carotid or middle cerebral artery occlusion were assessed for pre-treatment thrombolysis in cerebral infarction (TICI) grade and the presence of antegrade or retrograde contrast opacification at the distal thrombus end. Digital subtraction angiograms were reviewed for pre-treatment TICI grade, presence of antegrade opacification distal to the thrombus as well as post-intervention TICI grade.

**Results:**

On 4D-CTA, there was evidence of antegrade flow in 5 of 43 cases (11.6%). Compared to angiography, 4D-CTA correctly classified antegrade flow in 4 cases (80.0%), there was 1 false positive and no false negatives. Recanalisation (TICI 2a or greater) was achieved in all 5 cases with evidence of antegrade flow on 4D-CTA versus 34 out of the 38 cases (89.5%) without evidence of antegrade flow.

**Conclusion:**

4D-CTA can distinguish antegrade flow across a cerebral artery occlusion from retrograde collateral flow. Further studies, preferably with a larger sample size are needed to confirm our findings and assess whether 4D-CTA can be used to predict success of recanalisation procedures in select cases.

B-0501

**10:39 Poor collateral status on timing-invariant CTA is a strong predictor of poor clinical outcome in acute stroke patients with large vessel occlusion**

E.J. Smit1, E.-j. Vonken1, T. van Seeters1, J.W. Dankbaar1, I.C. van der Schaaf1, E.J. Smit1, E.-j. Vonken1, T. van Seeters1, J.W. Dankbaar1, I.C. van der Schaaf1, I.C. van der Schaaf1, E.J. Smit1, E.-j. Vonken1, T. van Seeters1, J.W. Dankbaar1, I.C. van der Schaaf1, I.C. van der Schaaf1

**Purpose:**

We selected 40 consecutive ischaemic stroke patients with ICA and/or MCA occlusion from our clinical database. CTA and CT perfusion (CTP) at admission and clinical outcome data (modified Rankin Scale, mRS) after three months were available. CTP source images were used to reconstruct timing-invariant CTA (TI-CTA), a technique that is insensitive to delayed contrastarrival. Four experienced observers assessed collateralstatus on CTA and TI-CTA in an independent, blinded, randomised manner. Collateral status was rated good if ≤50% of collaterals were present or poor if < 50% were present. Clinical outcome was defined as good for mRS ≤2 or poor for mRS > 2.

**Results:**

Collateral status was rated significantly more often as good on Ti-CTA (84%) than on CTA (49%; p < 0.05). Inter- and intraobserver agreement were good for assessing collateral status on CTA and TI-CTA (mean kappa = 0.63 and 0.76, respectively). Poor collateral status on Ti-CTA had a predictive value of 100% for poor outcome. This number was only 69% for CTA. Good collateral status on CTA or TI-CTA predicted good outcome in only 64% and 56%, respectively.

**Conclusion:**

Poor collaterals status on timing-invariant CTA is a strong predictor of poor clinical outcome in acute stroke patients with large vessel occlusion. Ti-CTA detects more collaterals than standard CTA due to its insensitivity to delayed contrast arrival.

B-0502

**10:48 CT angiography “Spot Sign” predicts haematoma expansion in patients with acute spontaneous ICH**

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**Purpose:**

Spontaneous intracerebral haemorrhage (P-ICH) expands in up to 50% of cases and spot sign detection on CT-angiography (CT-A) enables prediction of haematoma expansion which has been linked to death and bad outcome. The aim is to investigate the strength in the correlation between presence of spot-sign and haematoma expansion.

**Methods and Materials:**

Six-hundred and twelve patients underwent standardised work up for i.v. thrombolysis at Bispebjerg University hospital, Copenhagen from April 2009 to May 2011 within 4.5 hours after stroke symptom onset. A non-contrast CT scan (NC-CT) and CT-A was performed routinely in patients with ICH and NC-CT was control planned next day when possible. One radiologist reviewed all data for spot sign and estimated the haematoma volume in the acute and follow-up NC-CTs with the ABC/2 method of measurement. Samples were assessed with the Mann-Whitney test. The study was approved by the Danish Data Protection Agency file no 2009-41-313.

**Results:**

CT-A was obtained in 69 patients and next day NCCT was obtained in 40 patients mainly due to early transferal of stable patients. In 43.5% of patients spot sign was observed. There was significant difference in haematoma expansion in groups with and without spot sign, p=0.0008. Mean acute volume was 65.8 ml (range 8.8-362.4 ml) in patients with spot sign vs. 15.9 ml (range 0.5-78.0 ml).

**Conclusion:**

Spot sign identifies patients with later haematoma expansion and may be useful in identifying patients for proof of principle trials in acute spontaneous ICH aiming at preventing or stopping early haematoma expansion.

B-0503

**10:57 Dual energy CT for detection of contrast leakage within high-density haematoma in patients with intracranial haemorrhage: iodine images versus combined images**

Y. Watanabe, H. Tanaka, M. Nishizawa, Y. Kunitomi, A. Tsukabe, N. Tomiyama, Sulia/JP (watanabe@radiol.med.osaka-u.ac.jp)

**Purpose:**

To elucidate the detectability of contrast leakage in high-density haematoma on early phase dual energy CT and compare the results with those obtained on delayed-CT (reference standard).

**Methods and Materials:**

Twenty-six patients with intracranial haemorrhage were retrospectively included in this study. All patients had undergone source dual source dual energy CT (100 kV and 140 kV) and delayed-phase-enhanced CT (2 minutes after contrast injection) between April 2010 and July 2011. Dual energy CT images were post-processed with commercial software applying a three-material-decomposition algorithm to calculate iodine images and virtual unenhanced images and also to generate combined CT images that create the impression of 120 kV CT images.

One neuroradiologist, blinded to the patient’s data, reviewed the iodine images and combined images to detect contrast enhancement or contrast leakage in the haematoma.

**Results:**

The patients’ diagnosis was as follows: 12 idio pathic intracerebral haemorrhage, 11 traumatic haemorrhage, 2 subarachnoid haemorrhage, and 1 brain tumour with haemorrhage. Contrast leakage or enhancement was detected in 15 of 26 patients (58%) on delayed-CT. Among these 15 patients, 5 patients showed an equivocal leakage on combined images, but the iodine images revealed clear contrast leakage in the haematoma. In 2 patients iodine leakage could be detected on both iodine and combined images, but iodine image was superior in depicting the leakage. Eight patients were equal to depict the contrast leakage in both iodine and combined images.

**Conclusion:**

Dual energy CT is able to differentiate iodine contrast-medium from haematoma and facilitates the detection of contrast leakage especially in patients with faint iodine enhancement.

B-0504

**11:06 Cerebral perfusion CT quantifying regional functional parameters at the onset of the stroke and 24hs after intravenous thrombolytic therapy**

Z.M. Metalfarati, E. Ale Xu, M. Fanarioti, P. Argiri, A. Chovas, A. Konnos, Lanka/GY

**Purpose:**

To assess the changes in regional functional parameters (rFPs) of ischaemic and normal brain at the onset of acute stroke (AS) and 24hs after thrombolysis therapy. Correlate rFPs to NIHSS in both time frames and to evaluate utility of the initial rFPs to predict the clinical outcome at 24hs.
Methods and Materials: Seventeen AS patients who thrombolysed underwent brain unenhanced CT and CT perfusion (CTP) at admission and 24hs after thrombolysis. All CT studies were reviewed and rFPs (CBF, CSV, MITT) of ischemic and normal brain at both time frames were calculated. rFPs were correlated with baseline and 24hs NIHSS, respectively. A multivariate linear regression analysis was used to investigate the effect of the initial rFPs on the clinical outcome.

Results: Normal brain rFPs at 24hs were significantly different compared to initial rFPs. CBF and MITT of diseased brain were significantly reduced (p<0.003) and increased (p<0.001), respectively, compared to the contralateral healthy side. rFPs of the diseased brain were significantly improved at 24hs (MTT, p<0.001/ CBF, p<0.015/CBV, p<0.034). NIHSS was significantly improved at 24hs (p<0.001). CBF was the strongest predictor of improvement of NIHSS followed by MITT (R²=0.078, p<0.001).

Conclusion: rFPs and NIHSS are significantly improved 24hs after thrombolysis at the settings of AS. The clinical severity expressed by NIHSS is strongly correlated to CBF of the diseased brain at presentation of the stroke and at 24hs later. Further studies of this parameter at admission had a poorer clinical outcome as it is expressed by higher NIHSS.

B-0505
11:15
Dynamic perfusion CT (PCT) imaging and alteration of blood brain barrier permeability (BBB-P) after acute ischaemic stroke (AIS), prognostic significance
E. Puglielli, M. Baffle, M. Fuschi, V. Di Egidio, M. Monina; Teramo/IT (edopug@hotmail.com)

Purpose: Aim of the study was to assess the correlation between BBB permeability alteration and the final outcome in AIS.

Methods and Materials: From January 2009, sixty patients with AIS less than 6h for anterior or 12h for vertebrobasilar circulation, mean age 67y, evaluated by PCT were included. Increase on microvascular permeability (MP) of the BBB was detected and MP colour maps were retrospectively generated. Two expert readers analysed each map by drawing 3 circular 10 mm regions of interest on the focal abnormality. The mean of these 3 regions of interest represented the MP of the infarct (MPI) and on the non-ischaemic hemisphere (MPC control). The modified Rankin score (mRS) test was performed. MPI and MPC were compared (exactWilcoxon test). MPI that developed HT on follow-up (MP-HT) was compared with all of the others (MP-No-HT) (exactMann-Whitney test).

Results: Fifty-four infarcts (90%) showed focal MP elevation in the region of infarct. Cerebral blood flow (CBF) (ml/100 g/min), MPI ranged from 0 to 15 (mean: 3.7±2.1) versus MPC of 0-9 (mean: 0.38±0.15; P<0.001). Six infarcts (10%) developed HT, all of which were within the areas of MP elevation. MP-HT ranged from 4.9 to 14 (mean: 8.5±2.4) versus MP-No-HT of 0-5.7 (mean: 3.8±2.0; P<0.001). Forty infarcts (66%) were treated with embolectomy and local rtPA. A significant difference between MP-HT and MP-No-HT persisted with respect to local treatment.

Conclusion: PCT can be an inaccurate correlation with the mRS, while elevated BBB-P was directly correlated with the outcome and PCT can predict HT.

B-0506
11:24
CT perfusion and CT angiography: can they better predict the final infarct? M. Fernández Tamarina, C.R. Caracela Zeballos, I. Herrera, E. Barcena, J.M. García Benassi, R. González-Gutierrez; Toledo/ES

Purpose: To evaluate cerebral CT-perfusion imaging (CCPT) predicting final infarcted cerebral areas (ICA). To review correlation of the imaging findings between non-enhanced-CT (NECT) and cerebral blood volume (CBV) maps, identifying the ICA. To assess the impact of collateral arteries (CA) in the development of the final outcome in AIS.

Methods and Materials: To analyse the outcome of the cerebral areas at risk in fibrinolysis-treated ICA. To assess the impact of collateral arteries (CA) in the development of the final outcome in AIS.

Conclusion: MP-HT was directly correlated with the outcome and PCT can predict HT.

B-0507
11:33
Automated assessment of regional CT perfusion in acute ischaemic stroke A. Kemmling, R. Krumm, L. Feyen, T. Niederstadt, W.L. Heindel; Münster/DE (akemmling@web.de)

Purpose: To present a novel algorithm for fully automated user-independent assessment of regional relative cerebral CT perfusion (CTP) parameters in acute ischaemic stroke.

Methods and Materials: Acute stroke imaging (native CT and dynamic CTP) was performed in 83 consecutive acute middle cerebral arterial strokes on a 128-slice CT scanner (Somatom Definition AS+, Siemens Medical Solutions). Regional CTP values were obtained by a fully automated routine: (1) robust non-linear registration of CTP maps to MNI-152 space regardless of brain coverage was accomplished by rigid body transformation of native CT to the anatomical average CT perfusion image followed by inversion of the transformation matrix (CTPtoCT). The matrix CTPtoCT and the non-linear warped CTPtoMNI were concatenated (CTPtoMNI). The warfield CTPtoMNI was applied to perfusion maps. (2) A probabilistic atlas covering 68 structures (Harvard-Oxford structural atlas) was used to calculate brain perfusion parameters weighted by the anatomical probability of a region. (3) An error correction term excluded non-significant voxels defined by cerebrospinal fluid and vessels. (4) Relative CT perfusion values were calculated (regional perfusion of ischaemic hemisphere divided by the contra-lateral side). Automated perfusion values were compared with selected manually traced perfusion values for reference.

Results: Registration of perfusion maps to MNI-152 space was robust and reliable. Automated and manually obtained regional brain perfusion values were not significantly different (p>0.01). The average difference between automated and manual regional perfusion parameters was less than 4.3% (SD 3.1%).

Conclusion: The presented algorithm is robust and reliable for automated calculation of regional perfusion parameters.

B-0508
11:42
Recommendations for selecting the vascular input functions to optimise the validity in CT-perfusion imaging in 256 (or more)-slice scanners J. Niesten, I. Van Der Schaaf, A. Riordan, H. De Jong, W. Mait, B. Velthuis; Utrecht/NL (jniesten@hotmail.com)

Purpose: To improve accuracy of quantitative perfusion measurements and reduce operator-dependent postprocessing steps by optimising the selection of the arterial input function (AIF) and the venous output function (VOF) in CT-perfusion (CTP).

Methods and Materials: Forty-four patients with acute middle cerebral artery (MCA) ischaemic stroke underwent non-contrast CT, CTP and CT-angiography on admission with a 256-slice CT-scanner. In CTP-measurements, different arteries were selected as the AIF and the area under the AIF-curve (UAIF) was calculated. To investigate the AIF accuracy, we compared the quantitative perfusion measurements in both symptomatic and asymptomatic hemisphere (repeated Measures’ test) for each AIF location. To reduce operator steps and improve reproducibility we examined if selection of the VOF could be replaced by the AIF. The resulting quantitative measurements of both AIF and VOF were compared (paired t-test).

Results: The internal carotid artery (ICA) had significantly the largest UAIF, followed by the basilar artery (Abas), the MCA and the anterior cerebral artery (between all groups p<0.0001). Selecting the ICA and Abas as AIF resulted in the most accurate values with lowest quantitative mean CBV and CBF and accordingly highest quantitative MTT (all p<0.0001). Replacement of VOF by AIF showed significantly higher mean CBV (i.e. overestimation) on both the hemisphere ipsi- and contra-lateral to the thrombus (p=0.003 and p=0.001 respectively), and a significantly higher CBF (p=0.014) on the ipsilateral hemisphere.

Conclusion: To improve validity of quantitative perfusion values we recommend to select the ICA as the AIF and a large vein as the VOF.
Effect of radiation exposure on quantitative evaluation of cerebral CT perfusion maps: results from a hybrid digital phantom

**Purpose:** To use a hybrid digital phantom to study the effect of mAs on quantitative evaluation of cerebral CT perfusion scans.

**Methods and Material:** The hybrid digital phantom consists of scans of a homogenous skull phantom on which circular objects (10-20 mm) are digitally superimposed. Tissue perfusion curves derived from patient data were superimposed on the background (white matter) and on the objects (grey matter). We tested a CTP sequence using 30 scans every 2s over 60s (80 KV, 5 mm thickness) derived from a 320-row CT scanner. The mAs values per CTP sequence were varied per scan (10-200 mAs). A synthetic dataset without noise was the gold standard. CBF maps for each mAs setting and for the synthetic dataset were calculated using the ASIST CT program. Noise in CBF maps was measured in the background; contrast between background and objects was measured in circular ROIs with a diameter of half the object diameter. Size- and dose-dependence of absolute values and CNR in CBF maps was calculated.

**Results:** Above 45 mAs per scan, the CBF values for the 20 mm objects were within ±12% of the gold standard. At 10 mAs CBF was overestimated by >100%. With smaller objects the estimation of CBF became less precise. CNR for CBF in 20 mm decreased rapidly: CNR at 230 mAs was 4.2 and decreased to 2.4 at 100 mAs and 0.4 at 10 mAs.

**Conclusion:** Absolute CBF values require sufficient dose to be correct: values at low dose are overestimated. In addition, CNR rapidly decreases with lower dose.

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**B-0511** 10:39

Digital chest tomosynthesis: impact on patient management

**Purpose:** To assess the clinical impact of digital tomosynthesis (DTS) in the management of patients with suspected pulmonary lesions on chest radiographic examination (CRE).

**Methods and Materials:** Three-hundred and thirty-nine patients (200 males, 139 females; age, 71.19±11.9 years) with suspected pulmonary lesion(s) on CRE underwent DTS. Two readers (experience, 10 and 25 years) prospectively analysed CRE and DTS images and proposed a diagnosis according to a confidence score: 1 = definite or probable benign pulmonary or extra-pulmonary lesion, or pulmonary pseudolesion deserving no further diagnostic work-up; 3 = indeterminate; 4 = probable or definite pulmonary lesion deserving further diagnostic work-up by CT. Mean interpretation time and effective dose were measured both for CRE and DTS.

**Results:** Final diagnoses included 128 pulmonary and 29 pleural lesions in 157/339 patients, and pulmonary pseudolesions in the remaining 182/339 patients. DTS resolved the CRE doubtful finding without requiring further diagnostic work-up in 256/339 (76%) patients, while 83/339 (24%) patients underwent chest CT. The mean interpretation time for DTS (meansSD, 220±40 secs) was higher (P < 0.05; Wilcoxon test) than for CRE (110±30 secs). Mean effective dose was 0.06 mSv (range, 0.03 - 0.1 mSv) for CRE, and 0.2 mSv (range, 0.1 - 0.3 mSv) for DTS.

**Conclusion:** DTS avoided the need for chest CT in about three-fourths of patients with suspected pulmonary lesions on CRE with a slight increase in the interpretation time and effective dose compared to CRE.

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**B-0512** 10:48

Ultra-low-dose CT for the detection and characterisation of the most common CT patterns of pulmonary disease

**Purpose:** To assess the accuracy of ultra-low-dose CT for the detection and characterisation of the most common CT-patterns of pulmonary disease compared to middle-dose CT scans of the chest.

**Methods and Materials:** Ten patients with pulmonary infections, 20 with interstitial lung diseases and 30 with lung nodules were scanned according to an ultra-low-dose (6x4.75 mm, 40 reference-mAs, 120 kVp) and a middle-dose (150 reference-mAs, 120 kVp) contrast-enhanced chest-CT protocol (Xenetics). Two radiologists with 3 and 10 years of thoracic imaging experience searched individually both dose images for the most common CT patterns consisting of 34 different subgroups of ground glass opacities, nodules, interstitial and airspace diseases. The standard of reference was established by two different expert radiologists in consensus.

**Results:** The 1080 lung segments showed 818 nodules, 596 ground glass opacities, 74 airspace and 575 interstitial diseases and 64 normal segments. Both readers' sensitivities, specificities and accuracies of ultra-low-dose CT did not drop significantly (McNemar) for 28 of the 34 patterns. The sensitivity of only one reader dropped for small ground glass nodules (≤ 5 mm) from 85% to 64% (p-value < 0.0001) and sensitivity for all interstitial lung diseases together was significantly lower for both readers with an average loss of sensitivity of 19% from 57% to 43% (Reader 1) and from 67 to 64% (Reader 2), respectively.

**Conclusion:** Except for small ground glass nodules and interstitial lung disease, the pattern detectability is not significantly impaired at ultra-low-dose CT. It is applicable for lung nodule or consolidation follow-up examinations.

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**B-0513** 10:57

Impact of 4th generation iterative reconstruction technique on image quality in ultra-low-dose computed tomography of the lungs

**Purpose:** To independently and compare the influence of the 4th generation iterative reconstruction (iDose) technique on ultra-low-dose MDCT of the lungs with regard to anatomical delineation, lesion conspicuity and artefact reduction.

**Methods and Materials:** In 23 immunocompromised patients with suspected pulmonary infection the raw data of unenhanced MDCT scans (120 kV, mean CTDiVol: 2.4 mGy, mean DLP: 125 mGy/cm) were reconstructed using a prototype reconstruction processor featuring iDose4™ (Philips, Best, the Netherlands). iDose™ level settings varied between 0, 2, 4, 6 and 7. Images were reconstructed with a slice-thickness of 1 mm. Three radiologists blinded to the reconstruction technique independently performed image analysis. A 4-point grading-scale was
applied regarding the depiction of anatomical details and the degree of artefacts observed (1, worst; 4, excellent; 11:06). The signal-to-noise ratio (SNR) was assessed for each data set. Statistical evaluation included kappa analysis and Wilcoxon-test.

Results: Best image quality was assessed with iDose™ level 6. Compared to filtered-back-projection, the high iDose™ level of 6 improved the conspicuity of subtle infiltrations, groundglass opacities and mosaic perfusion. Even at the lower iDose™ level of 2, image ratings scored superior to filtered-back-projection. With increasing iDose™ levels, reduction of streak artefacts was successfully quantified by a decrease of the standard deviation at constant mean attenuation values.

Conclusion: Iterative reconstructions obtained in ultra-low-dose MDCT substantially improve image quality, conspicuity of subtle lesions and decrease image noise even at lower iDose™ levels. Thus, the implementation of this technique into clinical routine imaging seems to be desirable, e.g. for immunocompromised patients, in whom the identification of subtle changes can be crucial.

B-0514 11:06
Upgrading to adaptive statistical iterative reconstruction (ASIR) in 64-row computed tomography (CT) of the chest: detailed analysis of the performance of different ASIR modes and levels by intra-individual comparison of dose-reduced ASIR scans to full-dose filtered back projection series
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Purpose: To compare image quality in dose reduced 64-row-CT of the chest at different levels of adaptive statistical iterative reconstruction (ASIR) to full dose baseline examinations reconstructed solely with filtered back-projection (FBP) in a realistic upgrade scenario.

Methods and Materials: A waiver of consent was granted by the IRB. Baseline examinations of the chest (noise index N=29; LightSpeed VCT XT; GE) were intra-individually compared to follow-up studies on a CT with ASIR option (N=45; other scan variables constant and as provided by the vendor: Discovery 750HD; GE; n=46). For this, images were calculated in ASIR slice and volume mode; with ASIR blendings of 0% to 100% in standard and lung kernel. Three experienced radiologists independently compared image quality of these 828 series to the corresponding full-dose baseline examinations (-2: diagnostically inferior; -1: inferior; 0: equal; 1: superior; +2: diagnostically superior). Statistical analysis used the Wilcoxon- and the pair-wise student t-test.

Agreements for reticular opacity of reduced-dose CT were almost perfect (κ>0.81). Agreement for reticular opacity of reduced-dose CT was also almost perfect, while the respective agreements of low-dose CT without ASIR and with ASIR 3D were moderate (κ=0.49) and substantial (κ=0.74).

Conclusion: ASIR 3D is useful for image noise reduction and radiological finding assessments obtained with reduced- and low-dose CTs for patients with various pulmonary diseases.

B-0515 11:15
Intraindividual comparison of image quality using retrospectively and prospective respiratory gating for the acquisition of thin sliced 4D MDCT of the thorax
M. Regier1, F.O. Henes1, D. Schwarz1, M. Groth1, G. Riesenberg1, G. Adam1, M. Körner1, Munich/DE (m_regier@med.uni-muenchen.de)

Purpose: To intraindividually compare image quality and anatomical depiction of the lung and mediastinum using retrospective as well as prospective respiratory gating for the acquisition of 4D MDCT in a porcine model.

Methods and Materials: Five tracheally intubated pigs underwent 64-row MDCT of the thorax. For retrospective and prospective gating the frequency of the respiratory cycle was adjusted to 10, 14, 18 and 22 respiratory cycles/min. The table speed varied between 3.9, 5.7 and 7.6 mm/sec. Free-breathing scans of the lungs were performed with the same respiratory frequencies. After respiratory cut-off an additional scan in breathhold technique was acquired which served as the reference. Three reviewers independently analysed the CT data applying a 4-point grading scale regarding the degree of artefacts observed and the anatomical depiction (1: excellent; 2: good; 3: moderate; 4: non-diagnostic). Comparison of different techniques was performed using Wilcoxon-matched paired test.

Results: Breathhold imaging allowed for the highest image quality (mean values: trachea, 1.00; bronchi, 1.10; lung parenchyma, 1.08; diaphragm, 1.05; pericardium, 1.86). Retrospective gating proved to be of superior image quality compared to prospective gating for all respiratory frequencies (p<0.05). With the respiratory frequency set to 14/min and a table speed of 5.7 mm/sec retrospective gating even enabled the same image quality as breathhold imaging. Performing image acquisition during free breathing lead to a minor image quality compared to all other techniques applied.

Conclusion: In an experimental setting, retrospective gating is superior to prospective gating and can even be equivalent of image quality same as broad approach if set to lower respiratory frequencies and table speed.

B-0516 11:24
Adaptive iterative dose reduction using three-dimensional processing (AIDR 3D) for reduced and low-dose CT examination: comparison with standard-dose CT of image quality and radiological finding assessment for patients with various pulmonary diseases
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Purpose: To compare the image noise reduction capabilities and radiological findings assessments for reduced- and low-dose chest CT without and with adaptive iterative dose reduction using three-dimensional processing (AIDR 3D) with those for standard-dose CT for patients with various pulmonary diseases.

Methods and Materials: Chest CT examinations with three different tube currents and 16- and 64-detector row CT were administered to 37 patients. 150 mAs (standard-dose) data was reconstructed as thin-section CT without AIDR 3D, and CT data at 25 mAs (low-dose) and 50 mAs (reduced-dose) as thin-section CT without and with AIDR 3D. To compare image quality, image noise of all CT was calculated using means of ROI measurements. For comparison of radiological finding assessments, probabilities of emphysema, ground glass opacity, reticular opacity, bronchiectasis, honeycomb and nodules were evaluated on a 5-point scale. Then, image noise and agreements of radiological findings between standard-dose CT and others were statistically evaluated.

Results: Image qualities of reduced- and low-dose CTs without AIDR 3D were significantly lower than that of others (p<0.05). All intra-method agreements for emphysema, GGO, bronchiectasis, honeycomb pattern and nodules, except for those observed on low-dose CT without AIDR 3D, were almost perfect (κ=0.81). Agreements for reticular opacity of reduced-dose CT were also almost perfect, while the respective agreements of low-dose CT without and with AIDR 3D were moderate (κ=0.49) and substantial (κ=0.74).

Conclusion: AIDR 3D is useful for image noise reduction and radiological finding assessments obtained with reduced- and low-dose CTs for patients with various pulmonary diseases.

B-0517 11:33
Model-based iterative reconstruction technique for radiation dose reduction in chest CT

Purpose: To intraindividually compare image quality characteristics of low-dose chest CT reconstructed with model-based iterative reconstruction (MBIR) and adaptive statistical iterative reconstruction (ASIR), and standard-dose CT reconstructed with ASIR.

Methods and Materials: In this prospective study, 100 patients (malefemale 55/45, age 65.6±12.4years) underwent unenhanced chest CT scan at standard-dose and low-dose with a 64-row multidetector CT scanner, which involved the use of automatic tube current modulation with fixed noise indexes (11.1±4.82 of 5 mm for standard-dose/low-dose CT). Images were reconstructed blending of 50% filtered back projection and 50% ASIR image data (ASIR50) for standard-dose, and at ASIR50 and MBIR for low-dose CT. Two radiologists assessed the images in a blinded and randomised manner for subjective image noise, artefacts, critical reproduction of visually sharp chest structures, and diagnostic acceptability. Objective image noise was measured in the lung parenchyma. Data were analysed by using the sign test and the pair-wise student t-test.

Results: There was a 79.0% decrease for dose-length product with low-dose CT, compared to standard-dose CT. Low-dose MBIR images had significantly lower objective image noise in the lung parenchyma (16.9±3.0, compared with low-dose ASIR (49.2±6.0, P<0.01) and standard-dose ASIR images (24.9±4.6, P<0.01). Diagnostic acceptable images were obtained with all low-dose MBIR images, although they tended to have motion artefacts and pixilated blotchy appearances.

Conclusion: In chest CT images acquired with nearly 80% radiation dose-reduction, MBIR significantly improves image quality compared to ASIR, and provides diagnostic acceptable images; however, image qualities of low-dose MBIR are not completely equivalent to those of standard-dose ASIR.
**B-0518 11:42**

**Can iterative reconstruction restore image quality at 60% dose reduction? Clinical experience in 50 patients with simultaneous availability of low-dose and standard-dose images from dual source datasets**

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**Purpose:** To compare image quality of low-dose images reconstructed with a raw-data-based iterative reconstruction technique (SAFIRE) with standard-dose filtered back projection (FBP) CT.

**Methods and Materials:** 50 consecutive dual source chest CT datasets, acquired in the conditions of routine clinical practice (120 kVp; 110 mA) with (a) both tubes set at similar energy, (b) the total reference mAs split up in a way that 40% of the reference mAs was applied to tube A (i.e., 44 mAs); (c) while 60% of the reference mAs was applied to tube B (i.e., 66 mAs). Two series of images were generated: (a) full-dose images (generated from both systems) reconstructed with FBP (group 1); and (b) low-dose images (generated from tube A) reconstructed with SAFIRE (group 2).

**Results:** On group 2 images, there was: (a) a significant reduction in the objective image noise measured at the level of the trachea on mediastinal (16.04 ± 5.65 vs 17.66 ± 8.44) (p=0.0284) and lung images (29.77 ± 7.9 vs 37.96 ± 9.03) (p < 0.0001); (b) a similar visual perception of noise on mediastinal (p=1) and lung images (p=1), mainly rated as minimal; and (d) a similar overall image quality, rated as excellent in 66% (33/50) of examinations, without loss of diagnostic information as assessed by the comparative analysis of individual CT features of lung infiltration (84.4%; 95% CI=95.9%-89.9%).

**Conclusion:** Despite 60% dose reduction, the raw-data-based iterative reconstruction technique allowed better objective and similar subjective image quality of low-dose images compared to full-dose FBP images.

**B-0519 11:51**

**Evaluation of dose reduction and image quality in chest CTs using adaptive statistical iterative reconstruction with the same group of patients**

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**Purpose:** To compare the image quality and radiation dose of chest CT images reconstructed with a blend of adaptive statistical iterative reconstruction (ASIR) and filtered back projection (FBP) with images generated using conventional FBP.

**Methods and Materials:** Patients with chest CT reexaminations were alternately assigned to two scanners with different reconstruction techniques. The study groups included noise index (NI) 11 with 30% ASIR (A30), NI 13 with 40% ASIR (A40), NI 15 with 50% ASIR (A50) and NI 17 with 60% ASIR (A60), sequentially changed every two months. The control images were obtained using FBP and NI 11. All acquisitions were performed with automatic dose modulation. Paired-t and non-parameters tests were applied to compare the difference.

**Results:** The radiation doses were significantly lower in the examinations used ASIR (p < 0.001). The mean dose reduction rate for each group (A30-60) was 27.7%, 45.2%, 57.1% and 71.8%, respectively. The image quality of groups A30-A50 was not inferior to those of the control examinations. The image noise of group A60 was greater and subjective image quality was inferior to that of the control.

**Conclusion:** ASIR enabled the use of a higher NI with automatic dose modulation. With 50% ASIR and a NI of 15, the effective radiation dose was reduced by 57%, without compromising image quality.

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**B-0520 10:30**

**Predictive factors of downstaging of hepatocellular carcinoma (HCC) beyond the Milan criteria treated with intra-arterial chemoembolisation**

V. Bouy, L. Maruzzelli, R. Miraglia, G.B. Vizzini, F. Tuzzolino, A. Luca; Palermo/IT (valentinabova@inwind.it)

**Purpose:** The present study was undertaken to retrospectively analyse the long-term clinical results in patients suitable for liver transplantation, who underwent transarterial chemoembolisation (TACE), with hepatocellular carcinoma (HCC) who exceeded the Milan criteria, to determine predictive factors of successful downstaging.

**Methods and Materials:** Between January 2004 and December 2010, 304 consecutive patients with HCC were treated by repeatedly performed TACE, 80 of them exceeding the Milan criteria. Patients with infiltrative HCC, hypovascular HCC, portal vein thrombosis, were excluded, with a final study population of 46 patients. Tumour response to TACE was evaluated at 1 month with CT/MR according to American Association for Study Evaluation Response Criteria in Solid Tumours (RECIST) guidelines. Successful downstaging was defined as a reduction in the number and size of viable tumours to within the Milan criteria and AFP < 400 ng/ml for at least 6 months.

**Results:** After TACE, 19 patients (39%) had their tumours successfully downstaged; 29 patients (61 %) did not. No intergroup differences existed with respect to patient characteristics or types and number of treatments. However, at multivariate analysis, alpha-fetoprotein levels < 100 ng/ml and 3-years Metroticetol were significant independent prognostic variables of successful downstaging (p < 0.023, p < 0.049, respectively). Kaplan Meyer patient survival rate was significantly higher in the downstaged group than in the not-downstaged group (p < 0.00113).

**Conclusion:** In patients with HCC beyond the Milan criteria, biological characteristics of the tumour may predict a good response to downstage after TACE.

**B-0521 10:39**

**Balloon-occluded percutaneous radio-frequency thermal ablation (RFA) plus transarterial chemoembolisation (TACE): a new combined single-step therapy for treatment of single large hepatocellular carcinoma**

M. Nestola, R. Iezzi, M. Santoro, R. Dattesi, M. La Torre, L. Bonomo; Rome/IT

**Purpose:** To evaluate the feasibility and safety of combined single-step therapy with balloon-occluded RFA followed by superselective TACE in patients with single unresectable hepatocellular carcinoma larger than 3 cm.

**Methods and Materials:** 10 consecutive patients with single unresectable large HCC (mean diameter 4.43 ± 1.27 cm; range: 3-5.6 cm), not suitable to thermal ablation alone for size and site of the lesion, were enrolled in our single-centre multidisciplinary pilot study. The schedule of treatment consisted of: percutaneous RFA (single 3-cm monocarp needle insertion) of the target lesion during occlusion of the hepatic artery supplying the tumour followed by superselective TACE with epirubicin (Farmorubicin® 50 mg Powder)-loaded DC Bead (100-300micron). Adverse events as well as intra/procedural complications were clinically assessed. Early local efficacy in target lesions in terms of persistence of contrast enhancement and presence of necrotic diameter was evaluated on 1-month follow-up multiphasic CT basing on m-RECIST criteria.

**Results:** Technical success was achieved in all patients. No major complications occurred. Overall technical success, defined as complete devascularisation during the arterial phase of the target lesion, was achieved in 8/10 patients with 2 partial response (persistence of vital tissue less than 30%), with a nonenhancing area corresponding in shape to the previously identified HCC (mean necrotic diameter 5.62 ± 1.07 cm; range: 4.2-8 cm).

**Conclusion:** Balloon-occluded-RFA plus TACE seems to be a safe and effective combined therapy for the treatment of advanced unresectable single large HCC, allowing to obtain a high complete local response rate also in patients not suitable to thermal ablation alone.
Purpose: The objective was to report on the long-term recurrences of HCC that presented complete response after treatment with 2-4 scheduled sessions of chemoembolisation with doxorubicin-loaded DC bead.

Methods and Materials: 173 patients not suitable for curable treatments have been prospectively enrolled (mean age 70.4±7.4 years). Child Pugh class was A/B (102/71; 59% / 41%), Okuda stage was 0/1/2 (91/61/19; 53.2%/35.7%/11.1%), and mean lesion diameter was 7.6±2.1 cm. Lesion morphology was one dominant lesion ≤5 cm occurred in 36.4%/63.6%/90.9%, with dominant lesion > 5 cm occurred in 33.3%/33.3%/33.3% during 1st, 3rd, 5th year, respectively. Overall survival at 1-yr, 2-yr, 3-yr, 4-yr and 5-yr was 100%/97%/88%/62% and 62%, respectively.

Conclusion: DEB-DOX achieves high rates of 5-yr survival for patients that yielded CR after initial scheduled treatments but cannot be classified among curative treatments.

Purpose: To evaluate the feasibility and safety of single-ballon-occluded RFA followed by TACE in patients with “complex” unresectable HCC, previously not suitable to RFA alone due to their localisation.

Methods and Materials: 15 consecutive patients with single HCC (mean diameter 4.17±1.02 cm), adjacent to the diaphragm (7 lesions), proximal to the hepatic portal vein (2 lesions), Glisson’s capsule (6), or located on the intra-abdominal free surface (2), considered as “complex” for their unfavourable location, and not suitable for RFA alone, were enrolled in our single-centre multidisciplinary pilot study. The treatment was composed by RFA (single 2-cm or 3-cm monopolar needle insertion) during occlusion of the feeding artery followed by selective superselective TACE (conventional-TACE or with DC-Bead) of 4.67±1.43 was obtained. Based on mRECIST criteria, a tumour response was evaluated on 1-month follow-up multiphasic CT based on mRECIST criteria.

Results: Technical success was achieved in all patients. No major complications occurred. A mean total treated diameter (necrotic diameter plus circumferential peripheral lipiodol uptake for conventional TACE; mean necrotic diameter for TACE with DC-Bead) of 4.67±1.43 was obtained. Based on mRECIST criteria, a tumour response was obtained in all patients, with a complete response achieved in 11 out of 15 patients (73.3%), with a partial response in the last 4 patients (residual tumour < 50%), without any progressive disease.

Conclusion: Balloon-occluded RFA plus TACE seems to be a safe and effective therapy for the treatment of “complex” HCC, allowing to obtain a high complete local response rate, without complications, also in patients not suitable to RFA alone.
the 15 assessable pts the mean follow-up was 6 months and the response rate in their 17 lesions was 3 CR, 8 PR and 6 SD.

Conclusion: All embolisation procedures were successfully carried out with no complications and responses were encouraging: objective response rate (CR+PR) in 11/17 lesions (64.7%). No correlation emerged between the residual active lesion and the accessory artery territory. Our findings confirmed the actual intra-tumoral flow redistribution after embolising the accessory arteries, which makes it possible to treat the tumour through its single main feeding artery.

**B-0527** 11:33
Transarterial chemoembolisation (TACE) with mitomycin and cisplatin in hepatocellular carcinoma: curative, palliative and neoadjuvant therapy protocol
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Purpose: To evaluate the effect of transarterial chemoembolisation (TACE) on local response and survival of patients with hepatocellular carcinoma (HCC) in a curative, palliative and neoadjuvant protocol.

Methods and Materials: In a retrospective study, 356 patients (male:259/ female:97) with histopathologically proven HCC were treated with repetitive TACE (every 4-6 weeks) between 11/2000 and 12/2011. A 1.75" T25 underwater physiology pathway. Child-Pugh score, tumour volume, number of tumours, local response and survival since first diagnosis and first TACE were analysed. Local tumour response was evaluated by MRT and CT volumetric measurements, and survival rates from first TACE and last TACE were calculated according to the RECIST criteria.

Results: Local tumour control showed partial response (PR) in 113 patient (31.74%), stable disease (SD) in 123 patients (34.55%) and progressive disease in 120 patients (33.71%). Local response rate per patient was 0% CR, 29% PR, 37% SD and 34% PD. The survival rates of all patients since first diagnosis and first TACE were 35.45 months (median) and 26.22 months (median), respectively. For neoadjuvant intervention and resection survival rates since first diagnosis and first TACE were 12.0 months and 6.6 months, for neoadjuvant intervention and transplantation 21.88 months and 21.12 months and for neoadjuvant intervention followed by different ablation techniques (LITT, MW, RFA) 28.55 months and 19.58 months.

Conclusion: TACE for the treatment of HCC is an effective therapy for all three therapy protocols. In neoadjuvant therapy it can be used as a bridging therapy, in palliative therapy it stabilises the tumour load.

**B-0528** 11:42
Preprocedural 3D-CT image blending with fluoroscopy to guide catheterisation of proper hepatic artery during transarterial chemoembolisation: a feasibility study
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Purpose: To assess feasibility of preprocedural computed tomography 3D model fusion with fluoroscopy to guide the catheterisation of the proper hepatic artery during transarterial chemoembolisation (TACE) of hepatocellular carcinoma (HCC).

Methods and Materials: Twenty consecutive cirrhotic patients with HCC undergoing TACE were prospectively enrolled in the study. The early arterial phase axial images of the preprocedural CT were post-processed on an independent workstation connected to the angiographic system (Innova 4100, GE Healthcare), obtaining a 3D volume rendering image (VR) that included: abdominal aorta, celiac trunk, common, proper, left and right hepatic arteries, superior mesenteric artery, origin of the renal arteries, first and second lumbar vertebrae. The VR image was manually registered to the 2D fluoroscopic image using the lumbar spine as reference. The VR image was then used as guidance to selectively catheterise the proper hepatic artery using an adequately shaped 5 Fr hydrophilic catheter and a 0.035″ hydrophilic guidewire. The procedure was successful when performed with no need for intra-arterial contrast injections or angiographic acquisitions.

Results: The procedure was successful in 19/20 patients (95%). In one patient, celiac trunk angiography was required for the presence of a severe ostial stenosis that was under-estimated at CT. Time for image reconstruction and registration was < 10 minutes in all cases.

Conclusion: The use of preprocedural CT image blending to fluoroscopy enables confident and direct catheterisation of the proper hepatic artery with no need for celiac trunk angiography or other acquisitions, thus reducing radiation exposure, contrast media administration and procedural time.

**B-0529** 11:51
Radioembolisation with Y-90 glass microspheres in hepatocellular carcinoma: safety and long-term survival
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Purpose: Radioembolisation with glass microspheres allows effective locoregional therapy of patients with hepatocellular carcinoma (HCC) not eligible for local therapies. The aim of this study was to validate evidence on safety and efficacy of this treatment in a European sample of patients with advanced HCC.

Methods and Materials: 106 consecutive patients with advanced HCC were included in this prospective open label study. Y-90 microspheres were administered in a lobar fashion over the right or left branch of the hepatic artery. Response to treatment was evaluated by CT imaging applying RECIST and WHO criteria with recent EASL/NCI amendments. Time to progression and overall survival were estimated by the Kaplan-Meier method.

Results: 106/108 patients had underlying liver cirrhosis, with Child-Pugh scores between 4 and 8. 176 treatment sessions were performed ranging between 1 and 3 treatments per patient. The mean radiation dose per treatment was 120 (±18) Gy. According to EASL criteria, complete responses were determined in 3%, partial responses in 37%, stable disease 53% and primary progression in 6%. Time to progression (TTP) was 10.0 months, the median overall survival was 16.4 months. No lung or visceral toxicity was observed. The most frequent adverse event was a transient fatigue-syndrome.

Conclusion: Radioembolisation with Yttrium-90 glass microspheres for patients with advanced HCC is a safe and effective treatment which can be utilised even in cases with compromised liver function.
Sodium imaging of the lumbar intervertebral disc at 7 Tesla: correlation with T2 mapping and modified Pfirrmann score at 3 Tesla.

**Methods and Materials:** In 10 asymptomatic volunteers (9m, 1f; mean age 30 years, range 23-43), the discs L2/3 to L5/S1 were examined. At 7 Tesla, normalised sodium signal-to-noise ratios were calculated, using region-of-interest analysis. At 3 Tesla, T2 mapping was performed with a multi-echo-spin echo sequence (TR/TE 1200/ 13.8, 27.6, 41.4, 55.2, 69.0 and 82.8 msec). T2 values were calculated over the nucleus, with a pixel-wise, mono-exponential non-negative least squares fit analysis. Morphological grading according to a modified Pfirrmann score was assessed, and Pearson’s correlation analysis of the covariates was performed.

**Results:** In total, 40 discs were evaluated. The mean normalised sodium signal intensity was 275.5 (SD 115.4). The T2 mapping showed a mean value of 89.8 ms (SD 19.34 ms). The median modified Pfirrmann score was 2b (with 90% < 3c). The Pearson correlation coefficient showed a near moderate inverse correlation between sodium imaging and the Pfirrmann score (r = -0.49), a moderate inverse correlation between T2 mapping and the Pfirrmann score (r = -0.62), and no correlation between sodium imaging and T2 mapping (r = 0.06).

**Conclusion:** Our results suggest that MRI imaging of the intervertebral disc, using sodium imaging and T2 mapping, characterises different, measurable biochemical component changes, and that both of these methods affect the Pfirrmann score.

**B-0532** 10:48

MR imaging of the lumbar spine: comparison of 3D isotropic turbo spin-echo SPACE sequence versus conventional 2D sequences at 3.0 T

**Purpose:** To compare isotropic three-dimensional (3D)-T2-weighted-turbo-spin-echo sequence (TSE-SPACE) with conventional two-dimensional (2D)-TSE sequences for evaluating the neural foramina and nerves of the lumbar spine at 3.0 T MRI imaging.

**Methods and Materials:** The institutional ethics committee approved this retrospective study and waived the requirement of informed consent. 43 patients who had spine surgery for disc herniation and had 3.0 T-spine-MRI were included. In addition to conventional 2D-TSE sequences, sagittal-3D-T2-weighted-TSE-SPACE was obtained to produce multiplanar intermediate-weighted images with 0.6-mm isotropic resolution along the axial, coronal, and oblique coronal planes. Each 2D and 3D-TSE images were independently scored for the degree of lumbar neural foramina stenosis, nerve compression, and nerve swelling by two reviewers. These scores were compared with operative findings and initial symptoms. Interobserver agreements were compared with kappa statistics and correlation with the surgery was done by McNemar test.

**Results:** 33 neural foraminal stenoses in 30 patients and 60 nerve compromise in 39 patients were found at surgery. The mean diagnostic sensitivity and accuracy of 2D-TSE sequences versus 3D-TSE SPACE were 73% and 82% versus 84% and 92% for neural foraminal stenosis; 66% and 56% versus 79% and 81% for nerve compression. Coronal and oblique coronal reformatted images of 3D-TSE SPACE demonstrated higher correlation with the laterality of the symptoms than 2D-TSE sequences (73% versus 49%). The interobserver agreements were substantial (κ = 0.72) on 3D-TSE-SPACE and moderate (κ = 0.44) on 2D-TSE sequences.

**Conclusion:** Isotropic 3D-T2-weighted-TSE-SPACE sequence was comparable to conventional 2D-TSE sequences for diagnosing foraminal stenosis and nerve compression at 3.0 T-Lumbar spine MRI and showed better symptomatic correlation.

**B-0533** 10:57

Multi-echo MRI for muscle-fat quantification in patients with low back pain: comparison to spectroscopy

**Purpose:** To prospectively compare fat-signal–fractions derived from spoiled-gradient dual-echo (SPGR-DE) and multi-echo (SPGR-ME) MRI with and without correction of T2-“bias” for quantification of muscle-fat content (MFC) in patients with low back pain (LBP) using single-voxel spectroscopy as the standard of reference.
Conclusion: Our results suggest that the percentage of degenerated muscle and diffusion properties can be used as an indirect marker for muscle strength. Muscular function has, in turn, been demonstrated to be associated with the development and persistence of lower back pain. Quantification of muscular degeneration and ADC values may offer important benefits to MR-based morphologic analysis of the lumbar spine.

B-0536  11:24
Diffusion-weighted MR imaging of the spine at 3-T: feasibility, optimization of b-value and utility to differentiate benign from pathologic vertebral compression fractures
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Purpose: To evaluate the feasibility, the optimal b-value, and to assess the utility of 3-T diffusion-weighted MR imaging (DWI) of the spine in differentiating benign from pathologic vertebral compression fractures.

Methods and Materials: Twenty patients with 38 vertebral compression fractures (24 benign, 14 pathologic) and 20 controls (total: 23 men, 17 women, mean age 56.2±years) were included from December 2010 to May 2011 in this IRB-approved prospective study. MR imaging of the spine was performed on a 3-T unit with T1-w, fat-suppressed T2-w and T2*-w, non-fat-suppressed T1-w and T2-w, and two diffusion weighted sequences (2D RF excitation pulse combined with reduced field-of-view single-shot echoplanar readout) diffusion-w (b-values: 0, 300, 500 and 700s/mm²) sequences. Two radiologists independently assessed zoomed-EPI image quality in random order using a 4-point scale: 1=excellent to 4=poor. They subsequently measured apparent diffusion coefficients (ADCs) in normal vertebral bodies and compression fractures, in consensus.

Results: Lower b-values correlated with better image quality scores, with significant differences between b=300 (mean±SD=2.6±0.8), b=500 (3.0±0.7) and b=700 (3.6±0.6) (all p < 0.001). Mean ADCs of normal vertebral bodies (n=162) were 0.23, 0.17 and 0.11×10⁻³ mm²/s with b=300, 500 and 700s/mm², respectively. In contrast, mean ADCs were 0.89, 0.70 and 0.59×10⁻³ mm²/s for benign vertebral compression fractures and 0.79, 0.66 and 0.51×10⁻³ mm²/s for pathologic fractures with b=300, 500 and 700s/mm², respectively. No significant difference was found between ADCs of benign and pathologic fractures.

Conclusion: 3-T DWI of the spine is feasible and lower b-values (300s/mm²) are recommended. However, our preliminary results show no advantage of DWI in differentiating benign from pathologic vertebral compression fractures.

B-0537  11:33
High-resolution magnetic resonance imaging of the brachial plexus using an isotropic-enhanced scan of 3-D STIR sequence
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Purpose: To investigate the feasibility of imaging brachial plexus in enhanced scan of 3-D STIR sequence in MRI and its diagnostic accuracy in the evaluation of brachial plexopathies.

Methods and Materials: The 3-D STIR sequence scanning and 3-D STIR sequence of enhanced scan were used in 88 patients in the diagnosis of brachial plexus pathologies involving primary and secondary brachial plexus lesions, and in 30 volunteers. All patients had clinical, nerve conduction, and electromyographic findings consistent with brachial plexus lesions.

Results: 3-D STIR sequence and enhanced scan can clearly display all the volunteers from the brachial plexus, course, continuity, shape, signal, and the enhanced scan can improve the suppression effects of background. It is the case that trauma and tumour can be clearly seen involving the brachial plexus due to a variety of signs.

Conclusion: We conclude that the enhanced scan of 3-D STIR sequence is a useful technique in evaluating patients with brachial plexus lesions, and receive a better suppression effects of background. Magnetic resonance imaging may have significant potential to provide more information about problems such as brachial plexus injuries and peripheral nerve compression.

B-0538  11:42
Diffusion tensor imaging of the median nerve in patients with recurrent carpal tunnel syndrome after surgical release
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Purpose: Preliminary studies suggest that diffusion tensor imaging (DTI) may be of use for the quantification of structural integrity of the median nerve in patients with carpal tunnel syndrome (CTS). However, how DTI relates to electromyography (EMG) and behavioural measures remains unclear. We hypothesised that DTI measures of the median nerve would correlate with slowed nerve conduction and impaired grip force control in patients with postoperative recurring symptoms.

Methods and Materials: Cohort: 16 patients with EMG evidence of recurrent CTS after surgical release (mean post-op time=4 years). The median nerve DTI sequence consisted of 6 noncollinear diffusion gradients (b=1000s/mm²). Anatomical MR images were also collected. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) values were extracted. Regions of interest were drawn on the median nerve 1.5 cm proximal to and in the carpal tunnel (ratio=distal/proximal).

Results: The median nerve was identified successfully through fibre tracking in all patients. Diffusion parameters for the median nerve were (mean±SD): FA=0.60±0.06 and ADC=1.96±0.11. Mean distal/proximal ratios were: FA=0.87±0.09 and ADC=1.2±0.2. EMG revealed reduced motor conduction (≤ 50 m/s) in 8 and reduced sensory conduction in 15 patients. Grip force tracking error was higher than normative values in all patients. Sensory nerve conduction correlated with FA ratio (R=0.51, P=0.05). Tracking error correlated with mean FA for the median nerve (R=0.60, P=0.02) and with FA ratio (R=0.56, P=0.03).

Conclusion: The results suggest that DTI may be useful for the evaluation of the median nerve in patients with recurrent CTS.

Oncologic Imaging

SS 916
New applications for US and CT in evaluating patients with cancer
Moderators:
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B-0539  10:30
Multicentric prospective study of DCE-US for the evaluation of antiangiogenic treatments: determination of criteria with correlation to overall survival
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Purpose: A prospective study of dynamic contrast-enhanced ultrasound (DCE-US) with quantification for the evaluation of antiangiogenic treatments was launched (19 centres), supported by the French National Cancer Institute. The objectives were the diffusion of the standardised method, a cost evaluation and the identification of perfusion parameters predicting tumour response.

Methods and Materials: All patients had DCE-US at baseline, D7, D14, D30, D60 and every two months. Each examination included a bolus injection of sonovue (Bracco) and 3 minutes of raw linear data with an Apio (Toshiba). Raw data were analysed with a mathematical model (patent PCT/IB2006/003742) to evaluate 7 parameters characterising the tumour perfusion curve. Response to treatment was evaluated every 2 months with RECIST criteria. In order to have sufficient follow-up data, the statistical analysis has to be performed more than 6 months after the inclusion of the last analysed patient. Inclusions were closed in March 2010.

Results: A total of 539 patients have been included (mainly RCC (157) and HCC (107)): more than 2000 DCE-US and 1700 CT-scan were performed. A follow-up more than 12 months showed that 3 parameters have a strong significant difference (P < 0.0005) according to the response at 6 months. The decrease of more than 40% of AUC at one month is correlated to the TTP (P < 0.01) and OS (P < 0.04)

Conclusion: Final results confirm the usefulness of this tool to monitor anti-angiogenic treatments. The criteria : the decrease of more than 40% of AUC at one month is predictive of response.

B-0540  10:39
Parametric maps of tumoral perfusion with dynamic contrast-enhanced ultrasound versus histology: multimodalities melimage project
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Purpose: To identify correlations between dynamic contrast-enhanced ultrasonography (DCE-US) and histology in the assessment of the tumoral perfusion with specific methodological tools we developed.
Methods and Materials: Study was conducted on 26 melanoma-bearing nude mice and on 5 patients with metastatic node of melanoma. For preclinical study, DCE-US was performed after a 0.1 ml bolus injection of SonoVue® (Bracco, Italy). From the linear raw data, we established parametric maps using the mathematical model of the time intensity curve of tumoral perfusion patented by the team. Tox parameters were considered: area under the curve (AUC) and peak intensity (PI). Histological study evaluated microvessel density (MVD) and vessel diameter. These data were obtained within 3 to 6 distinct sections in each tumour and confronted to the parametric maps from DCE-US. For clinical study, DCE-US was performed before surgery with a 4.8 ml bolus injection of SonoVue®.

Results: Among the 26 studied mice, 17 were evaluable with 67 analysed sections. Spatial distribution of AUC and PI was significantly correlated with MVD (respectively, R²=0.54 p < 0.0001 and R²=0.63 p < 0.001). 12 hypervascularised sections from DCE-US corresponded to a weak MVD but with large vessel diameter. Correlation was also significant (AUV: R²=0.69 p < 0.001; PI: R²=0.60 p=0.003). From the 5 patients included, 4 could be studied with a contrast uptake between 30 and 100%. Histological analyses are in progress and results will be presented.

Conclusion: Our study shows a correlation between the spatial distribution of perfusion parameters (AUC and PI) and the MVD associated with the vessel size.

Evaluation of the reliability and repeatability of dynamic contrast-enhanced tumour perfusion imaging parameters with high-frequency ultrasound

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Purpose: To evaluate the reliability and repeatability of dynamic contrast-enhanced tumour-perfusion-imaging with high-resolution-ultrasound in colon-cancer-xenografts in mice.

Methods and Materials: 8 mice with subcutaneous colon-cancer-xenograft tumour models were examined with a Vewo770 ultrasound system (Visualonics Inc., Toronto, CA) using a RMV 706 40-MHz high frequency transducer and three different microbubble concentrations (2x108, 1x109, 1.2x1010 microbubbles/mL). Three separate 150 μL bolus injections of each microbubble concentration were examined in each tumour. The recording of each dynamic study was triggered 3 seconds prior to the contrast agent injection and a total of 750 images were recorded over a 64sec period. The following semi-quantitative perfusion parameters were extracted from the time-intensity curves: peak intensity (in arbitrary units=AU), time to peak intensity (in sec), area under the time-intensity curve (AUC) during wash in (in AU), and slope coefficient of the wash in (in AU/sec). The coefficient of variation was calculated for each dynamic parameter of each set of microbubble-concentrations for each tumour.

Results: Peak intensity, time to peak, as well as AUC values correlated significantly (P < 0.05) with microbubble-concentration while slope coefficient values did not (P>0.22). The semi-quantitative perfusion parameters following 3 injections with the same microbubble-concentration were obtained with varying reliability with a coefficient of variation for peak intensity values of 0.26±0.18, for time to peak values of 0.26±0.25, for AUC values of 0.23±0.13, and for slope coefficient values of 0.32±0.22.

Conclusion: The evaluated semi-quantitative perfusion parameters demonstrate a varying reliability and repeatability during dynamic contrast-enhanced tumour-perfusion-imaging with high-resolution ultrasound.

Dual source dual energy CT scan to evaluate the mediastinal lymph node metastases in non-small cell lung cancer: feasibility study

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Purpose: To evaluate the accuracy of the weighted iodine concentration from second generation dual source dual energy (DSDE) CT scan in diagnosing mediastinal lymph node metastases in patients with non-small cell lung cancer (NSCLC).

Methods and Materials: A contrast-enhanced dual energy CT scan was performed 30 seconds after the contrast injection (60 ml CM at 3 ml/s) on 21 patients with histopathologically proven NSCLC. The size of lymph nodes and the iodine concentrations (mg/ml) of the mediastinal lymph nodes as well as the aorta on the same image plane were measured in a DE post-processing workstation. The iodine concentrations from the lymph nodes were normalised by the iodine concentration of the aorta according to the blood supply of mediastinum to minimise the patient variation. Statistical analysis was performed to investigate the radiologic-pathologic correlation.

Results: 83 mediastinal lymph nodes from the 21 patients were analysed with 25 proved to be malignant at pathology examination and 58 benign. By comparing the size of lymph nodes and the weighted iodine concentrations, statistically significant differences was found (both with p < 0.01). The weighted iodine concentration was 0.10±0.09 mg/ml for malignant lymph nodes group and those for benign group was 0.21±0.13 mg/ml.

Conclusion: The weighted iodine concentrations from DE scan correlated with pathological results of lymph nodes in patients with NSCLC. The weighted iodine concentrations could be a new method to evaluate the mediastinal lymph node metastases in NSCLC.

Is blood flow-blood volume mismatch in colorectal cancer associated with advanced disease?

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Purpose: Vasodilatation in the presence of low blood flow represents an adaptation to hypoxia which, in tumour, may reflect an aggressive phenotype. This study uses perfusion CT to undertake a preliminary assessment of whether such blood flow-blood volume (BF-BV) mismatch in primary colorectal cancer is associated with the presence of advanced disease.

Methods and Materials: IRB approval and informed consent were obtained. Perfusion CT blood flow and blood volume measurements were acquired prospectively in primary colorectal cancers from 35 patients. Nodal and metastatic disease status were determined from pathological examination of the resection specimen and 18F-fluorodeoxyglucose PET. Tumours with blood flow values below the median and blood volume measurements above the median were considered to exhibit BF-BV mismatch. The frequency of mismatch amongst node-negative and M1 tumours was compared to N0 and M0 tumours using Fisher’s exact test.

Results: Median BF and BV were 81.0 ml/min/100 g and 5.1 ml/100 g, respectively. 5 of 35 tumours demonstrated BF-BV mismatch. Mismatch was significantly more common amongst M1 tumours (3/7 versus 2/20; p=0.044) but not amongst node-negative positives (3/15 versus 2/22; p=0.044).

Conclusion: This study provides preliminary evidence of an association between BF-BV mismatch and the presence of distant metastases in colorectal cancer. BF- BV mismatch may potentially provide a marker of tumour adaptation to hypoxia.

Dual source dual energy CT for lung cancer evaluation: correlation study between weighted iodine concentrations and pathological results of tumour lesion

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Purpose: To evaluate the correlation between pathological subtypes of lung cancer and the weighted iodine concentration in the tumour lesion from second generation dual source dual energy (DSDE) CT scan.

Methods and Materials: 51 patients with lung cancer underwent contrast-enhanced dual energy CT scan which was performed 30 seconds after the contrast injection (60 ml CM at 3 ml/s). The CT values (blended value from high and low kV images) and iodine concentrations (mg/ml) from the tumour as well as those from pulmonary artery and aorta on the same image plane were measured in a DE post-processing workstation. The iodine concentrations from the lesion were normalised by the iodine concentrations of pulmonary artery and aorta due to the dual blood supply of lung tumour to minimise the patient variation. Statistical analysis was performed to investigate the correlation between the weighted iodine value of tumour and corresponding pathological results.

Results: 28 patients were pathologically proved with adenocarcinomas and 23 patients with squamous cell carcinoma. The mean CT values provided no difference between the two groups (p=0.708). However, by comparing the weighted iodine concentrations, statistically significant differences was found (p < 0.01). The mean value of weighted iodine concentration was 0.30±0.30 mg/ml for adenocarcinomas group and that for squamous cell carcinoma was 0.12±0.11 mg/ml.

Conclusion: Dual energy CT scan could be a useful tool in differentiation of pathological lung cancer subtypes as the weighted iodine concentration for lung tumour lesion correlates with the tumour pathological subtypes.
Comparing T0 and T1: (a) the median values of BV and CP were significantly reduced in group 2 (BV at T1: 1.392 vs BV at T0: 4.368 mL; p=0.0395; CP at T1: 0.1459 vs CP at T0: 4.435 mL/min; p=0.0150) without any change in tumour size, (b) functional parameters did not change in group 1. Comparing T0 and T2, a significant decrease in CP at T1 was found to be strongly related to the reduction in tumour size (p=0.0192) at T2.

Conclusion: MDCT is able to early detect peritoneal recurrence in patients treated by means of cyto-reductive surgery and HIPEC and can predict rising tumour markers levels.

B-0548 11:51
Multimodal imaging for therapy monitoring of loco-regional alpha therapy (213Bi-DOTATOC) in patients with hepatic metastases of neuroendocrine tumours

Purpose: Radiolabeled somatostatin analogs play an emerging role in the therapy of patients with neuroendocrine cancers. The first-in-human peptide receptor alpha-therapy with 213Bi-DOTATOC was assessed with multimodal imaging (MRI, PET, CT and US) for initial therapy monitoring and surveillance of possible local side effects of this new approach.

Methods and Materials: In 12 patients the recently introduced alpha-particle-emitting 213Bi-DOTATOC was administered loco-regional in the liver. Multi-modal imaging of liver metastases was assessed using MRI with standard sequences and diffusion-weighted imaging (DW-MRI) before and after therapy. This modality delivers the lesion diameter (LD), apparent diffusion coefficient (ADC) as a surrogate of tumour integrity as a surrogate of tumour perfusion. In addition, contrast-enhanced ultrasound (CEUS) was accomplished as an onsite imaging modality to assess tumour microvasculatisation (time-to-peak (TTF)).

Results: In the early MR analysis, most metastases demonstrated only a moderate decrease in LD, whereas median tumour ADC as a representative of tumour integrity increased from 1.21x10-3 mm2/sec to 1.47x10-3 mm2/sec 4-6 weeks after last loco-regional therapy. Prior to therapeutic intervention CEUS presented a pronounced enhancement in the liver metastases compared to the adjacent liver parenchyma (median TTP metastasis = 26.6 sec; median TTP liver parenchyma = 53.6 sec). 2 months after intervention the i.a. 213Bi-treated patients showed a decline in contrast enhancement in 56%.

Conclusion: In this ongoing study, CEUS, diffusion-weighted and perfusion MRI were able to demonstrate such tumour changes also early after treatment with alpha-therapy. Therefore, this functional tumour imaging assessment seems to be a reliable bio-surrogate of treatment response and might predict in an early stage lesion responses.
mammography region between January 1997 and August 2009. During 2-year follow-up, breast imaging reports, surgical pathology and pathology results were collected of all screen detected cancers and interval cancers. Screening outcome parameters were calculated for each screening couple. Results: A minimum of 7500 screens for each pair of radiologists had been read by 26 unique combinations of two screening radiologists, totalling 300154 screens. The number of screens per pair of radiologists varied from 7500 screens to 20633 screens. Breast cancer incidence did not differ significantly among these 26 couples and ranged from 6.0 (95%CI 4.7-7.7) to 8.8 (95%CI 6.7-10.9) per 1000 screens. The referral rate among couples ranged from 0.9% (95%CI 0.7-1.1%) to 1.5% (95%CI 1.3-1.8%), whereas the sensitivity for breast cancer detection and the decision positive predictive value of referral ranged from 55.1% (95%CI 44.5-65.6%) to 84.1% (95%CI 74.9-93.4%) and from 28.9% (95%CI 21.1%-36.9%) to 50.6% (95%CI 40.0%-61.2%), respectively. Conclusion: Screening outcome varied significantly among pairs of screening radiologists. We advise a continuous monitoring of screening outcome parameters for each screening couple that participates at screening mammography. Regular feedback of this outcome to each couple may avoid screening of women by pairs of radiologists with suboptimal screening performance.

**B-0550** 10:39
Tailored breast cancer screening program in 40-49ers: results from an Italian single centre pilot study

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Purpose: The aim of our study was to assess the feasibility of a screening program on 40-49ers; usually, 40-49ers are not included in screening program due to the low sensitivity and negative predictive value of mammography in this population. Our innovative screening program is tailored on individual risk profile and breast tissue density and implements mammography with further assessment (US/MRI), usually not included in evaluation of first level.

Methods and Materials: From September 2010 to May 2011 we invited 2,709 women from the town of Segrate (Milan, Italy). Los-dose photon-counting digital mammography (Sectra) was performed in 2 views (CC/MLO). The US and MRI were performed when needed.

Results: 1,345 women were enrolled (participation rate: 49.6%). The average glandular dose was 0.745 with an average breast thickness of 50 mm. The recall rate for US was 57.8%. The recall rate for MRI was <0.008% (7792). The US early recall rate was 6.56%. The cancer detection rate was 7.4%. (10 cases). Eight cancers were diagnosed with mammography and two were detectable only at US (US-ICDR 0.31%, US-false positives 0.90%).

Conclusion: Preliminary results demonstrated an elevated breast cancer detection rate (7.43%) in women 40-49ers, higher than the incidence reported by the Italian Cancer Registry (0.15-0.2%). The US examination performed for high breast tissue density allows to detect other two cases of cancer.

**B-0551** 10:48
Phenotypic characteristics of interval breast cancers diagnosed in a population-based screening program in Catalonia, Spain. Correlation with radiological findings

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Purpose: To analyze if there are phenotypic differences between prevalent, incident and interval cases of breast cancers, diagnosed in a breast cancer screening program in Catalonia, Spain. To Correlate the data with the radiographic presentation of these tumors.

Methods and Materials: We performed a retrospective study of all breast cancers diagnosed in the screening program between 2006-2010: analyzing histological type, prognostic factors and radiological findings. Subgroups were made of prevalent, incident or early interval cases.

Results: We have studied 424 cases, 372 invasive carcinomas and 52 intraductal carcinomas. Interval breast cancer cases were invasive carcinomas in 89% and 11% in situ. Analysis of radiological findings and prognostic factors was achieved in 364 cancer cases. The triple-negative phenotype was more frequent in interval invasive carcinomas cases (17.4%) than in cancers detected at screening (7.8%). This difference was statistically significant (p=0.006). Phenotypic type Her2 (5.7%) and luminal A (69.4%) tumors were more frequent in breast cancer cases detected in screening compared to interval cases (0% and 60.5% respectively), although not statistically significant. Radiologically, triple negative tumors were more often circumscribed and had ill-defined margins without microcalcifications, with areas of necrosis and posterior acoustic enhancement.

Conclusion: Analysis of prognostic factors in breast carcinomas confirms that interval cases are more aggressive than those diagnosed in screening. The radiological presentation may predict clinical characteristics and histological type.

**B-0552** 10:57
Stage-specific incidence rates of breast cancer in participants and non-participants of a population-based mammographic screening programme

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Purpose: To compare stage-specific incidence of breast cancer in the target population of the Norwegian Breast Cancer Screening Programme.

Methods and Materials: We compared the incidence among 640,347 invited women aged 50-69 years who received 1,925,727 invitations and stratified the analyses by invited participants and invited non-participants. Two-sided chi-square tests were used to determine statistical significance between groups.

Results: The incidence of breast malignancy (DCIS or invasive breast cancer) was 1.6 times higher in invited participants compared with invited non-participant; 659.0/100,000 versus 409.3/100,000 (p < 0.001). For invasive breast cancers only, the rate ratio was 1.5. The incidence of stage I cancer was two times higher for participants (345.9/100,000 invitations) compared with non-participants (173.2/100,000 invitations, p < 0.001), while the incidence of stage III cancer was 50% lower and stage IV cancer 70% lower (p < 0.001 for both). The rate of mastectomy was higher for participants in comparison to non-participants.

Conclusion: Participants in an organised breast cancer screening programme run a higher risk of stage 0 and I breast cancer and lower risk of advanced breast cancer compared with invited non-participants. Efforts to support early detection of breast cancer in non-participants in organised screening are needed.

**B-0553** 11:06
Proportional incidence and review of T2+ screen detected carcinomas: a new measure of diagnostic accuracy?

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Purpose: Large size (T2+) screen detected that carcinomas might be assumed as screening failures and monitored for quality control as interval cancers (IC).

Methods and Materials: Based on T2+ cancers screen detected during 2001-2009 at Trento screening programme, we a) assessed the proportional incidence as compared to pre-screening (1999-2000) incidence, and b) reviewed previous screening tests preceding diagnosis. Blind review of films mixed (3:1) to negative controls was performed by a panel of three external reviewers, screening errors being defined according to majority (cancers seen by at least two reviewers). A subset of IC diagnosed during 2008-2010 was included in the review set.

Results: Proportional incidence (271,385 women year) was 68% (168/247 observed/expcted, 95% confidence interval 61-73.5, higher as compared to 20.3% (101/495, 17-24.1) recently determined for IC in the same centre. Review of 54 T2+, 50 IC and 170 controls classified 14/50 screening errors among IC (28%, 17.4-41.7) and 15/54 among T2+ (28%, 17.6-40.9; p=0.84). Differences in detection and recall rate observed among reviewers were not statistically significant.

Conclusion: Assessing T2+ proportional incidence and review is feasible as a modality for screening surveillance. T2+ assessment is easier as compared to IC, but no reference standards are available yet, particularly for proportional incidence which was higher as compared to IC. Comparable review findings between T2+ and IC cases might suggest to adopt the EC standard (<20%) also for T2+. Further studies are needed to confirm the present results.

**B-0554** 11:15
Incidence and review of interval cancers in a community biannual mammographic screening programme

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Purpose: To assess the performance of an Italian mammographic screening programme in terms of interval cancers (ICs) observed from 2001 to 2006.

Methods and Materials: ICs were identified by matching the screening archives with local cancer registry, pathology archives, and hospital discharge records.
Proportional incidence was determined according to breast cancers expected in the absence of screening, estimated on the basis of patients/year at risk and age-specific incidence. Three offsite high-experienced reviewers blindly evaluated the screening mammograms prior to the diagnostic ones, randomly mixed with age and breast-density-matched negative controls with a 1:2 ratio.

Results: 86,276 first-level mammograms in 6 centers were acquired; the mean recall rate was 6.8% at first screening and 4.6% at repeat screening. A total of 476 screen-detected cancers and 145 ICs were diagnosed. The IC proportional incidence was 46/234 (19.6%) for the first year, 99/234 (42.3%) for the second year, and 145/468 (31%) for the two-year interval. Of 145 CI mammograms, a total of 130 of them (89.7%), randomly mixed with 287 negative controls, were reviewed; 28/130 (21.6%) were recalled by 2 or 3 reviewers (errors), 31/130 (23.8%) were recalled by only 1 reviewer (minimal signs), and 71/130 (54.6%) were not recalled (occult).

Conclusion: Our screening programme can be considered within EC standards for what concerns IC analysis.

B-0555 11:24
Presorting by CAD according to lesion type: increasing the reader’s awareness of mammographic lesions in a screening environment
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Purpose: To explore the capability of CAD run in the background to automatically presort prioritised subgroups with higher prevalence of either malignant masses or clusters. Knowing that prevalence is increased for either lesion type, readers should review the tagged cases with higher suspicion.

Methods and Materials: Since breast cancers are usually visible in both views, CAD can presort cases with matching CAD marks of the same type in both views, creating prioritised subgroups with increased prevalence of malignant clusters or masses. Although false marks tend to occur randomly, these subgroups will also include normal cases, since matching false marks may also be generated in both views coincidentally. 15892 FFDM cases (280 cancers-182 masses) culled retrospectively from 6 facilities were run with a prototype CAD algorithm (Siemens) and presorted by matching marks according to lesion type, to explore the cancer prevalence in the prioritised subgroups.

Results: Of normal cases, 16.2% (2527 cases) had coincidentally matching mass marks and 5.1% (786) matching cluster marks. Conversely, of the malignant cases, 70.3% (128) had matching mass marks, and 80.9% (79) had matching cluster marks. In the subgroup with matching mass marks, cancer prevalence, thus, increased 4.2 times, from 1.15% to 4.82% (128 of 2655), while for clusters, cancer prevalence increased 14.6 times, from 0.62% to 9.0% (79 of 877).

Conclusion: Presorting by matching CAD marks substantially increases the breast cancer prevalence in the prioritised subgroups of cases, especially in the cluster subgroup, thereby focusing the readers’ attention on cases which are more suspicious.

B-0556 11:33
Can CAD be used as a preliminary reader in screening mammography?
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Purpose: To explore the potential of CAD as a preliminary reader run in the background in screening mammography, to reduce reading time by creating for the radiologist subsets of normal cases and of cases considered suspicious for a specific lesion type.

Methods and Materials: 12675 FFDM cases were run with a prototype CAD device (Siemens), with separate algorithms for detecting masses and clusters. The malignant cases included 319 masses, 79 clusters and 75 masses with micro-calculifications. When using CAD as a preliminary reader, the algorithm is designed to create subsets of cases suspicious for either masses or clusters, directing radiologists to select the appropriate visual process for finding the specific lesion type. The remaining cases with no marks for that lesion type bypass review.

Results: CAD found only 43.7% of the normal cases, to be suspicious for clusters, and 48.6% to be suspicious for masses. For malignant cases with clusters, the algorithm suspected clusters in 94.9%, for malignant cases with masses, 90.3% were suspicious for masses, and for cases of masses with calcifications, 98.7% were suspicious for either lesion type or both.

Conclusion: CAD as a preliminary reader in screening mammography could substantially reduce the workload by nearly half for either lesion type. Using CAD as a preliminary reader for clusters might warrant consideration, since only about 1% of masses with calcifications and 5% of clusters would be missed. Recent algorithm modifications to improve detection of masses and clusters should make this approach practical for masses as well.

B-0557 11:42
Standalone computer-aided detection compared to human readers for the detection of breast cancer in screening mammograms
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Purpose: We developed a computer-aided detection (CAD) system aimed at decision support for detection of malignant masses in screening mammograms. In contrast to current CAD systems, which have many false positives due to their focus on high sensitivity, this system is aimed to operate at high specificity comparable to that of radiologist. The purpose of this study was to compare the performance of this CAD system to that of radiologists and residents.

Methods and Materials: In a retrospective study eight certified screening radiologists and three residents with mammography experience read 200 screening mammograms without the use of CAD. Cases included 63 screen-detected cancers, 17 missed cancers, 20 false positives from screening, and 100 normals. Microcalcification cases were excluded. Readers and CAD were compared using localisation ROC (LRROC) analysis, by computing the mean true positive fraction (MTPF) at a false-positive fraction (FPF) less than 0.2.

Results: CAD performance (MTPF=0.518) was similar to that of the residents (MTPF=0.484) but still significantly below the performance of the radiologists (MTPF=0.598). However, at very high specificity (FPF<0.1) and for the subset of cases missed in screening CAD standalone performance was similar to that of the radiologists.

Conclusion: The performance of a novel CAD system aimed at decision support is approaching the level of performance of experienced human readers. These results show the potential of CAD to be used as second or third reader in breast cancer screening.

B-0558 11:51
Retrospective comparison of the accuracy of two different computer-aided detection systems for detecting malignant lesions on mammography
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Purpose: To retrospectively compare the accuracy of two computer-aided detection (CAD) systems (SecondLook versus AccuDetect Galileo) for the detection of malignant breast lesions on full-field digital mammograms.

Methods and Materials: Digital mammograms of 326 patients were analysed (117 patients with breast cancer, 209 negative cases). Positive cases consisted of 85 masses, 6 calcifications, and 26 masses plus calcifications. Each set of cases was read by both CAD systems and true positive fraction (TPF) for both systems and per image, case, and total cancers was assessed. Operating points for both systems was set at comparable false positive rates per image and case. One-sided, exact McNemar’s tests were used to assess statistical significance of the results.

Results: When compared to SecondLook, AccuDetect Galileo significantly increased TPF per image for masses (increase of 10.6% to 72.2%, p<0.0001) and calcifications (increase of 12.8% to 61.5%, p<0.03). Per case, AccuDetect Galileo did not significantly increase TPF for masses and calcifications. AccuDetect Galileo achieved higher TPF for all cancers (per image increase to 6.9% to 72.2%; per case increase to 4.3% to 84.6%). Most interestingly, AccuDetect Galileo, using a new voting methodology algorithm, had a significant performance improvement in detecting masses on extremely dense breasts over SecondLook, increasing TPF with 15.4% to 69.2% (p=0.0156).

Conclusion: AccuDetect Galileo showed significantly better overall performance than SecondLook in detecting masses, microcalcifications and all cancer types, even in extremely dense breasts.
SS 901
Abdominal Viscera

Pancreas

Moderators:
K. Coenegrachts; Bruges/BE
R. Pozzi-Mucelli; Verona/IT

B-0559 10:30
Diffusion-weighted MRI of pancreas cancer: comparison of free-breathing, respiratory-triggered and breath-hold sequences

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Purpose: To compare respiratory-triggering (RT), free-breathing (FB), and breath-hold (BH) diffusion-weighted imaging (DWI) techniques regarding a) subjective image quality, and b) signal intensity (SI) characteristics and ADC measurements in patients with pancreatic adenocarcinoma.

Methods and Materials: Prospectively, 15 consecutive patients with histopathologically proven disease (mean size 3.2 cm), underwent DWI at 1.5 Tesla with 5 b-values (0, 50, 300, 600, and 1000 s/mm²) with the 3 different techniques. Two radiologists, independently and blindly, assessed image quality, by assigning a total quality score [score sum of rating diffusion images (lesion detection, anatomy, presence of artefacts) and ADC maps (lesion characterisation, overall image quality)] per sequence and by ranking them (sequences viewed simultaneously). Lesion signal intensity (SI), signal-to-noise ratio (SNR), mean ADC and coefficient of variation (CV) were compared. A p-value < 0.05 was considered significant.

Results: Total quality score for RT, FB, and BH was 17.9, 16.5, and 17.1, respectively (RT significantly higher than FB but not than BH). RT had a significantly higher ranking compared to both FB and BH. SI on all b-values and SNR on b300 and b600 were significantly higher for RT compared to FB and BH. Mean ADCs for RT, FB, and BH were 1.201, 1.132, and 1.253, respectively (BH significantly higher ranking compared to both FB and BH). Mean CV for RT, FB, and BH were 8.9, 10.8, and 14.1 respectively (RT significantly lower than BH but not than FB).

Conclusion: In both analyses, RT-DWI showed superiorly and seems the optimal technique for DWI of pancreas adenocarcinoma.

B-0560 10:39
Comparison of abdominal MRI including diffusion-weighted sequences with 68Ga-DOTATATE PET/CT in detecting neuroendocrine tumours of the pancreas

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Purpose: To compare abdominal MRI including diffusion-weighted MRI (DW-MRI) with 68Ga-DOTATATE-PET/CT (PET/CT) in detecting neuroendocrine tumours (NET) of the pancreas.

Methods and Materials: 19 patients were retrospectively included with pancreatic NET who underwent MRI including DW-MRI and PET/CT within 6 weeks. Two blinded reader compared T2-weighted (T2w), T2w+DW-MRI, T2w+contrast-enhanced T1-weighted (CE T1w) sequences and PET/CT images for NET detection and confidence level using a 5-point-scale. Sensitivity, confidence level and ADC of NET 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. Observers 1 and 2 detected 15/25 (60%) and 16/25 (64%) NET on their review of T2w+CE T1w image combination, 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 images and DW-MRI or CE T1w images (p < 0.04). There was no significant difference between the NET detection rate of T2w+DW-MRI and T2w+CE T1 image combinations (p > 0.05). Detection rate and confidence level of PET/CT were significantly higher than MRI (p < 0.02). 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).

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

B-0561 10:48
Are pancreatic calcifications predictive of impairment of pancreatic exocrine function? A retrospective study with S-MRCP and abdominal CT in patients with known or suspected pancreatic disease

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Purpose: To establish correlation between pancreatic calcifications detected by CT and pancreatic exocrine function evaluated with S-MRCP in subjects with known or suspected pancreatic disease.

Methods and Materials: 197 consecutive patients (MF=88:99; mean age: 49±16 y/o) underwent S-MRCP and upper abdominal helical CT for suspected or known pancreatic disease. S-MRCP were evaluated for the presence and grade of chronic pancreatitis according to Cambridge classification and for assessment of pancreatic exocrine reserve according to Matos classification. CT examinations were evaluated for the presence or absence of pancreatic calcifications. The findings were compared with Fisher’s exact test.

Results: Cambridge score was 1 in 73 patients, 2 in 13 patients, 3 in 20, 4 in 66, and 5 in 25 patients. Matos score was 3 in 159 cases, 2 in 32 cases, 1 in 4 subjects and 0 in 1 patient. Pancreatic calcifications were detected by CT in 23/197 patients (11.6%). There was a significant correlation between prevalence of calcifications and grade of chronic pancreatitis (p < 0.0001) and pancreatic exocrine reserve (p < 0.0001). Calcifications were observed in 10/159 (6.3%) patients with normal pancreatic exocrine reserve (Matos:3) versus 13/37 (35.5%) patients with impaired reserve (Matos: 2, 1.0), with significant difference (p < 0.0001), even after adjusting for sex and age. Among patients with mild and severe chronic pancreatitis (Cambridge score 3 and 5), the presence of pancreatic calcifications was statistically significant compared to those with impaired exocrine function (p=0.005 and, respectively, p < 0.001).

Conclusion: Unlike previously published papers, our study shows that pancreatic calcifications are independent predictors of impairment of pancreatic exocrine function.

B-0562 10:57
Comparative performance of CT and MRI in prognostication of acute pancreatitis: correlation with clinical outcome

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Purpose: To compare the diagnostic and prognostic performance of computed tomography (CT) and magnetic resonance imaging (MRI) in acute pancreatitis.

Methods and Materials: In this institution review board approved prospective study, patients with clinical suspicion of acute pancreatitis were enrolled after taking informed consent. All patients underwent a contrast-enhanced CT (CECT) and contrast-enhanced MRI (CEMRI). A CT severity index (CTSI) and MR severity index (MRSSI) was assigned in all cases by two different radiologists based on Balthazar scoring system. The CTSI and MRSSI were compared with each other and with various clinical outcome parameters.

Results: 40 patients (male/female 30:10; mean age: 40.93 years; age range: 12 - 80 years) were enrolled from January 2010 to April 2011. There was excellent inter-observer agreement for assessing CTSI (kappa value: 0.754) and good interobserver agreement for MRSSI (kappa: 0.745). Both CTSI and MRSSI showed statistically significant correlation with the need for percutaneous intervention, development of infection or organ failure and duration of hospital stay. MRSI also showed a statistically significant correlation with mortality. Patients with signs of pancreatic/pseudocyst haemorrhage on MRI showed a statistically significant correlation with all parameters of clinical outcome. Pancreatic duct disruption could only be diagnosed on MRI; however, poor image quality (motion artefacts) was seen more often on MRI.

Conclusion: MRI and CT are equally efficient modalities for assessing severity and predicting complications of acute pancreatitis. MRI is superior in demonstrating ductal pathology and haemorrhage.

B-0563 11:06
CT assessment of sarcopenia in patients with pancreatic cancer and chronic pancreatitis

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Purpose: As metabolic disorders, such as cachexia and sarcopenia (muscle wasting), are common conditions in patients with pancreatic cancer and chronic pancreatitis, we studied the role of CT in assessing sarcopenia in these two groups of patients.

Methods and Materials: We evaluated 42 CT-images of patients with pancreatic cancer (20) and chronic pancreatitis (22), which underwent operative treatment in...
Results: 14/20 patients with pancreatic cancer were found sarcomenic (70%). Mean value of L3-index was 44.7±5.6 cm²/m² for men and 35.7±3.8 cm²/m² for women. There were 15/22 sarcomenic patients with chronic pancreatitis (86%), mean value of L3-index for men and for women were 47.6±7.5 cm²/m² and 39.0±10.8 cm²/m², respectively. Sarcopenia was diagnosed not only in patients with decreased BMI but also with normal and increased BMI.

Conclusion: CT is a useful tool to evaluate sarcopenia in patients with pancreatic cancer and chronic pancreatitis using L3-index. The use of CT for body composition analysis opens up new possibilities in metabolic disorders research in these groups of patients.

B-0564  11:15
Relationship between clinicopathological factors and total lesion glycolysis in pancreatic cancer
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Purpose: The purpose of this study was to investigate the relationship between fluorine-18-fluorodeoxyglucose (FDG) uptake (maximum standardised uptake value [SUVMax], total lesion glycolysis [TLG]), and clinicopathological factors associated with pancreatic cancer.

Methods and Materials: FDG-positron emission tomography/computed tomography was performed on 33 patients with pancreatic cancer for initial staging prior to surgery. Diagnosis was histopathologically confirmed for all cases. The relationship between clinicopathological factors (i.e., tumour size, pathological T-stage, lymph node metastasis, pathological stage, tumour differentiation, lymphatic invasion, venous invasion, intrapancreatic neural invasion, and tumour growth pattern [INP]), TLG, and SUVmax was investigated. TLG was calculated by multiplying mean SUV and metabolic tumour volume.

Results: TLG significantly correlated with tumour size (TLG, r = 0.573, p < 0.001; SUVMax, r = 0.533, p = 0.006) and associated with tumour differentiation (TLG, p = 0.042; SUVMax, p = 0.078), whereas SUVmax did not. In contrast, SUVmax associated with INP, whereas TLG did not (SUVMax, p = 0.034; TLG, p = 0.163). No significant difference was observed between clinicopathological features and SUVMax or TLG.

Conclusion: Tumour size and differentiation were more highly correlated with TLG than SUVMax, suggesting that TLG is more reflective of clinicopathological factors and likely to be useful in the clinical management of pancreatic cancer.

B-0565  11:24
Timing bolus dynamic contrast-enhanced magnetic resonance imaging for characterization of solid focal pancreatic lesions
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Purpose: To assess the feasibility of dynamic contrast-enhanced (DCE) MRI timing bolus data using a three-dimensional radial gradient-echo technique with K-space-weighted image contrast (Radial-KWIC) can be postprocessed for characterisation of solid pancreatic diseases.

Methods and Materials: A total of 45 patients with suspected pancreatic diseases who underwent pancreatic MRI at 3 T scanner, which included a low-dose (2 mL gadopentetate) timing bolus using a radial-KWIC technique. There were 24 patients with pancreatic cancers, 8 with PNETs, 3 with chronic pancreatitis, and 10 with normal pancreas. Using the dedicated, post-processing software program for DCE-MRI, the several perfusion parameters were measured for tumour and non-tumorous parenchyma.

Results: The K-trans, Kep and IAUC values in patients with pancreatic cancer (0.042 min⁻¹, 0.76 min⁻¹, 2.841 mmol/L/min, respectively; P < 0.05) were significantly lower than those with normal parenchyma (0.387 min⁻¹, 8.376 min⁻¹, 7.156 mmol/L/min, respectively; P < 0.05). In addition, the kep values of PNETs and normal pancreas were also different (P < 0.0001). Furthermore, the Ktrans, kep, IAUC values of pancreatic cancers and PNETs were significantly different (P < 0.05). The prevalent TIC patterns of the pancreatic cancer, PNETs, chronic pancreatitis and normal pancreatic parenchyma were different: pancreatic cancers showed a slow gradual enhancement pattern (1/8, 75%) while PNETs showed a rapidly increasing and gradually decreasing enhancement pattern (4/8, 50%).

Conclusion: Timing bolus DCE MRI using the radial-KWIC sequence from routine examinations can be postprocessed to yield potentially useful perfusion parameters for characterisation of pancreatic diseases.

B-0566  11:33
Single energy low-voltage arterial phase scans for the detection of adenocarcinoma of the pancreas
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Purpose: To test a single energy low-voltage protocol for detecting adenocarcinoma of the pancreas.

Methods and Materials: 22 patients with pathology-proven pancreatic adenocarcinoma underwent MDCT with arterial phase at 80 kVp (group A) on a 64-row scanner and were compared to a similar group of 22 patients scanned with a 120 kVp arterial phase protocol (group B). Except for tube voltage, all other scan parameters were kept constant. Scans were compared for quantitative image parameters (attenuation and standard deviation in the 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 the two protocols was calculated with TLD measurements.

Results: Mean attenuation was significantly higher in group A in the aorta (255.6±126.6 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=ns). CTDI and DLP were significantly lower in group A (6.0±1 vs 7.9±2.6 mgy, and 184.6±40.3 vs 369.6±133.4 mgYmx, respectively; all p < 0.0001). Tumour conspicuity (HUPancreas-HUtumour) was significantly higher in group A (94.2±39.3 vs 39.5±22 HU; p < 0.0001). Mean image noise was significantly higher in group A (12.3±3.5 vs 9.5±2.9 HU; p < 0.0001). TLD effective dose was significantly lower for the test protocol (0.157 vs 0.201 mSv; p=0.008).

Conclusion: The use of 80 kVp arterial phase for nodenome CT increases the conspicuity of adenocarcinoma thus potentially improving its identification.

B-0567  11:42
Quantification of pancreatic fat fraction and confounding factors in an adult population-based cohort study using magnetic resonance imaging
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Purpose: To establish the proportion of pancreatic fat fraction and their correlates in an ongoing population-based cohort-study using T2* corrected Dixon magnetic resonance imaging (MRI).

Methods and Materials: MRI was performed in a 1.5 T system (Avanto, Siemens) using a work in progress T2* corrected three-echo Dixon technique. Fat phantom was constructed using fat solutions of 0, 25, 50, 75, and 100% to test the accuracy of fat quantification. In addition, a total of 2,136 healthy volunteers (1,008 men, 1,128 women, mean age: 52.7±14.25 years, mean BMI: 27.8±15.1 kg/m²) underwent an abdominal MRI, including the study sequence. Fat fractions of the pancreas (head, body, and tail) were calculated using a region-of-interest-based image evaluation. Pancreatic fat (log-transformed) was regressed on demographic, behavioural, and cardiometabolic factors.

Results: The correlation between predicted fat content by MRI and true fat content in phantom was very high (rPearson=0.989). The median pancreatic fat fraction among volunteers was 6.7% (25th percentile (Q1): 5.1%; 75th percentile (Q4): 9.1%). There are no significant changes in fat distribution between head: 6.2%, body: 7.2%, and tail: 6.7% (p=0.53). In multivariable linear regression models, male gender, age, obesity, dyslipidemia, and triglycerides were associated with pancreatic fat. For example, men had 14% higher values than women; those with BMI larger than 25 32%; and subjects with dyslipidemia 8.5% higher pancreatic fat. Conclusion: MRI is a useful tool to quantify the pancreatic fat fraction. Sex, age, BMI, dyslipidemia, and triglycerides are associated with pancreatic fat, whereas smoking status, alcohol consumption, hypertension, diabetes, and fasting glucose are not.

B-0568  11:51
Preoperative CT findings predicting the recurrence of pancreatic cancer after surgical resection
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Purpose: To determine useful preoperative CT findings for predicting the recurrence of pancreatic cancer after surgical resection.

Methods and Materials: From October 2005 to March 2009, multiphasic multidetector CT data were acquired in patients undergoing curative resection for ductal pancreatic cancer.
adenocarcinoma of the pancreas. Forty consecutive patients were divided into recurrence or recurrence-free groups. Two radiologists retrospectively reviewed the CT findings in consensus with regard to the size of the tumour, local invasion, vascular invasion, regional lymph node enlargement and the presence of associ- ated pancreaticitis. The results from CT were analysed to identify the risk factors associated with tumour recurrence after surgery. Kaplan-Meier method and Cox proportional hazards regression model were used for evaluation.

Results: Presence and number of regional lymph node enlargement on CT were important predictors of tumour recurrence (p=0.019 and 0.002, relative risk estimate 3.75 and 1.47, respectively). The presence of retroperitoneal lymph node enlarge- ment was a significant predictor (p=0.0006, relative risk estimate 5.95) in multivari- ate analysis. The median tumour recurrence times were 7 months and 21 months in patients with and without lymphadenopathy, respectively (p=0.001). However, other CT findings were not statistically significant predictors of tumour recurrence.

Conclusion: The presence of regional, especially retroperitoneal lymph node enlargement on CT may improve predicting patients at high risk of tumour recur- rence after surgical resection of pancreatic cancer.

SS 903
Cardiomyopathies: CT, MRI and PET

B-0569 10:30
Myocardial late enhancement in hypertrophic cardiomyopathy: spread more than amount predicts evolution towards heart failure
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Purpose: This study aimed to explore by cardiac magnetic resonance (CMR) rela- tive relevance of morpho-functional and structural informations related to potentially life-threatening clinical events in hypertrophic cardiomyopathy (HCM) patients.

Methods and Materials: 50 HCM patients (pts) (mean age 52±16) underwent CMR between 2004 and 2011, performed on a 1.5 T magnet (Achieva Philips) with assessment of left ventricular end-systolic/enddiastolic volumes, ejection fraction, end-diastolic wall-mass, maximum-wall-thickness (MWT), outflow-tract-obstruction, mitral regurgitation, diastolic function (DF) and late-enhancement (LE) after i.v. injection of gadolinium-based contrast-medium. During 39±24 months follow-up, cardiac events (CE) were recorded and divided into two groups: arrhythmic CE [sustained ventricular tachycardia, ventricular fibrillation, sudden cardiac death, ICD discharge] and heart failure (HF)-related CE [atrial fibrillation (AF), unplanned hospitalisation, progression to NYHA class III/IV, HF-related death].

Results: 43 pts showed LE (10±8% mean) with mean number of involved seg- ments (LENS) 4±3. We recorded HF-related events in 10 pts; no arrhythmic CE occurred. According to events (E), we divided pts into two groups (E=10, noE=40): data assessed by CMR showed significant differences about MWT (E=22±4 vs noE=19±5, p=0.045), LVEF (E=14±7 vs noE=9±3, p=0.038) and LENS (E=6±3 vs noE=3±3, p=0.002), number of patients with DF impairment (E=8/10 vs noE=14/40, p=0.002). At multivariate analysis, apart from age (p=0.025), number of LE involved segments seems to be the best predictor of HF-related events; the involvement of any segment increased the risk of HF-related events (p=0.032, OR=1.6).

Conclusion: Myocardial LE could predict evolution towards HF in HCM: LE spread seems stronger than its amount.

B-0570 10:39
Feasibility, reproducibility and reliability for the T2* Iron evaluation at 3 T in comparison with 1.5 T

Purpose: We aimed to determine the feasibility, reproducibility and reliability of the T2* magnetic resonance imaging (MRI) at 3 T for heart and liver iron burden quantification and the relationship between T2* values at 3 T and 1.5 T.

Methods and Materials: 38 transfusion-dependent patients underwent MRI. Segmental and global cardiac T2* values were calculated after developing a cor-

B-0571 10:48
Relationship between myocardial T2* values and right and left ventricular volumetric and functional parameters in thalassemia major (TM) patients evaluated by cardiac magnetic resonance (CMR)
I. Di Giampietro, C. Ligouri, I. Sansoni, A. Feliziani, P. Cianciulli, B. Beomonte Zobel; Rome/IT

Purpose: CMR has become the most useful imaging technique in TM patients thanks to T2* acquisition in order to quantitatively evaluate myocardial iron overload. The aim of the study was to assess the relationship between the myocardial T2* value and left-ventricular functional parameters and to examine the associa- tions between the degree of cardiac iron load and ventricular function impairment.

Methods and Materials: A retrospective analysis of 50 patients (24 M and 26 F mean age 34.5±7.2 years) with TM was performed. Myocardial iron load was as- sessed by T2* measurements and volumetric functions were analysed using the steady state free precession (SSFP) sequences.

Results: In patients with myocardial iron deposition (T2*<20 ms), the mean LVEF was 58.7±6% resulting significantly lower compared to LVEF measured in patients without iron deposition 64.7±3.2±8%. Statistically significant correlations were found between both the LV volumes and the myocardial T2* value: inverse correlations between both the LV end-systolic volume index (r=-0.3, P<0.01) and the LV end-diastolic volume index (r=-0.28, P<0.01) were observed. In contrast cardiac T2* values were not associated with functional modifications in the right ventricle functional parameters.

Conclusion: Myocardial iron load assessed by CMR is associated with deterio- ration LVEF and the degree of the overload is inversely correlated with the T2* values. Non-correlation has been found between T2* values and right ventricle functional parameters.

B-0572 10:57
Septal late gadolinium enhancement at the right ventricular insertions: more frequent than expected in hypertrophic and dilative cardiomyopathy

Purpose: The particular pattern of septal Late Gad-enhancement (LGE) at the right ventricular-(RV)-insertions has been described in conjunction with pulmonary hypertension. Aim of this retrospective study was to characterise the distribution and prevalence of septal LGE at the RV-insertions in cases of hypertrophic and dilative cardiomyopathy (HCM/DCM).

Methods and Materials: A total of 517 contrast-enhanced cardiac MRI studies performed (1.5 T and 3.0 T, Achieva, Philips) for different clinical indications. The MRI protocol consistently contained Cine SSFP in long and short axes and 3D T1w IR-LGE in long and short axes 8-15 min after double dose (0.2 mmol/kg) gadobutrol. All cases were reviewed in a retrospective analysis. DCM and HCM patients with LGE at the anterior and/or inferior septal RV-insertion were evaluated and compared to cardiomyopathy patients without LGE.

Results: In total, DCM or HCM were found in 46/517 pts (8.9%). Hypertrophic- non-obstructive cardiomyopathy (HNCM) was detected 15/517 pts (2.9%), hypertrophic-obstructive cardiomyopathy (HOCM) was detected in 12/517 pts (2.3%). Therof, anterior or inferior LGE at the RV-insertions was found in 26/517 pts (29.6% -HNCM: 4/15 pts, 26.7% -HOCM: 4/12 pts, 33.3%), only inf. LGE was found in 527 pts (18.5% -HCMC: 3/15 pts, 20% -HOCM: 2/12 pts, 16.7%). 19/517 pts
(3.7%) presented DCM, thereof 4/19 pts (21%) demonstrated ant. and inf. LGE at the RV insertions. 2/19 pts (10.5%) had only an inferior LGE.

Conclusion: LGE at the septal right ventricular anterior and inferior insertions is a frequent finding in dilative and hypertrophic cardiomyopathy. This specific LGE pattern seems to be useful in the differential diagnosis of myocardial disease. However, its clinical relevance remains unclear.

**B-0573** 11:06

**Visualisation of amyloid deposition in the heart of familial systemic amyloidosis using [11C]BF-227 PET**

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**Purpose:** The purpose of this study was to examine whether an amyloid-imaging tracer, [11C]BF-227, usually used for early diagnosis of Alzheimer’s disease, can visualise the β-amyloid deposition in the cardiac muscle of a familial systemic amyloidosis patient.

**Methods and Materials:** The subject was a man with familial systemic amyloidosis, confirmed by biopsy of gastrodudenal specimen. Cardiac amyloidosis was also strongly suspected by echocardiography and MRI. For this patient, PET with [11C]BF-227, that does not show LE specifically binds to aggregated amyloid fibrils, was conducted. PET imaging was conducted using SET-2400 W (Shimadzu Inc., Kyoto, Japan). SUV values in the heart and lung were compared with those of normal database.

**Results:** The PET images revealed significantly robust retention of [11C]BF-227 in the heart of the patient compared to the normal control. His biopsy specimens from the duodenum also showed high signals of [11C]BF-227. SUV value of the heart was significantly higher than the normal database, while those of the lung showed no-signal difference.

**Conclusion:** To our knowledge, this is the first report showing the usefulness of a β-peptide sheet structure-specific PET in investigating visceral organ amyloidosis. None of the previous tracers was able to specifically bind to aggregated amyloid fibrils which forms a β-peptide sheet structure. It is truly important to detect the accumulation of real amyloid fibrils for early and accurate diagnosis of amyloidosis. Our result may provide a new evidence that our amyloid-specific PET tracer, [11C]BF-227, can successfully detect amyloid deposition in the heart, as well.

**B-0574** 11:15

**Multidetector computed tomography with late enhancement (MDCT-LE) for pre-treatment planning of ventricular tachycardia (VT) RF-ABLation**

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**Purpose:** Myocardial scars are the common substrate of VT; radio-frequency ablation (RFA) guided by electro-anatomical map (EAM) is frequently the therapy of choice. An imaging tool providing an anatomical and structural substrate to guide EAM and subsequent RFA should be an important help to reduce procedural time and improve success rate. We aimed to evaluate MDCT for this role, being MRI use mainly precluded from defibrillators (ICD) implanted to prevent sudden death.

**Methods and Materials:** 13 pts with recurrent VT underwent 64-slice-MDCT before EAM and RFA, including an angiographic-scan and a low-energy (80 kV) delayed-scan (10 minutes after contrast-media injection). MDCT scans were merged with EAMs.

**Results:** MDCT scans were prospectively-ECG-triggered in 10 pts and retrospectively gated in 3 pts. 8 pts had ICD. 6 pts showed subepicardial LE suggestive for post-mycaridal scars. EAM, performed with epicardial approach, confirmed scars identified at MDCT-LE (voltage < 1.5 mV) in all these pts. 6 pts did not show LE areas and underwent RFA in areas with voltages between 0.5 and 1.5 mV (border zone) at EAM.

**Conclusion:** In most of enrolled patients MDCT-LE allowed us to map the scars responsible for electrical substrate of VT. MDCT-LE may be proposed to provide anatomic and structural substrate for guiding EAM and RFA in patients with recurrent VT. It also suggests the more appropriate approach (endocardial vs epicardial). MDCT-LE, instead of MRI, may allow imaging guide also in patients with ICD.
44.3% of patients believe most of their exposure derives from electronic Cramér’s V correlation tests. was used as instrument and assigned to patients who would undergo medical and if their knowledge on medical radiation exposure affects their own decisions.

Results: In group 1 we observed the following Results: EDV 125±40 ml, ESV 36±22 ml, EF 72±10%, SV 88±25 ml and LE mass 10±14 g; in group 2 we observed EDV 110±32 ml, ESV 27±21 ml, EF 77±7%, SV 85±24 ml. A significant positive correlation between LE mass and EDV (p=0.007), ESV (p=0.001) was obtained, meanwhile a negative correlation with EF (p=0.001). A correlation between SV and LE mass was not reported (p=0.6).

Conclusion: Patients with LE present a worst left ventricular function compared to control group. LE mass is correlated with a progressive systolic dysfunction. This finding could be relevant in terms of therapeutic approach especially in case of early HCM onset.

B-0578 11:51
Black blood versus bright blood T2* acquisition in cardiovascular magnetic resonance (CMR) for thalassemia major (TM) patients: which can do better?
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Purpose: To assess between black blood and bright blood T2* CMR acquisition which is superior in terms of images artefacts presence and to establish if significant differences can be founded in terms of T2* values, intra and inter-observer variability.

Methods and Materials: In a setting of 50 TM patients we performed both conventional bright blood and black blood T2* CMR sequences to determine intra and inter-observer variability and the presence of artefacts. In all patients, 2 separate studies of both techniques were performed to assess interstudy reproducibility. Image quality was assessed using a 5-point grading scale (0-very poor quality; 5-excellent quality) and image analysis was in all cases conducted by 2 experienced observers. Results: Cardiac T2* values ranged from 5.30 to 50.63 ms. The mean T2* values were not different between black and bright blood T2* acquisitions (32.04± 1.80 vs 34.52± 2.02 ms, p <0.001). Compared with the conventional bright blood diastolic acquisition, the coefficient of variance of the black blood technique was superior for intra-observer reproducibility (p < 0.001), inter-observer reproducibility (p < 0.001) and inter-study reproducibility (p=0.001). Assessment of artefacts showed a superior score for black blood vs white blood scans (p < 0.001).

Conclusion: Black blood T2* CMR has superior reproducibility and reduced imaging artefacts for the assessment of cardiac iron, in comparison with the conventional bright blood technique, which make it the preferred technique for clinical practice.

SS 914
Dose and technique optimisation from the radiographer’s perspective
Moderators:
P. Blackbum Andersen; Kolding/DK
D. Tack; Baudour/BE

B-0579 10:30
Patient’s knowledge about radiation and radiological protection
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Purpose: To obtain and analyse patient’s knowledge and perceptions regarding radiation exposure, from both natural and man-made radiation of medical procedures and interventions. Verify if patients worry about their exposure when undergoing medical exams, are aware of associated risks and means of radiological protection and if their knowledge on medical radiation exposure affects their own decisions.

Methods and Materials: On a medical environment a self-applied questionnaire was used as instrument and assigned to patients who would undergo medical imaging exams involving ionising radiation. A total of 300 valid questionnaires were interpreted and statistically analysed through descriptive statistics and Phi & Cramer’s V correlation tests.

Results: 44.3% of patients believe most of their exposure derives from electronic appliances and 25% from medical imaging exams, while patient’s with higher education levels tend to consider is comes from the environment. The great majority of patients (95%) consider that only certified personnel should operate medical imaging equipment, but 74% never ask for their qualifications. 66.3% of patients claim that Technologists have more education on radiological protection and about 60% of patients rarely or never worry about radiation exposure when undergoing medical imaging exams.

Conclusion: Patients overestimate the risks of industrial radiation exposure while they underestimate the associated risks of medical radiation exposure and the Technologists’ ability to reduce the inherent radiation exposure of medical imaging exams. Patient’s knowledge on radiation and radiological protection is based more on perceptions and beliefs, rather than factual knowledge.

B-0580 10:39
A study of the awareness of x-ray radiation doses among Norwegian student radiographers
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Purpose: To assess the level of student radiographers’ knowledge concerning both the radiation doses received by patients undergoing commonly requested radiological investigations and the associated risks of these doses.

Methods and Materials: A survey was sent to all radiography program teachers in charge (n=6) in Norway, along with a request to administer and return survey to final year student radiographers in their final term of study. The questionnaires pertained to radiation-related issues and demographic information.

Results: The response rate was 79% (122/155). The majority of the student radiographers reported poor knowledge of radiation doses. They were either ignorant of or underestimated the radiation doses used in the various imaging examinations. Only 4 student radiographers answered more than 50% of the items in a questionnaire designed for assessment of their level of knowledge correctly. Overall 63% (n=77) of the student radiographers were not aware of the radiation dose received from a chest x-ray and 64% (n=78) of the students were ignorant of the annual dose limit for the patients. The study identified no statistically significant differences among radiography institutions (p=0.08) and between genders (p=0.61).

Conclusion: Overall, final year student radiographers’ knowledge regarding radiation doses and the risks associated with ionising radiation is reported to be poor.

B-0581 10:48
Radiographer’s role in dose optimisation in co-operation with dentists in orthopantomography
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Purpose: To find out consequence of referral in orthopantomographic imaging of the teeth in order to decrease patient’s dose. Follow-up of doses was made in order to find out how permanent is the manner of dentists to ask partial OPTG.

Methods and Materials: Dentists have been reminded of the possibility of partial OPTG also later. Form of indication and due to this orthopantomogram was always taken as whole mandible.

Results: After meeting the dentists started to write better referrals with clear indications and detailed information. On the basis of this information radiographer takes whole or partial mandible and set the kV and mA according to the required image quality. The dentists have to be reminded of this possibility to make the procedure permanent.

Conclusion: It is easy to decrease patient dose in co-operation the referral dentists. It requires radiographer’s professional attitude and activity to remind the dentists of the importance of referral and its effects to patient’s dose and harms due to ionising radiation to children. Multiprofessional co-operation, open discussions and awareness of the dose levels are the key points.

B-0582 10:57
Radiographic imaging: image quality and radiation dose optimisation in digital imaging
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Digital imaging applications have been increasing rapidly in the past years. Implementation of digital imaging systems has introduced a need to study the possibilities that digital imaging has to offer. Traditional tradeoffs between image quality and dose no longer exist.
Purpose: The purpose of the study was to make a standard of activity for optimizing image quality and radiation dose with the CDRAID analyser program and contrast-detail phantom. The product is intended for radiographers, students and professionals working in the field of radiographic imaging. The functional aim was to create a standard of activity that enabled uniform procedure in optimising the image quality and radiation dose.

Methods and Materials: Images were taken using different parameters (mA, kVp, filtration, etc). Three images were taken with the same parameters to achieve better reliability. The images taken of the contrast-detail phantom were evaluated with CDRAID analyser program. The study revealed how different imaging parameters affected the image quality.

Results: According to the results, image quality was better and radiation exposure was lower when kVp was added to 75 from 66 and when 2 mm Al added filtration was used.

Conclusion: The results of the project can be utilised by radiographer students as part of evidence-based learning. Oulu University of Applied Sciences can also implement the results of the study in the curriculum. Thus, radiation safety can be improved in the School of Health and Social Care in accordance with the regulations of the Ministry of Social Affairs and Health.

B-0583 11:06
Mammography image quality in Switzerland
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Purpose: Although image quality in mammography has been positively associated with screening performance, mammography quality has seldom been assessed. In Switzerland, regional screening programmes undergo strict quality management procedures, which include continued training of radiographers. This study aimed at evaluating quality of mammograms in Switzerland, its evolution over time, and at identifying its determinants.

Methods and Materials: 7352 mammograms, performed between 1999 and 2007, were randomly drawn from 6 hospitals in 2 cantons with and without a screening program, and evaluated according to the PGMI (P: Perfect, G: Good, M: Moderate, I: Inadequate) classification system. Determinants of quality were assessed by multivariate logistic regressions for 2 indicators of quality.

Results: Overall, the inadequate image rate decreased over time (-0.8%/year, CI95%: -1.14;-0.45) while the proportion of good or perfect images increased (+0.51%/year, CI95%: +0.18;+0.84). Higher image quality was associated with a mammogram being performed recently, for a cranio-caudal view, in a hospital with a high output (> 250 mammographic images/radiographer/year) and within a screening programme. The inadequate image rate was 28% (95%CI: 12-42) lower with a digital mammogram and a perfect or good image classification twice as likely with a high output (> 250 mammographic images/radiographer/year) and within a screening programme.

Conclusion: Mammography image quality is steadily improving since 1999. Although quality-assurance procedures for screening programmes has contributed in the canton with an organised screening program (OR=1.96, 95%CI: 1.65-2.34). With a digital mammogram and a perfect or good image classification twice as likely with a high output (> 250 mammographic images/radiographer/year) and within a screening programme. The inadequate image rate was 28% (95%CI: 12-42) lower with a digital mammogram and a perfect or good image classification twice as likely with a high output (> 250 mammographic images/radiographer/year) and within a screening programme.
without any parameter change with respect to adult protocol in 12.4% of cases. Paediatric CT parameters were not adjusted on the basis of the age of the child in 52.5% of cases. For children 1, 5, and 10 years old and for adults correspondingly, the third CTDI quarter was calculated at 42.7, 50.9, 55.4 and 66.9 mGy for brain CT, 12, 13.5, 15.6 and 24.9 mGy for chest CT and 16.9, 17.7, 17.7, and 27.7 mGy for abdomen CT.

Conclusion: There is a considerable potential for dose reduction by optimisation of scan protocols and better education of the personnel. A reduction of CTDI in adult protocols (up to 38%) is required which will result in a significant dose reduction in paediatric protocols.

B-0588 11:51
The control infection in a mammography setting: a looking over practices and analysis of microorganisms
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Purpose: The cleaning and disinfection of medical surfaces and equipments, as well the hand hygiene are basic measures to guarantee safe practices in the control infection of health care. This study aimed to identify the steps in mammography CR (computed radiology) process, characterising them according to the presence of microorganisms and identify the practices that lead to their transmission.

Methods and Materials: The observational data were collected in a form from WHO in order to characterise the hygiene practices applied by radiographers. In addition, for 3 different times, microorganisms were collected from five surfaces in the mammography room (analytic component). Before performing each examination, the radiographer never washed her hands. Using water and soap, she always washed her hands, after the examinations, except in 1 case. Only one time she used an alcohol-based antiseptic solution. The equipment was disinfected in 88.9% of the cases. The microorganisms found in the mammography surfaces were: coagulase-negative Staphylococcus; Micrococcus spp; Suspected Enterococcus spp (6.7%); Streptococcus spp (13.3%); Bacterial contamination of surfaces (40%) and the pathogenic microorganism-Escherichia Coli (6.7%) collected on the keyboard.

Results: The hands hygiene should be performed before and after the contact with the patient, using an alcohol-based antiseptic solution. The mammography’s equipment and other medical surfaces must be disinfected between each patient at the beginning and end of each work session.

Conclusion: Although x-ray examinations, such as mammography, are under-valued in this matter due to the procedures mostly with ambulatory patients, this study allowed the identification of the many types of microorganisms being one of these pathogenic.

B-0589 10:30
Quantitative evaluation of chronic lung disease in infant with thin-section CT
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Purpose: A clinical chronic pulmonary disorder group of infant is named with chronic lung disease (CLD). CLD is defined that a respiratory distress symptom to need oxygenation follows infancy ahead of opening, day instars 28. We evaluated above-mentioned thin-section CT findings and performed objective quantification of emphysema in patients with CLD.

Methods and Materials: Very or extremely low birth weight infants of 19 cases in this hospital in September, 2009 since May, 2011 were listed. Their mean birth weight was 976.5 (32.3-1646) g and mean gestational age was 26.7 (22.6-32.3) weeks. Thin-section CT were performed at 40 weeks corrected age in all cases. The entire lung was scanned with 0.625-mm section thickness with a MDCT scanner (LightSpeed16; GE, USA). The total lung volume (CT number < -400 HU) and volume of emphysematous change (CT number < -900 HU) were measured using the threshold method on a workstation.

Results: Eleven of all cases that were clinically diagnosed as CLD. All cases had CT findings of emphysematous change. Their mean total lung volume was 71.2 (55.6-97) ml and mean volume of emphysematous change was 11.3 (0.2-93.4) ml. Six infants had a severe initial respiratory course and went home on oxygen. Five of six cases who had large amount of emphysematous change had consequently become with home oxygen therapy. Their mean volume of emphysema was 21.6 ml. There was no difference between each illness type and lung volume measurement.

Conclusion: Quantitative evaluation of emphysematous changes classification of prognosis in infant with CLD.

B-0590 10:39
Coronary artery abnormalities in Kawasaki disease: comparison between CT and MR coronary angiography
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Purpose: To compare visibility and diagnostic performance of coronary artery abnormalities between CT and MR in children and adolescents with Kawasaki disease.

Methods and Materials: Between 1989 and 2010, a total of 56 children and adolescents (38 males; range 1-21 years) with Kawasaki disease who performed CT (n=58) or MR (n=39) coronary angiography were included in this study. In 17 of them, both CT and MR were performed. Visibility was graded on a 4-point scale (1, no contrast filling; 2, incomplete filling; 3, filling with partial opacification; 4, filling with full opacification). The presence of microorganisms at catheterisation (n=29), echocardiography (n=56), follow-up CT and MR, and clinical history. Coronary artery visibility and diagnostic performance were compared between CT and MR.

Results: On CT and MR studies, 84.8% and 71.3%, respectively, of coronary arterial segments were assessable (P < 0.001). In 17 patients with both CT and MR, 89.2% and 68.9%, respectively, of them were assessable (P < 0.001). On CT and MR studies, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were 93.1% vs. 77.8% (P = 0.001), 99.2% vs. 99.7% (P = 0.653), 96.8% vs. 98.7% (P = 0.652), 98.2% vs. 94.1% (P < 0.001), and 98.0% vs. 94.9% (P = 0.008), respectively. In the 17 patients, they were 91.8% vs. 70.4% (P < 0.001), 99.5% vs. 99.5% (P = 1.000), 98.5% vs. 98.0% (P = 1.000), 97.2% vs. 91.1% (P = 0.006), and 97.6% vs. 92.3% (P = 0.004), respectively.

Conclusion: CT shows significantly higher coronary artery visibility, sensitivity, NPV, and accuracy in evaluating coronary artery abnormalities of Kawasaki disease.

B-0592 10:48
Iterative image reconstruction techniques in paediatric cardiovascular CT angiography: image quality and potential for radiation dose reduction
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Purpose: We assessed image quality, image noise, and the potential for further radiation dose reduction in children undergoing ultra-low radiation dose cardiovascular CT angiography (cCTA) using iterative reconstruction techniques.

Methods and Materials: Twenty-four children (median age: 4 months) with suspected or known congenital cardiovascular anomalies underwent dual source cCTA with (n=10) or without (n=14) ECG-synchronisation. Data were reconstructed with filtered back projection (FBP), iterative reconstruction in image space (IRIS), and sinogram-allowed-iterative-reconstruction (SAFIRE). For ECG-synchronised studies, half-dose image acquisition was simulated by discarding projections from one tube. Signal/noise was measured within the ascending and descending aorta, left atrium, main pulmonary artery, and the trachea. Image quality was graded from 1 (non-diagnostic) to 5 (excellent) for the ventricular septum, mitral valve, and all structures described above. Effective dose (ED) was estimated using age/weight-specific conversion factors. Results were compared using T- and Chi-square testing.

Results: Image noise for ECG-synchronised SAFIRE was lower than with FBP (30.5±18.9 and 32.2±15.7 versus 44.9±24.4; all p < 0.001), while SNR was higher (19.0±8.4 and 17.6±8.5 versus 12.8±5.3; p < 0.01). Image quality scores were higher for IRIS and full-dose-SAFIRE than for FBP (3.7±0.6 and 3.6±0.6 versus 3.4±0.5; p < 0.05). Average ED was 0.28mSv without and 1.6mSv with ECG-synchronisation. In half-dose ECG-synchronised SAFIRE studies, ED was 0.8mSv without and 1.6mSv with ECG-synchronisation. Image noise (38.4±21.9) was still significantly (p < 0.01) lower and SNR (13.9±7.3) higher than in full-dose-FBP studies, while image quality (3.8±0.5) was maintained.

Conclusion: At ultra-low radiation dose paediatric cCTA, iterative reconstruction techniques improve image quality and hold potential for substantial further reductions in radiation exposure.
B-0593 10:57
New conversion coefficients for dose reconstruction in high-resolution computed tomography (HR-CT) of the chest in neonates and infants
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Purpose: Reconstruction of organ and tissue doses achieved during computed tomographic (CT) examinations is performed by applying conversion coefficients (synonymously: normalised organ doses) to basic dose indicators like the CTDI or the dose length product. The calculations of conversion coefficients published so far consider only slice thicknesses of more than 5 mm. As a consequence, especially in small organs the tissue doses are greatly underestimated. As HR-CT examinations of the lungs in neonates and infants are performed with slice thicknesses of 1 - 1.5 mm new conversion factors are needed.
Methods and Materials: For the calculation of new conversion coefficients, a new algorithm named CTx was developed by the authors in order to apply the commercially available PCXMC Monte Carlo algorithm developed by the Finnish Radiation and Nuclear Safety Authority STUK for dose calculations in CT.
Results: New conversion coefficients for organ dose reconstruction in HR-CT of neonates and young infants are presented with a slice resolution of 1 mm and an angular resolution of 1 ° with a formal consideration of various bow tie filters. In small organs such as the thyroid gland and the mammary glands organ doses calculated by applying the new method can exceed the tissue doses, predicted by the conversion coefficients published so far, by more than 50%.
Conclusion: After implementation of real bow tie filtration data, the new conversion coefficients should allow a realistic reconstruction of organ doses achieved during HR-CT examinations in neonates and infants.

B-0594 11:06
Radiation dose reduction in chest CT with the adaptive statistical iterative reconstruction (ASIR) technique in children
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Purpose: To retrospectively compare radiation dose and image quality of pediatric chest CT taken with adaptive statistical iterative reconstruction (ASIR) and with routine protocol.
Methods and Materials: Twenty-six paediatric patients (M:F = 13:13, age 0-17 years; mean 11.7) had separate chest CT with low dose 50% ASIR and routine dose on different days between January 2010 and June 2011 (mean follow-up interval 148 days). Volume CT dose indices (CTDiver), dose length products (DLP) were recorded, and effective dose were calculated to estimate radiation dose. The image quality was evaluated subjectively by three radiologists for noise, sharpness, artefacts, and diagnostic acceptability with a four-point scale (1-4). Objective noise and CT number were measured in the descending aorta and paraspinal muscle at the level of carina.
Results: The ASIR studies presented 56%, 60%, and 55% reductions in CTDiver (from 18.73 to 7.43 mGy), DLP (from 307.42 to 134.50 mGy x cm), and effective dose (from 4.11 to 1.84 mSv), respectively, compared to the routine dose studies. The subjective image quality was not different between the ASIR and routine protocol.
Conclusion: The use of 50% ASIR lowers the radiation dose in paediatric chest CT more than 55%, while maintaining image quality.

B-0595 11:15
Comparison of non-breathheld single phase CT and 3D reconstructed bronchoscopic images with bronchoscopy for diagnosing airway malacia in infants
H. Hong; S.-A. Im; Seoul/KR (daydreamer.hong@gmail.com)
Purpose: The clinical diagnosis of airway-malacia in children is difficult and an accurate and non-invasive method is being required. The purpose of our study is to compare the accuracy of free-breathing CT scans of the airway in children, for the diagnosis of airway-malacia using bronchoscopy as the “gold-standard”.
Methods and Materials: This retrospective study includes 90 children who received both bronchoscopy and CT scan of the airways in our institution. CT scans included the chest, 3 dimension (3D) CT bronchoscopic, neck, and brain CT scans. All patients were scanned with a non-breath-held protocol, using a 64-detector-multislice-helical-CT-scan. Anteroposterior (AP) and transverse (Tr) diameters of the supra-glottic-larynx, glottis, trachea and bronchus were measured in the supra-CT scans. Air-trapping and airway narrowing in the 3D-reconstructed-images were checked. Bronchoscopy was used as the gold standard and airway-malacia was defined as more than 50% narrowing of the airway. Logistic-regression model was used for correlation between CT measurements and the bronchoscopic finding, and receiver-operating-characteristic curve was used to find cut-off values.
Results: 90 children under 16 years (32 infants) were included, of which 26 had airway-malacia. CT measurements which demonstrated significant correlation with bronchoscopic findings, included the supra-glottic-larynx-AP (AUC 0.952), tracheal-AP (AUC 0.825), bronchial-AP (AUC 0.808), tracheal-AP/tracheal-Tr ratio (AUC 0.922), bronchus-AP/Idiastal-tracheal-Tr ratio (AUC 0.827) and airway narrowing in 3D-reconstructed-images (p=0.000).
Conclusion: The accuracy of free-breathing CT scan of the airway in detecting airway-malacia in children is comparable to the bronchoscopy, with lesser radiation dose compared to dual phase or cine-CT scans of the airway.

B-0596 11:24
Chest MRI in the evaluation of pulmonary alterations detected by CT in the follow-up of paediatric patients with middle lobe syndrome (MLS): comparison with XR
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Purpose: To assess the most frequent pulmonary alterations detected by CT in a group of pediatric patients with middle lobe syndrome (MLS) at the time of diagnosis and the possible role of chest-MRI, in comparison with XR, in their follow-up.
Methods and Materials: 17 patients with MLS (mean age 6.2 years) underwent a chest CT at time of diagnosis (100 kV, CAREdose with quality reference: 70 mAs; collimation: 24 x 1.2 mm; rotation-time: 0.33 sec; scan-time: 5 sec). At follow-up (mean time: 15.2 months) all patients were evaluated with chest MRI (respiratory triggered DP weighted BLADE sequence; TR: 2000; TE: 27; FOV 400 mm; flip angle: 150; slice-thickness 5 mm; axial and coronal plane) and XR. The following lung alterations were assessed: bronchectasis; bronchial-wall-thickening; atelectasis/consolidation; mucus-plugging. Lympathadenopathies were evaluated on CTs and MRIs; frequencies of each alteration were recorded for each examination in all patients.
Results: CT at diagnosis reported bronchectasis in 35% of patients; bronchial-wall-thickening: 53%; atelectasis/consolidation: 100%; mucus-plugging: 35%; lympathadenopathies: 47%. Follow-up MRI: bronchectasis in 35% of patients (XR: 29%; bronchial-wall-thickening: 59% (XR:6%); atelectasis/consolidation: 65% (XR: 35%); mucus-plugging: 25% (XR: 0%); lympathadenopathies: 47%. The most frequent localisation was middle lobe for all alterations both at baseline and follow-up. Conclusion: CT evaluation showed that MLS can be characterised by various parenchymal and airways alterations already at diagnosis; at follow-up, XR under-estimated the number of alterations compared to chest-MRI. MRI might represent a feasible option in the follow-up of patients affected by MLS.

B-0597 11:33
Flow-sensitive 4D MRI of aortic blood flow in patients with Marfan syndrome
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Purpose: To apply flow-sensitive 4D MRI for the characterisation of flow pattern changes in patients with Marfan syndrome (MFS) compared to normal controls.
Methods and Materials: Flow-sensitive 4D MRI of the thoracic aorta (temporal resolution=45 ms, spatial resolution=2x2 mm, venc=200 cm/s) was performed in 24 patients (mean age 18y) with confirmed MFS and 10 healthy volunteers (mean age 24y). Aortic haemodynamics was visualised by 3D particle traces and streamlines. Abnormal flow patterns (helix and vortex flow) in the ascending aorta (AAo), aortic arch, and descending aorta (DAO) were graded in three categories (blinded reading, 2 observers). Quantitative evaluation comprised the calculation of regional time-averaged absolute wall shear stress (WSS) and peak velocities at eight sites of the AAo and DAO.
Results: Local helical flow in the AAo was significantly (p < 0.05) increased in MFS patients and was associated with aortic sinus dilatation. The incidence of global and vortex flow in the DAO was increased in patients (77% and 50%) compared to volunteers (none and 10%). Interobserver agreement was substantial (κ =0.7). Quantitative analysis revealed a significant increase in regional aortic WSS (0.38±0.10Nm² in patients vs. 0.34±0.07Nm² in volunteers, p < 0.01) at the location of local helix flow.
Conclusion: 4D flow analysis revealed marked differences of the aortic flow patterns between MFS patients and controls. The presence of local helix flow and the increased WSS in the MFS patients' AAo may be associated with the increased incidence of aortic root dilatation. The high prevalence of vortex and helix flow in the proximal DAO may promote Type-B dissection originating from this site.
B-0598 11:42

Quantitative pulmonary perfusion imaging at 3.0 T of 2-year-old children after congenital diaphragmatic hernia (CDH) repair
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Purpose: To investigate whether dynamic contrast-enhanced MRI imaging (DCE-MRI) of the lung in survivors after CDH-repair at 3.0 T is feasible in 2-year-old children.

Materials and Methods: 12 children with a mean age 2.0 ± 0.2 years and 9.12 kg of body weight after CDH-repair, including 5 female and 7 male children, underwent DCE-MRI at 3.0 T using a time-resolved angiography with stochastic trajectories (TWIST) sequence. Quantification of lung perfusion was performed using a pixel-by-pixel deconvolution approach implemented in an in-house OsiriX plug-in. Six ROIs were carefully placed in the upper, middle, and lower part of the right and left lung to access differences in pulmonary blood flow while avoiding the inclusion of larger pulmonary arteries and veins.

Results: Average regional pulmonary blood flow (rPBF) for the hypoplastic lungs was 43 ± 16 ml/100 ml/min and 72 ± 18 ml/100 ml/min for the contralateral side. The difference between hypoplastic and contralateral lung was significant (p=0.0003). Also, the differences in rPBF measured in the apical, middle and lower lung were significantly different between hypoplastic lungs and contralateral sides (apical: p=0.0001, middle: p=0.0118, lower: p=0.014). Significant differences between upper, middle and lower lung regions of the same side could not be detected.

Conclusion: DCE-MRI of the lung in 2-year-old patients is feasible at 3.0 T. Ipsilateral lung hypoplasia with reduced perfusion is reflected by significant lower rPBF values compared to the contralateral lung. DCE-MRI of the lung in CDH can help characterising lung hypoplasia initially and in long-term follow-up of children after CDH-repair.

10:30 - 12:00 Room Z

Computer Applications

SS 905

Computer assisted diagnosis (CAD)
Moderators: B. Merlino; Rome/IT
R. van ’t Klooster; Leiden/NL

B-0599 10:30

A simple and robust classification tree for differentiation between benign and malignant lesions in MR mammography
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Purpose: A multitude of lesion descriptors has been proposed in order to improve differential diagnosis in breast MRI. In clinical routine, a practical algorithm for lesion classification is needed. Such an algorithm should be as simple as possible and estimate its diagnostic accuracy.

Methods and Materials: 82 consecutive patients receiving MRM with subsequent histological verification or MRM-follow-up > 2 years were included into this prospective cross-sectional investigation (exclusion: BI-RADS VI, adjuvant/neoadjuvant chemotherapy or any other breast-treatment between initial- and follow-up MRM). Initial-MRM was interpreted by non-expert readers (~500 MRM).

Results: There were 24 nodal-positive and 58 nodal-negative cancers. BLRA was defined as reference-standard. Breast MRM was analysed using commercial CAD-software: It evaluates semi-automatically functional tissue-parameters of the most-suspect-voxel as well of the whole tumour, e.g.: initial-enhancement, wash-out, peak-enhancement, time-to-peak-enhancement, etc. Significant and independent predictors for lymph-node-metastasis were identified (logistic-regression, backward feature-selection) and combined into a multivariate model to predict nodal-positive breast-cancers (AUC: area under the ROC curve).

Conclusion: MRM provides excellent overall diagnostic accuracy, sensitivity and negative predictive. Even in non-expert readers MRM has a high specificity.

B-0600 10:39

“Magnetic resonance mammography has a high sensitivity but low specificity!”: new thoughts and fresh data on an old mantra

Purpose: Even in its 3rd decade of clinical application, diagnostic-accuracy of MR-mammography (MRM) is still not well understood and remains discussed controversially. To a major part - this is certainly due to different standards-of-reference (SOR: histological verification, follow-up, etc.) and composition of patient collectives in previous studies: particularly the group of true-negative MRM-results is challenging to analyse, as such often do not get histological sampling anymore and are followed-up clinically/radiologically. In this scenario, only long-term MRM-follow-up is able to provide a valid SOR. Accordingly, we designed this investigation to identify the accuracy of MRM as interpreted by non-expert readers defining histological verification and long-term MRM follow-up as SOR.

Methods and Materials: Over 3 years all consecutive patients receiving MRM for the noninvasive prediction of axillary lymph node metastases were included into this prospective cross-sectional investigation (exclusion: BI-RADS VI, adjuvant/neoadjuvant chemotherapy or any other breast-treatment between initial- and follow-up MRM). Initial-MRM was interpreted by non-expert readers (~500 MRM).

Results: 448 patients were included (SORhistology: 321; SORfollow-up: 175), Pretest-probability was 0.24. Main indication for initial-MRM was screening for recurrence of breast-cancer (22.9%), or BI-RADS II (7.7%), III (13.8%) and IV (37.1%) classification in conventional-imaging. The non-expert readers achieved high specificity (96.3%) and positive-likelihood-ratio (7.0). Overall accuracy reached excellent odds-ratio (160.1), Sensitivity (96.2%), negative- predictive-value (98.3%) and negative-likelihood-ratio (0.04).

Conclusion: MRM provides excellent overall diagnostic accuracy, sensitivity and negative predictive. Even in non-expert readers MRM has a high specificity.
Purpose: Daily routine of radiologists includes differentiating a variety of lesion types in CT-scans - a challenging and time-consuming task. We evaluated an innovative THESEUS-MEDICO CBIR-CAD (content-based image retrieval+computer-aided-decision) system that assists the reader in discriminating liver lesions by retrieving, scoring, ranking and displaying similar lesions according to user-defined similarity criteria including lesion benignancy, density and type.

Methods and Materials: A set of 523 CT scans containing 854 liver lesions annotated by 2 experienced radiologists were used for generation and evaluation of the learning-based models in the system. A ranked list of lesions showing similar benignancy (benign/malignant), density (hypodense/hyperdense) or lesion type (osteolytic/osteoblastic) was retrieved from just a region of interest as input query. Additional input (e.g. characterising semantic features) has shown to improve the performance, especially for indeterminate sub-centimeter lesions.

Results: Algorithm runtime is within a few seconds per lesion. On unseen test data, the classification accuracy obtained was 95.5% for retrieval with similar density, 85.5% for similar benignancy, and 91.2% in the lesion type case. The data collection used is the biggest sample compared to similar studies and the predictive performance achieved is competitive with respect to state of the art.

Conclusion: As proven by this study, the investigated system automatically discriminates reliably between different types of liver lesions. The system assists reading and decision-making process by quick retrieval, ranking and displaying similar lesions with related radiological report information. This serves as a second opinion and provides valuable additional information for radiological decision making especially when MRI is contra-indicated.
type of branching. In some cases, sequential shift of assigned names to proximal occurred in the belonging bronchi at the deleted site of the expected bronchus by poor reconstruction of a bronchial image and by congenital or operative deletion of the bronchus was present. Strict name matching to doctors’ interpretation revealed 100% matched for the trachea and main bronchi. For the distal bronchi, overall results of 80% of labelled names were correct.

Conclusion: According to the knowledge of computational anatomy, automated assignment of bronchial branch names may help doctors during virtual bronchoscopy.

B-0607 11:42
Development of a computer-aided independent monitor unit verification system using Clarkson’s sector integration routine
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Purpose: To develop a computerised method for verification of monitor unit (MU) based on geometrical factors in radiation treatment planning, and to investigate the clinical effectiveness of our system.

Methods and Materials: Shape information on Xjaw, Yjaw, and multi-leaf collimator (MLC) was read from the planning data, and radial direction distance (ri) of the division for integration of 36 segments was calculated. Clarkson’s sector integration routine was used to calculate the mean phantom scatter correction factor (Sp) and mean tissue-maximum ratio (TMR) for external photon beams of irregular and conformal fields with MLC. Our system with a user-friendly graphical interface was installed on a personal computer (1.5GHz CPU) to verify its accuracy in 51 cases, including five square fields, six rectangular fields, four kinds’ wedge-shaped fields, eight irregular fields, and three conformal fields.

Results: Average ri difference, the difference in MU, and measured absorbed dose were < 0.3 mm, 0.5%, and -0.2%, respectively. Maximum values were ±1.5 mm, 1.5%, and -0.9%, respectively. The time to calculate one field was < 1 s. Our system provided fully automated MU verification without any manual “hand calculation.”

Conclusion: It is necessary to ensure disagreement between verification and primary calculations with homogeneous conditions or heterogeneity corrections is < 2%-5% by independent MU verification, according to the report of AAPM Task Group 114. The results indicated that our system will aid operators in MU verification with high accuracy and less complexity for external radiation therapy.

B-0608 11:51
Fully iterative reconstruction algorithm for MDCT: initial results
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Purpose: To evaluate fully iterative reconstruction (IR) in MDCT with respect to image quality and diagnostic value compared with conventional FBP.

Methods and Materials: The study was performed prospectively with patients who had suffered from malignant diseases in a tumour follow-up. Data were acquired on a Philips Brilliance ICT and reconstructed using conventional FBP and IR. IR uses edge-preserving regularisation to trade off noise and resolution. Noise texture is controlled by a parameter and by fading the FBP image to the IR result. To determine the diagnostic value of IR, experienced radiologists independently defined pathological and anatomical features in the reconstructions.

Results: An extreme choice of IR parameters resulted in almost complete removal of image noise while producing an unfamiliar image texture. Without FBP fading, sharpness of some organ edges was found to be difficult to rate. In one case, the surface of the liver seems to have nodular-like cirrhotic changes. Less extreme parameters for IR led to still strongly reduced noise, less unfamiliar texture and no artificial changes. In the portal venous phase, vascular structures are better delineated in IR reconstructions compared to FBP. All pathological and anatomical features could be detected and defined in FBP and IR images. However, these features are more clearly visible in IR images. Overall, IR was assessed to be superior to FBP.

Conclusion: In this study, we illustrate the clinical value of IR. IR has the potential to reduce patient dose and improve diagnostic value for any clinical protocol.
Whole body MRI in cancer patients

Methods and Materials:
One hundred and thirty-five patients with previously diagnosed MM underwent 3 T WB-MRI for pre-treatment staging. The kappa values for these three zones with T1-weighted MR imaging were compared with the results of a review panel.

Results:
Regarding volume of bone marrow abnormalities, a low correlation (r = 0.2) was found. SDNR was substantially higher on DWIBS images than on 3D T1-weighted contrast-enhanced (mean, 117.7 vs 89.3; P < 0.001). The qualitative analysis demonstrated the same imaging pattern with both sequences in 12% (kappa = 0.035) of normal-appearing marrow with limited disease, in 96% (kappa = 0.74) of focal infiltration, and in 10% (kappa = 0.041) of diffuse infiltration. Inter-observer reproducibility of the three imaging patterns was similar for both sequences. The kappa values for these three zones with T1-weighted contrast-enhanced MR imaging were 0.61, 0.58, and 0.63, and those for the DWIBS sequences were 0.32, 0.64 and 0.22, respectively. Staging determined with MR findings with each sequence were compared with the results of a review panel.

Conclusion:
Whole body diffusion-weighted imaging (WB-DWI) for staging of non-Hodgkin lymphoma (NHL).

Methods and Materials:
16 patients with NHL underwent 3 T WB-DWI with 2 b-values (b=0-1000 s/mm²). Regions-of-interest (ROI) were drawn on coronal reformatted b=0- and b-1000-images. Pretreatment ADC, ADC-change to pretreatment ADC (ADCbase), ADC-change to 2 weeks (ADCratio2w) and at 4 weeks (ADCratio4w) during treatment of responding and non-responding lesions were compared using a Mann-Whitney-U-test.

Results:
Differences in ADC-base, ADCratio2w and ADCratio4w between patient groups correlated significantly with PFS (ADCbase - p=0.028, ADCratio2w - p=0.0002 and ADCratio4w - p=0.004), in contrast to the IPI. Conclusion: WB-DWI may allow for treatment prediction and early treatment assessment of DLBCL using differences in ADCbase, ADCratio2w and ADCratio4w.

Whole body diffusion-weighted imaging at 3 Tesla field-strength feasible for staging lymphoma?

Purpose:
Whole body diffusion-weighted imaging (WB-DWI) at 3 Tesla was compared with serum analyses to detect recurrence versus remission.

Methods and Materials:
Three T WB-DWI with 2 b-values (b=0-1000 s/mm²) were performed for 31 patients. ADC-values (0-1000 s/mm²) were measured. Staging determined with MR findings with each sequence were compared with the results of a review panel.

Results:
The kappa values for these three zones with T1-weighted contrast-enhanced MR imaging were 0.61, 0.58, and 0.63, and those for the DWIBS sequences were 0.32, 0.64 and 0.22, respectively. Staging determined with MR findings with each sequence were compared with the results of a review panel.

Conclusion:
Whole body diffusion-weighted imaging (WB-DWI) at 3 Tesla field-strength is feasible for staging lymphoma.

Whole body magnetic resonance imaging with diffusion-weighted sequences for the follow-up of stage III melanoma patients

Methods and Materials:
28 patients with stage III melanoma were included. The patients underwent 3 T WB-MRI with diffusion-weighted (DW) sequences as a substitute of whole body computed tomography (CT) for the follow-up of stage III melanoma patients.
Methods and Materials: we evaluated seventy-one WB-MRI in 19 patients with stage III melanoma, performed at baseline and every 3 months during adjuvant therapy. Findings were classified benign or suspicious for metastasis and divided into 9 body regions: brain, neck, thorax, upper abdomen, liver, pelvis, soft tissues, bone and lymph nodes. Biopsy or follow-up was considered as gold standard for diagnosis. The sensitivity (SE), specificity (SP), positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy (DA) of WB-MRI were calculated per patient and per single body region.

Results: All patients well tolerated the exam. One-hundred and forty findings were considered for analysis, with the following per patient values: SE (93%), SP (89%), PPV (52%), NPV (99%), DA (90%). The DA per single body region was: brain (55%), neck (78%), thorax (85%), upper abdomen (85%), liver (100%), pelvis (100%), soft tissues (97%), bone (85%) and lymph nodes (60%). The smallest metastasis detected was 3 mm in the liver; the largest metastasis missed was 5 mm in the brain.

Conclusion: WB-MRI was feasible in the follow-up of patients with stage III melanoma. WB-MRI achieved acceptable diagnostic performance per patient and per single body region, making it comparable to other whole body imaging techniques, including computed tomography and positron emission tomography, however, avoiding ionising radiation.

B-0614  11:15
Whole body MRI with DWI and 3D-CE-T1w in tumour staging: comparison with PET-CT
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Purpose: To assess the diagnostic performance of whole body magnetic resonance imaging (WB-MRI) with diffusion weighted whole body imaging with background body signal suppression (DWIBS) in malignant tumour detection and to explore the potential diagnostic advantages in generating fused DWIBS/3D-contrast-enhanced T1w (3D-CE-T1w) images.

Methods and Materials: 45 cancer patients underwent WB-MRI for staging purpose. Fused DWIBS/3D-CE T1w images were generated off-line, 3D-CE-T1w, DWIBS images alone and fused with 3D-CE T1w were compared by two readers for detection of primary diseases and local/distant metastases. Diagnostic performance between the three WB-MRI datasets was assessed using receiver operating characteristic (ROC) curve analysis. 18 F-FDG PET-CT and histopathological results were used as standard of references.

Results: Areas under the ROC curves of DWIBS vs 3D-CE-T1w vs both sequences in fused fashion were 0.97, 0.978, and 1.00, respectively. The diagnostic performance in tumour detection of fused DWIBS/3D-CE-T1w images were statistically superior to DWIBS (P < 0.001) and 3D-CE-T1w (P≤0.002), while the difference in tumour detection of fused DWIBS/3D-CE-T1w images were statistically reproducible previously defined increase (100%) of single or combined markers CA-125 at 6-week intervals within an intensified diagnostic aftercare algorithm. A reproducible previously defined increase (100%) of single or combined markers was considered as a strong indicator of recurrent disease. All patients with pathologic marker increase underwent WB-MRI on a 1.5 T scanner and PET-CT in addition for verification (median: 3 days). Presence and distribution of local recurrence, lymph node involvement and distant metastatic disease were assessed. All patients underwent WB-MRI or FDG-PET-CT follow-up exams within 6 months after individualised therapy.

Results: WB-MRI and FDG-PET-CT detected tumour recurrence in 65% (26/40) of patients, 15% (6/40) had secondary malignancies and 22.5% (9/40) had no detectable malignancy. Limited disease (1 organ< 5 metastases) was found in 39% of patients. WB-MRI and PET-CT equally detected 23/24 metastases, PET-CT was superior detecting local recurrence (PET-CT 2/2 vs WB-MRI 0/2). Secondary tumours detected were: ovarian-, gastric-, lung-, parotid cancer and multiple myeloma. Concordance between both modalities was 52%.

Conclusion: Monitoring of tumour marker kinetics combined with whole body imaging is effective for early detection of tumour recurrence in clinically asymptomatic breast cancer patients. Both FDG-PET-CT and WB-MRI are reliable methods for metastases detection, PET-CT shows advantages in local recurrence.

B-0616  11:33
Whole body MRI and FDG-PET-CT for triage in patients planned for radioembolisation therapy
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Purpose: To evaluate the potential of whole body MRI (WB-MRI) and FDG-PET-CT as diagnostic triage methods for patients planned for radioembolisation (RE) of liver metastases.

Methods and Materials: 135 patients with multifocal liver metastases were evaluated for potential palliative therapy with RE using 90-Yttrium microspheres. All patients were examined with WB-MRI and PET-CT for validation of liver metastases and for pre-operative triage of extrahepatic tumour manifestations. All patients underwent 99mTc-albumine angiography followed by scintigraphy to exclude significant hepato-pulmonary shunting.

Results: Out of the 135 patients included into the pre-therapeutic diagnostic algorithm, 56% were eligible and received RE, while 44% could not be treated. In 91% exclusion criteria was diagnosis of significant extra-hepatic metastatic disease. In 85% diagnosis was made concordantly by both FDG-PET-CT and WB-MRI, in 9% by PET-CT, in 6% by WB-MRI alone. Patient-based sensitivity for detection of extra-hepatic disease was 94% for PET-CT and 91% for WB-MRI. False-positive diagnosis of extrahepatic disease leading to exclusion for RE was made in 2% of patients, in one patient by PET-CT and in one patient by WB-MRI alone. Overall, specificity for inclusion to RE by combining both modalities was 99%. In 9% of patients angiographic diagnosis made RE impossible.

Conclusion: Both FDG-PET-CT and WB-MRI are efficient diagnostic triage methods for patients planned for RE of liver metastases. Overall, FDG-PET-CT shows a higher diagnostic accuracy compared to WB-MRI and may be used as imaging method of choice as a standalone examination. In combination, both modalities exhibited high sensitivity for the diagnosis of extra-hepatic tumour manifestations and result in high specificity.
**B-0619** 10:30
High-pitch dual source CT pulmonary angiography in freely breathing patients
R.W. Bauer, B. Schell, M. Beeres, J. Wichmann, B. Bodelle, T. Lehner, T.J. Vogl, J.M. Kerl; Frankfurt a. Main/DE (ralfwbauer@aol.com)

**Purpose:** Breath hold may lead to Valsalva's manœuvre-induced contrast artefacts in the pulmonary arteries such as inhomogeneous enhancement or loss of the contrast bolus during pulmonary CT angiography. We investigated a novel high-pitch dual source CT protocol that does not require a breath hold phase.

**Methods and Materials:** 76 consecutive patients underwent CT pulmonary angiography (CTPA) in dual source high-pitch mode (pitch 3.0, 100 kV, 180 mAs, 50 ml contrast material) without breathing command. Pulmonary arterial (PA) enhancement, image noise, signal-to-noise ratio, overall image quality, incidence of total or partial interruption of the contrast column in the PA tree, motion artefacts of the aortic root, diaphragm and pulmonary structures were recorded.

**Results:** Mean central and peripheral PA attenuation was 404±104 HU and 453±119 HU, mean image noise 11±2 s, mean DLP 142±31 mGy/cm. There were no motion artefacts of the diaphragm or the pulmonary vessels related to breathing. There was no case of partial or total interruption of the contrast column in the PA tree, no examination was rated non-diagnostic. In 62/76 cases, the aortic root was pictured without any motion artefact and with satisfying contrast enhancement to rule out dissection.

**Conclusion:** High-pitch dual source CTPA in freely breathing patients effectively avoids artefacts related to breath hold or breathing as well as to cardiac motion and thus represents a reliable tool to rule out pulmonary embolism. With further optimised contrast injection, aortic dissection may be additionally ruled out within the same examination without the use of ECG-synchronisation.

**B-0620** 10:39
Breath-hold at ease: a method of improving the diagnostic quality of CT pulmonary angiogram
K.K. Lau, J. Li, N. Ardley, T. Lau; Melbourne, Victoria/AU (kenklau@yahoo.com.au)

**Purpose:** 6-8% of CT pulmonary angiography (CTPA) is inconclusive due to poor contrast enhancement of pulmonary arteries (PA). Typically, CTPA is undertaken after patient taking fully inspiration and breath-holding. The sudden negative intrathoracic pressure during quick inspiration increases venous return to the heart and dilutes the contrast in PA (transient interruption of contrast). The valsalva associated with breath-holding lowers the cardiac output and delays the peak contrast opacification of the PA. The aim of this study was to assess the efficacy of breath-hold at ease during CTPA on the contrast enhancement of PA.

**Methods and Materials:** CTPAs were undertaken in 51 consecutive patients who deeply inspired and breath-held during scanning, and 73 consecutive patients who simply breath-held at ease. Housefields units (HU) in pulmonary trunk, main pulmonary arteries and proximal branches were measured by 2 blinded readers. Results were compared between 2 patient groups. PE and co-existing lung diseases were also recorded.

**Results:** Suboptimal contrast enhancement was found in 15.6% of the deeply inspired group and 2.8% of the at ease group. HUs ranged from 320 to 337 in different part of PAs in the inspired group and 375 to 400 in the at ease group, with 18.8% mean increase of contrast density (p = 0.001). Images of the lung parenchyma in both groups were considered adequate. Less breathing artefact was noted in the at ease group.

**Conclusion:** Breath-holding at ease during scanning improves the overall contrast density in the PA, and therefore, the diagnostic quality of the CTPA.

**B-0621** 10:48

**Purpose:** To evaluate the pulmonary blood flow using dynamic chest x-ray without contrast enhancement in comparison with 99mTc-MAA scintigraphy.

**Methods and Material:** Dynamic chest pulsed x-ray at 7.5 frames per second in total 10 second of tidal breathing was performed in 30 patients with pulmonary disease. The institutional review board approval and written informed consent was obtained in all patients. Image datasets were extracted by signal intensity pixels of blood flows using a band-pass filter optimised for heart beats. Determined blood flows was divided into eight fields (upper, middle, lower, subpleural in right and left) in each arterial and capillary phases, and was compared with the 99mTc-MAA scintigraphy.

**Results:** All patients were performed technically with the total exposed dose of 0.131 mGy. The blood flows in each upper, middle, lower, and subpleural fields were 14.2±4.6, 20.0±5.2, 16.3±4.6, and 1.1±0.8 in the right, and 18.1±5.2, 21.3±8.0, 21.0±3.8, 7.7±4.5 and 1.5±1.3 in the left in arterial phase. The capillary blood flow signals were 17.7±4.5, 21.3±8.3, 19.5±3.4, and 1.5±0.9 in the right and 15.1±3.3, 15.7±5.7, 7.3±3.1, and 1.9±1.7 in the left in this study. In those cases, The 99mTc-MAA uptake was 63±32.8, 18.0±6.5, 22.8±7.5, 4.3±3.1 in the right and 8.9±4.2, 19.2±3.9, 15.3±5.3 and 5.2±3.2 in the left, respectively. Comparison of the examinations had good correlations with R=0.742 in arterial phase and R=0.714 in capillary phase.

**Conclusion:** Dynamic chest x-ray blood flows had good colation with 99mTc-MMA scintigraphy. This method may allow measurement and quantification of pulmonary blood flows without contrast.

**B-0622** 10:57
"Stunned lung": a novel observation of resolving pulmonary embolism on lung perfusion CT
J.H. Reid, E. van Beek, M. Williams, M. Connell, J.T. Murchison; Edinburgh/UK (joh.reid@borders.scot.nhs.uk)

**Purpose:** Pulmonary emboli (PE) frequently resolve in an inconsistent manner. A pilot study was carried out to assess CT perfusion patterns of PE resolution and to potentially identify viable parenchyma exhibiting delayed perfusion similar to the phenomenon of 'stunned' myocardium.

**Methods and Materials:** Following institutional approval, a pilot study of 12 patients (6M:6F; mean 62 years) with CTPA diagnosis of major PE were prospectively evaluated by CT lung perfusion after an average of 4 months. Thrombus load (modified Miller score MMS) and RV:LV ratio were determined. Perfusion maps were visually scored and correlated with residual endoluminal filling defects. Defects were further assessed by generating time/perfusion curves using regions of interest.

**Results:** The mean initial thrombus load was MMS 15 and mean RV:LV ratio was 1.36:1. The mean residual thrombus load was MMS 2 (range 0-7) with no post-treatment RV dilatation. Only 4 (33%) patients were clear of residual thrombus, and only 2 patients (16%) had no residual perfusion defects after a minimum of three months treatment. Perfusion defects ranged from 10% to 80% of the affected lung. CT perfusion defects matched areas showing residual embolic material in only 3 cases. In 4 (33%) patients perfusion defects showed delayed contrast enhancement.

**Conclusion:** Most patients have perfusion defects throughout three months, often substantial and these may not correspond with the areas of residual endoluminal material. Some defects exhibit delayed enhancement (which we have termed ‘stunned’) lung suggesting they may potentially respond to revascularisation techniques.

**B-0623** 11:06
Volume rendering reconstruction of right ventricle improves interobserver agreement and accuracy of interventricular septum bowing sign in patients with acute pulmonary embolism
G. Staskiewicz, E. Czekajska-Chehab, J. Przegalinski, S. Uhlig, K. Torres, R. Maciejewski, A. Drop; Lublin/PL (grzegorz.staskiewicz@gmail.com)

**Purpose:** Bowing of interventricular septum (IVS) is one of the signs of severe PE adapted from echocardiography; however, it is affected by high interobserver variability. The aim of the study was to evaluate application of volumetric reconstruction of the right ventricle for improvement of reliability of this sign.

**Methods and Materials:** 60 consecutive patients with CTPA diagnosis of acute PE and echocardiographically measured pulmonary artery systolic pressure (PASP) were included into the study. IVS bowing was evaluated with planar reformat-
Assessment of the correlation between CT angiographic clot load score, pulmonary perfusion defect score and global right ventricular function by dual source CT for acute pulmonary embolism

Y.-F. Zhou, P. Han, Y. Wang, H. Shi; Wuhan/CN (zhouyufengmm@126.com)

Purpose: To investigate the correlation between CT angiographic clot load (CTACL) score, pulmonary perfusion defect (PPD) score and the global right ventricular function in the assessment of the severity of pulmonary embolism (PE).

Methods and Materials: Forty-nine patients with acute PE, who underwent dual source CT scan, were included in the study. CT angiography and perfusion imaging were performed. The data from ECG-gated coronary angiography scanning protocol were used for right ventricular function analysis. Two readers evaluated the CTACL and PPD scores according to the Qanadli and Chae methods, respectively, and their results were in consensus.

Results: The PPD score had a strong positive correlation with the CTACL score ($r = 0.72, p < 0.001$) and both scores, in turn, had a strong positive correlation with the right ventricular/left ventricular (RV/LV) diameter ratio ($r = 0.80, r > 0.001, p < 0.001$). However, the PPD score had a strong negative correlation with ejection fraction (EF) ($r = 0.83, p < 0.001$) while the CTACL score had a low negative correlation with EF ($r = -0.33, p < 0.05$). Between the RV/LV<1 group (n=35) and the RV/LV>1 group (n=14), the PPD score, CTACL score, pulmonary artery trunk diameter, EF and reflux of inferior vena cava were significantly different, all with $p < 0.001$. The end-diastolic volume ($p>0.01$) was significantly different but the end-diastolic volume ($p=0.08$) showed no statistically significant difference between the two groups.

Conclusion: Therefore, considering PPD scores, CTACL scores and cardiovascular manifestations together may be helpful in the evaluation of PE severity (accepted by BJR).

Comparison of high sensitive troponin I and quantitative CT parameters for prediction of adverse clinical events in patients with acute pulmonary embolism

P. Apfaltrer1, F. Weilbacher1, M. Meyer1, T. Henzler1, T. Walter1, J. Gruettner1, U.J. Schoepf2, C. Fink1; 1 Mannheim/DE, 2 London/UK

Purpose: To compare high sensitive troponin I (hsTnI) and quantitative CT parameters for prediction of adverse clinical events in patients with acute pulmonary embolism (PE).

Methods and Materials: Pulmonary CTA studies of 629 patients were retrospectively evaluated. 65 patients (67 years [20 - 90]) had acute PE and hsTnI measurement within 24 hours of CT. Right ventricular dysfunction (RVD) was assessed on CT by calculating the right ventricular/left ventricular (RV/LV) diameter ratios on transverse sections (RV/LVtrans), four-chamber views (RV/LV4ch), RV/LV volume ratio (RV/LVvol). Pulmonary CTA obstruction scores (OS) (Qanadli, Mastora) were calculated. HsTn, RV/LV ratios, and OS were compared for predicting adverse clinical events.

Results: 12 patients with PE had at least one adverse clinical event (intensive care treatment n=11, death n=2); those patients showed significantly higher RV/LV ratios and OS compared to those without (RV/LVtrans 1.63±0.48 vs 1.5±0.31; RV/LV4ch 1.67±0.41 vs. 1.3±0.34; RV/LVVolume 2.92±1.16 vs. 1.34±0.58; Mastora 61.5 [26.5-92] vs 6.5 [4-15.5]; and Qanadli 20 [10-32] vs. 11 [3-31] (p=0.0058)). Elevated hsTnI was significantly associated with adverse clinical events (14% vs. 9%; $p < 0.05$; adjusted OR= 4.88; 95% CI 1.3-16.7; $p < 0.05$). HsTnI showed no correlation with RV/LV ratios or OS. The AUC for the prediction of adverse clinical events of RV/LV4ch, RV/LVVolume, and hsTnI were 0.77, 0.75, and 0.64. The combination of hsTnI and RV/LV ratios revealed no increase in the AUC.

Conclusion: HsTnI is associated with adverse clinical events. A combination of hsTnI with CT parameters showed no further improvement in the prediction of adverse clinical events.
B-0622 11:51
Use of pulmonary CT angiography to diagnose anaemia

Purpose: Anaemia is associated with increased mortality in patients with acute symptomatic pulmonary embolism (PE). The purpose of this study was to evaluate the feasibility of a Hounsfield unit (HU) measurements on a single unenhanced trigger scan of pulmonary CT angiography scans for the diagnosis of anaemia as a potential prognostic marker.

Methods and Materials: 150 consecutive patients with suspected PE underwent pulmonary CT angiography. Two radiologists, blinded to laboratory results, performed HU measurements in the single unenhanced trigger scan independently by region-based analysis (ROI). HU values from ascending and descending aorta and the calculated mean of both were correlated with serum haemoglobin levels. Inter- and intraobserver variability was determined for HU measurements, and receiver operating characteristic (ROC) analysis was performed for diagnosis of anaemia. Calculated linear models were used to assess formulas for estimation of haemoglobin levels from HU measurements.

Results: HU measurements revealed high intra- and interrater reliability (ICC> 0.981 and ICC> 0.965, respectively). Calculated mean HU values showed a moderate correlation with serum haemoglobin levels (r=0.734), which allowed generation of different formulas for calculation of haemoglobin levels from HU measurements. ROC analyses confirmed a high sensitivity (80.4 for men; 91.3 for women) and specificity (84.0 for men; 84.9 for women) for diagnosing anaemia.

Conclusion: Diagnosis of anaemia and quantification of haemoglobin levels upon a single unenhanced trigger scan of pulmonary CT angiography is feasible. We suggest disclosing the anaemic state in the radiological report, independent of the presence of PE, since anaemia carries increased risks of morbidity and mortality.

10:30 - 12:00 Room D2
Interventional Radiology
SS 1309
Special indications
Moderators:
E. Criado Paredes; Sabadell/ES
M.J. Lee; Dublin/E

B-0629 10:30
Predictors and volume measurement of residual flow in embolised intracranial aneurysms at follow-up
Z. Serafin, P. Strzebinski, W. Lasek, W. Beuth; Bydgoszcz/PL (serafin@cm.unik.pl)

Purpose: The possibility of recanalisation and the need for retreatment are the most important drawbacks of intracranial aneurysm embolisation. The volume of residual flow at follow-up is a key factor that determines decision on the aneurysm re-embolisation. The purpose of the study was to determine factors predicting the presence of residual flow at follow-up and to compare volumes of the flow measured with 3D digital subtracted angiography (DSA) and magnetic resonance angiography (MRA).

Methods and Materials: In 72 consecutively examined patients 26 aneurysms were found incompletely occluded. Independent predictors of the residual flow were determined including anatomical and clinical factors. Diameter and volume of residual flow areas were compared between three-dimensional DSA (3D-DSA), time-of-flight MRA (TOF-MRA), contrast-enhanced MRA (CE-TOF-MRA), and contrast-enhanced MRA (CE-MRA).

Results: Aneurysm neck size and sac-to-neck ratio were independent predictors of residual flow (P<0.0001). A ROC curve cut-off points were 2.8 mm for aneurysm neck size, and 1.73 for sac-to-neck ratio. The mean recanalisation volume ranged from 16.3 mm³ in TOF-MRA to 30.5±44.6 mm³ in 3D DSA (P=0.04, ANOVA). A direct comparison revealed significant differences in the volumes measured with 3D DSA and CE-MRA as compared to TOF-MRA and CE-TOF-MRA (P<0.05).

Conclusion: The presence of the residual flow within the embolised aneurysm is predicted by the aneurysm anatomy. TOF-MRA and CE-TOF-MRA tend to underestimate the size of the flow. The definitive decision on re-embolisation should be made basing on 3D DSA.
during a mean follow-up period of nine months (range 3 months to 3 years). Stents malfunction occurred in 7 cases and all these stents were easily withdrawn; in the rest of the cases the stents remain in place and functional.

**Conclusion:** Treatment of epiphora with polyurethane stents is a technique that is well tolerated by patients and achieves a high long-term success rate comparable to surgical dacryorhinostomy.

**B-0633** 11:06
The 100 classical papers of interventional radiology - the evolution of a specialty
M.T. Crockett, O. Buckley, W. Torreggiani, R. Browne; Dublin/IE
(CROCKETTMTMT@GMAIL.COM)

**Purpose:** The value of a scientific paper is defined by its impact on the biomedical field in which it is published. Papers which impact greatly on their field achieve classical status. This may be defined using the concept of a citation classic—the number of times a paper is cited reflects its impact and relevance. The purpose of this study was to identify and analyse the 100 most cited interventional radiology papers of the last 70 years.

**Methods and Materials:** Using the JCR database the 50 highest impact factor radiology journals were selected for review. From these journals the 100 most cited interventional radiology papers of last six decades and provides a fascinating insight into the changing discourse within the field. It also identifies the topics, authors and institutions which have had the greatest impact on the specialty.

**Results:** The most cited paper received nearly 2500 citations whilst the average number of citations was 320. The oldest paper was published in 1953 and most recent in 2005. Most papers originated in the USA followed by Italy, France and Germany. The three most prolific institutions were Harvard University (USA), Os- torericklar Hospital (Italy) and Massachusetts General Hospital (USA). The 100 most cited papers were published in 10 journals with Radiology & AJR making up the majority. Five authors have > 3 first name papers in the top 100 with SN Goldberg on top.

**Conclusion:** This analysis identifies many of the landmark interventional radiology papers of last six decades and provides a fascinating insight into the changing discourse within the field. It also identifies the topics, authors and institutions which have had the greatest impact on the specialty.

**B-0634** 11:15
Percutaneous arterio‑venous shunting in patients with severe COPD: a novel interventional treatment
T. Schlösser, M. Burbeilko, M. Ulrich, G. Antoch, R. Adamus; Essen/DE (thomas.schloesser@uni‑due.de)

**Purpose:** The aim of this study was to evaluate the technical feasibility and safety of a new interventional-radiological technique to create a shunt between the external iliac vein and arteries in patients with severe COPD. The creation of this fistula aims improving pulmonary oxygenation, reducing systemic vascular resistance and increasing cardiac output in these patients.

**Methods and Materials:** Thirty-seven patients were included in this multicentre trial. Two patients had to be excluded from the study based on two cases of iliac vein and arteries in severe COPD. The new publications were chosen and further analysed.

**Results:** Shunt implantation was successful in all 35 patients. The perfused arterio‑venous shunts could be well documented in DSA and the diameter was measured between 3 and 4 mm in all cases. Peri-interventional dissection of the iliac artery occurred in one patient. This dissection was not flow limiting. Post-interventional arterio‑venous bleeding in one patient was treated successfully by local compression.

**Conclusion:** The new intervention-radiological technique to create an arterio‑venous shunt in the iliac vessels presented in this study has proven to be feasible and safe. The intended improvement of pulmonary oxygenation to reduce dyspnoe in patients with severe COPD has to be evaluated.

**B-0635** 11:24
The safety and efficacy of flow diversion treatment of intracranial aneurysms: preliminary results
D. Bagatto, B. Petralia, R. Girometti, M. Bazzocchi; Udine/IT (daniele.bagatto@gmail.com)

**Purpose:** To illustrate monocentric experience of flow diversion approach for endovascular treatment of intracranial aneurysms. To assess the safety and efficacy of this alternative and promising technique in comparison with coil and stent-assisted coil embolisation.

**Methods and Materials:** We retrospectively reviewed one-hundred and fourteen consecutive patients (36 males, 78 females; mean age, 56.2 years; s.d., ±13.8) with 125 intracranial aneurysms treated in our Institution with endovascular approach between January 2009 and July 2011. Efficacy in deployment procedure and angiographic outcomes at follow-up (in terms of complete aneurysm occlusion) were compared using Fischer’s exact test between patients treated with a flow diverter device (SILK flow diverter (SFD)), patients treated with coil and those treated with stent-assisted coil embolisation.

**Results:** Among all cases, 10 (8%) were treated with SFD, 97 (77.6%) with coiling and 18 (14.4%) with stent-assisted coiling. Endovascular treatment was successfully performed in 114/125 (91.2%) aneurysms. SFD could not be delivered in 210 (20%) cases while coil embolisation failed in 8/97 (8.2%) cases and stent-assisted coil embolisation in 1/18 case (5.5%) (p=0.04). We obtained a complete aneurysm occlusion in all cases treated with SFD and no significant statistical difference (p=0.05) was found at 8.3±7.4 months (mean±s.d.). angiographic follow-up between the three different groups.

**Conclusion:** Although some difficulties in deployment procedure in comparison with coil and stent-assisted coil embolisation the treatment of intracranial aneurysms with SFD seems to be highly efficacious and early angiographic follow-up results are quite encouraging.

**B-0636** 11:33
Post--traumatic epistaxis treated with embolisation
K. Pyra, T. Jargiello, P. Trojanowski, M. Jarzabek, M. Szczerbo-Trojanowska; Lublin/PL (k.pyra@pozca.pl)

**Purpose:** Epistaxis is a common consequence of craniofacial injury, involving damage to the external carotid artery branches. Depending on the intensity and the site of bleeding and also on the experience of the medical team conservative treatment, surgical or endovascular treatment is applied. In this paper, the possibility of endovascular embolisation and its effectiveness in the treatment of epistaxis following craniofacial injury is evaluated.

**Methods and Materials:** There were 24 patients (16 males and 8 females) in the mean age 41 years (21-64) with post-traumatic epistaxis. In 14 patients angiography. Disclosed pseudoaneurysms of the external carotid branches, in 7 extravasation of contrast media, in 3 caverno-carotid fistulae. Following diagnostic angiography the risk of endovascular embolisation was regarded to be too high in 3 patients. Remaining 21 patients were embolised using gelatin foam, polyvinyl alcohol particles, particles of acrylic polymer and platinum microcoils.

**Results:** In all embolised patients immediate arrest of epistaxis was achieved. In 4 cases (19%) the bleeding recurred, and in 2 was controlled with repeated embolisation. In 9 patients (43%) the side effect of the procedure was transient facial pain and swelling, parasthesia, trismus and fever. Those symptoms disappeared within a few days. In 3 patients (14%) sensory disturbances in the cheek area were permanent. One patient developed a small ulceration of the palate, successfully treated conservatively. There were no serious neurological complications in any of the patients.

**Conclusion:** Endovascular embolisation is an effective method of posttraumatic epistaxis and should be considered in planning of the treatment.

**B-0637** 11:42
Tracheobronchial stenting for malignant airway disease: long‑term results from a single centre

**Purpose:** To investigate the immediate and long-term outcomes of covered and uncovered self-expandable metallic stent (SEMS) insertion for the management of tracheobronchial malignant disease.

**Methods and Materials:** We retrospectively searched our department database for patients treated with covered or uncovered SEMSs for the management of tracheobronchial pathology owing to local or metastatic disease. Between January 2009 and December 2010, in total, 49 patients (27 males, mean age 60.9±s.d. years) underwent 77 SEMS insertions (57 uncovered, 20 covered). The hybrid procedure was performed under bronchoscopic and fluoroscopic guidance. The study’s primary endpoints included technical success, and symptomatology recurrence rates, while secondary endpoints included patients’ survival and complication rates. Baseline demographics and procedural details were recorded.

**Results:** Technical success rate was 97.9% (48/49 cases). In total 14 kissing (both bronchus), 23 main bronchus, 1 distal bronchus, 9 tracheal and 2 tracheal plus main bronchus stenting deployments were performed. The mean time follow-up was 5.5±s.d. months (range 0.3-24 months). The symptomatology recurrence rate
was 14.5% (7/48 patients) and was attributed to stent occlusion due to tumour ingrowth (4/48, 8.3%), stent migration (2/48, 4.1%) and bronchospasm (1/48, 2%). The estimated patients’ survival rate according to the Kaplan-Meyer statistical analysis was 21.5%, up to 2 years of follow-up, while the overall complications rate was 3.8% (3/77 stents).

**Conclusion:** Tracheobronchial SEMSs provide safe and effective minimally invasive management of patients suffering from symptomatic malignant airway disease.

**B-0638** 11:51

Follow-up of radiotherapeutically inserted TCVAP of the upper arm: long-term complications in 127750 catheter days

J.D. Bunsch, F. Heller, J. Herrmann, B.P. Schoenagel, G. Adam, C.R. Hiebermann; Hamburg/DE (j.d.bunsch@uke.de)

**Purpose:** To retrospectively evaluate radiotherapeutically placed totally implantable central venous arm ports (TCVAP) in terms of safety, technical feasibility and device-related complications.

**Methods and Materials:** 507 consecutive patients (mean age 59.2 years, range 19.5-88.5 years, male/female ratio 236/271), who received a TCVAP between January 2005 and July 2010 at our university hospital, were included into this study. The insertion procedure was performed in an interventional radiology suite. Two different vascular access systems (Titanium Vital-Port® Mini, Cook Medical Inc., Bloomington/USA (n = 465); Titanium Vital-Port® Petite, Cook Medical Inc., Bloomington/USA (n = 58)) were used. No antibiotic prophylaxis or long-term anticoagulant medications were routinely administered.

**Results:** In 507 patients in total 523 devices were implanted. All procedures were completed without major complications with a primary technical success of 99.04%. During follow-up and a total number of 127750 days (in mean 248±279 days per patient; range 1-1687 days) of TCVAP implantation, 50 patients had to be revised due to complications (9.9%). Those were observed after a mean duration of 114±183 days (range, 1-1113 days): 21 (4.1%) early complications and 29 (5.7%) late complications. Complications were as follows: 25 patients (4.9%) had local infection; two had systemic infection (0.4%); eight patients developed venous thrombosis (1.4%); three had paralysis of the median nerve (0.6%), one suffered from skin dehiscence at the port site (0.2%) and eleven patients (2.2%) required revision owing to mechanical problems.

**Conclusion:** Radiotherapeutically inserted TCVAP can be safely used and has a low complication rate during follow-up.

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

**Musculoskeletal**

**SS 1310**

**Tumours**

Moderators: G.M. Allen; Oxford/UK C. van Rijswijk; Leiden/NL

**B-0639** 10:30

DCE MRI in differential diagnosis of soft tissue masses

T. Bobba1, V. Clementi2, M. Stratta1, G. Reggi1, A. Gallo1, A. Linari1, R. Plana1, C. Paletti1; 1 Turin/IT, 2Bologna/IT (tiziarobba@yahoo.it)

**Purpose:** The role of DCE MRI (dynamic contrast-enhanced magnetic resonance imaging) in differential diagnosis between benign/malignant soft tissue masses.

**Methods and Materials:** During standard MRI we performed DCE MRI in 33 soft tissue mass using 3D FSPGR (fast-spoiled-gradient-recalled-acquisition-in-steady-state) multi-phase sequences (temporal resolution ranging from 4 sec - to 10 sec after contrast-media Multihance 2.5 ml/s) and saline (20 ml at 2.5 ml/s) injection. The signal-intensity/time curves were obtained from regions of interest on arterial and venous vessels, skeletal muscle and the areas with highest enhancement. We evaluated the morphologic patterns of signal-intensity/time curves and correlated them with histologic diagnosis data, except for 1 angioma, 1 myositis ossificans and 2 haematoma.

**Results:** We obtained four patterns of curves: 1) an exponential curve parallel to arterial curve followed by a plateau or a further increase of enhancement: 7 sarcoma and 1 myositis ossificans; 2) gradual progression of enhancement with the peak between arterial and venous curve, followed by a plateau: 4 sarcoma; 3) gradual progression of enhancement with the peak after the venous curve, followed by a further increase of enhancement: 5 sarcoma and 4 benign tumours (2 neurinoma, 1 angiomia, 1 desmoid tumour); 4) none or equal to muscle enhancement: 9 benign lesions, 3 liposarcoma lipoma-like.

**Conclusion:** In our experience the presence of an exponential curve parallel to arterial is highly suspicious for malignant lesion, while an enhancement equal to that of muscle excludes the malignancy, except for the liposarcoma lipoma-like. DCE MRI may confirm the diagnosis of neuromia.

**B-0640** 10:39

Diffusion-weighted imaging as a non-invasive predictor of tumour grading in soft tissue sarcoma

M.C. Herbrick, L. Umutlu, J. Kalkmann, S. Bauer, L. Podleska, F. Grabellus, G. Taeger, T. Lauenstein; Essen/DE (m.herbrick@gmx.de)

**Purpose:** Tumour grading is a valuable predictor with regard to prognosis and therapy management of soft tissue sarcomas (STS). Histopathology has been considered the gold standard of tumour grading. The aim of our study was to assess the diagnostic potential of diffusion-weighted MRI as a non-invasive predictor of tumour grading.

**Methods and Materials:** 17 patients with histologically proven STS were enrolled in this trial and were examined prior to isolated limb perfusion (ILP) on a 1.5 Tesla scanner. Beyond clinically applied sequences, a transversal EPI-DWI sequence was collected. Signal intensity-time curves were compared to tumour viability volumes estimated by computer-aided quantification of ADC values.

**Results:** According to histopathology 5 tumours were rated as G2 and 6 tumours were rated as G3 and G4 each. Correlation of histopathologic grading and ADC values allowed for a statistical significant differentiation of G2 (ADC 0.009) and G3 tumours (ADC 0.01) (p=0.04). However, assessment of ADC values did not show a statistical significant difference in the differentiation of G2 to G4 or G3 to G4 tumours (p=0.06).

**Conclusion:** Diffusion-weighted imaging can be a non-invasive predictor of tumour grading for differentiation between G2 and G3 soft tissue sarcoma.

**B-0641** 10:48

Comparison of viable tumour volumes estimated on dynamic MRI by computer-aided quantification technique with the tumour viability scores of pathology following excision of soft tissue sarcoma’s: prospective study

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**Purpose:** To assess the accuracy of viable tumour volume estimated using computer-aided technique on dynamic MRI datasets.

**Methods and Materials:** In this on-going prospective study, viable tumour estimates obtained by pathologist on 16 slices of soft tissue sarcoma specimens, post-excision were compared to tumour viability volumes estimated by computer-aided post-processing of post-gadolinium, dynamic T1-weighted fat-saturated (FS) sequence from MRI datasets. The MRI for these patients was performed after undergoing pre-operative chemotherapy or radiation treatment and within 7-10 days before excision.

**Results:** The viable-appearing tumour volume percentage derived from dynamic MRI contrast acquisitions was within 1.96 standard deviation (SD) [-82.0 to 115.7] of the BA plot indicating similarity to pathological tumour viability estimates and good correlation (r = 0.804; p < 0.0001; 95% confidence interval= 0.7309 to 0.9455). There were no outliers in the BA plot.

**Conclusion:** The viable tumour fractions obtained by computer-aided quantification methods on dynamic MRI datasets for soft tissue sarcoma show similar results to surgical pathology estimates of viable tumour fraction after excision of soft tissue sarcoma. These findings warrant validation on a larger cohort of patients.
Conclusions: by means of a significant decrease under therapy. showed a statistically significant increase of mean ADC values, in terms of a regression correlation with histopathologic response, the evaluation of DWI imaging parameters included TR/TE = 9700/78 ms, slice thickness 7 mm, voxel size: 2.0x2.0x7.0 mm, acquisition time 6:18 min, b-values: 50, 500, 1000). Morphologic analysis was assessed according to RECIST-criteria. For functional analysis ADC-values as well as CNR (in correlation to healthy muscle tissue) were evaluated. Results were correlated with histopathologic regression after surgery. The changes in ADC values were compared by Wilcoxon signed rank test. Results: According to histopathology 14 patients were determined as responders. While morphologic assessment of therapy response did not show statistical significant correlation with histopathologic response, the evaluation of DWI imaging showed positive statistically significant increase of mean ADC values, in terms of a regression of diffusion disruption. CNR values confirmed positive pathologic response, by means of a significant decrease under therapy. Conclusion: DWI can be used for the assessment of therapy response of STS after ILP.

B-0644 11:15
MRI with diffusion-weighted imaging and apparent diffusion coefficient (ADC) in patients with multiple myeloma: preliminary results
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Purpose: To assess the added value of ADC in the evaluation of response to chemotherapy (CT) in patients with multiple myeloma (MM). Methods and Materials: 20 patients with MM underwent 1.5 T WB-MRI (Achieva, Philips) from vertebra to feet, before and after CT, with the following protocol: coronal and sagittal short T2 inversion recovery (STIR) T2, T1 TSE and axial DWIBS sequences (b-factor: 0, 500, 1000 mm2/sec). DWIBS images were compared with T1 and STIR images in five districts (skull, spine; sternum and ribs; pelvis; upper and lower limbs) to evaluate response to treatment. ROI were manually drawn along contours of tumours on ADC maps. The mean ADC values of lesions and percent-age variation of ADC (ΔADC) before (MR1) and after (MR2) CT were calculated and compared between responders and non-responders. Results: All primary tumours were correctly detected on MRI and response to CT was established in intensity signal decrease over a period of time during follow-up. Compared to normal bone marrow, tumour showed high signal intensity on DWI. The mean ADC values were on MR1: 0.54 ± 0.22 x10-3 mm2/sec and on MR2: 0.99 ± 0.25 x10-3 mm2/sec. The mean percentage of tumour ADC changes in responders (Δ=66%) was significantly different (p<0.05) than that in non-responders (Δ=15%), in relation to the higher cellularity of neoplastic bone marrow involvement. Conclusion: MRI DWI is a non-invasive tool able to predict early therapeutic response in patients with MM, by determining individual changes of ADC values corresponding to biological changes in tumour tissue.

B-0645 11:24
Diagnostic value of quantitative diffusion-weighted MRI and chemical-shift imaging in the differentiation of benign and malignant vertebral fractures: evaluation in a prospective group of patients
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Purpose: To compare the diagnostic value of qualitative diffusion-weighted imaging (DWI), quantitative DWI, and chemical-shift imaging in a single prospective cohort of patients with acute osteoporotic and malignant vertebral fractures. Methods and Materials: Patients with 26 osteoporotic (18 women, 8 men, mean age 69, 31.5-86.2 years) and 20 malignant vertebral fractures (9 women, 11 men, mean age 63.4, 24.7-86.4 years) were included. T1-weighted, STIR and T2-weighted sequences were acquired at 1.5 T. A diffusion-weighted steady-state free-precession sequence (PSIF) at different delta values was evaluated qualitatively. A diffusion-weighted echo-planar imaging (EPI) and diffusion-weighted single-shot turbo spin echo (ssTSE) sequence at different b-values were evaluated qualitatively and quantitatively, using the apparent diffusion coefficient. Opposed-phase sequences were used to assess signal intensity qualitatively. The signal loss between in–lopped-phase images was determined quantitatively. Two-tailed Fisher’s exact and Mann-Whitney tests, and ROC-analysis were performed. Sensitivities, specificities and accuracies were determined. Results: Qualitative DW-PSIF showed the highest accuracy (delta=3 ms: sensitivity 100%, specificity 88.5%, accuracy 93.5%). Qualitative DW-EPI and DW-ssTSE indicated no significant differences between benign and malignant fractures (p>0.05), except DW-EPI at b=500/500 ms (p<0.05). Quantitative DW-EPI and qualitative opposed-phase imaging exhibited no significant differences (p>0.05). Quantitative DW-ssTSE and quantitative chemical-shift imaging showed significant differences between benign and malignant fractures (p<0.05).

Conclusion: DW-PSIF (delta=3 ms) had the highest accuracy in differentiating benign and malignant vertebral fractures. Quantitative chemical-shift imaging and chemical-shift DW-EPI had a lower accuracy (Delta<39%) in DW-ssTSE because of a large overlap. Qualitatively assessed opposed-phase, DW-EPI and DW-ssTSE and quantitative DW-EPI were not suitable to differentiate between benign and malignant vertebral fractures.

B-0646 11:33
Magnetic resonance-guided focused ultrasound (MRgFUS) for the treatment of osteoid osteoma
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Purpose: The aim of our study was to evaluate the safety and efficacy of the MRgFUS as a non-invasive method for the treatment of pain caused by osteoid osteoma. Methods and Materials: Selected and informed patients with limited joint function and reduced quality of life due to painful osteoid lesion, confirmed at work-up MRI and CT exam underwent MRgFUS (ExAblate 2100, InSightec, Haifa, Israel) in repositioning the T3 MR system (GE). Clinical evaluation was assessed using visual analogue scale (VAS). Each patient was planned with a maximum of 5 son.yations to complete nidus ablation. Clinical and imaging follow-up was performed 1 and 3 months after treatment. 3 patients with osteoid lesion underwent MRgFUS treatment. In two patients we treated a small and subperiosteal-located osteoma: one patient had a larger lesion (osteoblastoma).

Results: After treatment, VAS questionnaires demonstrated in two patients with typical osteoma the complete disappearance of painful symptoms, while third patient referred an initial reduction of pain and a gradual recurrence of symptoms. There were no observed treatment-related complications peri and post-procedure.

Conclusion: In our experience, MRgFUS represents a safe and effective treatment for the ablation of osteoid osteoma.
**B-0647** 11:42

**Pain palliation of bone metastasis: initial clinical experience using high-intensity focused ultrasound therapy with magnetic resonance guidance**

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**Purpose:** To determine the efficacy of non-invasive high-intensity MR-guided focused ultrasound (MRgFUS) treatment for palliation of bone metastasis pain in patients not candidates for external beam radiotherapy (EBRT).

**Methods and Materials:** Under the IRB approval 18 patients with 21 lesions underwent MRgFUS treatment using the ExcAblate 2000 system (inSightec). Treatments were done in a single session, in an ambulatory setting. 12 patients underwent prior EBRT with a mean 6 months recurrent pain. In 6 patients MRgFUS treatment was performed as first treatment modality. Effectiveness of pain palliation was evaluated at follow-up using the visual analog pain score (VAS) and measurable changes in analgesics intake. For tumour control perfusion T1w-images were obtained pre- and post-treatment in order to determine the non-perfused sonication-related area.

**Results:** All patients and all lesions were treated. Mean follow-up time was 4 months. At baseline VAS was 7.1; it was 4.8 at 3 days, 3.0 at two weeks and 2.6 and 2.4 at one and four months, respectively. No heating-related adverse event was recorded during this clinical application; patient medication intake was considerably reduced. Variable degree on non-perfused volume was observed after treatment, mainly within the pericortical region. Deeper penetration of the acoustic energy is at present desirable even if technically difficult to achieve with the current system.

**Conclusion:** MRgFUS is a promising non-invasive treatment modality for successful palliation of bone metastasis pain in patients who are not candidate for EBRT.

**B-0648** 11:51

**Iterative decomposition of water and fat with echo asymmetry and least-squares estimation (IDEAL) fast spin-echo imaging of the vertebral column metastasis: initial clinical experience**

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**Purpose:** Our purpose was to test reliability and accuracy of iterative decomposition of water and fat with echo asymmetry and the least-squares estimation (IDEAL) method in combination with fast spin-echo imaging, in detecting vertebral metastasis and comparison of IDEAL and routine sequences in detection of the metastasis.

**Methods and Materials:** We compared IDEAL fast spin-echo with conventional fat-suppressed fast spin-echo imaging in 22 patients, who came for metastatic work up in the vertebral column. Routine spin echo and STIR sequences were acquired in all the cases. Each lesion was documented as benign or malignant based on the routine sequences and IDEAL sequence, and a corroborative data were also generated. Statistical correlation was performed.

**Results:** 6 subjects demonstrated breast metastases, 4 showed prostatic metastasis and 3 from unknown primary and one had a large presumptive schwannoma. 15 subjects demonstrated degenerative disc disease with associated ModicType I or II changes at one or more levels. In all cases, marrow signal abnormalities could be particularly well characterised with IDEAL-derived images and parametric ratio maps. Marrow signal abnormalities could be particularly well characterised with IDEAL-derived images and parametric maps. Correlation of the lesion detection by routine spin-echo sequences and IDEAL sequence, a significant statistical difference was found in characterisation of the marrow signal abnormalities and lesion characterisation.

**Conclusion:** IDEAL sequence provides robust water-fat separation with optimised SNR performance. IDEAL imaging is a promising MRI technique affording a rapid automated high-resolution, high-contrast survey of the entire spine with optimised tissue characterisation.

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**SS 1301a** Rectal and gastro-oesophageal cancer

**Moderators:** A. Dieguez; Buenos Aires/AR

**C. Kulinna-Cosentini; Vienna/AT**

**B-0649** 10:30

**Nodal restaging after chemoradiation for locally advanced rectal cancer: predictive factors**

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**Purpose:** Restaging N-stage after CRT is more accurate than N-stage prediction at primary staging of rectal cancer. A ypN0 status after CRT is mandatory to allow for less invasive treatment after CRT (e.g. local excision). Aim was to identify predictive factors which can help a radiologist in predicting yN-stage.

**Methods and Materials:** For 39 patients with locally advanced rectal cancer all visible nodes in the mesorectum were measured and recorded before and after CRT on a 3D-T1W-GRE-sequence with 1 mm3 voxels. Baseline characteristics were collected and compared between patients with and without nodal involvement at histopathology. With regression analyses predictive factors for nodal involvement were identified. ROC curves were constructed for a predictive model based on the regression analyses.

**Results:** 882 nodes were identified, of which 380 (43%) disappeared after CRT. Patients with ypN+ had larger nodes than ypN0-patients: mean 6.3 vs 3.6 mm before CRT and 4.5 vs 2.3 mm after CRT, respectively (both p < 0.0001). Regression analyses identified pre- and post-CRT size, T-downstaging and higher age as predictive factors for ypN0. AUCs for the regression-based model, pre-CRT size and post-CRT size were 0.86, 0.78 and 0.78, respectively (p < 0.05).

**Conclusion:** Nodal size (both pre- and post-CRT), T-downstaging and higher age at primary staging are predictors of ypN0-stage. With this knowledge and by use of these criteria a radiologist could select ypN0-patients with higher sensitivity than when size is used as a single criterion. With a higher sensitivity less invasive treatment after CRT can be applied more safely.

**B-0650** 10:39

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

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**Purpose:** Nodal staging in rectal cancer remains insufficiently accurate. In a recent pilot-study we have shown improved performance in expert hands using gadofosveset-enhanced MRI (sensitivity 80%, specificity 97%). For the current study, gadofosveset-MRI was implemented in clinics (as part of ongoing research) and assessed by ‘non-expert’ abdominal radiologists. Aim was to identify the pitfalls of gadofosveset-MRI for nodal staging.

**Methods and Materials:** 44 patients underwent standard (T2W-FSE) and gadofosveset-MRI. Treatment-planning was based on T2W-MRI: 16 patients underwent (5x5 Gy) immediate surgery, 28 underwent chemoradiation + a restaging MRI and surgery. Patients were scored as cN0/cN+ 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, nodes were re-evaluated by a pelvic MR-expert on a per-node basis and compared with histology to identify the pitfalls.

**Results:** 27 patients were pN0-17 pN+. Thirty-three were correctly staged on gadofosveset-MRI (sensitivity 82%, specificity 70%); 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: decreased gadofosveset-uptake in presacral/per-vascular nodes (n=4), interpretation errors that were corrected after re-evaluation by the expert (n=3) and absence of gadofosveset-uptake eci (n=1).

**Conclusion:** Pitfalls mainly occur due to readers’ inexperience and insufficient uptake of gadofosveset in nodes located between vessels (high in the mesorectum). Gadofosveset-MRI can improve radiologists’ performance for nodal staging. Understanding the pitfalls and learning curve is crucial to allow broad clinical implementation.
Purpose: To evaluate the response of rectal adenocarcinoma to chemoradiation therapy (CRT) by 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.

Methods and Materials: We enrolled 28 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. ADCs values were calculated through the specific formula, while tumour-perfusion was calculated by a semi-quantitative perfusion software (DYCHO), developed on Matlab. We evaluated the changes of ADCs and D-CE-MR dividing patients into two groups: not-downstaged group (NR) and downstaged group (R) at histologic postoperative staging.

Results: 6 patients were NR while 22 were R. Pretreatment ADCs values were significantly lower; we observed a progressive increasing of ADCs values during treatment in R, while there was no significant ADCs increase in the NR (p = 0.003). The mean values of tumour ADCs change in the R was significantly higher than in the NR at each time point (p < 0.001). 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: Tumour response more likely occurs in pts who report higher LPI values on D-CE-MR analysis during treatment with respect to pre-treatment.

B-0652 10:57
Standardised index of shape (SIS): a novel semi-quantitative DCE-MRI parameter based on pattern analysis (PA) able to divide responder (R) by not responder (NR) after preoperative radio-chemo-therapy (pCRT) in locally advanced rectal cancer (LARC)
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Purpose: MRI is considered the best available tool for LARC staging after pCRT although in most cases to tumour response does not correspond a size reduction. To identify a DCE-MRI index based on PA which could differentiate between responders (R, TRG1 or TRG2) and not responders (NR, TRG3 or TRG4) after pCRT.

Methods and Materials: 40 patients underwent DCE-MRI examination before and after pCRT. Pre- and post-contrast T1w scans were acquired after GD-DOTA injection. Regions of interest (ROI) were drawn inside the tumour and after time intensity curves (TIC) were plotted. Basing on PA 13 shape descriptors were computed and SIS was defined as a new semi-quantitative parameter of PA able to evaluate residual tumour activity after pCRT in LARC, defining a robust cut-off value of 11.6% to separate R by NR.

Results: Performing Kruskal Wallis and Wilcoxon test for percentage change before and after pCRT in responders, maximum slope deviation (MSD), wash-in slope, wash-out intercept, area under the curve (AUC), AUC wash out (AUCWO) and heights ratio (HR) showed statistically significant differences (P < 0.05). According to the hotelling train criterion (HTC) ΔMSD & ΔAUCWO match provided the best results and cut-off value change of 11.6% divided R from NR with SEN of 85.0%, SPE of 83.3%, NPV of 71.4% and PPV of 91.7%.

Conclusion: ΔMSD & ΔAUCWO match, defined “standardised index of shape” (SIS) seems to be a promising semi-quantitative numerical parameter capable to evaluate residual tumour activity after pCRT in LARC, defining a robust cut-off value of 11.6% to separate R by NR.

B-0653 11:06
Reproducibility of 2D and 3D fractal analysis techniques for the assessment of spatial pattern of perfusion CT regional blood flow in rectal cancer
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Purpose: To determine the reproducibility of 2D and 3D fractal analysis techniques for the assessment of spatial pattern of perfusion CT regional blood flow in rectal cancer.

Methods and Materials: Following institutional review board approval and informed consent, 10 prospective patients (8 males, 2 females, mean age 70.6 years) with rectal adenocarcinoma underwent two repeated volumetric helical perfusion CT studies (4D adaptive spiral; 11 cm 2-axis coverage: dual source CT; Siemens Healthcare) without intervening treatment within 24 hours, deriving regional blood flow by deconvolution analysis (VPCT, Siemens Healthcare). 2D and 3D fractal analysis of the rectal tumour were performed following segmentation from surrounding structures by thresholding, deriving fractal dimension (FD) and fractal abundance (FA). 2D and 3D fractal parameters were compared by Bland-Altman. Reproducibility was assessed by Bland-Altman statistics. Statistical significance was at 5%.

Results: Mean (SD) blood flow was 63.50 (8.95) mL/min/100 mL. Fractal dimension and fractal abundance were significantly lower for 2D than 3D analysis: 1.648 versus 2.486; p= 0.0001; and 7.278 versus 10.338; p= 0.0001 respectively. Good agreement was noted between the repeated studies for fractal dimension (mean difference 95% limits of agreement): 0.079 (-0.027 to +0.371) and 0.024 (-0.307 to +0.355) and fractal abundance mean difference (95% limits of agreement): 0.354 (-0.091 to +0.802) and -0.043 (-1.154 to +1.238) for 2D and 3D fractal analysis, respectively.

Conclusion: As a measure of spatial heterogeneity, fractal analysis complements perfusion CT, and is a reproducible technique.

B-0654 11:15
Accurate identification of complete responders after CRT for rectal cancer with endoscopy and MRI

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

Methods and Materials: 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 a 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 79% and 89% for endoscopy.

Conclusion: Endoscopy is more accurate in identifying a CR after CRT than MRI (ADWI), mainly because of a higher sensitivity, which corrects for the understaging of a CR with MRI. MRI remains crucial to evaluate the presence of any extramural residual tumour and/or involved nodes. A combination of endoscopy and MRI+DWI is therefore recommended to identify patients with a CR after CRT, making less invasive treatment after CRT feasible.
**B-0656** 11:33

Apparent diffusion coefficient (ADC) assessments in assessing gastrooesophageal cancer (GEC) response to neoadjuvant treatment (NT): comparison to tumour regression grade (TRG) at histology

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**Purpose:** To evaluate whether modifications in the ADC before and after NT (ΔADC) for locally advanced GEC are related to TRG, an objective histological parameter of treatment response scoring the residual neoplastic in 5 grades, obtained after radical resection, predictor for disease-free survival.

**Methods and Materials:** 20 patients affected by a biopsy-proven locally advanced GEC underwent 1.5 T diffusion-weighted imaging pre- and post-NT. Mean lesion ADCs, lesion volumes (V), ΔADC, V changes pre- and post-NT (ΔV) were calculated. Patients with TRG 1-3 were considered responders (R), patients with TRG 4-5 non-responder (NR).

**Results:** No correlation between ΔV and TRG (R= 0.078) was found. The difference in ΔV between the two groups was not statistically significant different (P=0.333). After NT, 14/20 patients (70%) showed an increase in ADC values; 1/20 patients (5%) did not show significant changes; 5/20 patients (25%) showed decreasing ADC values. ADCs changes showed a significant inverse correlation with response to NT (r = - 0.67). R showed a statistically significant lower pre-NT ADC (1.21±0.37 to 10.3 mm2/s) than NR (1.77±0.30 to 10.3 mm2/s) (P=0.010) and higher post-NT ADC (2.29±0.49 to 10.3 mm2/s vs 1.76±0.6x to 10.3 mm2/s) (P=0.028). ΔADC was statistically significantly higher for R than for NR (+105.89±101% vs -3.77±25.03%) (P=0.002).

**Conclusion:** The only dimensional criteria ΔV is not a good indicator of response. ADC can be considered a predictor of treatment response even before the beginning of NT. ΔADC can be used to assess tumour response to NT, as a reliable indicator of the TRG classification.

**B-0657** 11:42

PET-guided prognosis: a promising role of metabolic imaging in oesophageal cancer

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**Purpose:** To evaluate the prognostic value of FDG-PET/CT after neo-adjuvant therapy in locally advanced oesophageal cancer (EC) patients.

**Methods and Materials:** Among 108 EC patients who underwent FDG-PET/CT after neo-adjuvant treatment, we selected 56 patients without evidence or suspicion for distant metastases. All patients were followed for a mean period of 13±9 months from nuclear imaging. PET/CT findings were correlated with patient management and long-term prognosis. Chi-square test was used for comparison of categorical variables and t-Student test for continuous data. Survival curves were computed using Kaplan Meier method. A p value of < 0.05 was considered statistically significant.

**Results:** 15 patients had negative and 41 positive (27 vs. 73%) PET/CT after neo-adjuvant therapy. 6/15 patients underwent radical-intent surgery and 9/15 did not, whereas 31/41 performed surgery and 10/41 did not (p < 0.05). After a median time of 10 months, 29 patients were disease-free, 15 relapsed and 11 died. The event-free survival was significantly higher in patients with negative than with positive PET/CT after neo-adjuvant treatment (73 vs. 41%; log rank p < 0.05). Considering patients with positive PET/CT, in non-surgery subset only 1 patient was alive without evidence of disease while in surgery subset 17 patients were disease-free (10 vs. 55%, p < 0.001).

**Conclusion:** PET/CT could stratify the recurrence risk of EC patients based on treatment efficacy. After 13 months from PET/CT, 91% of patients with negative PET/CT who did not undergo surgery resulted disease free. A positive PET/CT after neo-adjuvant therapy should be followed by surgery for improving the event-free survival.

**B-0658** 11:51

Spectral pre-saturation inversion-recovery MR imaging sequence after gadolinium injection to identify mesorectal fascia infiltration in patients with rectal carcinoma undergoing MR restaging after neoadjuvant chemoradiotherapy (CRT).

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**Purpose:** To retrospectively assess the value of spectral pre-saturation inversion-recovery (SPIR) MR imaging sequence after gadolinium injection to identify mesorectal fascia infiltration in patients with rectal carcinoma undergoing MR restaging after neoadjuvant chemo- and radiation therapy (CRT). Adrenaland kidney imaging

**B-0659** 10:30

Evidence-based medicine: decision-making on renal lesions based on meta-analysis of MR diffusion-weighted imaging

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**Purpose:** Commonly performed contrast-enhanced MRI can only distinguish to a limited extent between malignant and benign focal renal lesions. The aim of this meta-analysis is to review renal diffusion-weighted imaging to compare ADC-values for different renal lesions, which can be applied in clinical practice.

**Methods and Materials:** A search on PubMed was performed to identify relevant articles published on renal DWI of focal renal lesions between 2004 and 2011 by selected studies by lesion type to determine the dignity of a lesion within the kidney. The data table was finalised in a consensus read. The ADC-values were evaluated statistically by a meta-regression based on a linear mixed model. A two-sided p-value of less than 5% indicated statistical significance.

**Results:** The meta-analysis is based on 17 studies with a cumulative number of 764 patients. Renal cell carcinomas have significantly lower ADC-values than benign tissue (1.61 ± 0.08 s/mm2 vs. 2.10 ± 0.09 s/mm2; p-value < 0.01). Uroepithelial malignancies can be differentiated by lowest ADC-values (1.30 ± 0.11 s/mm2; p-value < 0.01). There is a statistically significant difference between the ADC-values of renal cell carcinomas and oncocytomas (1.61 ± 0.08 s/mm2 versus 2.00 ± 0.08 s/mm2; p-value < 0.01).

**Conclusion:** The evaluation of ADC-values can be helpful to determine between benign and malignant lesions, in general, but also seems able to differentiate oncocytomas from malignant tumours hence potentially reducing the number of unnecessarily performed nephrectomies.

**B-0660** 10:39

Comparison of immediate delayed contrast-enhanced CT and chemical shift MR in the evaluation of adrenal masses

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**Purpose:** To retrospectively compare the diagnostic performance of delayed enhanced computed tomography (CT) and chemical shift magnetic resonance (MR) imaging for evaluating adrenal masses.
Methods and Materials: 15-minute delayed adrenal protocol CT (unenhanced, 60 seconds and 15 minute delayed CT) or chemical shift MRI images for 900 adrenal masses in 835 patients were retrospectively reviewed for the period from January 2000 through August 2011. 562 hyperattenuating adrenal masses (>10 HU) on unenhanced CT images in 532 patients (287 men and 255 women; mean age, 51.7 years) analysed using absolute percentage washout (APW) and relative percentage washout (RPW) for evaluating CT, and 49 hyperattenuating adrenal masses were analysed with chemical shift MR by calculating adrenal-to-spleen ratio (ASR) and signal intensity index (SII). Receiver operating characteristic (ROC) analysis was performed to compare the diagnostic performance of CT and MR.

Results: All adrenal masses presented restriction of diffusion (ADC values <1.9x10-3 mm2/s). Vital parameters were calculated for adrenal adenomas (mean value: 1133±63.9 mm2/sec), myelolipomas (mean value: 1240±204.9 mm2/sec) and primitive carcinomas (mean value: 1133±63.9 mm2/sec). A higher ADC value was seen in the adrenal metastasis (mean value: 145±145.9 mm2/sec) compared to the other adrenal lesions (p<0.05), in relation to the presence of more homogeneous water protons diffusion.

Conclusion: We could not obtain differential diagnosis between benign and malignant adrenal lesions using diffusion-weighted images and ADC map. Quantitative DWI evaluation by ADC maps offers a further non-invasive tool in terms of characterisation only of metastatic lesions against the other adrenal lesions. The chemical shift images remain the most helpful sequences in characterisation of adrenal lesions.

B-0663 11:06
Quantitative 23Na, and DW-imaging of the healthy human kidney for establishing norm values for the 23Na, concentrations at 3.0 T
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Purpose: The purpose of this prospective study was to establish physiological ranges for the renal cortico-medullary 23Na-concentration ([23Na]c) gradient, the correlation with DW-imaging at 3.0 T and physiological parameters in a collective of healthy volunteers.

Methods and Materials: 45 healthy volunteers (18F, 27m; mean age: 29a) were included in this IRB-approved study. For 23Na-imaging a 3D-density adapted, radial GRE-sequence (TE=0.55 ms; TR=120 ms; projections=8000; spatial resolution=5x5x5 mm3) was used at 3.0 T (TimTrio Magnetom, Siemens) in combination with a dedicated 23Na-coil and 0.6% reference 23Na-phantoms with 2% agarose. Axial diffusion-weighted images (TE=87.3 ms; TR=4435 ms; b-values=800; spatial resolution=0.6x0.6x5 mm3) were acquired with a standard body-coil. Mean values a standard deviations for [23Na]c and ADC-values were calculated for each volunteer and as overall values. Pearson correlation coefficients were calculated to check for statistically significant correlations with [23Na]c, gender, serum [23Na], body mass index (BMI) and glomerular filtration rate (GFR).

Results: The mean cortico-medullary [23Na]c for all healthy volunteers increased from cortical 0.4±0.7 mm2/mol to medullar location 20.4±13.5 mm2/mol. Inter-individual differences ranged from cortical/medullary 49.7±15.9/49.4±15.1 mm2/mol to 71.5±11.9/137.6±15.6 mm2/mol, with significant higher values for women (p=0.004). The mean cortico-medullary [23Na]c gradient was 4.2±0.5 mm2/mol. The mean renal ADC value was 1.6±0.3 mm2/s and ranged inter-individually from 1.6±0.3 mm2/s to 1.9±0.3 mm2/s. No statistically significant correlations were found between the renal cortico-medullary 23Na-concentration and ADC values, serum [23Na], BMI and GFR.

Conclusion: Despite intra-individual differences a range of normal values for the cortico-medullary [23Na]c could be defined and the lacking correlation with other physiological parameters could be shown.

B-0664 11:15
Tumour necrosis on magnetic resonance imaging correlates with aggressive histology and disease progression in clear cell renal cell carcinoma
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Purpose: The aim of this study was to correlate the MRI imaging features of clear cell renal cell carcinoma (ccRCC) with the pathological appearance and to assess if the MRI imaging features correlate with disease progression.

Methods and Materials: Initial staging MRIs of patients with ccRCC were retrospectively assessed by two radiologists for the presence of tumour necrosis, cystic degeneration, intravoxel fat, haemorrhage, retroperitoneal collateral vessels and renal vein thrombosis. Quantitative analysis of the MRI imaging for intracel-lular lipid within the tumours was also performed. These findings were correlated with histopathologic findings of clear cell percentage, growth pattern and time to disease progression.

Results: 76 patients with ccRCC were included, 69 patients had follow-up data available for progression analysis. The presence of tumour necrosis, retroperitoneal collaterals and renal vein thrombosis on MRI were significantly associated with low clear cell percentage for both readers (p<0.01). MRI evidence of necrosis, retroperitoneal collaterals and renal vein thrombosis was associated with disease progression (p<0.01). Multivariable analysis demonstrated that when tumour size, necrosis, retroperitoneal collaterals and renal vein thrombosis were considered together, necrosis was the only feature that remained statistically associated with disease progression (p=0.03, adjusted odds ratio=24.2, CI 95%=1.3–453.8 for reader one and p=0.02, adjusted odds ratio=32.2, CI 95%=1.8–569.1 for reader two).
B-0665 11:24
Diagnostic performance of multi-detector CT for detecting renal sinus invasion in patients with renal cell carcinoma
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Purpose: The purpose of our study was to evaluate the accuracy of multidetector CT for detecting renal sinus invasion in the preoperative assessment of patients with renal cell carcinoma.

Methods and Materials: 433 patients with surgically resected renal carcinoma patients who underwent MDCT were included in this study. Contrast-enhanced acquisitions were obtained during arterial, corticomedullary, and nephrographic phase. Image analysis was first performed with only axial CT images. A second analysis was then performed with both axial and coronal CT images. Presence of renal sinus invasion of perirenal fat was evaluated in axial images and combined axial and coronal reformatted images. Histological evaluation has been the diagnostic standard. The value of addition of coronal images to axial images was evaluated by means of receiver operating characteristic (ROC) analysis.

Results: The mean tumour size was 4.9 cm. The sensitivity, specificity, accuracy of axial images and combined images were 85%, 91%, 91% and 94%, 93%, respectively. The AUCs of ROC analysis were 0.915 for axial images and 0.881 for combined images (p = 0.237).

Conclusion: MDCT is accurate in the preoperative evaluation of renal sinus invasion in the patients with renal cell carcinoma, but there was no additional diagnostic value of coronal reformatted image to axial images.

B-0666 11:33
Utility of 3 Tesla diffusion-weighted magnetic resonance (DWMR) imaging for the characterisation of small solid renal tumours
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Purpose: To determine the utility of apparent diffusion coefficients (ADCs) for the characterisation of small solid renal lesions.

Methods and Materials: 26 patients (GFR 30-60 ml/min) with 39 small (1-3 cm) solid renal masses [16 RCCs (10 clear cell types; 6 other types); 18 AMLs (10 fat-containing; 8 minimal-fat) and 5 oncocytomas] were examined on a 3 T system using DW-SS-EPI (b-values 0, 1000 s/mm²). The ADC of the lesions and the ADC of kidney were evaluated. Receiver operator characteristic analysis was performed to evaluate the diagnostic value of ADC for differentiating clear cell RCCs from other type RCCs, AMLs and oncocytomas.

Results: The mean ADC of the lesions [1.22а±0.27 28 mm²/sec (0.76–1.96)] was lower than that of kidney [1.85±0.12 mm²/sec (1.38–2.13)] (p < 0.005; Mann-Whitney test). The mean ADC was different between AMLs [1.23±0.34 mm²/sec (0.76–1.73)] and oncocytomas [1.66±0.28 mm²/sec (1.1–1.96)] (p < 0.05, Kruskal-Wallis test). The mean ADC of clear cell RCCs was significantly higher than that of other AMLs [1.46±0.34 mm²/sec (1.04–1.73) vs 0.83±0.34 (0.76–1.10)] (p < 0.005; Student t-test). There was no significant difference between mean ADC of fat-containing [1.06±0.48 mm²/sec (0.86–1.28)] and minimal-fat AMLs [1.11±0.33 mm²/sec (1.04–1.22)] (p=0.46; Student t-test). The best cut-off ADC value for differentiating clear cell RCCs from other AMLs and oncocytomas were 1.5±1.12 and 1.73 mm²/sec, respectively.

Conclusion: DWI is useful to differentiate benign from malignant small solid renal lesions.

B-0667 11:42
Central scar in renal oncocytomas: late contrast enhancement with MR imaging
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Purpose: The purpose of this study was to evaluate the late Gd-enhancement of central area of renal tumours, compatible with fibrous scar or necrosis.

Methods and Materials: This retrospective study was institutional review board approved; informed consent was waived. Based on the thesaurus of our institutional RIS, 63 tumours in 59 patients, imaged with late Gd-enhanced MR sequences between 2006 and 2011 with high signal intensity (SI) central area on T2w sequences compatible with central scar. SI was measured in all renal tumours and spleen in on- and opposed-phase images. SI index (SII) and tumour-to-spleen ratio (TSR) were calculated. Two experienced radiologists visually assessed presence and distribution of late enhancement in central areas (median: 10 mn, SD: 3.7).

Results: Among these 63 tumours, there were 18 oncocytomas in 15 patients who were identified presenting with a central scar, 44 renal cell carcinomas (RCC) in 43 patients with a central necrosis, and 1 leiomyoma. Complete late enhancement of the central zone was observed in 13 oncocytomas (72%) and in 7 RCCs (16%) (p=0.024). SII and TSR were significantly different (p<0.005 and p=0.002, respectively) between oncocytoma and RCC groups. Combination of complete enhancement and SII or TSR provided sensitivity of 40% and 50%, specificity of 95% and 97%, positive predictive value of 67% and 53% and negative predictive value of 85% and 88%, respectively.

Conclusion: Central scar of oncocytomas and central necrosis of RCCs may both enhance on late Gd-enhanced MR images. However, a complete enhancement is highly evocative of oncocytoma.

B-0668 11:51
Study of renal iron overload by T2* MRI in a large cohort of thalassemia major patients
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Purpose: This study aimed to describe the renal T2* values in patients with thalassemia major (TM), to investigate the correlation between renal and cardiac or hepatic siderosis and biventricular cardiac function.

Methods and Materials: 119 TM patients (58 men, 30.7±8.2 years) underwent MRI. Multiecho T2* sequences were used for iron overload assessment. In the heart, the mean T2* value of the left ventricle and of the right ventricle was calculated. The mean T2* value assessed was a single ROI. For each kidney, T2* values were calculated in different ROIs and were averaged to obtain a representative value for the kidney. The mean T2* value over the kidneys was also calculated. Biventricular morphological and functional parameters were evaluated by cine images.

Results: T2* values in the right kidney were significantly lower than those in the left kidney (40.3±11.9 ms vs 44.1±12.7 ms, P < 0.0001). The mean T2* value over the kidneys was 42.2±11.9 ms and 40 patients (33.6%) had a pathological value (T2*<36 ms).

Mean renal T2* values increased with age (r=0.321, P<0.0001) and were significantly negatively correlated with serum ferritin levels (r=0.446, P<0.0001). Significant positive correlations of the mean T2* values were demonstrated for liver (r=0.51, P<0.0001) and global heart (r=0.262, P=0.004) T2* values. No correlation was found between renal iron overload and biventricular function parameters.

Conclusion: Systemic T2* differences between left and right kidneys were found, with significant lower values in the right side. Mean T2* value increased with age. Renal iron deposition was not very common in TM, but it was correlated with iron deposition in liver and heart.

Scientific Session

SS 1302 Interventional procedures
Moderators: S. Allen; Sutton/UK
M. Álvarez-Benito; Córdoba/ES

B-0669 10:30
Multicentre cooperative study of the effectiveness of fine needle aspiration cytology (FNAC) of axillary lymph nodes under sonographic guidance in the pre-treatment management of breast cancer patients: results after 792 consecutive cancer cases
P. Palana1, J. del Riego1, M. Villajos1, M. Teixido2, M. Vilagran3, M. Diaz-Ruiz4, P. Palapa1, J. del Riego1, M. Villajos1, M. Teixido2, M. Vilagran3, M. Diaz-Ruiz4

Purpose: To determine the sensitivity of FNAC in a consecutive series of patients with breast cancer.

Methods and Materials: A multicentre prospective study of the effectiveness of FNAC of axillary lymph nodes under sonographic guidance in the pre-treatment management of breast cancer patients was carried out. A logistic form was completed in each case, giving the following data: age, number of nodes examined, number of positive lymph nodes, type of malignancy, correlation with histological examination, localisation of nodes, etc. Sensitivity and specificity were calculated.

Results: A total of 792 consecutive cancer cases (40.3±11.9 ms vs 44.1±12.7 ms, P < 0.0001). The mean T2* value over the kidneys was 42.2±11.9 ms and 40 patients (33.6%) had a pathological value (T2*<36 ms).

Mean renal T2* values increased with age (r=0.321, P<0.0001) and were significantly negatively correlated with serum ferritin levels (r=0.446, P<0.0001). Significant positive correlations of the mean T2* values were demonstrated for liver (r=0.51, P<0.0001) and global heart (r=0.262, P=0.004) T2* values. No correlation was found between renal iron overload and biventricular function parameters.

Conclusion: Systemic T2* differences between left and right kidneys were found, with significant lower values in the right side. Mean T2* value increased with age. Renal iron deposition was not very common in TM, but it was correlated with iron deposition in liver and heart.
Patients were stratified according to the final nodal staging obtained by axillary dissection or sentinel node biopsy, histology, tumour phenotype and prognostic factors.

**Results:** FNAC was positive in 27% and sentinel node biopsy was avoided in all these cases. The prevalence of lymph node metastases in the series was 44.7%.

**Conclusion:** The sensitivity of FNAC is lower than previously reported. Triple-negative cancers had a higher percentage of positive lymph node (52%) regardless of tumour size.

**Methods and Materials:** Axillary and breast core biopsies (CB) were performed in the same clinic session by any one of 8 practitioners. This protocol was undertaken throughout 2008-2010 and its effectiveness evaluated.

**Results:** 595 invasive cancers presented during the study period of which 251 (42%) were lymph node positive at surgical histology. CB was performed in 130 (22%) of patients. 85% of malignant nodes with TS diameter >10 mm were malignant at CB. 87% of nodes with a cortex > or =4 mm were malignant at CB. 92% of nodes with an absent hilum were malignant at CB and 77% of nodes with a lobulated cortex were malignant at CB. Overall pre-operative diagnosis of axillary metastases was 4%. 

**Conclusion:** The suggested biopsy protocol can be successfully implemented into a busy clinical setting undertaken by a number of practitioners. Adoption of such a protocol enabled over 40% of patients with lymph node metastases to be diagnosed pre-operatively whilst minimising the number of unnecessary biopsies.

**Pre operative staging of the axilla: UK audit of screen detected breast cancer 2008/9 and 2009/10**

**Methods and Materials:** Data on axillary staging were first included in the annual United Kingdom audit of screen-detected cancers in 2008/09 and repeated in 2009/10. Scotland is unable to provide data and Wales only provided data for 2009/10.

**Results:** Of the 26,299 surgically treated invasive breast cancers, 5,720 (22%) were node positive. In 2008/9 there was an axillary ultrasound record for 49% of invasive cancers, this rose to 59% in 2009/10. Of the 2,054 abnormal ultrasound records, 1,758 (85.6%) underwent axillary biopsy. Of the 2,956 node positive patients with an ultrasound record, 610 (20.6%) were correctly staged pre-operatively. In 2008/9, 259 (11%) of women confirmed to be node positive at surgery were correctly staged pre-operatively, avoiding a repeat operation, rising to 401 (16%) in 2009/10. In the original data 40 false positive needle biopsies were reported. Individual records were available for 39 patients. Data entry errors accounted for 31 cases with 8 true false positives (6 cytology and 2 core biopsy).

**Conclusion:** Data entry and completeness have improved but require further improvement. Our rate of successful staging is equivalent to published data when the underlying rate of node positivity is taken into account. Care need to be taken in interpreting cytology from the axilla.

**Management of flat epithelial atypia diagnosed at vacuum-assisted breast biopsy performed on suspicious microcalcifications.**

**Methods and Materials:** VABB performed on under ultrasound-guidance, with 14G tru-cut core needles. Costs, excluding medical man hours for an ultrasound-guided breast biopsy in our institution is €58 with a further €140 for pathological processing of these cases.

**Conclusion:** The underestimation rate (UR) of malignancy for each group and the proportion of group A patients were compared between the two centres.

**Results:** The UR of FEA was 3.5% (2/57) with 9G (centres 1 and 2) and 6% (5/84) with 11G (centre 2). For patients considered as a whole, the UR of group A was 0% (0/85), the UR for group B was 19% (7/36) (p < 0.05). In centre 1 the UR for group A was 4% (0/46), the UR for group B was 18% (2/11) and in centre 2 the UR for group B was 16% (5/32). The proportion of patients in group A was 80% (46/57) in centre 1 and 60% (39/64) in centre 2 (p < 0.05).

**Conclusion:** Women with FNAC with residual microcalcifications could be managed with mammographic FU. 9G VABB is associated with a lower prevalence of residual microcalcifications compared to 11G.

**Pre-operative staging of the axilla: UK audit of screen detected breast cancer 2008/9 and 2009/10**

**Methods and Materials:** The use of ultrasound-guided needle biopsy of axillary lymph nodes in breast cancer assessment, with the Axillary node biopsy criteria for patients with suspected breast cancer were determined. Axillary and breast core biopsies (CB) were performed in the same clinic session by any one of 8 practitioners. This protocol was undertaken throughout 2008-2010 and its effectiveness evaluated.

**Results:** Of the 26,299 surgically treated invasive breast cancers, 5,720 (22%) were node positive. In 2008/9 there was an axillary ultrasound record for 49% of invasive cancers, this rose to 59% in 2009/10. Of the 2,054 abnormal ultrasound records, 1,758 (85.6%) underwent axillary biopsy. Of the 2,956 node positive patients with an ultrasound record, 610 (20.6%) were correctly staged pre-operatively. In 2008/9, 259 (11%) of women confirmed to be node positive at surgery were correctly staged pre-operatively, avoiding a repeat operation, rising to 401 (16%) in 2009/10. In the original data 40 false positive needle biopsies were reported. Individual records were available for 39 patients. Data entry errors accounted for 31 cases with 8 true false positives (6 cytology and 2 core biopsy).

**Conclusion:** Data entry and completeness have improved but require further improvement. Our rate of successful staging is equivalent to published data when the underlying rate of node positivity is taken into account. Care need to be taken in interpreting cytology from the axilla.
Methods and Materials: We reviewed consecutive 518 patients with negative core needle biopsies performed under stereotactic mammographic or ultrasound guidance that underwent subsequent surgery during a period between January 1, 2005 and March 15, 2009. Indications for surgery were: high-risk/borderline pathologic result (HR), radiologic-pathologic discordance (RPD), pathologist’s recommendation (PR), fibroepithelial lesion (FEL), or patient’s preference (PP). The incidence of cancer in the pathology of surgical excisions was calculated for each group and overall. Chi-square test was used to compare groups with and without cancer at excision.

Results: Final pathologic assessment revealed an overall incidence of 72/518 (14%) malignancy. In particular, there were 71/354 (17%) cancers in the HR group, 9/95 (9%) in the RPD group, 2/26 (8%) in the PR group, 0/21 (0%) in the FEL group, and 0/22 (0%) in the PP group. Significant difference was found between HR, RPD, PR groups (8-17% cancer incidence) and FEL and PP groups (0% cancer incidence) (p=0.008).

Conclusion: A non-negligible cancer incidence (14%) was found among negative core needle biopsies submitted for surgery. Sub-group analysis of indications for surgery showed that the cancer incidence was null for the patient’s preference and fibroepithelial lesions groups, and moderate (8-17%) for the high risk lesion, radiologic-pathologic discordance and pathologist recommendation groups. Therefore, these latter three indications should prompt surgical excision.

B-0676 11:33 US-guided 14G core needle biopsy of breast masses categorised as BI-RADS 3, 4 and 5: can the radiologist predict the accuracy of tissue sampling?
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Purpose: To investigate whether radiologist can predict the ‘probably diagnostic’ core sample on the basis of gross appearance when performing US-guided 14 g core-needle-biopsy (US-CNB).

Methods and Materials: In a prospective study, 303 consecutive US-CNBs were performed on BI-RADS category 3.4 and 5 breast masses in 283 women. A mean of five core samples per lesion (range 3-7) were obtained and the first specimen showing dense material was predicted to be diagnostic and was analysed separately. This was compared with the final histological diagnosis. Positive predictive values (PPVs) of the ‘probably diagnostic’ core sample were calculated.

Results: Diagnostic material representative of the lesion was obtained with the dense specimens in 285 (94%) of the 303 lesions. PPVs of dense core samples was 29/29 (100%; 95% confidence interval [CI] 88%-100%) for B1, 127/132 (96%; 95% CI 91%-99%) for B2, 152/21 (71%; 95% CI 48%-89%) for B3 and 114/121 (94%; 95% CI 88%-98%) for B5 lesions. The remaining 18 (6%) specimens containing dense but nondiagnostic material showed focal fibrosis and had missed the lesions (4% of benign, 29% of B2 and 6% of malignant lesions). 1 (5%) of 21 B3 lesions and 4 (3%) of 121 malignant lesions were diagnosed only in the dense specimen.

Conclusion: At the time of US-CNBs of breast masses, the gross appearance of core specimens helped us: 1) predict the adequacy of tissue sampling; 2) determine the number of core samples needed for a reliable diagnosis.

B-0677 11:42 Stereotactically guided vacuum assisted breast biopsy: diagnostic reliability and complication rate
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Purpose: The use of large core stereotactically guided vacuum-assisted biopsy (VAB) has shown multiple advantages over core needle biopsy. Purpose of this study is to evaluate the accuracy as well as the complications of VAB.

Methods and Materials: 415 VABs were performed on patients with microcalcifications detected on mammogram and rated as intermediate to suspicious (BI-RADS IV) or highly suspicious (BI-RADS V). VAB was performed according to a strict quality assurance protocol on a digital prone table, using 11- and 8-gauge vacuum probes. Specimen radiographs were obtained, for the detection of presentable microcalcifications.

Results: In 415 women with a mean age of 57 (SD: 11) years, we identified 4.6% invasive carcinomas (19/415), 18% ductal carcinomas in situ (DCIS; 77/415), < 1% atypical ductal hyperplasia (ADH; 3/415) and 2.9% lobular carcinoma in situ (12/415). After 111 surgical interventions, the final result needed an upgrading in 3 patients (3.1%) from ADH to DCIS and in 11 patients (2.7%) from DCIS to invasive carcinoma. However, 10 patients with DCIS after VAB had a benign diagnosis after surgery, indicating that DCIS was completely removed by VAB. Side-effects, such as bleeding occurred in 14.9% (62/415) patients: 11% (36/327) with 11G needle versus 29.5% (26/88) with 8G needle.

Conclusion: VAB is an effective tool for clarification of dignity of microcalcifications seen on mammograms and provides early cancer detection. Side effects were significantly less using 11 G needle for VAB.

B-0678 11:51 Bleeding, haematoma and scar formation after vacuum biopsy under stereotactic guidance: MammatomeR-system 11G/8G vs ATECR-system 12G/9G

Purpose: To evaluate the correlation of scar formations after vacuum-assisted biopsy (VAB) with different VAB-systems and needle sizes and peri-interventional bleeding/haematoma.

Methods and Materials: Between 01/2008 and 12/2009, 479 patients underwent VAB under stereotactic-guidance, using the MammutomeR-system with 11/8-gauge and ATECR-system with 12/9-gauge, whereas in 178 cases with representative benign histology no surgical-biopsy after VAB was performed and at least a 2-plane follow-up-mammogram after 6-month post-VAB was available. Bleeding during intervention, haematoma post-intervention and scar-tissue was scored as minimal and ATECR-system with 12/9-gauge showed significantly less bleedings/haematomas (8.4% vs 29.7%, p=0.015/p=0.001), no significant differences for the large-systems (13.1% vs 16.1% minimal scar formation and 1.2%/3.2% moderate/severe scars, whereas ATECR-12/9-gauge-system has shown 10.8%/3.8% minimal scar formation and 0%/11.5% moderate/severe scars, no significant differences. No significant difference comparing MammutomeR-11/8-g-systems vs ATECR-12-gauge-system revealed significantly less bleedings/haematomas (41.9% vs 84%, p < 0.001/p=0.029), no significant-differences for the ATEC-systems (26.9% vs 29.9%, p=0.799/p=0.596). 11-gauge-MammutomeR-system vs ATECR-12-gauge-system revealed significantly less bleedings/haematomas (8.4% vs 29.7%, p=0.015/p=0.001), no significant differences for the large-systems (p=0.135/p=0.352). Follow-up of MammutomeR-11/8-gauge-system has shown 13.1%/16.1% minimal scar formation and 1.2%/3.2% moderate/severe scars, whereas ATECR-12/9-gauge-system has shown 10.8%/3.8% minimal scar formation and 0%/11.5% moderate/severe scars, no significant differences. No significant difference comparing MammutomeR-11/8-g-systems vs ATECR-12/9-g-systems (p=0.609/p=0.823).

Conclusion: Using larger needle sizes significantly (MammutomeR) not significant for ATECR) more bleedings and post-interventional haematomas were detected, only a tendency concerning scar formation.
Lymph nodes and temporal bone

SS 1308

Moderators: H.P. Burmeister; Jena/DE S. Robinson; Vienna/AT

B-0679 10:30
Shear wave elastography of cervical lymph nodes: preliminary experience for detection of malignancy
K.S.S. Bhattacharya, C. Tong, C. Cho, Y. Lee, E. Yuen, J.K. Wong, A.T. Ahuja; Sha tin HK (drkbhatia@cuhk.edu.hk)

Purpose: Shear wave elastography (SWE) is a novel technology that permits real-time display and quantitative estimation of shear modulus, equating to tissue stiffness. A study was conducted to evaluate its potential for discrimination between malignant and benign cervical lymph nodes.

Methods and Materials: SWE was performed in 110 cervical lymph nodes undergoing US-guided needle aspiration for cytology in a routine ultrasound clinic. Shear modulus indices were measured on elastograms and correlated with cytosolic result.

Results: Shear modulus within the stiffest 2-3 mm diameter circular region within nodes was higher in malignant nodes (n=65, median 27.3 kPa, interquartile range 16.2-40.2 kPa, range 4.3-210.5 kPa) than benign nodes (n=45, median 15.3 kPa, interquartile range 11.6-20.3 kPa, range 6.6-41.0 kPa) (p < 0.0001, Mann Whitney U test). A cut-off of 22.3 kPa attained highest average of sensitivity and specificity (98.7%, 94.5%, 90%, 80%) (p < 0.0001, Mann Whitney U test). A cut-off of 22.3 kPa attained highest average of sensitivity and specificity (98.7%, 94.5%, 90%, 80%) (p < 0.0001, Mann Whitney U test). A cut-off of 22.3 kPa attained highest average of sensitivity and specificity (98.7%, 94.5%, 90%, 80%) (p < 0.0001, Mann Whitney U test).

Conclusion: SWE is feasible for cervical nodes although preliminary data suggest it offers only modest discrimination between malignant and benign nodes. It appears unsuitable for screening of nodal malignancy but may detect a subset of malignant nodes with high specificity. The cause of marked spatial heterogeneity using SWE in some malignant nodes is yet to be determined.

B-0680 10:39
Percutaneous US-guided interstitial laser ablation of metastatic lymph nodes in the neck from papillary thyroid carcinoma following thyroidectomy and lymphadenectomy
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Purpose: We report our experience with percutaneous US-guided interstitial laser ablation for metachronous cervical nodal metastases from papillary thyroid carcinoma following total thyroidectomy and central + laterocervical lymph node.

Methods and Materials: Twenty-three metachronous metastatic nodes (mean size 1.2 cm; range 0.6-2.6 cm) in 19 patients were treated. A 1,064 nm Nd:YAG laser (EchoLaser X4, Esaote, Genoa, Italy) was used. All cases were negative at 1311 whole body scan, but had positive 18 F-FDG PET and elevated serum levels of thyroglobulin. Under local anaesthesia a 300 mm quartz fiberoptic guide was placed into the node through a 21G needle. Nodes were treated with one (17 cases) or two (6) fibre insertions, each one with 3 W power for 400-600 sec (total energy 1,200-1,800 joules). All cases were followed at 3 and 6 months with B-mode US, CEUS, 18 F-FDG PET and assessment of serum levels of Tg.

Results: Laser ablation was technically feasible and well tolerated in all patients, with no either immediate or late complications. In 21/23 (91.3%) nodes complete ablation (lack of enhancement at CEUS, negative 18 F-FDG PET with normalisation of SUV and > 90% decrease of Tg serum levels) was achieved. In 2 cases residual uptake at 18 F-FDG PET with abnormal SUV was found and laser ablation was repeated.

Conclusion: Percutaneous US-guided interstitial laser ablation seems to be an effective, low cost and safe therapeutic tool for the treatment of metachronous nodal metastases from papillary thyroid carcinoma in the neck which would otherwise require often challenging further resections.
Results: Iodine content was significantly lower for metastatic (2.39 ± 0.41) than inflammatory lymph nodes (3.48 ± 0.63), p < 0.0001. Iodine overlay was also sig- nificantly lower for metastatic than inflammatory nodes, p < 0.0001. No significant differences were observed between iodine content for muscle and internal jugular vein of both groups, p=0.072 and 0.716. ROC curve of iodine content had larger area under the curve (0.948) than that of iodine overlay (0.913) denoting higher diagnostic accuracy in diagnosis of nodal metastases. Optimal threshold value for iodine content ≥2.8 to diagnose nodal metastases had 88.2% sensitivity and 100% specificity.

Conclusion: DCT-derived iodine content and overlay might help in characterisa-
tion of enlarged cervical lymph nodes.

B-0684 11:15 First experience with tri-exponential analysis of DWI signal attenuation in normal cervical lymphnodes: feasibility study M. Ravanel1, D. Farina, E. Botturi, A. Marconi, V. Mazza, R. Maroldi, Bresica/IT (marcoravanelli@hotmail.it)

Purpose: Bi-exponential model (IVIM) postulates two distinct components influ-
encing the DWI signal attenuation: a very-slow (diffusion) and a fast component (b-values<200 s/mm²), related to arterial perfusion. When DWI dataset is acquired with b-values>1000 s/mm², the accuracy of the bi-exponential model decreases. A third component, probably related to slow flows, could explain model inaccuracy. The study purpose is to assess the feasibility of tri-exponential analysis of DWI signal decay in cervical lymphnodes.

Methods and Materials: Four healthy volunteers had the neck examined by 1.5 T MR using EPI-DWI sequences with 13 b-values (0-2500 s/mm²). The DWI signal attenuation of 13 cervical lymphnodes was analysed by mono-exponential (ADC), bi-exponential (IVIM) and the hypothesised tri-exponential model. This model extracts three parameters: fast-perfusion-fracion (fT), slow-perfusion-fracion (fS) and slow-pseudodiffusion-coefficient (Dslow). All three analyses were also performed on 0-1000s/mm² and 0-2500s/mm² intervals; mono- and bi-exponential analyses were also performed on 500-2500s/mm² interval. Accuracy of fitting was measured by R2 coefficient.

Results: The bi-exponential model fitted 500-2500 s/mm² DWI signals better than the mono-exponential model (R2 0.996 vs 0.982). In the 0-2500 s/mm² interval, the tri-exponential analysis was superior to bi-exponential (R2 0.998 vs 0.992). Tri-exponential parameters in this interval were: fast (0-2500) 7±2%, fslow (0-2500) 53.9±9.8%, Dslow 1.05±0.13 x10-3 mm²/s. The perfusion fraction extracted by bi-exponential model in the 500-2500s/mm² interval (7500-2500) and fslow (0-2500) showed high positive correlation (r 0.96).

Conclusion: Tri-exponential analysis of lymphnodes DWI signals is feasible and accurate using very high b-values. It could provide new parameters (probably linked to venular and lymphatic flow) potentially valuable in the characterisation of the tissues microstructure and functionality.

B-0685 11:24 Comparative study of MDCT and CBCT of the temporal bone: anatomy-otosclerosis-superior semicircular canal dehiscence, early experience and preliminary results D. Volders1, N. Peters1, De Foer2, K. Bacher3, J.W. Casselman1; 1Antwerp/BE, 2Brescia/IT, 3ENT surgeon (david.volders@azsintjan.be)

Purpose: Multidetector CT (MDCT) is the current standard for radiologic examina-
tion of the temporal bone. This study wanted to verify the non-inferiority or superiority of conebeam CT (CBCT) over MDCT in the temporal bone for detecting anatomical structures, otosclerosis and superior semicircular canal dehiscence (SSCD).

Methods and Materials: Patients (100 patients - enrolment in progress) in three centres were prospectively studied, after informed consent and ethical committee approval. Both CBCT and MDCT, with a spatial resolution of, respectively, 0.125 and 0.23 mm, were performed in every patient. Two readers scored 28 small anatomical structures (score 1-5), otosclerosis stage (score 1-6) and SSCD (score 1-3) in a blinded randomised manner.

Results: Preliminary results showed that CBCT has an overall superiority for the visualisation of every anatomical structure in the axial and coronal plane of the tem-
poral bone, most significant in the coronal plane. CBCT correctly a false negative
diagnosis of MDCT for otosclerosis in 12.5% (3 out of 24 cases) and a false positive
diagnosis of MDCT for SSCD in 25% (6 out of 24 cases). The average radiation dose (CTDdvol) of CBCT and MDCT was, respectively, 26.84 mGy and 56.05 mGy.

Conclusion: CBCT allows studying the temporal bone anatomy in more detail. Moreover, the sensitivity to detect otosclerosis and especially the specificity to detect SSCD is higher compared to MDCT. The average radiation dose of an examination of the temporal bone with CBCT is less than half the dose of an examination with MDCT, making it the technique of choice.

B-0686 11:33 Prevalence of anterior internal auditory canal “diverticulum” on CT in patients with otosclerosis M.C. Hoeberechts, J.J. Waterval, R.J. Stokroos, A.A.R. Stadler; Maastricht/NL (christiannehoeb@gmail.com)

Purpose: In patients with otosclerosis an otosclerotic hypodense cavitation plaque at the medial margin of the otic capsule, seen as an indentation or “diverticulum” of the anterior margin of the internal auditory canal (IAC), might be present. We aimed to determine the prevalence of this easily identifiable anterior IAC indentation on CT in patients with otosclerosis.

Methods and Materials: 222 consecutive high-resolution CT scans (0.4-0.6 mm) of the mastoid bone in patients with conductive or mixed hearing loss from January 2008 to December 2010 were retrospectively reviewed by 2 neuroradiologists and 1 ENT surgeon. A total of 444 ears were scored for the presence and severity of otosclerosis (graded according to AAO-HNS criteria) and SSCD. A third component, probably related to slow flows, could explain model inaccuracy. The study purpose is to assess the feasibility of tri-exponential analysis of DWI signal decay in cervical lymphnodes.

Results: A third component, probably related to slow flows, could explain model inaccuracy. A trend towards a correlation was noticed between the hydrops and the caloric vestibular evoked myogenic potentials (VEMP).

Conclusion: Tri-exponential analysis of lymphnodes DWI signals is feasible and accurate using very high b-values. It could provide new parameters (probably linked to venular and lymphatic flow) potentially valuable in the characterisation of the tissues microstructure and functionality.
**SS 1301b**

**HCC diagnosis**

**Moderators:** C. Ayuso; Barcelona/ES
A. Furlan; Pittsburgh, PA/US

**Purpose:** To analyse the correlation between tumour markers production, histological findings and diagnostic vascular patterns obtained by non-EP DWI and histopathological examination. Univariate and multivariate analyses were performed on a retrospective study of 53 patients suspected with acquired or residual/recurrent cho- lesteatomas. All patients underwent 3 T and 1.5 T DEXA examinations. For each case 4 radiologists reviewed 3 incremental MRI protocols differing on the magnetic field of the DWI acquisitions (short T1, T1, T1+T2, and comprising the three non-DW ordered standard sequences. At each step diagnostic performances were expressed as sensitivity, specificity, positive and negative predictive values and accuracy. Univariate and multivariate analyses assessed reader, sequence adding and magnetic effect field upon diagnostic performances. Cholesteatomas’ ADC values and DWI signals were compared according to magnetic field using paired t and binomial tests.

**Results:** Univariate and multivariate analyses concluded to no significant predictor sequence adding effect over diagnostic performances obtained by non-EP DWI alone. Univariate analysis showed no significant magnetic field effect either. Cholesteatomas’ ADC values and DWI signals did not differ significantly according to magnetic field.

**Conclusion:** In 3 T and 1.5 T MRI a self-sufficient non-EP DWI protocol could be employed for cho- lesteatoma diagnosis. This needs to be confirmed by further studies over a wider and less heterogeneous cohort.

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**B-0689**

**Hypervascular hepatocellular carcinoma showing hyperintensity on gadoxetic acid-enhanced MR imaging:** a less malignant subtype with low production of AFP and PIVKA-II

**Methods and Materials:** Retrospective study conducted on a cohort of 53 patients suspected or diagnosed with acquired or residual/recurrent hepatocellular carcinoma. All patients underwent 3 T and 1.5 T non-EP DWI and 300 patients had additional unenhanced T1-, delayed gadolinium-enhanced T1- and high-resolution T2-weighted standard acquisitions. On the basis of initial clinical and imaging findings, patients whether benefited from tymanoplasty or from a strict otoscopic survey. Imaging, surgical and follow-up findings concluded to a total of 55 middle ear lesions including 28 cholesteatomas. For each case 4 radiologists reviewed 3 incremental MRI protocols differing on the magnetic field of the DWI acquisitions interpreted (3 T, 1.5 T, 3 T + T2) and comprising the three non-DW ordered standard sequences. At each step diagnostic performances were expressed as sensitivity, specificity, positive and negative predictive values and accuracy. Univariate and multivariate analyses assessed reader, sequence adding and magnetic field effect upon diagnostic performances. Cholesteatomas’ ADC values and DWI signals were compared according to magnetic field using paired t and binomial tests.

**Results:** Univariate and multivariate analyses concluded to no significant predictor reader or sequence adding effect over diagnostic performances obtained by non-EP DWI alone. Univariate analysis showed no significant magnetic field effect either. Cholesteatomas’ ADC values and DWI signals did not differ significantly according to magnetic field.

**Conclusion:** In 3 T and 1.5 T MRI a self-sufficient non-EP DWI protocol could be employed for cho- lesteatoma diagnosis. This needs to be confirmed by further studies over a wider and less heterogeneous cohort.

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**B-0690**

**Comparison of contrast-enhanced US to 64-row multidetector CT and MR with Gd-BOPTA in the depiction of diagnostic vascular pattern in hepatocellular carcinoma nodules ≤ 2 cm in diameter**

**Purpose:** To assess contrast-enhanced US (CEUS) in the depiction of the hepato- cellular carcinoma (HCC) diagnostic vascular pattern (hypervascularity during arterial phase) followed by hypovascularity during portal venous-late phase in small HCC nodules (≤2 cm) in comparison to contrast-enhanced 64-row multidetector CT and MR imaging with Gd-BOPTA.

**Methods and Materials:** One-hundred-and-twenty cirrhotic patients (68 males, 52 females; mean age±SD, 70±7 years) with 131 small HCCs were included. Each nodule was scanned by CEUS after sulphur hexafluoride-filled microbubble, multiphase contrast-enhanced 64-row multidetector CT, and contrast-enhanced MR imaging with Gd-BOPTA. CEUS vascularity at CEUS, CT, and MR imaging was evaluated side-by-side by 2 inde- pendent blinded readers.

**Results:** CEUS vs CT did not differ in the depiction of hypervascularity followed by hypovascularity (reader 1 vs 2. CEUS=57/131 vs 58/131; CT=60/131 vs 59/131 nodules; P=0.57, Wilcoxon test) with high inter-reader agreement (κ statistics; 0.89 for CEUS and 0.91 for CT), while MR imaging revealed this pattern in 85/131 nodules for both readers (P < 0.05). Other vascularities patterns included hypervascularity followed by isovascularity (reader 1 vs 2. CEUS=58/131 vs 58/131; CT=58/131 vs 50/131; MR=25/131 nodules for both readers), isovascularity followed by hypovascularity (reader 1 vs 2. CEUS=14/131 vs 50/131; CT=11/131 vs 20/131; MR=14/131 nodules), and persistent hypervascularity (CEUS=2/131, CT=2/131, and MR=7/131 nodules for both readers).

**Conclusion:** CEUS did not differ from multiphase contrast-enhanced 64-row multi- detector CT in the depiction of diagnostic vascular pattern in small HCCs, while MR imaging with Gd-BOPTA revealed this pattern in an higher number of nodules.
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Purpose: To determine the value of perfusion computed tomography (CT-p) in the quantitative assessment of tumour-related neoangiogenesis for the evaluation of diagnosis and treatment of HCC lesions.

Methods and Materials: A total of 97 CT-p study were performed in cirrhotic patients by analysing 56 biopsy-proven HCC lesions and 41 HCC-treated lesion, with TACE or RFA. Dynamic study was performed on 16 multidetectorCT (Brilliance 16 Philips, NL) by acquiring 8 dynamic slices/scan for a total of 40 scans, at fixed table position, during injection of 50 ml of non-ionic contrast agent at flow rate of 6 ml/sec. 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 for the whole liver and HCC lesions were considered: hepatic perfusion (HP), arterial perfusion (AP), blood volume (BV), hepatic index perfusion (HPI) and time to peak (TTP).

Results: In HCC lesions evaluated, the following quantitative data were obtained: HP (ml/sec/100 gr) 47.0±13.8; BV (ml/100 gr) 22.5±4.6; AP (ml/min) 42.9±8.7; HPI (%) 75.3±31.3; TTP (sec) 18.7±4.1. The perfusion values calculated in lesions HP (ml/sec/100 gr) 13.6±5.6; BV (ml/100 gr) 6.8±4.8; HPI (%) 75.3±31.3; TTP (sec) 18.7±4.1. Multivariate analysis including several nodule- and patient-related characteristics showed that only histological grade influenced vascularisation pat- tern at CEUS: well-differentiated HCC were more likely to show a slow or absent wash-out at 120s.

Conclusion: HCC shows different enhancement pattern at CEUS and MDCT. The presence of isoechogenicity in the portal or both portal and late phase is prevalent in well-differentiated lesions. For this reason, the association of CEUS to MDCT could provide additional information in the characterisation of hypervascular HCC nodules.

B-0695 11:24
Comparison of prospectively triggered (PT) FLASH with retrospectively self-gated (RSG) FLASH sequences for imaging of experimental liver tumours in rats at 9.4 T

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Purpose: To compare prospectively triggered FLASH (PT) (using respiratory sig- nals acquired by an external pressure transducer) with retrospectively self-gated FLASH (RSG) sequences (based on a navigator technique / Intra-Gate, Bruker, Germany) for unenhanced and contrast-enhanced T1w imaging of experimental liver tumours in rats at 9.4 T.

Methods and Materials: 8 rats (WAG-Rij) with experimentally induced hepatic colon cancer metastases were subjected to MRI using a 9.4 T animal scanner (Bruker, BioSpec, Germany) with a 16-channel volume coil. We acquired a PT (TR/ TE: 452.5, FA=45°, FOV 5x5 cm, matrix=256x256) and a RSG (TR/TE: 452.5, FA=45°, FOV 5x5 cm, matrix=256x256, slice thickness: 1 mm each) sequence at identical positions. After intravenous injection of 0.2 mmol/kg BW Gd-DTPA we performed an alternating acquisition of either sequences at four consecutive time points (up to 12 min. after injection). SNR and CNR were calculated based on ROI measurement within the tumour and adjacent normal liver tissue for both sequences. A Wilcoxon-matched pairs signed-rank test and a paired t-test were performed for statistical analysis (p < 0.05).

Results: No statistically significant differences were obtained between the PT and the RSG sequence after CM injection regarding SNR (tumour: RSG (mean±SD): 11.5±6.0 vs 12.5±2.5, p=0.31), SNR (liver: RSG:7.0±3.0, PT: 7.8±1.1, p=0.5) and the CNR (T1liver: RSG: 20.0±3.2, PT: 27.1±1.2, p=0.5).

Conclusion: PT and RSG FLASH sequences provide comparable SNR and CNR of normal liver tissue and experimentally induced liver tumours. Being independent of external trigger devices the retrospectively self-gated approach may be a favourable alternative for abdominal imaging in small rodents.

B-0696 11:33
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, R. Pozzi Mucelli; Verona/IT (gzamboni@hotmail.com)

Purpose: To assess if patients who undergo liver biopsy using an intra-patient single-energy low-voltage arterial phase protocol and a 120 kV protocol for detecting hypervascular focal liver lesions (HFLL) benefit from the use of a single-energy low-voltage protocol.

Methods and Materials: 27 patients with chronic liver disease and ≥1 HFLL underwent abdominal MDCT with 80 kv arterial phase (test group) on a 64-slice scanner. This was compared to a previous 120 kV scan. The mean inter-scan 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. Effective dose was calculated with TLD measurements.

Results: All scans were of diagnostic quality, according to the reporting radiologist. Mean attenuation was significantly higher in the test group than in the control group in the 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 in the test group (6.4±0.4 vs 12.9±4.3 mGy and 194.3±27.5 vs 405.4±117.4 mGy x cm, respectively; all p < 0.0001). Lesion conspicuity (HUodule - HUliver) was significantly higher in the test group (83.8±35.5 vs 48.8±21.5 HU; p= 0.0008). Mean image noise was significantly higher in the test group than in control group (12.3±3.6 vs 8.5±2.4 HU; p< 0.0001). Lesion CNR was not significantly different between the two protocols. TLD effective dose was significantly lower for the test protocol (0.158 vs 0.202mSv; p<0.008).

Results: HCC showed a significant higher frequency (all, p < 0.01) of a) T1-hypointen- sity (69.4% vs 30.6%), b) T2-hyperintensity (64.4% vs 35.5%), c) presence of fat (86.7% vs 13.3%), d) satellite-lesions (64.4% vs 35.5%), e) lack of arterial enhancement (73.1% vs 26.9%) f) contrast-media wash-out in the equilibrium-phase (67.7% vs 32.3%) as compared to both HA and FNH. Significant predictors for diagnosis of HCC (R, odds ratio; p < 0.05) were T1-hypointensity (R=6.0), presence of satellite-lesions (R=4.9) and contrast-media wash-out (R=3.8).

Conclusion: MR-imaging characteristics in primary non-cirrhotic liver tumours show significant differences. Independent parameters for diagnosis of HCC are T1-hypointensity, presence of satellite-lesions and contrast-media wash-out which might help to differ this entities in the future.
Accuracy of differentiating hepatocellular carcinoma (HCC) from dysplastic nodule (DN) at gadobenate dimeglumine-enhanced hepatobiliary-phase (Gd-BOPTA) magnetic resonance imaging

Purpose: To investigate whether Gd-BOPTA-enhanced hepatobiliary phase MRI could predict the histologic grade of HCC and dysplastic nodule (DN) in patients with cirrhosis.

Methods and Materials: We retrospectively evaluated MRI of 30 patients with 15 HCCs (10 well differentiated-5 moderately differentiated) and 15DNs (6 low grade-9 high grade), all histopathologically proved. MRI T1w 3D GRE images were acquired before, 30s-60s-180s-90s min after bolus injection of Gd-BOPTA (0.1 mmol/kg). Each lesion was defined as iso-hypo-hyperintense compared with the surrounding liver parenchyma on the DPl (delayed-phase-imaging). The tumour-liver contrast-to-noise ratio (CNR) of each lesion on the DPl was calculated (quantitative analysis).

Results: HCC nodules were hypointense in a greater percentage than DN (mean: 14/15 HCC and 10/15 DNs were hypointense); 1HCC (well differentiated) and 5/15 DNs (2 high grade-3 low grade) were isointense. There was a significant signal intensity difference between HCCs and DNs on the DPl (mean CNR of -15.86±13.58 and -7.07±6.4, respectively; p=0.03), between low-grade and high-grade DN (mean CNR of -2.6±3.7 and -10.05±6.17, respectively; p=0.02) and between low-grade DN and HCC (p=0.03). There was no significant difference between high-grade DN and HCCs and between well and moderately differentiated HCCs (mean CNR of -14.29±12.69 and -19.06±16.27, respectively; p=0.5).

Conclusion: The relative hypointensity of a lesion to normal surrounding liver on the DPl is helpful to distinguish HCC-high-grade DN from low-grade DN. There is no significant difference between high-grade DN and HCC and between the different pathologic grades of HCC.

Intraoperative high-resolution linear contrast-enhanced ultrasound to improve detection of malignant liver lesions before surgery or radiofrequency ablation

Purpose: To evaluate the value of linear contrast-enhanced intraoperative ultrasound to improve detection of malignant liver lesions before surgery or radiofrequency ablation (RFA).

Methods and Materials: 50 patients were included for surgery of malignant liver tumours (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 tumour manifestation. Before undergoing surgery, intraoperative conventional (IOUS) as well as CE-IOUS were performed by one experienced examiner in all cases using multifrequency linear probes (6-9 MHz, 6-15 MHz; LOGIQ E9; GE) 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 preoperative imaging.

Results: In 28 of 50 patients (56%), additional lesions were found using CE-IOUS (mean tumour size 8 mm, range 4-12 mm). This resulted in a change of surgical strategy or the intraoperative application of RFA in 27 patients (54%). Modification of therapy due to additionally found liver lesions was statistically significant (p < 0.05). Comparing conventional IOUS and CE-IOUS, 14 additional lesions in 10 patients were seen by CE-IOUS. All lesions seen in B-scan could also be detected with CE-IOUS.

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.
Tolerance and diagnostic value of gadoteric acid in general and in patients with risk factors: results in more than 84,000 patients
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Purpose: To review the tolerability and the diagnostic effectiveness of gadoteric acid under daily practice conditions in the general population and at-risk patients.

Methods and Materials: A total of 84,621 patients (45.4% male, 54.6% female, mean age 52.0±16.9 years) were studied in 129 German centres. Patients underwent contrast-enhanced magnetic resonance imaging (MRI) using gadoteric acid (Gd-DOTA, Dotarem, Guerbet, Roissy CdG, France) as IV contrast medium (mean volume, 16.4 ml). 22.9% of the patients had at least one risk factor (e.g., allergies, previous allergic reaction to a contrast medium, renal impairment). Forty-six patients received antiallergic pretreatment before contrast medium administration (0.1%). Adverse events were documented and image quality was assessed.

Results: A diagnosis was possible in 99.7% of all cases. Image quality was rated good or excellent in 97.1%. Adverse events (e.g., nausea, vomiting, and urticaria) were observed in 0.34% of the examinations and were mostly rated as minor. There were 8 patients with severe adverse events. The adverse event rate was significantly higher in patients with a history of allergies (0.62%; p < 0.001) and in patients with a previous allergic reaction to contrast medium (1.29%; p < 0.001). There was no elevated risk for adverse events in patients with renal or hepatic impairment.

Conclusion: Gadoteric acid was shown to be a well-tolerated MRI contrast medium in patients with and without risk factors associated with a low rate of adverse events and a good or excellent image quality in most patients.
Renal function of outpatients undergoing contrast-enhanced CT: what have we learned from universal eGFR testing?

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Purpose: To determine the frequency of abnormal renal function in all outpatients undergoing contrast-enhanced CT and to correlate this with the patients' knowledge of their renal function.

Methods and Materials: This retrospective HIPAA compliant study was approved by our IRB. eGFR (mL/min/1.73 m2) values for 2444 consecutive outpatients obtained immediately before CT were recorded. eGFR values were also compared to the serum creatinine (mg/dL) levels. eGFR > 60 mL/min/1.73 m2 was defined as normal.

Results: 1923 (80%) patients were younger than 70 years. 648 patients (27.0%) had abnormal eGFR (mean: 48.7±10.0 mL/min/1.73 m2). The average and median age for those with abnormal eGFR were 65.5±11.9 and 66.0, respectively. 550 (84.9%) patients with abnormal eGFR reported no history of renal disease. 121 (69.5%) of those with eGFR<45 mL/min/1.73 m2 reported no history of renal disease. Of those who indicated history of renal disease (164), 68 (40.0%) had normal eGFR. 505 patients (77.9%) with abnormal eGFR had creatinine levels below 1.5 mg/dL.

Conclusion: Patients referred for -enhanced CT are frequently unaware of their abnormal renal function status. Conversely, patients who report history of renal disease commonly have normal renal function. Universal eGFR testing may be necessary to determine the renal function in this population.

Evaluation of contrast injection protocols for thoraco-abdominal high-pitch dual source CT angiography: a phantom study

G.D. Puppe, A. Winkelhauer, A. Plass, T. Frauenfelder, S. Baumüller; Zurich/CH (gilbert.puppe@usz.ch)

Purpose: To experimentally evaluate three contrast protocols for thoraco-abdominal high-pitch dual source CT angiography (CTA), with regard to level and homogeneity of vascular enhancement at different cardiac outputs.

Methods and Materials: Uniphasic, biphasic and tailored contrast injection protocols were tested using a human vascular phantom. Protocols were scanned at 5 different cardiac outputs (3.5-11.0 mL/min, steps 0.5 mL/min) using a centrifugal pump. Thoraco-abdominal vascular enhancement was measured every 5 cm. Overall mean enhancement of each protocol and mean enhancement for each cardiac output within each protocol were calculated. Homogeneity enhancement along the z-axis was evaluated for each cardiac output and protocol. Amounts of administered contrast agent were noted.

Results: Overall mean enhancement was significantly higher in the uniphasic than in the other protocols (p<0.05), whereas the difference between the biphasic and tailored protocol was not significant (p=0.76). Cardiac output inversely influenced the level of vascular enhancement. Changing cardiac outputs lead to significantly different mean vascular enhancements (all p<0.05), with the exception at cardiac outputs of 3.5 mL/min vs. 5 mL/min (484±25 HU vs 476±19 HU, p=0.14) and 4 vs 5 mL/min (443±49 HU vs 476±19 HU, p=0.05) at the tailored protocol. Homogenous enhancement was feasible at all cardiac outputs with the uniphasic and tailored but not with the biphasic protocol. Amounts of contrast agent were significantly lower at the tailored (535±8 mL) than at the unip (100 mL) or biphasic (80 mL) protocol (all p<0.05).

Conclusion: Results suggest that homogeneous enhancement at thoraco-abdominal high-pitch dual source CTA is achievable with either uniphasic or tailored contrast protocol, the latter being favourable of needing significantly less contrast agent.

Evaluation of contrast injection protocols for thoraco-abdominal high-pitch dual source CT angiography: a phantom study

G.D. Puppe, A. Winkelhauer, A. Plass, T. Frauenfelder, S. Baumüller; Zurich/CH (gilbert.puppe@usz.ch)

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Conclusion: Results suggest that homogeneous enhancement at thoraco-abdominal high-pitch dual source CTA is achievable with either uniphasic or tailored contrast protocol, the latter being favourable of needing significantly less contrast agent.
utility for arterial disease using all 3 agents. Venous enhancement is significantly less conspicuous with the non-BFCAs.

**B-0711 10:48**

**Efficacy of Dotarem®-enhanced mra in the diagnosis of peripheral artery disease compared to Gadovist®-enhanced MRA**

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*Purpose:* To compare the diagnostic performance of Dotarem®-enhanced MRA and Gadovist®-enhanced MRA at 3 T.

*Methods and Materials:* In this prospective, multi-centres, randomised, parallel group, double-blind, phase IV trial, 189 patients (66±10.7 years) with peripheral arterial disease (PAOD) (stages II-IV) underwent and Fontaine classification were included. Patients randomly underwent MRA of the lower legs during injection with 0.1 mmol/kg of either Dotarem® (15.4±3.1 ml) or Gadovist® (7.6±1.3 ml). A total of 21 vascular segments were explored (from infrarenal aorta to peroneal artery). The primary criterion was the degree of agreement (within patient accuracy) of each type of MRA examination as compared to the gold standard, DSA, using a non-inferiority analysis, evaluated in a blinded manner by on-site reading. Main secondary criteria included specificity, sensitivity, positive/negative predictive values (PPV/ NPV), diagnostic confidence, and safety.

*Results:* The agreement in stenosis detection between Dotarem®-MRA and DSA was similar to that of Gadovist®-MRA (75.6±18.9% vs 69.0%±2.4%, respectively, 64.8%), and the between-exam difference excluding the non-inferiority limit (6.5%) demonstrated the non-inferiority. The MRA sensitivity for detecting significant stenosis (> 50%) was 73.7% with Dotarem® and 69.5% with Gadovist® whereas the specificity (92%), PPV (75.7% versus 72.5%), NPV (91%), and diagnostic confidence (86.3% vs 86.2%) were similar in both groups. Two patients (2.2%) in each group experienced adverse events (mostly mild and unrelated).

*Conclusion:* Dotarem®-MRA can be used with similar diagnostic accuracy as Gadovist®-MRA in the diagnosis of PAOD at 3 Tesla. This trial suggests that there is no direct correlation between higher intrinsic relativity and/or gadolinium concentration and improved clinical diagnosis.

**B-0712 10:57**

**Peripheral MRA at 3 T: Intraindividual comparison between nonenhanced Tof and SSFP sequences vs contrast-enhanced MRA for the detection of clinically relevant stenosis**

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*Purpose:* To provide diagnostic accuracy of two nonenhanced MRA (NE-MRA) sequences (ToF and SSFP) vs conventional contrast-enhanced MRA (CE-MRA) at 3.0 T in patients with peripheral arterial obstructive disease (PAOD), using CT-angiography (CTA) as reference standard.

*Methods and Materials:* 30 patients symptomatic for PAOD underwent NE-MRA of the femoral and calf regions with 3D ECG-gated ToF and ECG-gated SSFP sequences followed by CE-MRA with Gd-BOPTA. All patients underwent CTA as reference standard. Three blinded observers separately reviewed all MRA datasets in random order; one independent observer evaluated CTA images for the assessment of relevant stenosis (> 50%), extent and location. Image quality was evaluated by an independent observer for all MRA datasets. Intraobserver and interobserver agreement for the three MRA techniques were analysed using Cohen-k statistics. Sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV) were calculated for each technique. The McNemar's test was used to assess statistically significant differences in the diagnostic accuracy of each MRA technique.

*Results:* Intraobserver and interobserver agreement was substantial for stenosis assessment. The sensitivity, specificity, accuracy, PPV and NPV values of ToF/SSFP/CE-MRA sequences for stenosis assessment compared to CTA were, respectively, 90/92/97%, 78/87/94%, 85/86/87%, 94/93/97%, 72/83/94%. Diagnostic performance of CE-MRA was superior to ToF and SSFP sequences (p < 0.001); SSFP sequences were better for stenosis assessment compared to ToF sequences (p < 0.001).

*Conclusion:* 3 TE-MRA is superior to NE-MRA techniques for image quality and diagnostic performance. The diagnostic performance of SSFP sequences is significantly higher than that of ToF sequences and may be considered as a potential alternative diagnostic tool in selected patients.
Methods and Materials: Sixty-three patients (33 males, 30 females) with suspected renovascular hypertension were examined with NE-MRA using a 64-section CT scanner and a 1.5 T MR scanner; in 26/63 patients a respiratory trigger was used in addition to cardiac gating. During the same examination, CE-MRA was performed in all patients and its results were used as reference standard. MIP image quality, number of main renal arteries, accessory arteries and presence of stenoses were independently assessed by two readers. Sensitivity, specificity, positive (PPV) and negative predictive values (NPV) of NE-MRA in the identification of significant (≥50%) RAS were calculated.

Results: MIP image quality was considered better for NE-MRA by both readers. NE-MRA identified 143/144 arteries detected by CE-MRA (1 accessory missed). Fourteen stenoses were identified by CE-MRA (11 atherosclerotic, 3 dysplastic) with 4 significant RAS. Sensitivity, specificity, PPV and NPV of NE-MRA were, respectively, 100%, 100% and 100% for reader 1, and 100%, 98.2%, 87.5% and 100% for reader 2. Overestimation of the stenosis grade occurred in two cases for reader 2 (<50% vs. normal in one case, ≥50% vs. >50% in the other case). Contralateral: we calculated DS as absolute difference of left and right leg DG for each patient and compared with CE-MRA for the study of the renal arteries. In case of significant stenosis, given the risk of overestimation, the use of CE-MRA is still indicated.

B-0716 11:33
Evaluation of renal artery aneurysm by non-contrast magnetic resonance angiography: a SLEEK sequence comparison with CTA
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Purpose: To determine the performance of a new non-contrast magnetic resonance angiography (NC-MRA) sequence (spatial labelling with multiple inversion pulses, SLEEK) in its ability to present the renal artery aneurysm (RAA) and to investigate whether a suitable multiple blood suppression inversion time (BSP TI) can help to improve RAA visibility in SLEEK.

Methods and Materials: 32 RAAs confirmed by CTA was carried out NEC-MRA using SLEEK on a 1.5 T MR system with various BSP TI. A suitable BSP TI to increase RAA visibility was determined and RAA was evaluated for each patient by two experienced radiologists in their consensus, and were compared with CTA results using a joint reading performed in consensus.

Results: 32 RAAs consisted of 13 right and 19 left RAAs, 12 RAAs were performed by surgery, including 4 RAAs with <0.5 cm, 13 RAAs with >0.5 cm and <1.0 cm, 9 RAAs with >1.0 cm and <2.0 cm, 6 RAAs with >2.0 cm. The excellent correlation between SLEEK and CTA was found in presenting RAA size (Rs=0.889, p<0.05). The suitable BSP TI was 1100 ms for displaying RAA with <0.5 cm, 1400 ms for RAA with >0.5 cm and <1.0 cm, 1700 ms for RAA with >1.0 cm and <2.0 cm, and 2000 ms for RAA with >2.0 cm.

Conclusion: A suitable BSP TI in SLEEK may increase the RAA visibility. SLEEK represents a non-renal complication, relatively inexpensive, and reliable diagnostic method for evaluating RAAs. It can be as an alternative choice of CTA for evaluating RAAs, especially in subjects with renal insufficiency.

B-0717 11:42
Symmetry of atherosclerotic lesions at the lower extremities arteries on magnetic resonance angiography (MRA)
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Purpose: Our aim was to quantify the symmetry between right and left lower extremities atherosclerotic lesions on MRA.

Methods and Materials: We retrospectively evaluated a consecutive series of reports concerning 82 patients (aged 70±9 years, 22 females) who underwent lower extremities MRA. We performed a three-step MRA from aortic bifurcation to tibial arteries, including superficial, popliteal, anterior tibial and peroneal arteries. Patient's analysis showed a symmetrical lesions and severity distribution.

Conclusion: Patients showed a symmetrical distribution of atherosclerotic lesions, in particular, for the femoral profunda and superficial, poplitea, anterior tibial and peroneal arteries. Patient's analysis showed a symmetrical lesions and severity distribution.

B-0718 11:51
Study of the left renal vein variations and inferior vena cava variations by means of spiral computed tomography
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Purpose: A retrospective study was designed to evaluate the percentages of the left renal vein variations, inferior vena cava variations and the effect of gender on their frequencies, using spiral computed tomography (CT).

Methods and Materials: Between January 2010 and August 2011, the study population was recruited from 1204 patients who underwent a contrast-enhanced abdominal spiral CT examination for various abdominal problems.

Results: As the left renal vein variations, retroaortic left renal vein (RLRV) and circumaortic left renal vein (CLRV) were detected. The number of cases with the correspondent percentages of the total left renal vein variations, RLRV and CLRV was 63/1204 (5.23%), 38/1204 (3.15%) and 25/1204 (2.08%), respectively. There is a correlation between female gender and frequency of the left renal vein variations (P = 0.02). CLRV is 1.7 times more frequent in females than in males (95% confidence interval, 1.06-2.84). As the inferior vena cava (IVC) variations, duplication of IVC and transposition of IVC was detected. The number of cases with the correspondent percentages of the total IVC variations, duplication of IVC and transposition of IVC was 5/1204 (0.42%), 3/1204 (0.25%), 2/1204 (0.17%), respectively. There was no effect of gender on the frequencies of IVC variations (P = 0.769).

Conclusion: Abdominal spiral CT is useful in detecting the left renal vein variations (RLRV, CLRV) and the IVC variations. Radiological recognition of these variations is crucial when an IVC surgery and a left renal or retroperitoneal surgery are considered.
Conclusion: On-the-job dosimetry training and reject analysis may contribute to improve practices in DM. European guidelines are used in a limited number of sites. Manufacturer’s recommendations drive current practices in most sites. Efficient/financial gains may be obtained from standardising digital image output.

B-0721 10:39
How to increase the participation rate among non-European immigrants in the mammography screening programme in Oslo, Norway
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Purpose: To increase the participation among non-European immigrants at the mammography screening. Studies shows that less than 1 in 4 woman from minority groups knows about mammography screening and breast cancer despite the fact that breast cancer is a common cause of death among women in the group. Non-European immigrants in Oslo have low participation rate in the screening programme.

Methods and Materials: The department focused on the largest minority groups with women speaking Urdu, Arabic and Somali. Posters in these languages and Norwegian with a summary about mammography screening were printed and sent to all general practitioners in Oslo and hung up in public places and health offices in districts with many women from minority groups. Radiographers from the department visited women’s groups and informed about mammography screening and breast cancer. Not all women can read their native language so there were broadcasted several radio shows in Urdu, Arabic and Somali.

Results: The general practitioners are pleased with the posters and inform their patients about mammography screening. The response at the meetings in the women’s groups has been successful. The attendances at the meetings were doubled; the women were involved and asked relevant questions. During the radio show women called to comment on the topic. There has been increased participation from non-European immigrants at the mammography screening.

Conclusion: It is important to continue the ongoing work and include new initiatives to increase the participation among non-European immigrants in the mammography screening programme.

B-0722 10:48
Echoes from Estonia: introduction of sonography as a specialism for radiographers
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Purpose: An EU-funded project was initiated by the Estonian Society of Radiographers and Tartu Healthcare College to train 45 radiographers in one of three specialist areas, Radiotherapy, nuclear medicine and diagnostic ultrasound. This presentation focuses on one aspect of the project, designed to create an educational programme for a new group of radiographers in Estonia - sonographers.

Methods and Materials: The sonography project started in 2010, the first year being devoted to curriculum design, based on EFUMB guidelines. International links were made with Sweden, the UK and the USA. The education was implemented from February 2011, and this presentation examines the visit by a UK ultrasound educationalist. A bespoke educational programme, comprising lectures and hands-on practical training sessions, was delivered over one week. Subsequently the knowledge of the students was tested and the teaching evaluated.

Results: The students’ knowledge and skills were enhanced by the input. The Estonian staff acquired teaching resources and were assisted in developing ultrasound examination protocols. Successful students graduated in January 2012, and sonography specialism has been approved as new occupation by the Estonian staff acquired teaching resources and were assisted in developing ultrasound examination protocols. Successful students graduated in January 2012, and sonography specialism has been approved as new occupation by the Estonian staff acquired teaching resources and were assisted in developing ultrasound examination protocols.

Conclusion: This study indicates that APRI are qualified to perform US examination in upper abdomen in safe way in Norway, equal to radiologist given that they undergo a qualified education.

B-0724 11:06
Can radiologic technologists be trained to triage CT colonography for extracolonic findings?
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Purpose: Technologists have been shown to be capable CT colonography observers and we evaluated whether radiologic technologists can be trained to triage screening CT colonography for extracolonic findings.

Methods and Materials: Eight consenting technologists participated in a structured training program that consisted of study assignments and a 16-hour course with presentations, observation of expert reading and reading 100 unblinded cases. Subsequently, they reported extracolonic findings in 280 low-dose CT colonographies without intravenous contrast medium. This dataset contained 66 and 27 scans with a possibly (E3) or probably important (E4) finding as highest classified finding (C-RADS). The first and last 40 cases were identical examination cases. Immediate feedback was given after each case from the reference standard, except for examination cases. Technologists reported C-RADS classification, reporting time, and the need for a radiologist to read. We constructed learning curves for correct scan triaging using a moving average technique.

Results: For the final exam 70% (84/120) of scans with E3 or E4 findings and 69.5% (139/200) without E3 or E4 findings were correctly triaged. There was improvement between the first and final exam in identifying E3 scans (52.3% (46/88) vs 70.5% (62/88); p < 0.05). There was no improvement for identifying E4 scans (both 68.8% (22/32)). The technologists’ average reading time decreased from 11.51 to 4.13 minutes (p < 0.0001).

Conclusion: Technologists have an increased capability in triaging extracolonic findings at CT colonography after training. A higher number of cases and/or a modified training program is needed to determine whether technologists can reach sufficient competence.

B-0725 11:15
Proposed CT diagnostic reference levels for Ireland
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Purpose: Computed tomography (CT) is recognised as the largest contributor to population dose from medical exposures, accounting for 56% of the total dose, but only 10% of the total examinations in Ireland. Diagnostic reference levels (DRLs) are crucial to dose optimisation, facilitating the identification of abnormally high doses. DRLs should be based on local, regional or national data and reflect local practices; however, current Irish values are based on international data from 1991. Given the advances that have occurred in CT technology since then and its increasing application, this research proposes updated DRLs for the most common CT examinations.

Methods and Materials: Forty-four CT scanners in Ireland from various manufacturers and with various multidetector capabilities were surveyed. Each centre was asked to record CT dose data (DLP, CTDIvol, tube voltage and current) prospectively, on 10-20 anonymised adult patients of average size (70±10 kg) presenting for eight common CT examinations. Mean results from each site were pooled and the 75th percentile was used to set DRLs using both CTDIvol and DLP.
B-0726 11:24
Comparison of automatic exposure control in CT equipment 64 slices
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Purpose: To evaluate the influence of the technical parameters related to the AEC in the dose received by the patients and diagnostic image quality.

Methods and Materials: CT scans were acquired in two chest phantom boxes (adult and paediatric) in two different CT equipment, with changes in technical parameters, related to their AEC. Six different protocols were used for adult and 2 for paediatric and chosen two images from each one to be evaluated using a Table specified for that. To evaluate their influence in the final image quality, CTDIw and DLP were analysed.

Results: The changes made in the technical parameters did not induce significant changes in the diagnostic quality imaging. With the used protocols 50% dose reduction was achieved, without producing images enable to diagnose.

Conclusion: The noise and mAs may still be handled in a more meaningful way in order to decrease the dose values, without interfering in the image quality. However, this analysis must be appropriate for the patient and the anatomical region under study.

B-0727 11:33
Identification of sentinel nodes during radiographer performed lymphoscintigraphy prior to sentinel lymph node biopsy
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Purpose: The concept that malignant disease primarily affects the sentinel node/s before being disseminated to the axillary nodes (ALNs) has dramatically evolved towards minimally invasive approaches in breast cancer management. Radiographer-performed lymphoscintigraphy using the cutaneous (subdermal) peri-areolar approach prior to SLNB is rapidly emerging as the technique for axillary staging in breast cancer limiting the dissection to the sentinel node/s (SN). The objective of this study was to determine the role of radiographer-performed lymphoscintigraphy prior to SLNB and to establish the correlation between the numbers of SNs visualised on lymphoscintigraphy and the number of surgically identified SNs.

Methods and Materials: A quantitative approach was chosen for this non-experimental, correlation type of study. Between May 2009 and December 2010, a total of 55 female breast cancer patients (mean age, 58.35 years) who underwent SLNB with partial or total back-up axillary node dissection (ALND) were enrolled in this study. Lymphoscintigraphy reports and histology results were retrospectively evaluated.

Results: A minimum of 1 sentinel node was visualised on lymphoscintigraphy in 52 out of 55 patients (94.5%). Successful imaging was highly predictive (p < 0.001) of a successful SLNB. Results showed a significant association (p < 0.05) between the number of SNs visualised on lymphoscintigraphy and the number of surgically identified SNs during SLNB, with a concordance rate of 50.91%.

Conclusion: Lymphoscintigraphy performed by radiographers was shown to be indispensable in the reliable performance of SLNB.

B-0728 11:42
Ring-like contrast enhancement in liver metastases from rectal tumours - typical findings?
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Purpose: Rectal cancer can metastasize to almost any location in the body, most commonly the liver, lung, and peritoneum. The long-term results have improved, but long-term survival remains elusive for most. There are several therapeutic options - surgical, local or systemic chemotherapy - to manage metastases. These patients underwent contrast-enhanced CT (a Siemens Somatom Definition AS+ 64 detectors, row MDC) and/or a contrast-enhanced liver MRI (a Siemens Magnetom Symphony 1.5 T). We analysed the visual appearance, the vascularisation of the metastases and studied how they changed during the course of treatment.

Results: We found liver metastases in 343 patients, with 84 (24.48%) patients who had primary rectal tumours. We divided the metastases into two groups, based on the pattern of their vascularity: hypervascular and hypovascular metastases. All these patients received systemic chemotherapy. In the hypovascular metastases we found (21% with a 38%) regression whereas 8 patients (9.52%) had unchanged status. On further evaluation and correlation of images, we found a “typical ring-like contrast enhancement” in liver metastases. Every patient with these metastases suffered progression independent of chemotherapy treatment.

Conclusion: CT and MRI scan has proved to be an excellent and widely used modality for the detection of liver metastases. The hypervascularised liver metastases with typical ring-like contrast enhancement are more likely to progress, independent of systemic chemotherapy.

B-0729 10:30
Role of multimodal MR in brain glioma grading
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Purpose: To evaluate the diagnostic accuracy of optimised cut-offs determined in pre-established regions of interest (ROI) with advanced MR techniques (perfusion, spectroscopy, diffusion and DTI) for differentiating between glioma WHO grade II vs. III and II vs IV.

Methods and Materials: 149 consecutive patients with cerebral glioma were retrospectively evaluated with a 3 T MR scanner. Gold standard was histology in 103 (30 low and 73 high grade). Four ROIs were analysed: area of contrast enhancement (CE), T2 signal lower than that of liquor (T2-), T2 signal greater than or equal liquor (T2+), and area with reduced diffusion (RD). Several parameters were determined for each ROI: rCBV, MT, Cho/Cr, Cho/NAA, Lip/Cr, Lac/Cr, ADC and FA. Statistical differences were evaluated with test (p < 0.05) and ROC analysis.

Results: The parameters which were capable of distinguishing between the low and high grade gliomas were: rCBV in CE (cut-off= 2.60, sensitivity=72%, specificity=100%, AUC=0.85, p<0.0001), T2- (cut-off= 1.679, sensitivity=73%, specificity=84%, AUC=0.709, p=0.0004), DR (cut-off= 2.615, sensitivity=47%, specificity=90%, AUC=0.722, p=0.0058). Cho/Cr and Cho in T2- (cut-off= 1.93, sensitivity=61%, specificity=75%, AUC=0.71, p=0.0006), Cho/Cr in DR (cut-off= 1.08, sensitivity=94%, specificity=65%, AUC=0.809, p<0.001). A statistically significant difference in rCBV was not observed between grades II ODG and WHO grade II gliomas or grade II ODG and WHO grade III astrocytomas. Cho/Cr in CE was higher (cut-off= 1.83, sensitivity=100%, specificity=55%, AUC=0.872, p=0.024) in grade III ODG compared to grade II.

Conclusion: The integration of advanced MR quantitative biomarkers in the differential diagnosis between low and high grade gliomas can significantly improve diagnostic accuracy.

B-0730 10:39
DSC-MRI in glioblastomas: correlation of whole tumour histogram analysis of cerebral blood volume and vascular permeability (Ktrans) with biomarkers of tumour aggressiveness
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Purpose: To examine the relationship between rCBV and contrast transfer coefficient (Ktrans) values obtained with dynamic susceptibility-contrast MR imaging (DSC-MRI) and histopathological features associated with tumour aggressiveness.

Methods and Materials: DSC MR imaging (Siemens Avanto 1.5 T) was obtained in a consecutive series of 30 patients with histologically confirmed glioblastoma (GBM), with a whole-brain T2*gradient-echo planar sequence during I.V. injection of a bolus of gadolinium-DTPA. Perfusion data were processed offline with a dedicated software (NordicIce) to create colour-coded maps of rCBV and Ktrans. Regions of interest (ROIs) were manually drawn encompassing the whole
contrast-enhancing lesion and nonenhancing peritumoral area. Data analysis was performed with the histogram analysis of normalised CBVs and Ki67 in patients with glioblastoma from the total tumour volume. The following histopathological variables were included into the statistical analysis: proliferation index (MBB-1/Ki67), tumour angiogenesis (enhancer of Zeste 2, EZH2), epidermal growth factor receptor (EGFR) and p53.

Results: For whole tumour histogram analysis mean rCBV (p < 0,001 r = 0,605) and rCBV maximum value (p < 0,001 r = 0,718) were found to be significantly associated with EGFR expression. Mean and maximum rCBV values tended to be higher in patients showing increased overexpression of EGFR, with significant differences between subgroups as shown by post-hoc analysis (p < 0,05). No significant associations were found between Ki67 and histopathological markers.

Conclusion: According to our findings EGFR overexpression, a molecular marker associated with tumour invasiveness, angiogenesis and radioresistance, is positively correlated with rCBV values, which could represent a new potential preoperative predictor of GBM response to therapy.

B-0731 10:48
High diagnostic accuracy of dynamic susceptibility contrast (DSC) perfusion imaging to distinguish radiation necrosis from recurrent tumour in high-grade glioma patients
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Purpose: To assess diagnostic accuracy and optimal relative cerebral blood volume (rCBV) ratio thresholds of dynamic susceptibility contrast-enhanced (DSC) perfusion to distinguish radiation necrosis from recurrent high grade glioma (HGG).

Methods and Materials: From 157 HGG patients scanned at 3-month intervals between April 2010 and July 2012, with a standardized MR imaging protocol, 43 (27 males, mean age 51y) who had undergone radiotherapy and showed newly developed contrast-enhancing lesions were included in this retrospective study. DSC perfusion images were obtained at 1.5 T (GE Healthcare, US) with a 3 ml pre-load and 12 ml Gadovist 1.0 (Bayer Pharma) bolus administered at 5 ml/s using gradient-echo echo-planar imaging (TE 2000 ms). Ratios of maximum rCBV in contrast-enhancing lesions and contralateral white matter were calculated. The outcome measure was tumour progression, defined as clinical and/or radiological progression during 8-month follow-up. With logistic regression analysis the influence of patients’ age, sex, tumour type and rCBV values on outcome was determined. A receiver operating characteristic (ROC) curve was created using sensitivity and specificity of different rCBV ratio thresholds for progression.

Results: Only the rCBV ratio influenced outcome (p < 0.01). At an rCBV ratio of 1.35 100% sensitivity was obtained with specificity of 61%. At an rCBV ratio of 2.18 100% specificity was obtained with sensitivity of 72%. The area under the ROC (diagnostic accuracy) was 0.928 (SE 0.036).

Conclusion: DSC perfusion MR imaging has high (93%) diagnostic accuracy to differentiate recurrent HGG from radiation necrosis. Maximum sensitivity is obtained at an rCBV ratio threshold of 1.35.

B-0732 10:57
Diagnostic accuracy of multimodal MR (MRS, DWI, DTI and DSC-PWI) tumour recurrence and radionecrosis
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Purpose: Conventional MR often fails in the differentiation between tumour recurrence and alterations induced by therapy (radiation therapy and chemotherapy) in primitive brain tumours. The aim of this study was to determine the cut-offs of perfusion (PWI), spectroscopy (2D-MRS), diffusion (DWI) and diffusion tensor (DTI) with a high field scanner (3 T) and the relative diagnostic accuracy in determining between tumour recurrence and post-operative treatment cerebral modifications.

Methods and Materials: 56 patients who had undergone surgery and adjuvant radiation therapy for cerebral gliomas were retrospectively evaluated. Exams were acquired with a 3 T. Four regions of interest (ROI) were analysed: area of contrast enhancement (CE), T2 signal lower than that of liquor (T2-), T2 signal greater than or equal to liquor (T2+) and area with reduced diffusion (RD). Several parameters were determined for each ROI: rCBV e MTV, Cho/Cr, Chol/NAA, Lip/Cr, Lac/Cr, ADC and FA. Differences were evaluated with I-test and ROI analysis for optimal cut-offs. Gold-standard for was either histology or two-year follow-up.

Results: Parameters which yielded statistically significant differences were rCBV in CE (cut-off< 0,5, sensitivity=96%, specificity=100%, area under curve (AUC) 0.87, p=0.04), T2- (cut-off=0.58, sensitivity=96%, specificity=55%, AUC=0.80, p=0.0001) and T2+ (cut-off=0.54, sensitivity=64%, specificity=55%, AUC=0.78, p=0.001), Cho/Cr in T2- (cut-off=2.17, sensitivity=66%, specificity=100%, AUC=0.84, p=0.0001), and Lip/Cr in CE (cut-offs18.59, sensitivity=94%, specificity=100%, AUC=0.869, p=0.04) and T2+ (cut-offs1.045, sensitivity=70%, specificity=86%, AUC=0.78, p=0.017).

Conclusion: Given the elevated diagnostic accuracy observed for the indicated cut-offs, multimodal MR (MRS, and DSC-PWI) can be an instrumental method for the non-invasive differentiation between tumour recurrence and radionecrosis.

B-0733 11:06
Non-invasive differentiation of high- and low-grade glioma: a pulsed arterial spin labelling study using bolus arrival times
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Purpose: Pulsed arterial spin labelling (pASL) is a non-invasive MRI perfusion method using the water in the arterial blood as endogenous contrast agent. The purpose of this study was to determine the most suitable pASL inversion time point (TI) for the differentiation between high-grade and low-grade glioma, using a multi-TI-pASL approach which tracks the labelled bolus dynamically over time.

Methods and Materials: Thirty-five patients with gliomas, histologically classified as low-grade (n = 10) or high-grade (n = 25) according to the WHO brain tumour classification were included. A 3 Tesla MR scanner (Trio Tim; Siemens Medical Solutionss) was used to perform pASL sequences at eight different inversion time points (370 ms, 614 ms, 864 ms, 1114 ms, 1364 ms, 1614 ms, 1864 ms, 2114 ms). The bolus arrival time, reflecting the maximum of tumour perfusion for all fixed inversion time points was calculated. A three-way mixed ANOVA was used to reveal potential differences in the bolus arrival time between high-grade and low-grade gliomas.

Results: The difference of measured signal intensities between high-grade and low-grade gliomas obtained statistically significant results exclusively at 614 ms. (p=0.005). For all other determined inversion time points there was no significant difference of signal intensity between high-grade and low-grade gliomas (p-values ranged from 0.158 to 0.793).

Conclusion: Our findings suggest that, using pASL for the evaluation of tumour perfusion, the most suitable inversion time point for differentiation of high-grade gliomas from low-grade glioma is 614 ms. Use of this pASL-TI may facilitate a non-invasive characterisation of such tumours, in the future.

B-0734 11:15
Simultaneous [18 F]‑FETMR/PET in patients with cerebral tumours: comparison with conventional PET/CT
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Purpose: To compare performance between PET/CT and recently introduced whole body MR/PET concerning evaluation of brain tumours.

Methods and Materials: Twelve patients, referred to [18F] FET-PET for brain tumour diagnostics, underwent a single-injection/dual-imaging protocol, including a PET/CT scan (Siemens-Truepoint 64, 34.7± min p.i., 10 min 3D acquisition) and a subsequent MR/PET scan (Siemens mMR, 53±11 min p.i., 15 min 3D acquisition), after injection of 171±42 MBq [18F] FET. Images were reconstructed with filtered backprojection (Hann 4.9 mm, zoom 2.5), attenuation correction was performed using low-dose CT for the PET/CT and Dixon-MR sequences for MR/PET. Images were interpreted visually and by semiquantitative analysis. The respective lesion and Bg SUVs were compared as well as the lesion/background ratios (TI/Bg) by the Wilcoxon test.

Results: Visual interpretation turned out suspicion of tumour tissue in 9/12 scans with both MR/PET and PET/CT, 3/12 patients were read as negative. Overall, T/Bg ratios as well as lesion- and Bg-SUVmax values were not different between PET/CT and MR/PET. However, the mean lesion- and Bg-SUVs were significantly higher for PET/CT, as compared to the respective MR/PET-values (lesions:2.6±1vs.2.2±0.8; p<0.01; Bg:1.19±0.4 vs. 0.84±0.2; p<0.003). There was a significant correlation between the respective max and mean lesion and Bg SUVs as well as between the respective T/Bg ratios.

Conclusion: Imaging of brain tumours with [18F] FET is feasible with the integrated whole body MR/PET-scanner with high image quality. Despite technological differences, the quantitative evaluation of [18F]‑FET-PET data with MR/PET reveals comparable results as with PET/CT, indicating that established lesion/background ratio thresholds for distinguishing malignant brain tumour tissue, can be transferred.
B-0735 11:24
Contribution of diffusion and perfusion-weighted magnetic resonance imaging in the differential diagnosis of sellar and parasellar tumours: preliminary report
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Purpose: The most common pituitary tumours are adenomas, which, however, may be mimicked by other tumours that can show very similar appearance in plain MRI. The aim of our study was to evaluate usefulness of diffusion (DWI) and perfusion-weighted MR imaging (PWI) in the differential diagnosis of sellar/parasellar tumours.

Methods and Materials: Twenty-eight sellar/parasellar tumours (15 adenomas, 9 meningiomas, 1 intrasellar haemangioblastoma, 1 suprasellar glioma, 1 pituitary abscess, and 1 hamartoma) underwent standard MRI as well as DWI and PWI using 1.5 Tesla MR unit. In each tumour min. rADC and max. rCBV measurements were calculated. The relative peak height (rPH) and the relative percentage of signal intensity recovery (rPSR) were also evaluated.

Results: The mean values of min. rADC, max. rCBV, rPH and rPSR for different tumour types were as follows: adenomas (0.77; 5.19; 3.49; 0.36), meningiomas (1.07; 9.52; 3.91; 0.38), haemangioblastoma (2.0; 8.14; 9.05; -0.30), glioma (0.86; 7.48; 8.52; 0.93), abscess (0.68; 0.79; 1.26; 1.01), hamartoma (1.36; 1.07; 4.20; 0.57), respectively. There were significant differences between adenomas and all other tumour types in perfusion parameters and also in min. rADC values. There were no significant differences in rPH and rPSR between adenomas and meningiomas, while other tumours revealed significantly different values of rPH and rPSR, compared to pituitary adenomas.

Conclusion: PWI and DWI seem to be very useful in differential diagnosis of sellar/parasellar tumours, what may be of high importance in the clinical practice, especially in proper choice of surgical approach.

B-0736 11:33
Isolated cerebral susceptibility artefacts in patients with malignant melanoma: metastasis or not?
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Purpose: At initial staging patients with malignant melanoma often show isolated cerebral susceptibility artefacts in T2*-weighted/SWI sequences without corresponding lesion in contrast-enhanced T1-weighted MR images. cavernomas, microhaemorrhages and melanin-containing metastases without contrast enhancement represent possible differential diagnoses for these findings. Purpose of this study was to evaluate, if these lesions already represent metastases.

Methods and Materials: MR images (1.5 T) of 20 patients (6w, 14m) with malignant melanoma and no history of cerebral metastasis but signal intensity loss in T2*/SWI at initial staging by MRI were reviewed retrospectively. MRI protocol consisted of a T2*/SWI, a FLAIR sequence, non-enhanced T1w and contrast-enhanced MPR. Patients were followed by MRI in mean 19.6 months (range, 6 - 46 months, 2006 - 2009).

Results: All patients showed in mean 2.1 (range, 1-5) hypointense lesions in T2*/ SWI. Of these lesions could be confirmed as cerebral metastases by follow-up.

Conclusion: Isolated cerebral susceptibility artefacts in T2*/SWI sequences without correlate in contrast weighted T1 images do not seem to indicate cerebral metastases.

B-0737 11:42
Evaluation of susceptibility weighted imaging in distinguishing of high-grade gliomas from primary central nervous system lymphomas
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Purpose: To analyse the findings of high-grade gliomas and PCNSL on SWI and conventional MR imaging, and to evaluate SWI in differentiating between these two tumours.

Methods and Materials: This study was approved by the institutional review board, and informed consent was obtained from all patients. 27 patients with high-grade gliomas 12 patients with PCNSL who had undergone conventional MR imaging and SWI were confirmed by histopathology. The number of lesions which were found haemorrhage was separately counted on the conventional MR imaging and SWI, then haemorrhage detection rate within tumours between these two sequences was separately compared, haemorrhage rate between these two sequences on SWI was also statistically analysed. Furthermore, the volume of haemorrhage and the number of intraslesional vessels of these two tumours were statistically analysed.

Results: There was a statistically significant difference in the detection of haemorrhage between the conventional MR imaging and SWI (P < 0.05) in high-grade gliomas, but not in PCNSL (P > 0.05). There was a statistically significant difference in the haemorrhage rates of these two tumours on SWI (P < 0.05). The haemorrhagic volume of high-grade gliomas was statistically higher than PCNSL on SWI. No vessels were found in all the lesions of PCNSL. The number of intraslesional vessels of high-grade gliomas was statistically higher than PCNSL on SWI.

Conclusion: SWI is more sensitive than the conventional MR imaging in detecting haemorrhage in high-grade gliomas. SWI is helpful to differentiate high-grade gliomas and PCNSL.

B-0738 11:51
Subependymal nodules and giant cell tumour prevalence in genetically studied tuberous sclerosis complex patients
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Purpose: To estimate the association among the presence of subependymal nodules (SEN), subependymal giant cell tumour (SGCT) and gene mutation in tuberous sclerosis complex (TSC) patients.

Methods and Materials: Contrast-enhanced brain MRI studies of 81 TSC patients were retrospectively reviewed by two neuroradiologists in consensus. The number of SENs was recorded. Any enhancing SENa1 cm in diameter and placed near the foramen of Monro was considered as SGCT. Two brain MRI follow-up exams for each patient with SGCT were evaluated to assess tumour growth in terms of diameter and volume. Patients were categorised into three subgroups according to genetic assessment: TSC1, TSC2 and no mutation identified (NMI) patients.

Results: Out of 81 patients, 17 were NMI, 20 TSC1, 44 TSC2. Fifty showed at least one SEN. A higher trend of SEN and SGCT among TSC2-patients was observed (p=0.251 and p=0.187, respectively). There was a significative association between SGCT and TSC2-patients (p=0.038). There was a significant association between SEN and TSC2-patients (p=0.003). At follow-up, the median SGCT diameter significantly increased from 14 mm to 15 mm (p=0.017), while the median volume significantly increased from 589 mm3 to 791 mm3 (p=0.006).

Conclusion: TSC patients with SENs are more likely to present with SGCT and a closer follow-up is suggested, in particular, if affected with TSC2 mutation. Volume assessment is more sensitive than diameter to evaluate tumour growth.
Vascular and perfusion imaging

Purpose: The use of contrast media and the time-resolved imaging of contrast kinetics (TRICKS) technique has some theoretical advantages over time-of-flight magnetic resonance angiography (TOF-MRA) in the follow-up of intracranial aneurysms after endovascular treatment. We prospectively compared the diagnostic performance of TRICKS and TOF-MRA with digital subtracted angiography (DSA) in the assessment of occlusion of embolised aneurysms.

Methods and Materials: Seventy-two consecutive patients with 72 aneurysms were examined 3 months after the embolisation. Test characteristics of TOF-MRA and TRICKS were calculated for the detection of the residual flow. The results of the quantitative comparison of the flow were compared with weighted kappa. Intraobserver and interobserver reproducibility was determined.

Results: The sensitivity of TOF-MRA was 85% (95% CI, 65-96%) and of TRICKS, 89% (95% CI, 70-97%). The specificity of both methods was 91% (95% CI, 79-98%). Accuracy of the flow quantification ranged from 0.76 (TOF-MRA) to 0.83 (TRICKS). There was no significant difference between the methods in the ROC curve regarding both the detection and the quantification of the flow. The interobserver reproducibility was very good with both techniques (kappa, 0.86-0.91). The intraobserver reproducibility was moderate for TOF-MRA and very good for TRICKS (kappa, 0.72-0.81).

Conclusion: In this study, TOF-MRA and TRICKS presented similar diagnostic performance. Therefore, the use of time-resolved contrast-enhanced MRA is not justified in the follow-up of embolised aneurysms.

Follow-up after embolisation of ruptured intracranial aneurysms: a prospective comparison of two-dimensional digital subtraction angiography, three-dimensional digital subtracted angiography, and time-of-flight magnetic resonance angiography

Purpose: The most appropriate method for follow-up of intracranial aneurysms after endovascular treatment is still being discussed. The purpose of the study was a prospective comparison of the diagnostic performance of digital subtracted angiography (DSA) and time-of-flight magnetic resonance angiography (TOF-MRA) at follow-up.

Methods and Materials: A total number of 72 consecutive patients with 72 aneurysms were examined 3 months after the embolisation. The index tests included: two-dimensional DSA (2D-DSA), three-dimensional DSA (3D-DSA), and TOF-MRA. The reference test was a consensus between 2D-DSA and 3D-DSA. The evaluation included detection of the residual flow, quantification of the flow, and validity of the decision on the reembolisation. Intraobserver and interobserver reproducibility was determined.

Results: Sensitivity and specificity in the detection of the residual flow ranged from 84.6% (2D-DSA and TOF-MRA) to 92.3% (3D-DSA) and from 91.3% (TOF-MRA) to 97.8% (3D-DSA). Accuracy of the evaluation of the flow degree ranged from 0.78 (2D-DSA) to 0.92 (3D-DSA, Cohen kappa). 2D-DSA presented lower performance in the decision on re-embolisation than 3D-DSA (P < 0.05, ROC analysis). The intraobserver reproducibility was very good with all techniques (kappa, 0.86-0.97). The interobserver reproducibility was moderate for TOF-MRA and very good for 2D-DSA and 3D-DSA (kappa, 0.72-0.94).

Conclusion: The most precise method of aneurysm follow-up is 3D-DSA. 2D-DSA shows a lower diagnostic value with regard to the decision on re-embolisation. Considering the insensitivity of DSA and the minor difference in the diagnostic performance between 3D-DSA and TOF-MRA, the latter method should be the basic modality for follow-up after aneurysm embolisation.
for both carotids and for each patient the ratio between the biggest CAWT and the contra-lateral was calculated to obtain an index. Bland-Altman, logistic regression and ROC curve analysis were calculated.

**Results:** The Bland-Altman plot demonstrates a very good agreement between measurements with a mean difference value of only 3.4% and 95% CI from -8% to 14.8%. A statistically significant difference in CAWT between symptomatic and asymptomatic patients (with a p value of 0.0001) was found. The ROC area under the curve was 0.742 (p = 0.001). Logistic regression model indicated that CAWT, stenosis degree and fatty plaques were independent variables associated with cerebrovascular symptoms (p value, respectively, 0.0057, 0.0003 and 0.0178).

**Conclusion:** Results of our study indicated that the index of asymmetry in the CAWT may be used as further parameter to stratify the risk of symptoms related to carotid artery.

**B-0745** 11:15
Detection of cerebral vasospasm using dynamic CT: analysis of volume perfusion CT maps and 4D-CT angiography
P. Schramm1, K. Dolotowski1, R. Schramm1, A. Froelich1, E. Klotz2, M. Knauth1; Göttingen/DE

**Purpose:** Cerebral vasospasm is a well-known complication after SAH. We used the 4D-CT angiographic method on patients with SAH to detect cerebral vasospasm. Conventional CT angiography was performed to compare the results.

**Methods and Materials:** Two hundred and thirty six patients with SAH were included in this study. The VPCT scans were obtained at peak arterial time. Images were assessed for the presence of arterial vasospasm and compared with conventional CTA or DSA. The distribution of ischaemic lesions was assessed on 3D perfusion parameter maps of cerebral blood flow (CBF), cerebral blood volume (CBV), mean transit time (MTT) and time to drain (TTD).

**Results:** In all 11 patients, focal areas of cerebral hypoperfusion were detected on 4D CT angiographic maps. The distribution of hypoperfused areas corresponds to the distribution of ruptured aneurysms. The presence of DVSs differed significantly among subtypes. DVS was not seen in NMA type. The former three findings were statistically significantly different from NMA type. The absence of CT findings such as peripheral distribution, cavitation or cyst, heterogeneity, surrounding ground-glass opacity (GGO), bulging fissure, and CT angiogram sign. Accessory opacities (centrilobular nodules, cavities, GGO), pleural effusion, and pneumonic type adenocarcinoma may occur in nonmucinous adenocarcinoma (NMA) formerly classified as nonmucinous BAC. These tumours should be separated into different categories, because they have clinical, pathologic and genetic differences. The purpose of this study was to compare the CT findings of tumours and NMA. The absence of CT findings such as peripheral distribution, cavitation or cyst, heterogeneity, surrounding ground-glass opacity (GGO), bulging fissure, and CT angiogram sign. Accessory opacities (centrilobular nodules, cavities, GGO), pleural effusion, and pneumonic type adenocarcinoma occurred in both types with no significant difference.

**Conclusion:** The absence of CT findings such as peripheral distribution, cavitation or cyst, and bulging fissure indicates the possibility of pneumonic type NMA.
B-0749 10:39

Purpose: To evaluate the accuracy of dynamic magnetic resonance perfusion imaging (DCE-MRI) in the differentiation ofhistological subtypes of primary lung cancer and to determine whether tumour localisation effects perfusion kinetics.

Methods and Materials: In 28 patients suffering from primary lung cancer dynamic contrast-enhanced MRI was performed for six minutes using a 1.5 T 3D-GRE sequence (TR/TE, 4.9/2.4 ms; FOV, 375 mm; in-plane resolution, 1.9x2.2x2 mm; scan-time, 17sec) at 1.5 Tesla. Density-time curves were determined by placing a region-of-interest (ROI) on the entire tumour as well as high-enhancing areas. The perfusion and peak enhancement were calculated using the maximum-slope method. Results were compared according to histological subtype, differentiation, size and allocation. The statistical analysis included Wilcoxon-test and Spearman’s correlation coefficient.

Results: Tumour perfusion determined for both the entire tumour (p < 0.0001) and the maximum enhancing area (p < 0.0001) was significantly higher in smaller tumours than in larger ones. Peripheral carcinomas revealed a slightly higher perfusion than central tumours (p=0.07). The results may indicate an anteriorly higher perfusion (p=0.02) and peak enhancement (p=0.03) than the adenocarcinomas. 

The comparison of SCLC with other non-small cell lung cancers (NSCLC) did not reveal any significant perfusion differences. In six patients tumour signal intensity showed an increase prior to aortic signal increase alluding to distinct tumour blood supply from pulmonary vessels.

Conclusion: DCE-MR depicts kinetic differences in perfusion between common histological subtypes of primary lung cancer. Additionally, DCE-MRI can raise information about origin of tumour blood supply, perfusion and peak enhancement and might therefore be considered for therapy response monitoring.

B-0750 10:48
Conventional 18 FDG/PET-CT combined with first-pass CT-perfusion technique in lung cancer patients: clinical staging and functional information in a single study C. Caiozzo, D. Ippolito, L. Guerra, E. De Ponti, C. Messa, S. Sironi; Monza/IT (cristinacapraro@hotmail.it)

Purpose: To assess the additional functional information and the relationship between perfusion measurements and glucose metabolism, obtained including CT-perfusion study (CTp) into whole body contrast-enhanced PET-CT protocol for lung cancer staging.

Methods and Materials: A total of 49 patients with biopsy-proven lung cancer, who were referred for cePET/CT staging, were prospectively enrolled in our study. Low-dose unenhanced PET/CT was acquired first. The position of CTp study was determined for both the entire tumour (p < 0.0001) and the maximum enhancing area (p < 0.0001) was significantly higher in smaller tumours than in larger ones. Peripheral carcinomas revealed a slightly higher perfusion than central tumours (p=0.07). The results may indicate an anteriorly higher perfusion (p=0.02) and peak enhancement (p=0.03) than the adenocarcinomas. The comparison of SCLC with other non-small cell lung cancers (NSCLC) did not reveal any significant perfusion differences. In six patients tumour signal intensity showed an increase prior to aortic signal increase alluding to distinct tumour blood supply from pulmonary vessels.

Conclusion: DCE-MR depicts kinetic differences in perfusion between common histological subtypes of primary lung cancer. Additionally, DCE-MRI can raise information about origin of tumour blood supply, perfusion and peak enhancement and might therefore be considered for therapy response monitoring.
low-dose protocol (80 kV, 30 mA, 10 mm slice) was used with HC-12 o’clock for last 10 patients. One radiologist, at 10 o’clock position of the CT-table, wearing apron, finger dosimeter, collar and goggles, performed all interventions. Body-, hand- and eye lens (unshielded) operator doses were monitored; total fluoroscopic time (TFT) and total hand time entering primary beam (THT) were recorded.

Results: Median TFT was 84s (range, 36-860s), median THT was 35s (range, 13-138s). Average operator doses per procedure at different HC for routine protocol were comparable (range 0.049-0.063mSv, average 0.056mSv); low-dose protocol showed 42% dose reduction (0.032 mSv). Maximum average dose to hands and eyes were 19.84mSv and 0.38mSv, 15.22mSv and 0.31mSv, 17.54mSv and 0.51mSv for HC-12, -10 and -2o clock. They were 4.57mSv and 0.17mSv for the 80 kV protocol.

Conclusion: Compliance with occupational limits can be reached by matching radiologist and HC position and using low-dose protocols.

B-0754 11:24
Percutaneous transthoracic needle biopsy of pulmonary nodules with Xper-CT and Xper-guide: a new technical approach
D. Luca, F. Vacirca, D. Ippolito, R. Conco; MonzaIT (daleni@thin.it)

Purpose: To evaluate feasibility and efficacy of percutaneous transthoracic needle biopsy of pulmonary nodules using Xper-CT and Xper-Guide, new software applications provided by Philips Allura FD20. All procedures were performed with local anaesthesia in the angiographical suite. Before puncture patients underwent Xper-CT scan that allows to obtain images of small body volumes of conical shape due to cone beam acquisition. On the basis of 3D reconstruction, using Xper-Guide, we planned the path of the needle to the target lesion. 2-4 samples were obtained in each case with a coaxial technique. After the procedure, patients underwent again a Xper-CT scan to assess any complications. Samples were classified as adequate (identification of histotype, grade and prognostical factors), intermediate (diagnosis of benignity/malignancy; histotype<50%) and inadequate. Complications and mean time of execution were also recorded.

Results: In 130 patients samples were adequate, in 11 patients were intermediate and in 7 inadequate. Pneumothorax was recorded in 14.8% of patients but external drainage was never required. Perинаuclar haemorrhagic suffusion was observed in 32 patients and in only one case self-limiting hemoptysis was registered. Mean time of execution was 18 minutes.

Conclusion: Percutaneous transthoracic needle biopsy of pulmonary nodules with XperCT and Xper-guide is a safe and accurate procedure and can be performed in every patient with a high percentage of adequate samples and with a low risk of severe complications.

B-0756 11:33
Response monitoring for lung cancer therapy using dynamic contrast-enhanced CT scan: a correlation with PET-CT
M. Yoo; S. Hwang, T. Kim, S. Kim; Seoul/KR

Purpose: To assess the usefulness of dynamic contrast-enhanced computed tomography (DCE-CT) for prediction of treatment response and to compare the results of DCE-CT with those of integrated positron emission tomography-computed tomography (PET-CT) in patients with lung cancer.

Methods and Materials: Twenty-four patients who had chemotherapy or radiotherapy for lung cancer (22 with NSCLC and 2 with SCLC) were enrolled into this study. A total of 39 tumours (mean size, 3.1 cm; range 1.3-7.2 cm) were revealed on follow-up DCE-CT, obtained at 30, 60, 90, and 120 seconds following administration of contrast medium and PET-CT less than 4 weeks apart. We measured relative enhancement ratio (RER) at each time point on DCE-CT and maximum standardised uptake value (SUVmax) on PET-CT. According to the response evaluation criteria in solid tumour (RECIST), 39 tumours were classified into 3 groups as progressive disease (PD, n = 25), stable disease (SD, n = 6), and partial response (PR, n = 8).

Results: RER at 60 seconds of PD (mean, 98.0% ±36.4%) was higher (P < 0.01) than those of SD (mean, 40.4% ±30.5%) and PR (mean, 38.3% ±24.1%). SUVmax revealed significant correlation with RER at 60 seconds (r = 0.48, P < 0.01, respectively). 13 (92.8%) of 14 tumours classified as PR or SD showed SUVmax of 2.5 or less and RER at 60 seconds of 80% or less.

Conclusion: DCE-CT can provide the information about treated tumour, functional composition as well as anatomic change in the post-treatment evaluation for patients with lung cancer.

B-0757 11:42
Clinical application of tissue permeability factor for differentiation of benign and malignant pulmonary mass on dynamic contrast material-enhanced (DCE) MRI
S.H. Baik, G.Y. Jin, Y.M. Han; Jeonju/KR (lovegumamatn@hanmail.net)

Purpose: To determine whether tissue permeability factor on dynamic contrast material-enhanced (DCE) MRI can help to discriminate between malignant and benign pulmonary mass.

Methods and Materials: From June 2010 to May 2011, 30 patients (14 women, 16 men; median age, 64 years; age range, 41-80 years) with suspected lung cancer agreed to undergo DCE MR imaging at 3.0 T. 15 patients were lung cancer and 15 patients were benign lung lesions. A two-compartment kinetic model was used to calculate the perfusion parameters including: volume transfer constant (Ktrans), in min-1), extravascular extracellular space volume fraction (Ve), efflux rate constant (Kep), initial area under curve (iAUC). An unpaired T-test was used to calculate the statistical significance of quantitative perfusion parameters between malignancy and benign lung lesions. Receiver operating characteristic (ROC) analysis was also performed for evaluation of sensitivity and specificity of perfusion parameters.

Results: Malignant lesions had higher Ktrans value than benign lesions (0.22 vs 0.14, p=0.0031). But there were no significant differences in other parameters (mean Ve: 0.37 vs 0.05, mean Kep: 0.69 vs 0.83, mean iAUC: 19.1 vs 24.9, respectively). A Ktrans value of more than 0.22 (min-1) was optimal for predicting malignancy (sensitivity 93.3% and specificity 40%).

Conclusion: Ktrans value of perfusion parameters on DCE MRI can help to discriminate between malignant and benign lung lesions.

10:30 - 12:00
Room D2
Interventional Radiology

SS 1709
Oncology
Moderators: F. Melchiorre; Milan/IT
T. Rand; Vienna/AT

B-0758 10:30
Segmental radioembolization using Yttrium 90 and its effect on hepatic volume changes
J.M. Theysohn, S. Mueller, J.F. Schlaak, S. Sipilae, A. Bockisch, T.C. Lauenstein; Essen/DE (jens.theysohn@uni-duisburg-essen.de)

Purpose: Yttrium 90 is a beta emitter used for radioembolisation as an emerging therapy option for unresectable liver malignancies. After radiation therapy of one liver lobe, the other lobe is expected to compensate the therapy-induced loss of liver function. Aim of this study was to assess the amount of volume gain induced in the untreated liver lobe.

Methods and Materials: Thirty patients (21m, 9f, mean age 70.3y) suffering from hepatocellular carcinoma were studied. All patients underwent radioembolisation of the right liver lobe with Yttrium 90. A mean dose of 109Gy was delivered to the target hepatic volume (range 100-160Gy). Absolute volumes of the right (RLV) and left liver lobe (LLV) were assessed using CT: before, 3, 6 and 9 months after radioembolisation of the right liver lobe. Furthermore, the relative volume of the left liver lobe (LLV/RLV+LLV) was calculated.

Results: Baseline volumes of the right and left liver lobe amounted to 1039 ml (RLV) and 562 ml (LLV) on average. The absolute LLV showed an increase on averagely 28.3% after 6 months. However, the absolute RLV decreased significantly during follow-up (mean change: -17.8%). The average relative LLV was 35.1% before and 45.8% six months after radioembolisation.

Conclusion: Constraints of liver function after radioembolisation of one liver lobe can be partially compensated through hypertrophy of the contralateral lobe. This observation may be the basis to introduce the concept of a radiation lobectomy can be partially compensated through hypertrophy of the contralateral lobe. This observation may be the basis to introduce the concept of a radiation lobectomy.
B-0759 10:39
Long-term survival data of patients with liver metastases of colorectal cancer after MR-guided laser-induced thermoablation (LITT) and different aetiologies and local response rate
T.J. Vogl, A. Dommermuth, K. Eichler, S. Zangos, M.G. Mack; Tübingen/DE (t.vogl@em.uni-frankfurt.de)

Purpose: To evaluate retrospectively long-term survival of 594 patients with colorectal liver metastases treated with MR-guided laser-induced thermoablation (LITT) depending on different factors.
Methods and Materials: 594 patients with liver metastases from colorectal carcinoma treated with MR-guided LITT between 01/99 and 12/10 were included. For survival analysis tumour localisation, TNM classification, number of metastases, diameter and volume of metastases and necrosis, lobular spread, number of treatment sessions, performance of adjuvant chemotherapy and transarterial chemoembolisation were considered. The Kaplan-Meier method was used to conduct this survival analysis.
Results: Log-rank test showed statistically significant differences between survival curves, multivariate Cox-regression-analysis (p < 0.05) showed prognostic factors overall survival like number of metastases pre intervention, adjuvant chemotherapy, diameter of metastases, ratio of volumes of necrosis and metastases, and affected lymph nodes. Median overall survival rate at the time of last LITT was 25 months, 1-year survival: 78%, 2-year survival: 52.1%, 3-year survival: 28%; 4-year survival: 16.4%; 5-year survival: 7.8%. Numbers of metastases pre-intervention: 1-2 metastases with a median survival rate of 60 months; 3-4 metastases: 45 months; ≥5 metastases: 42 months. Median survival rate for metastases < 20 mm in diameter 36 months; 20-30 mm 27 months, 30-40 mm 24 months and > 40 mm 21 months. Affected lymph nodes: median survival rate for patients with N0-classification 30 months, N1-classification 24 months; N2/N3/N4-classification 22 months.
Conclusion: The multivariate Cox-regression-model provided the minimal number of significant variables with the maximal prognostic value concerning overall survival for MR-guided LITT, i.e. diameter and number of metastases and primary classification of lymph nodes.

B-0760 10:48
MR-guided radiofrequency ablation using a wide bore 1.5 T system: clinical results of 226 treated liver tumours
H. Rempp1, P. Hoffmann1, L. Wais1, P. Pereira1, C.D. Claussen1, S. Clausen1; 1Tübingen/DE, 2Heilbronn/DE

Purpose: To evaluate the effectiveness of MR-guided radiofrequency (RF) ablation of liver malignancies using a wide-bore 1.5 T MR-system.
Methods and Materials: In 110 patients (27 females, 83 males) a number of 226 liver lesions were treated in 157 sessions by percutaneous RF ablation. Patient mean age was 64 (range 29-92), 69 lesions were primary liver tumours, 157 lesions were liver metastases, including 114 colorectal liver metastases. Other primary tumours were melanoma, breast cancer and neuroendocrine tumours. Mean lesion diameter was 20 mm (range 5-69 mm). MR-compatible bi- or multipolar internally cooled RF-probes were used. Planning, targeting and post-interventional control imaging were carried out in a wide bore 1.5 T MR scanner (bore: 72 cm). Technical success was assessed by a contrast-enhanced MR liver examination directly subsequent to the intervention. Technique effectiveness was assessed by dynamic contrast success was assessed by a contrast-enhanced MR liver examination directly subsequent to the intervention. Technique effectiveness was assessed by dynamic contrast-enhanced MR examination and pathological findings. VEGF and MVD were detected by immunohistochemical staining and quantitative comparison of tumour VEGF/MVD in different groups was done by RT-PCR.
Results: Compared with control group, tumours in the other four groups grew slowly (p < 0.01) and with larger necrosis (p < 0.01). Compared with no As2O3 group B and C, group D and E grew slowly (p < 0.01). There are less intrahepatic and distant metastasis found in group D and E with As2O3 than the other groups (p < 0.05). MVD and VEGF/MVD expression in groups D and E with As2O3 are significantly reduced than no As2O3 groups (p < 0.05). MVD in group D combination with As2O3 and ADM is significantly lower than the other two groups C and D with ADM or As2O3, respectively (p < 0.01).
Conclusion: Combination of As2O3 and routine chemotherapeutic drugs can synergize the antitumour effects of TACE. As2O3 may reduce the expression of VEGF/MVD and prevent tumour growth and metastasis by inhibiting the angiogenesis process.

B-0763 11:15
Transarterial chemoembolisation (TACE) in patients with unresectable cholangiocarcinoma: results and prognostic factors
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Purpose: To evaluate the effectiveness of transarterial chemoembolisation (TACE) with four chemotherapeutic protocols regarding local tumour control and survival of patients with unresectable cholangiocarcinoma (CCC) and to identify the prognostic factors determining treatment success.
Local tumour response was evaluated by MRI according to the RECIST criteria. cisplatin in 25.1% (29/115), embolisation was performed with lipiodol and emboco. Local tumour response was evaluated by MRI according to the RECIST criteria. Survival data were calculated according to the Kaplan-Meier method. Prognostic factors for survival were evaluated using log-rank-test. Results: Local tumour controls were: partial response 8.7% (10/115), stable disease 57.4% (86/115), progressive disease 33.9% (39/115) of patients. Median and mean survival times from the start of TACE were 15 and 20.8 months. Survival rate from the start of TACE was 52% after 1 year, 29% after 2 years, and 10% after 3 years. Initial tumour response, high tumour vascularity, and Child-Pugh class A were statistically significant factors for survival, and number of tumour lesions and location in liver were not statistically significant. No statistically significant difference between patients treated with different chemotherapeutic protocols was documented.

Conclusion: TACE is a palliative and safe treatment option for patients with unresectable CCC. Child Pugh class B, tumour hypovascularity, initially progressive disease were poor prognostic factors for survival.

B-0764 11:24
DC-beads chemoembolisation of HCC and evaluation of the results using CEUS and MDCT: a two-year study
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Purpose: The purpose was to compare the accuracy of contrast-enhanced ultrasound (CEUS) and multidetector CT (MDCT) for evaluating the outcome of transarterial chemoembolisation with doxorubicin beads in patients with HCC.

Methods and Materials: We retrospectively studied the follow-up imaging studies of a total of 33 nodules, observed in 21 patients (13 males and 8 females that ranged in age from 56 to 78) with biopsy proven HCC, who had undergone chemoembolisation with DC-beads. All patients were examined with multiphasic contrast-enhanced MDCT and CEUS approximately 4 weeks after DC-beads chemoembolisation. Contrast enhancement appearing within the tumour was interpreted as incomplete treatment or tumour recurrence. MDCT was used as reference standard and angiography in case additional DC-beads treatment was performed due to incomplete response. All examinations were interpreted blindly by two radiologists and afterwards CEUS findings were compared with MDCT by an experienced radiologist in abdominal imaging.

Results: In 33 nodules a complete response revealed in 26 nodules and incomplete in the other 7. Percentage of complete response was 78.7%. Post DC-beads chemoembolisation, CEUS was able to detect 6 of 7 cases with residual tumour. The results obtained with CEUS agreed with those obtained with MDCT in all cases, rendering a diagnostic accuracy of 100%. There was no statistically significant difference in overall diagnostic accuracy between MDCT and CEUS in the evaluation of residual tumour (p > 0.05).

Conclusion: CEUS represents a cost-effective and valuable tool in the evaluation of the outcome of chemoembolisation with DC-beads in HCC.

B-0765 11:33
Transpulmonary chemoembolization (TPCE) as a regional oncological treatment for non-resectable lung metastases
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Purpose: To evaluate tumour response with volumetric assessment for tumour size after treatment of unresectable lung metastases with repetitive transpulmonary chemoembolisation (TPCE) in palliative intention.

Methods and Materials: Between 2001 and 2011, 223 patients (mean 57.3 years; 111 males/112 females) suffering from 4,202 unresectable lung metastases were treated with TPCE (range: 1-16 sessions, mean: 3.8). They featured a mean of 18.8 metastases of different origins: colorectal carcinoma (n=82), breast cancer (n=92), sarcoma (n=19), renal cell carcinoma (n=14), melanoma (n=6), thyroidal (n=5), and others (n=63). Lipiodol, mitomycin C and microspheres (Spheron) were administered via balloon protection. At 4-week intervals, diagnosis and follow-up were accomplished using unenhanced and contrast-enhanced computed tomography.

Results: All patients tolerated the repeated treatments without adverse effects. In 20.6% (n=46) moderate to high lipiodol uptake was found while 79.4% (n=177) of the treated tumours showed a low storage. In 21.1% (n=47) of embolized metastases, tumour volume was resolved to 45.2 ml on average, in 26.0% (n=58) it remained unchanged while in 52.9% (n=118) it increased to 18.8 ml on average.

According to the RECIST criteria 47 patients had “partial response”, 58 had “stable disease” and 118 “progressive disease”. Mean survival was 811 days in patients with colorectal carcinoma, 892 days in breast cancer, 599 days in sarcomas, 556 days in renal cell carcinoma, 399 days melanoma, 647 days in thyroid cancer, and 797 days in other cancers using the Kaplan-Meier method.

Conclusion: According to these findings TPCE might be a well-tolerated procedure for the palliative treatment of non-resectable lung metastases.

B-0766 11:42
Transarterial chemoembolization (TACE) using drug-eluting bead preloaded with irinotecan (DEBIRI) in the treatment of metastases from uveal melanoma (UM) confined to the liver: preliminary assessment of tumour response and predictive value of angiographic pattern and diffusion-weighted magnetic resonance imaging (DW-MRI)
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Purpose: UM, very aggressive/rare tumour, gives metastases confined to the liver in more than 60% of the patients. Systemic/regional chemotherapy (fotemustine) is usually ineffective. Our purpose was to assess feasibility, complications, tumour response, and predictive value of angiographic pattern and DW-MRI in 10 patients submitted to TACE with DEBIRI.

Methods and Materials: In 2010/11, 10 patients affected by UM metastases confined to the liver histologically diagnosed were enrolled. 5 patients with >5 lesions were submitted to TACE with DEBIRI as second-line approach, in case of disease progression after systemic/regional fotemustine. 5 patients with <5 lesions were directly submitted to TACE with DEBIRI as first-line approach. Tumour response was assessed by contrast-enhanced CT (Recist); at baseline, predictive value of angiographic pattern (hypervascular/nodular vs. hypovascular/infiltrative pattern) and apparent-diffusion-coefficient (ADC) at DW-MRI was considered.

Results: TACE with DEBIRI (24 total procedures, mean=2.4) was feasible with a low complication rate (one cholecystitis spontaneously resolved) in all patients. PD occurred in all 5 patients submitted to fotemustine. Tumour responses to TACE with DEBIRI were as follows: 1CR, 3PR, 4SD, 2PD (second-line DEBIRI: 1PR, 3SD, 1PD; first-line DEBIRI: 1CR, 2PR, 1SD, 1PD). PD was correlated with hypovascular/infiltrative angiographic pattern and baseline ADC values of lesions (p=0.03).

Conclusion: In our preliminary experience, TACE with DEBIRI was feasible, safe, and effective in all patients; it can be proposed as first-line treatment in patients affected by UM metastases confined to the liver. Hypovascular/infiltrative angiographic pattern and high baseline ADC are predictive of a low response.

B-0767 11:51
Impact of hepatic steatosis and fibrosis on segmental liver hypertrophy after pre-operative portal vein embolisation
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Purpose: Portal vein embolisation (PVE) allows the induction of segmental liver hypertrophy in initially irresectable liver malignancies. Purpose of this study was to determine the impact of preexisting hepatic steatosis and portal fibrosis on the relative and absolute hypertrophy of the left lateral segments in patients scheduled for extended right hepatectomy.

Methods and Materials: Histology from pre-interventional biopsy or the resec- tion specimen was evaluated in 67 patients that received PVE because of pri- marily irresectable malignancies (34 colorectal metastases, 6 other metastases, 24 cholangiocarcinoma, 3 HCC). All accessible portal branches of segments 4-8 were embolised with cyanoacrylate glue. CT-volumetry was performed prior and 4 weeks after embolisation, if necessary repeated every 2-4 weeks, until the future liver remnant weight exceeded 0.8% body weight. Diagnosis of hepatic steatosis and portal fibrosis were compared with hypertrophy rates calculating Levene-T-tests and Student's T-tests.

Results: Steatosis was found in 39 (58%) patients (gralded mild, 35; moderate, 3; and severe, 1), fibrosis in 26 (39%) patients (gralded mild, 18; moderate, 2; severe, 2; and cirrhosis, 2). Without stenosis volume gain was 74% after 28 days (2.45%/d), with stenosis only 51% after another 89 days (1.61%/d). These ab- solute and relative differences reached statistical significance (p < 0.05), whereas no significant difference (p=0.543) was found in the left-lateral segmental volume increase between non-fibrotic (58%) and fibrotic (64%) livers.

Conclusion: Hepatic steatosis reduces the hypertrophy capability after PVE. However, the more chronic liver damage of - in this study mostly mild - portal fibrosis did not limit liver hypertrophy.
Mean duration of 3D measurements was 2:55 min/ 2:42 min (for readers 1 and 2). Examination and agreement between different readouts was high (ICC=.926/ ICC=.995). Repeated EOS measurements were only 0.2° for both readers. Interreader agreement coefficients were statistically significant (p <.001). There was no significant difference between diaphyseal length on MRI and US data, whereas total length was significantly longer than the US measurements (p <.001).

Conclusion: Our study provides MRI reference data of normal femoral length in utero, which, in addition to US, may be helpful to determine normal long bone growth as well as abnormalities. Diaphyseal length on MRI and US are equivalent, whereas total length, including the epiphyses, is significantly different from US findings.

B-0770 10:48

Is it possible to identify a pathologic hindfoot alignment on non-weight-bearing coronal MR-images? An attempt using different measurement techniques

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Purpose: To investigate the ability to discriminate between patients with normal and pathologic hindfoot alignment (HA) on coronal non-weight-bearing MR images.

Methods and Materials: IRB approval and informed consent of all patients was obtained. HA was quantified on HA view radiographs of 49 patients (mean age, 48 years; range, 21-76 years) using three different measurement techniques (calcaneal axis, medial and lateral calcaneal contour). These measurements were used to define a group of patients with a normal HA (0°-10° valgus) and a group with a clearly pathologic HA (> 10° valgus or varus). HA was then measured on coronal MR images using six different measurement techniques (calcaneal axis, medial and lateral calcaneal contour, sustentaculum-tangent, fibulocalcaneal distance, talar offset). ROC analysis was performed to find the one MR measurement technique with optimal sensitivity and specificity for discrimination between normal and pathologic HA.

Results: If on the HA view radiographs the measurements using the medial calcaneal contour were defining the assignment of the patients into the normal or the pathological group, all measurements on MR images could clearly (p <.05) identify the pathology. MR measurement with the calcaneal axis, however, reached the best combination of sensitivity (86%) and specificity (79%) with a cutoff of > 11° valgus.

Conclusion: It is possible to discriminate between patients with normal and pathologic HA on coronal non-weight-bearing MR images with a sensitivity of 86% and a specificity of 79%.

B-0771 10:57

Screw-home mechanism and its influence on tibial tuberosity-trochlear groove (TTTG) distance: measurement on MR examinations of the knee in asymptomatic volunteers in full extension, 15° flexion and 30° flexion

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Purpose: Increased tibial tuberosity-trochlear groove (TTTG) distance leads to patellar instability. The so-called screw-home mechanism refers to an outward rotation of the tibia when the knee reaches full extension. We hypothesised that the so-called screw-home mechanism of the knee in end stage extension increases the distance of the TTTG distance of the knee on MRI.

Methods and Materials: Transversal spin-echo T1-weighted MR images of the knee were acquired in full extension, 15° and 30° flexion of the knee in 19 asymptomatic volunteers (patients’ mean age: 28.9 years, range: 19.9-37.6 years, 10 left, 9 right) using a flexible coil. Following parameters were used: slice thickness: 3 mm, matrix: 256 x 384, FOV: 150 x 150 mm. The TTTG distance was measured in all three positions. The Student’s t-Test served for statistics.

Results: The mean TTTG distance was 15.3 ± 3.4 mm (range: 8.4-19.9 mm) in full extension, 10.4 ± 3.8 mm (range: 4.0-15.6 mm) in 15° flexion and 8.8 ± 3.4 mm (range: 2.5-13.3 mm) in 30° flexion. The mean values were significantly different (p-value < 0.001) between three positions.

Conclusion: The TTTG distance increases significantly in the endstage extension of the knee. Therefore, the comparability of published TTTG values measured on radiographs, CT and MRI at various flexion/extension angles of the knee is limited.

B-0772 11:06

Femoral and tibial torsion measurements using 3D models based on low dose biplanar x-ray in comparison to standard CT measurements

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Purpose: To compare femoral and tibial torsion measurements and interreader agreement of measurements using 3D models based on low dose biplanar x-ray in comparison to standard CT measurements and evaluate interchangeability of the two methods.

Methods and Materials: Institutional review board approval was obtained and all patients signed an informed consent. Femoral and tibial torsion were measured based on 3D models based on low dose biplanar x-rays (EOS imaging system) and on axial CT images by two independent readers, respectively. The two measurement modalities were compared by means of Bland-Altman plots and descriptive statistics. Interreader agreement was quantified by means of intraclass correlation coefficients (ICC).
Results: The maximal measurement difference between the two CT readers (femur 11° / Tibia 12°) was slightly bigger than the maximal measurement difference between the two readers using 3D models based on biplanar x-rays (Femur 9°/Tibia 10°). Bland-Altman plots showed no relevant differences between the results of the two measurement modalities. Except for one measurement of the femoral torsion and one measurement of the tibial torsion all results based on the 3D models were within the 95% limit of agreement (mean ± 1.96 standard deviation). Interrater agreement was significant (p < 0.9).

Conclusion: Femoral and tibial torsion measurements using 3D models based on biplanar x-rays are interchangeable with CT measurements.

B-0773 11:15

Is the alpha-angle able to discriminate between symptomatic patients with femoroacetabular impingement (FAI) and asymptomatic volunteers?

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Purpose: To assess diagnostic characteristics of different alpha-angle thresholds in volunteers and FAI patients.

Methods and Materials: 106 individuals (20-50 years) were included (53 patients with cam deformities and 53 age- and gender-matched asymptomatic volunteers). The patient group consisted of 33 cam-type FAI and 20 mixed-type FAI. Alpha-angles were measured on a 3 T-MRI unit. The T2-maps were analysed with FAI-Alphas. Alpha-angles > 55° were measured in 20 and 33 out of 53 volunteers (38%/63% for reader 1) / 30/20 (57%/54% for reader 2) / 32/10 (50%/30% for reader 3), albeit with a large overlap. Interobserver agreement was good (ICC=0.712). ROC showed the largest area under the curve at the anterosuperior segment (area 0.791/0.624 for reader 1/2; p < 0.001): a 55°-alpha-angle threshold gave a sensitivity/specificity of 82%/66% for reader 1 and 90%/47% for reader 2, while a 60° threshold gave 72%/78% for reader 1 and 80%/73% for reader 2.

Conclusion: The alpha-angle is suboptimal to discriminate volunteers and FAI patients with cam-type deformities. Discrimination is most reliable at the anterosuperior segment. Raising the alpha-angle threshold from 55° to 60° reduces false-positives and might result in less overtreatment.

B-0774 11:24

Is there a relationship between T2-mapping of knee cartilage or the whole-organ MRI scoring method (WORMS) for knee osteoarthritis and the patient’s pain, symptoms, function in daily life (ADL), function in sport and recreation (Sport) and knee-related quality of life (QOL) as given by the knee osteoarthritis outcome score (KOOS) questionnaire?

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Purpose: Both T2-mapping of cartilage and the WORMS method are established research tools for knee osteoarthritis: is there a relationship with the patients’ KOOS-questionnaire?

Methods and Materials: After introducing T2-mapping and the KOOS-questionnaire in our routine protocol for knee MRI, we included the first 50 females and 50 males, respectively (female mean-age 41y, range 18-75y; male mean-age 42y, range 27-58y). We employed a sagittal multi-echo-spin-echo-sequence for T2-mapping of cartilage and the WORMS method. Both were calculated with linear regression to look for relationships between T2 values and the KOOS-questionnaire. The T2-maps were analysed with FAI-Alphas. Alpha-angles > 55° were measured in 20 and 33 out of 53 volunteers (38%/63% for reader 1) / 30/20 (57%/54% for reader 2) / 32/10 (50%/30% for reader 3), albeit with a large overlap. Interobserver agreement was good (ICC=0.712). ROC showed the largest area under the curve at the anterosuperior segment (area 0.791/0.624 for reader 1/2; p < 0.001): a 55°-alpha-angle threshold gave a sensitivity/specificity of 82%/66% for reader 1 and 90%/47% for reader 2, while a 60° threshold gave 72%/78% for reader 1 and 80%/73% for reader 2.

Conclusion: The alpha-angle is suboptimal to discriminate volunteers and FAI patients with cam-type deformities. Discrimination is most reliable at the anterosuperior segment. Raising the alpha-angle threshold from 55° to 60° reduces false-positives and might result in less overtreatment.

Conclusion: Although T2 mapping of cartilage and the WORMS are valuable in knee osteoarthritis research, both of them show only a very weak if any relationship with the patients’ pain, symptoms, ADL, function in sport and QOL.

B-0775 11:33

Comparison of 3D-SPACE vs. 2D-FSE sequence for the evaluation of internal knee derangement at 3.0 T

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Purpose: To assess the diagnostic performance of the 3D-SPACE (sampling perfection with application-optimised contrast using variable flip-angles) sequence as compared to routine 2D FSE in the evaluation of internal knee derangement at 3.0 T.

Methods and Materials: From January to July 2011, a sagittal isotropic fat-saturated 3D-SPACE FSE sequence was added to a conventional 2D knee MRI imaging protocol. Sequence parameters of 3D-SPACE were: TR=1200 ms; TE=47 ms; voxel size=0.6x0.6x3mm. Subsequent knee arthroscopy was performed in 40 patients. Two radiologists, blinded to operative results, independently evaluated multiplanar 2D-FSE and 3D-SPACE data sets, with a 4-week interval, for the presence of meniscal tears, anterior cruciate ligament (ACL) and cartilage lesions. Agreement of both readers was calculated with the Kappa-statistic. McNemar’s test was used to identify significant differences (p < 0.05) between 2D and 3D sequences. Interobserver agreement was determined using Cohen’s kappa test.

Results: For the diagnosis of tears of medial and lateral meniscus, and ACL lesions, accuracy of both sequences ranged from 78% to 88%, 88% to 95%, and 92% to 100%, respectively, for both readers. For the detection of cartilage lesions, accuracy of both sequences ranged from 75% to 81% for both readers. We found no significant differences in diagnostic yield between 2D and 3D sequences. Interobserver agreement was excellent for meniscus and ACL lesions (kappa 0.81), and it was moderate for cartilage lesions (kappa 0.60).

Conclusion: The diagnostic performance of 3D-SPACE is similar to routine 2D-FSE for the detection of meniscal, anterior cruciate ligament and cartilage lesions of the knee at 3.0 T.

B-0776 11:42

Through-plane distortion correction and view-angle tilting for reduction of metal artefacts at MR imaging in patients with total hip arthroplasty: performance of STIR and T1 sequences

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Purpose: To determine the performance of the new WARP sequence for reduction of both through-plane and in-plane artefacts in patients after total hip arthroplasty (THA).

Methods and Materials: 40 patients with THA were prospectively included. Slice encoding metal artefact correction (SEMAC), view-angle-tilting (VAT), and increased bandwidth were applied by the WARP-TSE sequence at 1.5 T. Coronal STIR-images and T1-weighted images were acquired. The T1-weighted images were optimised with high bandwidth (STIR-hiBW) and STIR-TSE, as compared to routine 2D FSE in the evaluation of internal knee derangement at 3.0 T.

Results: Signal void was assessed on a five-point scale (1, no artefacts; 5, not visible due to severe artefacts) by two readers. Clinical findings were recorded. Quantitative data were analysed with a t-test and qualitative data with a Wilcoxon signed rank test.

Conclusion: Although T2 mapping of cartilage and the WORMS are valuable in knee osteoarthritis research, both of them show only a very weak if any relationship with the patients’ pain, symptoms, ADL, function in sport and QOL.
**SS 1716**

PET for cancer patient management

**Moderators:**
- J. Grimm, New York, NY/US
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**B-0777 10:30**

**Oncologic Imaging**

**B-0777** 10:30

Assessment of the metabolic-flow phenotype of primary colorectal cancer: correlations with microvessel density are influenced by the histological scoring method


**Purpose:** To investigate how different methods of histological scoring of microvessel density (‘Hotspot’ versus Chalkley) affect correlation between integrated 18F-FDG and BF parameters and CD105 microvessel density. The purpose of the study is to investigate how different methods of histological scoring of microvessel density (Hematologic Scoring Method) affect correlation between tumour metabolic parameters and BF parameters and CD105 microvessel density. The study is performed using low dose CT-data for PET/CT and Dixon-MR sequences for MR/PET. PET/CT and MR/PET were performed simultaneously and compared using visible lesion location, number of suspicious lesions, image quality, and alignment. For quantitative comparison, SUV-based assessment of the detected lesions and different organs was performed. Suvmetry, mean, and regional blood flow (BF) were derived for the entire tumour. Immunochemical staining for CD105 expression was assessed by Spearman rank correlation with statistical significance at 5%. Results: Mean (SD) tumour size was 38.5 (20.5) mm. Mean (SD) for SUVmax, SUVmean, and BF were 19.4 (5.5), 11.6 (2.5), and 85.4 (40.3) mL/min/100 g tissue, respectively. The mean (SD) for CD105 microvessel density was 71.4 (23.6), 66.8 (22.9), and 6.18 (2.07), respectively, for 2 hotspot, 4 hotspot, and Chalkley methods. The positive correlation between BF and CD105 expression was modest but higher for Chalkley than for Hotspot analysis (r=0.33; p=0.05; r=0.38; p=0.03, respectively). There was no correlation with 2 hotspot analysis (r=-0.20, p=0.26). There were no significant correlations between metabolic parameters (SUVmax or SUVmean) and CD105 expression (r=0.08 to 0.22, p=0.21-0.63).

**Conclusion:** The histological analysis method affects correlations between tumour CD105 expression and BF but not SUVmax or SUVmean.

**B-0779 10:29**

Diffusion-weighted MRI and (68)Ga-DOTATOC PET for early monitoring of response to loco-regional (90)Y-/(177)Lu-DOTATOC therapy in patients with neuroendocrine liver metastases


**Purpose:** Monitoring response to therapy is predominantly based upon evaluating tumour size before and after treatment, for example, in the response evaluation criteria in solid tumours (RECIST). Therefore, we evaluated if diffusion-weighted MRI imaging (DW-MRI) and (68)Ga-DOTATOC PET are potential surrogate biomarkers for providing earlier information about a possible treatment response to intraarterial DOTATOC therapy.

**Methods and Materials:** In 12 consecutive patients with 29 liver metastases of gastroenteropancreatic neuroendocrine cancer (GEP-NET) were evaluated. All patients underwent both diffusion-weighted and dynamic contrast-enhanced magnetic resonance imaging (DWI-DCE-MRI) including breath-hold echoplanar Dwi sequences (b-values 50, 300, 600xmm2) as well as (68)Ga-DOTATOC PET before therapy (baseline) and after therapy (follow-up). In 12 patients (n=22) both PET/CT and MR/PET were performed. MRI/PET-findings obtained by MR/PET or PET/CT. Anatomical allocation of suspicious lesions, image quality and alignment. For quantitative comparison, SUV-based assessment of the detected lesions and different organs was performed. In 12 patients, baseline median tumour ADC increased from 1.21x10^-3 mm2/sec to 1.47x10^-3 mm2/sec while the lesionADC increased from 1.06x10^-3 mm2/sec to 1.32x10^-3 mm2/sec after last loco-regional intervention (p<0.001) whereas the change in SUVmax of (68)Ga-DOTATOC was not significantly different.

**Conclusion:** After loco-regional DOTATOC therapy non-responder and responder subgroups both presented a change in ADC, prior to SSTR2-receptor expression changes and although morphological response according to RECIST criteria was only measurable in few lesions. Therefore, this work suggests that diffusion-weighted imaging is an earlier tumour integrity surrogate for therapeutic intervention and possible early indicator for treatment response.

**B-0780 10:48**

Simultaneous whole body MR/PET in patients with oncological diagnoses: comparison to PET/CT


**Purpose:** To evaluate comparability of the clinical performance of PET/CT and MR/PET in patients with oncological diagnoses.

**Methods and Materials:** Thirty-two patients underwent a single-injection/dual-isotope protocol, consisting of a PET/CT and subsequent MR/PET scan. PET/CT was performed according to standard clinical protocols (500±50 min p.i. of 400±40 MBq[18F]FDG, 2 min/bed position (BP)). SUV(max) of both modalities were reconstructed iteratively (OSEM 3D), attenuation correction and regional allocation was performed using low dose CT-data for PET/CT and Dixon-MR sequences for MR/PET. PET/PET and PET/CT were compared visually by rating number and location of suspicious lesions, image quality and alignment. For quantitative comparison, SUV-based assessment of the detected lesions and different organs was performed. Results: Simultaneous MR/PET acquisition was feasible. No significant difference was found between the numbers of suspicious lesions (n=80) or lesion-positive patients (n=22) detected with MR/PET or PET/CT. Anatomical allocation of PET-findings obtained by MR-PET was significantly feasible on the basis of the non-diagnostic Dixon-MR sequences, with comparable performance as with low dose CT for PET/CT. Quantitative evaluation revealed a high correlation between mean SUV measured in lesions and organs with MR/PET or PET/CT (p = 0.93; p = 0.92, respectively).

**Conclusion:** Simultaneous whole body MR/PET imaging is feasible with high quality in short time, allowing the detection of non-suspicous lesions (n=22) detected with MR/PET or PET/CT. Anatomical allocation of PET-findings obtained by MR/PET was significantly feasible on the basis of the non-diagnostic Dixon-MR sequences, with comparable performance as with low dose CT for PET/CT. Quantitative evaluation revealed a high correlation between mean SUV measured in lesions and organs with MR/PET or PET/CT (p = 0.93; p = 0.92, respectively).
B-0781
10:57
Staging of neuroendocrine tumours: comparison of 68Ga-DOTATOC-PET/CT and MIR
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Purpose: To compare 68Ga-DOTATOC-PET/CT and whole body (WB) MRI regarding metastatic lesion detection in patients with neuroendocrine tumours (NET).
Methods and Materials: In 51 patients with histologically proven NET 68Ga-DOTATOC-PET/CT and WB-MRI were performed. PET/CT was performed after administration of 150 MBq 68Ga-DOTATOC. CT protocol comprised multiphasic contrast-enhanced imaging. MRI protocol standard sequences (pre/post Gadolinium) at 1.5 T. Each modality (PET, CT, PET/CT, WB-MRI) was evaluated independently by two experienced readers. Consensus-decision based on imaging, histology, surgery and clinical follow-up served as standard of reference. Detection rates of each modality were compared using McNemar test. P values < 0.05 were considered significant.
Results: In 41 of 51 patients, metastatic lesions were detected (lung: 54, liver: 266, bone: 131, lymph node (LN): 99, other: 43). 68Ga-DOTATOC-PET was false negative in S41 patients due to lack of receptor expression. Of all 593 detected lesions, PET identified 570 (62%), CT 482 (81%), PET/CT 545 (92%) and WB-MRI 540 (91%). Organ-based detection rates of PET/CT were significantly higher for LN (100% vs 73%; p < 0.0001) and pulmonary lesions (100% vs 87%; p=0.0233) while WB-MRI had significantly higher detection rates for liver (99% vs 92%; p < 0.0001) and bone lesions (96% vs 82%; p < 0.0001). All of 593 lesions, 22 were found only in PET, 11 only in CT and 47 only in WB-MRI.
Conclusion: PET/CT and WB-MRI showed comparable overall detection rates in NET, but significantly differed in organ-based detection rates with superiority of PET/CT.

B-0782
11:06
Comparison of lesion detection in patient with cranial meningiomas using 68Ga-DOTATOC-PET/CT and contrast-enhanced MRI
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Purpose: PET imaging with somatostatin receptor ligands, such as 68Ga-DOTATOC-PET/CT, is a well-established method for detection and target volume definition of meningiomas prior to radiotherapy. Since DOTATOC-PET appears to detect more meningiomas than MRI, we conducted a retrospective analysis to compare the diagnostic accuracy of contrast-enhanced MRI (CE-MRI) with 68Ga-DOTATOC-PET/CT in patients with cranial meningiomas prior to radiotherapy.
Methods and Materials: Over a period of six years 134 patients (20-82yo, 107, 27) in our hospital underwent cranial CE-MRI and 68Ga-DOTATOC-PET/CT prior to radiotherapy of cranial meningiomas. Both methods were compared by a side-by-side read counting the detected meningiomas and recording the localisation and the SUVmax of those detected by PET/CT only.
Results: Within the 134 patients investigated by both modalities 190 meningiomas were detected. PET/CT only detected 19 meningiomas, detected in PET/CT only but located close to areas of previous craniotomy (possible relapses or remnants of former meningiomas) were excluded from further analysis. Conclusion: 68Ga-DOTATOC-PET/CT presented with a higher sensitivity in detecting meningiomas when compared to CE-MRI. Especially tumours adjacent to the falx cerebri, located in the skull base or tumours obscured by imaging artefacts are difficult to detect by MRI.

B-0783
11:15
Diagnostic performance of PET/MR versus PET/CT in the abdomen
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Purpose: To compare the diagnostic performance of PET/MR versus PET/CT in the abdomen.
Methods and Materials: Sixty-six oncologic patients (mean age 61) were examined on a TOF-PET/CT and a 3-T-MR platform (GE Discovery 690 & 750, respectively) integrated by a shuttle system. Unenhanced CT and T1w (LAVA) 3D-GRE images of the abdomen were acquired, co-registered with PET data and analysed independently by two double board certified radiologists/nuclear physicians. PET-positive lesions were characterised at CT and MR using a 3-point scale to grade image quality and lesion conspicuity. Cohen's k-statistics were calculated for interobserver agreement and the Wilcoxon rank-sum test was employed for intraobserver conspicuity grading.
Results: A total of 147 PET positive lesions were evaluated in the liver (n=49), bone (n=28), lymph nodes (n=21), lung (n=13), GI-tract (n=10), soft tissues (n=6), pleura (n=6), adrenal glands (n=5), pancreas (n=4), spleen (n=1), peritoneum (n=1), chest wall (n=1) and breast (n=1). Lesions were characterised and graded based on conspicuity in CT and MR with good (κ=0.72) and moderate (κ=0.46) interobserver agreement, respectively. In the overall lesion-based comparison, no significant difference was found. However, in the organ-based comparison, PET performed significantly better than CT in the liver (p < 0.001 for both readers) while CT tended to perform better than MR in depicting basal lung lesions (p < 0.05 and p < 0.32). Conclusion: Unenhanced PET/MR outperforms unenhanced PET/CT in the depiction and characterisation of liver lesions. However, in the evaluation of extrathoracic abdominal pathology in oncologic patients, no significant difference between theses modalities is seen.

B-0784
11:24
Staging and restaging Hodgkin's disease: low-dose non-enhanced FDG-PET/CT versus full-dose contrast-enhanced FDG-PET/CT
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Purpose: To compare the agreement between low-dose non-enhanced PET/CT with free contrast-enhanced PET/CT in the staging and restaging Hodgkin's disease (HL).
Methods and Materials: A total of 42 patients with histologically proven HL underwent a full FDG-PET/CT study that included low-dose non-enhanced CT and full-dose contrast-enhanced CT studies, performed in a single step procedure. 30 studies were performed for staging and 40 for the evaluation of residual disease after first line of chemotherapy (restaging). For every patient, each modality of PET/CT images was evaluated by either of 2 pairs of expert readers blinded about the clinical data and unaware of the results of the other type. Finally, the stage of the disease was defined according to PET/CT and PET/ceCT following the Ann Arbor classification. For restaging studies, images were interpreted considering the presence of residual mass with or without residual activity according to the International Harmonization Project.
Results: Of 630 sides considered as potentially involved by the disease, PET/CT and PET/ceCT were concordant in 622/630 (98.7%) sides in staging studies and in 40/40 (100%) patients of restaging studies. PET/CT and PET/ceCT were concordant with standard reference in 2830 (88.9%) and in 2930 (94.4%) patients, respectively, in staging studies. In restaging studies, both PET/CT and PET/ceCT results were concordant with standard reference in 3840 (92.8%) studies. Conclusion: Our study showed a good correlation between PET/ceCT and PET/CT both in staging and, in particular, in restaging studies. If these results are confirmed in a larger patients' population, PET/CT might suffice as the only imaging technique for staging and restaging HD, sparing added radiation burden and iodinate contrast administration to the patient and reserving ceCT for selected cases.

B-0785
11:33
Prognostic value of residual CT masses in HD patients with a negative FDG PET after chemo/radiotherapy
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Purpose: To properly define the negative predictive value of residual CT masses in HD patients with PET negative at the end of treatment and define its correlation with disease-free survival (DFS).
Methods and Materials: For our study we retrospectively analysed data deriving from patients (n=105; M/F: 62:43; median age 58 years) who underwent FDG-PET and CT scan at the end of treatment. For study purpose, we identified those presenting a negative PET scan and a residual mass on CT. 72 patients after first line treatment, while 31 after salvage therapy. All patients were followed up for a median period of 45 months.
Results: The five-year DFS for PET-/CT- Vs PET-/CT+ patients was 89.4% and 68.7%, respectively (p=0.053). The prognosis of residual mass at CT scan was significantly worse also when considering the dimension of the masses: the larger the mass, the lower the DFS (p=0.007). An optimal cut-off point was identified, with regard to maximal diameter, namely 4 cm. When introducing this cut-off, the DFS in this setting of patients was 50% vs 82% (p < 0.0029). Also, other potential prognostic factors have been analysed (number of masses, first Vs salvage treatment program, sex, bulky disease, B-symptoms), but among them no correlation with DFS or overall survival (OS) emerged.
Conclusion: These data suggest that the presence of residual mass, independently from the FDG PET result, should be carefully followed up and the patients should be considered at an increased risk for relapse/progression of the disease.

European Congress of Radiology 2012
Comparison of MR/PET and PET/CT in the assessment of pulmonary masses

Purpose: Comparison of the hybrid modalities MR/PET and PET/CT in the assessment of pulmonary lesions regarding FDG-uptake, lesion characterisation and tumour staging.

Methods and Materials: The study was approved by the local ethics committee. Ten patients with suspected or proven bronchial carcinoma were evaluated. MR/PET was performed with a new hybrid whole body system consisting of a 3 T MR scanner with an integrated PET system. Results were compared to those gained by a directly preceding [18 F]-FDG-PET/CT. Segmentation-based attenuation correction of PET data recorded in MR/PET was conducted with DIXON-based fat-water separation. Tumour and lymph node staging based on PET/CT and MR/PET studies was performed by two readers in consensus. Tumour-to-liver (T/L) ratios calculated in MR/PET and PET/CT were compared. Statistical testing was carried out using Pearson’s correlation and Bland-Altman analysis.

Results: In all patients, diagnostic MR/PET image quality with good tumour delineation was achieved. Most lesions (9/10) showed a pronounced FDG uptake. One lesion was morphologically suspicious for malignancy in CT and MRI but showed no FDG uptake. MR/PET showed higher T/L ratios than PET/CT (8.0 ± 3.9 vs 4.4 ± 2.0); however, significant correlation regarding T/L ratio was found between both scanners (r = 0.90, p = 0.0008). TNM score discrepancies occurred in 3/10 patients mainly due to modality-inherent differences in lesions size measurement.

Conclusion: MR/PET imaging of the lung is feasible and provides diagnostic image quality in the assessment of lung masses. Similar lesion characterisation and tumour stage was found comparing PET/CT and MR/PET in the majority of patients.

The impact of acquisition time on image in whole body 18 F-FDG-PET CT for cancer staging
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Purpose: To evaluate the impact of acquisition time on image quality, lesion detection rate, standard uptake values and lesion volume in F-18 fluorodeoxyglucose positron emission tomography (18 F-FDG PET) in cancer patients.

Methods and Materials: Over a time period of 7 months, 33 cancer patients were included in this study. In these patients, a total of 63 lesions were independently evaluated by two radiologists (experienced and beginner). A whole body 18 F-FDG PET-computed tomography scan with 3 min and 1.5 min acquisition time per bed position was performed in each patient. Lesions were visually identified and lesion locations compared. Lesion volumes and standard uptake values (SUV) of the primary tumour, lymph nodes and metastases were obtained and compared. For all parameters, interrater agreement was assessed.

Results: All relevant lesions were identifiable at both acquisition times. Image quality was significantly reduced in scans with an acquisition time of 1.5 min (p < 0.001). Nevertheless, the image quality was rated excellent/good in 91% of the scans with an acquisition time of 1.5 min. The quality of lesion visualisation was excellent regardless of the acquisition time. Lesion volume on PET images and SUVmax were not significantly different between both acquisition times (p < 0.001). Interrater agreement was good (κ > 0.8).

Conclusion: Despite significant decrease in image quality, a reduction of acquisition time per bed position seems to be clinically feasible without reduction of the lesion detection rate even for less experienced observers.

Diagnostic performance of a non-contrast-enhanced MR imaging protocol for potential living-related kidney donors
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Purpose: To prospectively evaluate the performance of a non-contrast-enhanced magnetic resonance (MR) imaging protocol for preoperative screening of living-related kidney donors.

Methods and Materials: Forty consecutive subjects (mean age 52.2 ± 11.3 years, range 29-73 years) underwent MR imaging with T2-weighted sequences (coronal and axial plane), with a non-contrast enhanced respiratory-gated 3D steady state free precession (SSFP) angiography (NCE-MRA) sequence and with contrast-enhanced magnetic resonance angiography (CE-MRA) sequences in the arterial and venous phase. Two blinded readers independently assessed arterial and venous anatomy and potential kidney lesions. Results of non-contrast-enhanced images were compared to CE-MRA, and in a subgroup of 21 subjects to surgery as standard of reference.

Results: Regarding arterial anatomy NCE-MRA yielded sensitivity, specificity and accuracy of 100%, 89% and 91% compared to CE-MRA. Three kidneys were found to have more accessory renal arteries at NCE-MRA but not at CE-MRA. In the subgroup of 21 subjects one surgically proven accessory artery was depicted with NCE-MRA but not with CE-MRA. Accuracy of T2-weighted images regarding accessory veins or variant venous course was 99%, with one missed circumaortic vein at T2-weighted images. Two simple cysts were missed on T2-weighted and NCE-MRA but not on CE-MRA images.

Conclusion: A non-contrast-enhanced MR imaging protocol including NCE-MRA and T2-weighted images allows for the accurate screening of living-related kidney donors and may serve as an alternative to CE-MRA.

Transplant imaging and special topics
Moderators:
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Pre-operative assessment of living renal transplant donors with computed tomography angiography versus magnetic resonance angiography in 118 patients
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Purpose: To compare modern multislice computed tomography angiography (CTA) with magnetic resonance angiography (MRA) in the pre-operative evaluation of vascular anatomy of living renal transplant donors.

Methods and Materials: 118 renal transplant donors were examined with both a modern multislice CT-scan (<= 1 mm slice thickness) and a 1.5 T MRI scanner. 236 kidneys were included in the CTA- and MRA-analysis. Renal vasculature was evaluated independently by two readers in each modality with a delay of 4 weeks between reading sessions. Surgical correlation on the operated side was available in all patients. Gold-standard was defined by surgical correlation and consensus reading of both modalities.

Results: There were 316 renal arteries and 287 renal veins in total. Sensitivity of CTA for arteries was 99.1% and 94.9% for readers 1 and 2, respectively. Sensitivity of MRA for arteries was 95.3%/94.6%. Most of the overlooked arteries were <= 1 mm diameter (reader 1: 2 of 3 in CTA and 12 of 15 in MRA; reader 2: 12 of 16 in CTA, and 10 of 17 in MRA). Sensitivity for arteries >= 2 mm was 99.7%/98.7% in CTA, and 99.1%/97.8% in MRA. Sensitivity for veins was 99.6%/97.8% in CTA, and 97.0%/95.1% in MRA. Both readers misdiagnosed between 1 and 3 non-present arteries and between 2 and 4 non-present veins in both modalities.

Conclusion: Modern multislice CT- and MRI-scanners allow highly accurate evaluation of the vascular anatomy of living renal transplant donors, especially for vessels of >= 2 mm diameter. CTA may provide slightly better depiction of very small arteries; however, this may be reader-dependent.
**B-0790**

**10:48**

**Diffusion-tensor imaging (DTI) for functional assessment of transplanted kidneys at 3 T**

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**Purpose:** The purpose of our study was to investigate diffusion tensor imaging (DTI) for functional assessment of transplanted kidneys at 3 T.

**Methods and Materials:** 40 renal transplant recipients (mean age 49.6 ± 14.9 years) were included in this study and examined on a 3 T MR scanner using a body array coil. Recipients were divided into two groups according to allograft function: group a, patients with good allograft function (GFR > 30 ml/min/1.73m²); group b, patients with poor allograft function (GFR ≤ 30 ml/min/1.73m²). The DTI sequence was acquired in the coronal plane with 5 b-values (0, 200, 400, 600, 800 s/mm²) and 20 direction (FOV 400 mm, matrix 192, slice thickness 6 mm, 10 slices, TR/TE 1500/90 ms). FA (fractional anisotropy) and ADC (apparent diffusion coefficient) maps were calculated and a ROI-based analysis was performed.

**Results:** Mean FA of the renal medulla was significantly higher in group a (0.39 ± 0.06) as compared to group b (0.27 ± 0.05). Furthermore, mean ADC values of the renal cortex and medulla were significantly higher in group a (1856.6 ± 107.4 and 1816.9 ± 126.4 10-6 mm²/s, respectively) than in group b (1722.8 ± 164.2 and 1722.8 ± 148.2 10-6 mm²/s, respectively). Medullary FA values correlated significantly with allograft function as assessed by GFR (r=0.65).

**Conclusion:** DTI is a promising nonenhanced technique for functional evaluation of renal allografts. FA values of the renal medulla correlate significantly with allograft function. Further studies are required to determine the clinical value of DTI for monitoring transplanted kidneys.

**B-0791**

**10:57**

**DWI with mono- and biexponential analysis in kidneys allografts early after transplantation**

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**Purpose:** To evaluate if DWI-related parameters, obtained by mono- and bi-exponential analysis early after transplantation, correlate with kidney allografts function and biopsy results.

**Methods and Materials:** Twenty-two consecutive kidney allograft recipients were examined by MR between 7 and 9 days after transplantation. MR protocol included EP-DWI sequences with 11 b-values (0-1000s/mm²). DWI ROI-metarsearch were performed by two radiologists with different experience in abdominal MR. One radiologist analysed twice ten datasets to assess the intra-observer variability. DWI-related parameters were: ADC (mono-exponential analysis); diffusion-coefficient (D) and perfusion-fraction (f) (bi-exponential analysis). Fourteen allografts showed normal function recovery. 6/8 patients with delayed function recovery underwent biopsy: 3/6 had acute rejection (AR), 2/6 had acute tubular necrosis (ATN) and one presented specific findings. T-test was used to compare mean values between patients groups. Inter- and intra-observer variability was assessed by Bland-Altman test.

**Results:** ADC, D and f values were significantly (p < 0.005) higher in normal-function allografts (10.6±1.3; 12.1±10-3 mm²/s; 12.3±2.2%) compared to the impaired-function group (10.9±0.1; 17±10-3 mm²/s; 15.1±0.21±10-3 mm²/s; 9.5±2.2%). Compared with the ATN, the 3 AR had lower D (1.3±0.1; 6.7±0.13±10-3 mm²/s); ADC (1.77±0.11; 0.92±0.10-3 mm²/s) and f (8.6±2.4%; 9±1%). The three patients with impaired renal function without AR or ATN, had ADC values greater than the ATN group (2.0±0.6; 19.2±0.10-3 mm²/s). Inter- and intra-observer variability was adequate.

**Conclusion:** These preliminary results suggest that DWI could represent a reliable non-invasive tool to evaluate the allograft status early after transplantation. Bi-exponential analysis is useful and successful to confirm the results of mono-exponential analysis. Difference between AR and ATN, critical for patients management, seems to be feasible.

**B-0792**

**11:06**

**Quantitative CT imaging of renal perfusion for assessment of renal allograft dysfunction**

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**Purpose:** To assess the feasibility of a quantitative CT-perfusion technique for the differential diagnosis between renal allografts with acute tubular necrosis (ATN) and graft rejection.

**Methods and Materials:** This study was performed with institutional review board approval. 21 patients suffering from acute unexplained kidney allograft dysfunction were included in the study. A dynamic multi-phase CT-angiography protocol (128 slice CT-scanner, 12 phases, temporal resolution 3.5 s) including the entire renal graft was performed to exclude post-operative or vascular complications. Dynamic CT data were used for the calculation of parenchymal blood flow and parenchymal blood volume using dedicated software. Renal biopsy (n = 15) or clinical follow-up (n = 6) served as the standard of reference.

**Results:** Renal parenchymal blood flow volumes were substantially lower in allografts with acute rejection (48 ± 15 ml/100 ml/min, n = 7), compared to ATN (76 ± 24 ml/100 ml/min, n = 14). In addition, renal parenchymal blood volume was reduced in case of renal graft rejection (8.7 ± 5 ml/100 ml) compared to subjects suffering from ATN (13.8 ± 5.6 ml/100 ml).

**Conclusion:** CT-perfusion has the potential to improve assessment of renal allograft dysfunction.

**B-0793**

**11:15**

**Comparison of diffusion-weighted MRI and histopathologic findings in kidney transplant patients with deteriorating renal function**

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**Purpose:** To determine whether diffusion-weighted MRI (DW-MRI) can be used to stratify patients for biopsy (BI) or follow-up (FU) based on various diffusion parameters.

**Methods and Materials:** Thirty-five consecutive kidney transplant patients (mean age 56 ± 14 years) with deteriorating renal function underwent DW-MRI (EP-sequence, b-values: 0-900s/mm²) on a 1.5 Tesla MR-scanner (Siemens Sonata) within ten days before or after biopsy. DW-MRI data were processed applying either mono-exponential (yielding ADC-values [x10-5 mm²/s]) or bi-exponential fitting (yielding values for pure diffusion ADCD [x10-5 mm²/s] and perfusion fraction FP [%]). If renal biopsy yielded at least one result with a direct implication for clinical management, e.g. rejection, patients were assigned to the BI-group. Statistical evaluation was performed using STATA and values are given as means ±SEM. Unpaired t-tests were used to compare the DW-MRI parameters between BI- and FU-group.

**Results:** Of the 35 patients who underwent renal allograft biopsy 22 were classified into the BI-group and 13 into the FU-group. Histopathologic findings in the BI-group included cellular rejection (n=8), humoral rejection (n=2), glomerulonephritis (n=1), IGA nephropathy (n=1), BK virus nephropathy (n=2), acute tubular necrosis (n=2), cyclosporine toxicity (n=8) and chronic allograft-nephropathy (n=3), whereas findings in the FU-group included chronic changes such as vascular or glomerular sclerosis, fibrosis, atrophy or minor interstitial inflammation. DW-MRI parameters of the BI-group were significantly lower compared to the FU-group: ADC (183±1 vs. 195±1; p < 0.01); ADCD (177±2 vs. 188±12; p < 0.01) and perfusion fraction FP (16±3% vs. 18±5%; p < 0.01), respectively.

**Conclusion:** DW-MRI in kidney transplant patients with deteriorated renal function might improve the diagnostic workup by stratifying patients for renal biopsy.
Conclusion: Our preliminary results demonstrate that in vitro imaging of murine placental functional morphology with MRI is feasible and results are comparable to time-consuming histological analysis.

**B-0795** 11:33

**Magnetic resonance diffusion tensor imaging identifies histopathological changes in a rat model of diabetic nephropathy**

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**Purpose:** To investigate whether magnetic resonance (MR) diffusion tensor imaging (DTI) allows assessment of renal pathologies in a rat model of diabetic nephropathy.

**Methods and Materials:** Twenty-one Sprague-Dawley rats were divided into three groups: controls, diabetes (DM), diabetes with uninephrectomy (DM UNX). UNX is known to accelerate renal impairment. Eight weeks after diabetes induction with streptozotocin MRI was performed on a 1.5-T scanner using an 8-channel wrist-coil. Morphological images and echoplanar DTI were obtained (b=0, 300 s/mm², 6 diffusion directions). Renal ADC and fractional anisotropy (FA) were calculated for each of the different layers of the kidney. Imaging results were compared to laboratory parameters and histology.

**Results:** All diabetic animals developed significant hyperglycemia and hypoinulinemia. Autonomic and peritubular vascular changes were more prone to casts in DM UNX. ADC values were not different between groups except for cortical ADC, which was higher in DM UNX than in controls. FA of different layers of the kidney was significantly reduced in DM UNX when compared to controls and to DM group. In DM without UNX only cortical FA was significantly lower than in controls. Cortical FA negatively correlated with glomerulosclerosis (r = -0.001, R²=0.42). In animals with tubulo-interstitial fibrosis and tubular enlargement, FA was significantly reduced in comparison to animals without those findings.

**Conclusion:** MR DTI identified renal pathologies of diabetic nephropathy such as glomerulosclerosis, interstitial fibrosis and tubular damage by reduction of FA. DM and DM UNX animals, representing different stages of disease, could be differentiated. Thus, DTI may be valuable for detection and monitoring of renal nephropathy in diabetic patients.

**B-0796** 11:42

**MRgFUS treatment for uterine myomas: safety, effectiveness and pathogenesis**

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**Purpose:** Clinical safety evaluation of MRgFUS treatment for uterine fibroids. Retrospective and prospective study. 664 patients suffering uterus fibromyoma had underwent MRgFUS treatment since March 2006 for March 2011 i group: 487 randomised included patients; II group: 177 patients according to patient selection criteria. Follow-up period up to 3.5 years.

**Methods and Materials:** Standard and specifying. Clinical effect was measured in scores using The Pictorial Blood Assessment Chart (Higham, Janssen), UFS-QOL chart and McGill pain questionnaire. MRgFUS ablation procedures were conducted using ExAblate-2000 system (InSightec*, Israel), guided by MRI 1.5 T (unsupervised Character - [¹FO5B.][GE, USA]).

**Results:** Results of the study proved MRgFUS technology to be a safe enough method for treatment of uterus fibromyoma. Complications and adverse effects were revealed in the course of first two years of the method's clinical use and 5 cases (1.02%) of these were: temperature-induced lesion of the small intestine - 1 (0.1%), temperature-induced local oedema of the anterior abdominal wall (without burn) - 1 (0.2%), sciatica - 2 (0.4%), passage of FUS-delirits via uterine body cavity - 1 (0.2%). There were no complications afterwards provided patient selection criteria were used.

**Conclusion:** Despite the fact that the method is sufficiently safe and has a short list of rare complications it should be remembered that curative agent of the technology is focused coagulating ultrasound. Patient selection criteria and regulations governing the procedure should be followed strictly in order to prevent complications and adverse effects.

**B-0797** 11:51

**Detection of localised prostate cancer using contrast-enhanced MRI and 11C-acetate PET/CT**

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**Purpose:** We assessed the ability of contrast-enhanced MRI at 1.5 Tesla and 11C-acetate PET/CT to detect localised prostate cancer. In addition, fusion of 11C-acetate PET with MRI was performed.

**Methods and Materials:** Thirty-six patients (mean age, 65 years; range, 46-78 years) with untreated localised prostate cancer were prospectively enrolled. A pelvic 11C-acetate PET/CT scan was performed in all patients, and a contrast-enhanced MRI scan in 33 patients (6 examinations using both endorectal coil and surface coils, and 27 examinations using surface coils only). Obtained PET/CT and MRI data were evaluated visually and compared with biopsy findings on a lobar level. In addition, PET data were fused with MRI data using in-house developed software. The lobe with the highest percentage of cancer in biopsy samples was determined to be the dominant lobe.

**Results:** The sensitivity, specificity and accuracy for the visual detection of prostate cancer on a lobar level by contrast-enhanced MRI were 85%, 37%, and 73% and 11C-acetate PET/CT was 88%, 41%, and 74%, respectively. Fusion of PET data with MRI increased diagnostic performance with sensitivity, specificity and accuracy of 90%, 72% and 85%, respectively. The accuracy of dominant lobe detection was 70%, 75% and 82% for contrast-enhanced MRI, PET/CT and fused PET/MRI, respectively. Maximal and average SUV values normalised to benign sextants correlated significantly with PSA only (r=0.0005 and 0.0002, respectively).

**Conclusion:** Fusion of sequentially obtained PET/CT and MRI data was feasible and superior in localisation of prostate cancer compared to both imaging modalities alone.

**B-0798** 10:30 - 12:00

**Breast SS 1702 MRI sequences: advances and applications**

Moderators:
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**Initial maximum slope of the contrast enhancement versus time curve for dynamic evaluation of breast lesions on ultrafast breast MRI**

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**Purpose:** Modern viewsharing sequences allow dynamic whole breast MRI at diagnostic spatial resolution within 5 seconds, showing the inflow of contrast in breast abnormalities. We evaluate the maximum slope of initial contrast enhancement for benign and malignant lesions. We measured the maximum slope of the relative enhancement versus time curve provided by the Curie Institute diagnostic spatial resolution of breast MRI and calculated the initial maximum slope.

**Methods and Materials:** We employed a bi-temporal breast MRI protocol on a 3 T MRI using a 16 channel bilateral breast coil. High-resolution VIBE acquisitions (0.8°x0.8°x1.0 mm, temporal resolution 94s) were interleaved with a series of ultrafast TWIST acquisitions (1°x1.25 mm, temporal resolution 4.2s) during the inflow of the contrast agent. Forty-two consecutive patients with 43 enhancing abnormalities (21 benign and 22 malignant) presenting between November 2010 and July 2011 were included. We measured the maximum slope of the relative enhancement versus time curve provided by the Curie Institute diagnostic spatial resolution of breast MRI and calculated the initial maximum slope.

**Results:** The maximum slope of the relative enhancement versus time curve was significantly better in discriminating between benign and malignant disease than the curve type (A2 0.865 vs. A2 0.723, p = 0.036). Cutoff values of 15%/sec and 3.15%/sec can be used to differentiate high-risk lesions (> 85% malignancies) from intermediate and low-risk lesions (< 10% malignancies). This simplification yields an Az of 0.808.

**Conclusion:** The initial maximum slope provides more diagnostic information than the curve types and can therefore be used to assess lesion dynamics. This can substantially shorten current scan protocols.
B-0799
Diagnostic performance of a dedicated breast MR system using spiral acquisitions
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Purpose: To assess diagnostic performance of breast MRI at dedicated breast imaging centers using a dedicated 1.5 T breast MR system that employed high resolution, high contrast spiral trajectory acquisitions.

Methods and Materials: We retrospectively assessed diagnostic performance for 1,100 consecutive screening cases (n=348) and diagnostic (n=752) cases performed from April 2006 to December 2007 for women aged 25-89 from four sites for which dedicated breast MRI reports and ground truth (biopsy for cancer cases; one year negative follow-up for negative cases). The study was IRB approved and HIPAA compliant. The sensitivity, specificity, and ROC for the breast MRI, mammography, and ultrasound were calculated and compared to each other to determine if there were statistically significant differences between the modalities with respect to these parameters.

Results: The sensitivity and specificity for the dedicated breast MRI system were 0.966 (p=0.0006) and 0.882 (p < 0.0001). For all cases, the negative predictive value (NPV) was 0.984, for screening cases, 1.0. The area under the receiver operating characteristic (ROC) curve was 0.966. Of the 120 false positives seen on dedicated breast MRI, 131% were high risk histologies.

Conclusion: We demonstrate high diagnostic accuracy in breast MRI.

B-0800
Evaluation of the ability of parametric dynamic contrast-enhanced MRI and diffusion tensor imaging to detect breast malignancies
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Purpose: To compare the ability of perfusion parameters and of diffusion parameters, obtained from breast DCE-MRI and DTI datasets, respectively, to identify IDC, ILC and DCIS.

Methods and Materials: High-resolution DCE and DTI breast datasets of 43 patients with breast malignancies (24 IDC, 9 ILC and 13 DCIS) confirmed by histopathology were analysed. Axial images of the two breasts were recorded at 3 T using high spatial resolution (DCE: 0.8x0.8 x2-2.5 mm3, ~10 min; DTI: 1.9x1.9x2.5 mm3, ~6 min).

Results: All malignancies were enhanced and were correctly diagnosed using morphological and dynamic features of enhancement. Most of the lesions exhibited high wash-in rate indicating high transcapillary transfer contrast, followed by constant enhancement or reduced enhancement (washout). In part of the lesions (6 IDC, 1 ILC and 6 DCIS) slow enhancement patterns were observed with no washout. Two DTI parameters, the prime diffusion coefficient and the maximum anisotropy index, were significantly lower in the cancers than in the normal breast tissue, enabling cancer delineation. In 4 IDC, 1 ILC and 6 DCIS, the two DTI parameters did not reveal clearly the boundaries of the lesions, primarily due to low SN and partial volume effects in fatty breasts. In part of the slow enhancing cancers the DTI parameters helped identify correctly the lesion.

Conclusion: The results confirm the high sensitivity of DCE-MRI and show the potential of DTI to provide high sensitivity as a standalone method in dense breasts. Further studies are required in order to incorporate DTI into the clinical setting.

B-0801
Correlation between apparent diffusion coefficient and molecular and histological prognostic factors in breast cancer: observations in 94 patients
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Purpose: To correlate apparent diffusion coefficient (ADC) with molecular and histological prognostic factors for breast cancer.

Methods and Materials: 94 female patients (mean age 48.6, range 28-81 years) with histologically proven breast cancer underwent conventional (including T2-weighted and T1 dynamic imaging post-contrast) and diffusion-weighted MRI (b-values 0, 250, 500 and 1000s/mm2). The ADC for breast cancer, as defined manually on the highest b-value images, was correlated with molecular and histological prognostic factors. ADC values were assessed for difference between gene profiling subtypes (Luminal A, Luminal B, HER-2, triple receptor negative), vascular invasion (present/absent), grading (G1/G2/G3), ER/PR/HER-2 expression (positive/negative), Ki67 (14%) and TMM staging using analysis of variance (ANOVA). Spearman coefficient was used to assess correlation between ADC values and continuous variables (age, percentage of ER, PR HER-2, Ki-67).

Results: The ADC of breast cancer visible on the high b-value image was 1.158±0.23 x 10-3 mm2/sec. The ADC for T4 tumours was higher than in T2 and T3 tumours (p < 0.05). The ADC for lymph node positive tumours (N1/N2) was lower than lymph node negative tumours (p < 0.02). The ADC value for triple receptor negative tumours was higher than other subtypes, only reaching significance when compared to Luminal B (p = 0.014).

Conclusion: Our results showed differences in ADC for different histological prognostic factors and genetic subtypes of breast cancer. The ADC differences in patients with different lymph nodes status encourages further studies to explore its clinical utility as an additional prognostic factor for breast cancer.

B-0802
Differentiating invasive and non-invasive breast carcinomas using diffusion-weighted MRI: a feasibility study
A.M. Choe1, V. Ai1, P.S.Y. Cheung1, R. Lee1, S.K. Yu1, G. Lo1, Happy Valley/HK (aprilcmlk@gmail.com)

Purpose: To establish threshold apparent diffusion coefficient (ADC) value for differentiating invasive and non-invasive breast carcinomas using diffusion-weighted imaging (DWI) at 3 T.

Methods and Materials: 73 female patients with biopsy-proven malignant breast lesions (N = 100) were prospectively evaluated. All MRI examinations were performed on a 3 T MRI scanner (MAGNETOM Trio, Siemens) using a 4-channel phased array coil. A single-shot echo-planar imaging DWI protocol was performed to obtain images axially using b-values = 0, 1000 s/mm2. A circular ROI was defined in the DW images over the breast lesions and used for ADC measurements. Threshold ADC values were determined using receiver operating characteristic (ROC) analysis.

Results: Pathological results showed that 67 lesions were invasive carcinomas, while 33 lesions were non-invasive carcinomas. ADC of invasive carcinomas (0.97 ± 0.14 x 10-3 mm2/s) was significantly lower (p < 0.001, two-tailed paired Student’s t-test) than that of non-invasive carcinomas (1.19 ± 0.13 x 10-3 mm2/s). The area under the receiver operating characteristic curve was 0.874, indicating a good diagnostic performance of ADC in differentiating invasive and non-invasive breast carcinomas. An ADC threshold value of 1.09 ± 10-3 mm2/s was determined, allowing differentiation between invasive and non-invasive breast carcinomas with sensitivity, specificity and accuracy of 80.6%, 84.9% and 82.0%, respectively.

Conclusion: DWI is a feasible method to characterise breast lesions quantitatively, offering promise as a robust non-invasive tool to differentiate between invasive and non-invasive breast carcinomas.

B-0803
Is 3D proton spectroscopic imaging at 3 Tesla able to discriminate benign and malignant breast lesions?* B. Brueck1, K. Pinker-Domenig2, H. Magometschnigg2, W. Bogner2, H. Bickel3, T.H. Helbich1, S. Gruber2, Vienna/AT (benedikt.brueck@meduniwien.ac.at)

Purpose: To assess whether 3D proton spectroscopic imaging at 3 Tesla (3 T 3D-HMRSI) is able to differentiate between benign and malignant breast lesions.

Methods and Materials: 89 patients with a suspicious breast lesion were included in this prospective IRB approved study and underwent 3 T 3D-HMRSI using a dedicated breast coil. For 3 T 3D-HMRSI, a point-resolved spectroscopy sequence with the following sequence parameters was used: TR/TE = 750/145 ms; FOV 12 x 12 x 12 cm3; matrix size 12 x 12 x 12 interpolated to 16 x 16 x 16; TA 11:17 min. 8 Patients had to be excluded due to insufficient quality of data due to motion artefacts. Signal-to-noise ratio (SNR) of choline (Cho) was calculated using JMRUI and a self-written software. MRSI voxels were assessed for the maximum SNR of Cho by an experienced spectroscopist and an SNR threshold of >2.55 was defined as indicative of malignancy. All lesions were histopathologically verified.

Results: 53 malignant and 28 benign lesions were confirmed in 81 patients. 3D-HMRSI had a sensitivity of 89% and a specificity of 93%. NPV was 0.81, PPV was 0.96 and diagnostic accuracy was 90%. The median SNR of Cho in was 5.7 in malignant and 2.0 in benign breast lesions.

Conclusion: 3D-MRSI at 3 T yields high diagnostic sensitivity and specificity for discrimination of benign and malignant breast lesions within clinically feasible scan times.
B-0804 11:24
Role of proton MR spectroscopy in the high field magnet (3 T) in diagnosis of indeterminate breast masses (BRADS 3&4)
N.M. Abdel Razay, A.O. Azab, Giza/EG (nagla.abdelrazak@yahoo.com)

Purpose: To evaluate the role of MR spectroscopy using the state-of-art high field magnet (3 Tesla) as a diagnostic method in indeterminate breast lesions (BRADS 3&4 lesions) aiming at decreasing the unnecessary breast intervention.

Methods and Materials: In this study, 240 female patients classified as BRADS 3&4 by sono-mammography (Sono-MX) were examined by MRI using the multiphase dynamic sequence and proton MR spectroscopy using a high field magnet (3 Tesla). Single voxel technique after adequate shimming was used. The graphs were interpreted for the presence of choline peak in the spectrum and the results were correlated to the results of the dynamic MRI. All lesions were histopathologically proven (FNB, CNB, VAB&OB).

Results: 88 cases (35%) of cases were malignant (based on the presence of high choline peak in the spectrum) and 152 cases (65%) were benign (no choline peak). Malignant cases were DCIS, IDC, medullary colloid and lobular carcinomas. Benign cases were fibroadenoma, papilloma, sclerosing adenosis and breast cysts. MR spectroscopy has increased the sensitivity and specificity of dynamic mammography for diagnosis of probable lesion from 94% to 78% to 97% to 95%. False-positive results were found in lactating females and in only one case of atypical fibroadenoma; however, the choline peak in such case was short and bifid. There was a strong agreement between the results of MRS and the histopathology (p value < 0.01).

Conclusion: MR proton MR spectroscopy in the high field magnet (3 T) offered additional information that increased the sensitivity and specificity of the conventional dynamic MRI in evaluating probable breast lesions and hence reduced the need for unnecessary intervention.

B-0805 11:33
To compare MR spectroscopy at 3 T with tumour type and grading of breast cancers
M. Luciani, F. Pediconi, M. Telesca, F. Vasselli, V. Casali, E. Miglio, C. Catalano; Rome/IT (marialauraluciani@gmail.com)

Purpose: To evaluate the diagnostic performance of magnetic resonance (MR) spectroscopy at 3 T to detect different cancer types and prognostic factors in patients with biopsy-proven breast cancer.

Methods and Materials: Breast MR spectroscopy was performed at 3 T in patients with biopsy-proven malignant lesions measuring 6 mm or larger at MR imaging. Single-voxel MR spectroscopy data were collected from a single rectangular volume of interest that encompassed the lesion. MR spectroscopy findings were defined as positive if the signal-to-noise ratio of the choline resonance peak was ≥2 and as negative in all other cases. MR spectroscopy findings were then compared with histologic findings. Lesion size, histotype, nuclear-grade, receptor status (ER, PgR), and Ki67 and HER2 expression were evaluated.

Results: 25 patients with 30 lesions were evaluated. Pathology confirmed 24 IDC, 5 ILC and 1 DCIS. Choline peak occurred in 17/30 lesions (16 IDC and 1 ILC). Three ILC with no choline peak presented with large central area of necrosis. Thus, a choline peak was more frequently associated with IDC than with ILC. DCIS and necrosis. No statistically significant association of choline peak with receptor status (ER, PgR), Ki67 and HER2 was found, although the choline peak was always present in triple negative patients.

Conclusion: Proton MR MR spectroscopy at 3 T was successfully incorporated into breast MR imaging for lesion defining measuring 6 mm or larger. MR spectroscopy could be an additional tool to predict tumour aggressiveness. Results need to be validated in larger-scale studies.

B-0806 11:42
Diagnostic performance and interobserver variation in quantitative proton magnetic resonance spectroscopy of the breast at 1.5 T: a prospective single-centre cross-sectional study
P.A.T. Baltzer1, J. Schelholm2, M. Benndorf1, W.A. Kaiser1, M. Dietzel1; 1Jena/DE, 2Weimar/DE (pascal.baltzer@med.uni-jena.de)

Purpose: An increase of choline metabolites in proton MR-spectroscopy (MRS) is associated with malignancy. One approach for differentiation of breast lesions is quantification of the choline resonance at 3.23 ppm normalised to the water resonance. As postprocessing is a subjective task, this investigation was performed to investigate interobserver variation and diagnostic performance of quantitative MRS of breast lesions.

Methods and Materials: 98 patients (mean age 54.8y) with enhancing lesion > 8 mm on contrast-enhanced MRI (1.5 T, 0.1 mmol Gd-DTPA/kg) were investigated using single voxel MRS (PRESS, TR 2000 ms, TE 270 ms). Reference standard (RS) was histopathology or follow-up of > 24 months. Spectra were analysed and postprocessed by two independent observers (O1, O2) using MRUI software. For Choline/water quantification, the AMARES algorithm was applied. Statistical analysis included interobserver correlation coefficient and receiver operating characteristics (ROC) analysis.

Results: 71 malignant and 27 benign lesions were investigated. Interobserver correlation coefficient was high with 0.974. Accuracy for discrimination between benign and malignant findings determined by ROC analysis was O1: 79.6%, S.E. 4.9%; O2: 79.9%, S.E. 5.0%; differences not significant (P= 0.05). A significant overlap of choline concentration between benign and malignant findings was observed.

Conclusion: According to the presented results, MRS quantification showed high interobserver correlation and no significant differences between the diagnostic performance of both observers. A quantitative and reliable diagnostic tool may be able to reduce diagnostic variation in breast MRI. However, elevated choline concentration seems not to be restricted to malignant findings and is also observed in benign lesions, limiting diagnostic power of MRS.

B-0807 11:51
Ex-vivo MRI of breast specimen: an innovative technique for the management of only or better MR-detected cancer
G. Treccat1, R. Agnesti1, D. Vergnaghi1, B. Valeri1, C. Ferraris1, S. Bohm1, I. Maurer1, M. Carcangiu1, D. Scaramuzz1a; Milano/IT (gio@doghunter.org)

Purpose: When better stages with MR, breast malignancies rise the radiological problem to be localised and the surgical issue of their complete resection. This mainly happens with lobular histotypes, where growth pattern shows minimal or absent desmoplastic reaction, or by in situ disease, especially if not associated with calcifications. The aim of our study was to invent a new strategy that firstly enabled the localisation of cancer and secondly demonstrated their true excision.

Methods and Materials: We enrolled 43 cases of better or only MRI emphasised lesions. We localised the disease by means of a careful three-dimensional reconstruction of breast parenchyma, made with a post-processing elaboration of images and combined with the measurement of the distances from the niple and skin outlines. Later, we injected contrast medium (Gd-DTPA) before surgical incision and finally performed ex-vivo MRI of surgical specimen within 15' after resection by means of a surface coil and SPAIR sequences. Informed consent was requested for both diagnostic and ex-vivo examinations.

Results: All enhancing lesions were retrieved in breast specimen after resection. The new technique reproduces primary disease even if associated with dendritic branches or small satellite nodes and the surface coil magnifies malignancies with a representation that is very similar to the pathological gross examination.

Conclusion: To our knowledge, this procedure is the first that re-enhances breast lesions within a surgical specimen. The technique reproduces morphology and extension of the disease by means of the same procedure that had previously provided the most accurate staging of cancer, giving the certainty of its true remotion.

SS 1708
New technical applications
Moderators:
H.B. Eggesbo; Oslo/NO
R. Ljumanovic; Amsterdam/NL

B-0808 10:30 - 12:00
Head and Neck

SS 1080
10:30
MR microscopy of the human eye: correlation with histology
P.-C. Kröger1, S. Langner2, K. Falke2, R. Guthoff2, O. Stachs2, N. Hosten1; 1Greifswald/DE, 2Rostock/DE

Purpose: Magnetic resonance imaging (MRI) at 1.5 and 3 Tesla with small surface coils is a well-established procedure in the diagnosis of space-occupying lesions of the eye and orbital cavity. Until now histological examination has been required to reliably assess tumour extent and possible infiltration of surrounding structures. With ultra-high-field MRI, however, it has become possible to evaluate tumour morphology as well as infiltration into surrounding structures with sub-millimeter resolution.

Methods and Materials: Ten human eyes with different space-occupying masses were examined ex vivo to compare the standard clinical examination (ultrasound) with ultra-high-field micro-MRI using a small surface coil. Imaging parameters...
were: slice thickness 500 μm; matrix size 1024 x 1024 pixels; in-plane resolution 39 x 39 x 500 μm/pixel; acquisition time 8:20 min per plane. Finally, the specimens were examined histologically, and the histological and MRI results were correlated.

**Results:** Ultra-high-field MRI at 7.1 Tesla provided images of anatomical structures of the bulb as well as different benign and malignant intraocular masses with high resolution, enabling reliable assessment of tumour morphology and extent. Subsequent histological examination confirmed MRI findings regarding origin, internal structure and extent of the masses.

**Conclusion:** This study demonstrates the potential of MR microscopy for imaging small anatomical structures. The findings correlate strongly with histology, making MRI of central importance in determining tumour morphology, extent and potential infiltration of surrounding structures. This work performed ex vivo, but with wider availability, ultra-high-field MRI microscopy is expected to become an essential tool not only in experimental studies but also for daily routine.

**B-0809** 10:39

**Contrast-enhanced ultrasonography (CEUS) using early dynamic microcirculation for localization of pathologic parathyroid glands:**

**Purpose:** Contrast-enhanced ultrasonography (CEUS) represents a new diagnostic tool to localize pathologic parathyroid glands. The aim of this study was to differentiate the capability of CEUS as first-line or complimentary modality for the detection of hyperfunctioning parathyroid glands.

**Methods and Materials:** 70 patients with pHPT were admitted to the University Hospital Regensburg between 8/2009 and 8/2011. Conventional and contrast-enhanced ultrasonography (CEUS) using a linear probe (6-9 MHz, LOGIQ E9/GE) was performed in all patients preoperatively. The sensitivity of CEUS was analyzed to determine its potential as first line or complimentary diagnostic procedure.

**Results:** Using CEUS 97 % of all pathological glands could be detected in the correct quadrant whereas conventional ultrasonography (70 %) (p < 0.001) resulted in less sensitivity. In all patients CEUS indicated a correct side localization of the hyperfunctioning parathyroid gland. The advantage of CEUS was the detection of the early dynamic on the capillary level immediately after contrast injection. Overall, CEUS permit minimally invasive video-assisted parathyroidectomy in 52 patients. 18 patients required conventional procedure due to concomitant goiter. All patients showed normal calcium and parathyroid hormone serum levels three months after surgery.

**Conclusion:** CEUS represents a highly sensitive diagnostic modality for localization of pathologic parathyroid glands in patients with pHPT. Nevertheless, it can only be recommended as first-line diagnostic procedure in specialized clinical centers with experienced investigators.

**B-0810** 10:48

**Ventilation imaging of the paranasal sinuses using xenon-enhanced dual energy CT**

**Purpose:** To show the feasibility of dual energy CT (DECT) and dynamic single energy CT for the visualisation of the ventilation of the paranasal sinuses.

**Methods and Materials:** For a dynamic quantification and visualisation of sinus ventilation, xenon gas was administered to a nasal cast with a laminar flow of 7 L/min. Repeated dynamic single energy CT measurements of the nasal cavity and the sinuses were performed. This procedure was repeated with pulsating xenon flow. The xenon-related enhancement level in the different compartments of the model was quantified and local xenon concentrations were determined. Additionally, using DECT, CT measurements were performed both during laminar and pulsating xenon administration. The xenon concentration in the different compartments was quantified directly based on the spectral information.

**Results:** Neither with single energy CT nor with DECT xenon-related enhancement could be detected in the paranasal sinuses during laminar air flow, while the xenon concentration in the nasal cavity reached 100%. Using pulsating air flow, the dynamic measurements showed a xenon wash-in and wash-out in the sinuses that followed a mono-exponential function with time constants of a few seconds. Accordingly, DECT images revealed xenon enhancement in the sinuses only after pulsating xenon administration.

**Conclusion:** DECT and dynamic xenon-enhanced CT imaging demonstrated the superiority of pulsating gas flow over laminar flows for the administration of gas or aerosols to the paranasal sinuses. DECT with xenon ventilation may represent an attractive option for therapy planning before medical aerosol treatment or surgery.

**B-0811** 10:57

**Reducing the radiation dose for low-dose CT of the paranasal sinuses using organ-specific dose reduction (X-CARE) and iterative reconstruction:**

**Purpose:** To prospectively evaluate image quality of dose-reduced CT of the paranasal sinus using organ-specific dose reduction (X-CARE) and iterative reconstruction technique (IRIS).

**Methods and Materials:** In this prospective study, 100 patients (mean age: 47.9±18 years) underwent low-dose CT of the paranasal sinus (Siemens Definition, Forchheim, Germany) using iterative reconstruction technique with either standard settings (A: 120 kV, 48 mAs, bismuth eye-tens shield protection) or with tube voltage and tube current-time product lowering using organ-specific dose reduction (X-CARE) in groups of 20 patients each (B: 120 kV, 48 mAs, C: 120 kV, 37 mAs, D: 100 kV, 74 mAs and E: 120 kV, 37 mAs). Objective image quality was evaluated and subjective image quality was independently assessed by two blinded observers using a semiquantitative five-point grading scale (1=poor, 5=excellent). Effective radiation dose was calculated. Mann-Whitney-U-test was used for statistical analysis.

**Results:** Best image quality was observed at 100 kV, 74 mAs (4.86), whereas scores for tube-voltage shielded standard low-dose CT (A) and maximum dose reduction with X-CARE (E) provided nearly the same subjective image quality (4.78/4.73; p=0.69). Mean effective doses were: 0.22±0.02 mSv (A), 0.21±0.01 mSv (B), 0.17±0.01 mSv (C), 0.22±0.02 mSv (D) and 0.11±0.01 mSv resulting in a maximum dose reduction of 50% without loss in diagnostic image quality. Background noise was moderately higher in dose reduced areas when employing X-Care (perinal 56.7±8.9 HU vs. periangular 54.4±8.3 HU, p=0.018). Interobserver agreement was excellent (κ values 0.89).

**Conclusion:** As compared with bismuth-shielded CT, application of iterative reconstruction and organ-specific dose reduction allows for significant dose reduction of up to 50% for paranasal-sinus low-dose CT without loss in diagnostic image quality.

**B-0812** 11:06

**Quantification of metal artefacts on cone beam computed tomography images**

**Purpose:** To quantify metal artefacts obtained from a wide range of cone beam computed tomography (CBCT) devices and exposure protocols, to compare their tolerance to metals of different densities, and to provide insights regarding the possible implementation of metal artefact analysis into a QC protocol for CBCT.

**Methods and Materials:** A customised polyethylene macheatry (PMMA) phantom, containing titanium and lead rods, was fabricated. It was scanned on 13 CBCT devices and 1 micro-slice computed tomography (MSCT) device, including high dose and low dose exposure protocols. Artefacts from the rods were assessed by two observers by measuring the standard deviation of voxel values in the vicinity of the rods, and normalising this value to the percentage of the theoretical maximum standard deviation.

**Results:** For CBCT datasets, artefact values ranged between 6.1% and 27.4% for titanium, and between 10.0% and 43.7% for lead. Most CBCT devices performed worse than MSCT for titanium artefacts, but all of them performed better for lead artefacts. In general, no clear improvement of metal artefacts was seen for high dose protocols, although certain devices showed some artefact reduction for large FOV or high mAs protocols.

**Conclusion:** Regions in the vicinity of the metal rods were moderately or gravely affected, particularly in the area between the rods. In practice, the CBCT user has very limited possibilities to reduce artefacts. Researchers and manufacturers need to combine their efforts in optimising exposure factors and implementing metal artefact reduction algorithms.

**B-0813** 11:15

**A customised dental CT software for automatic correction of patient positioning error and detection of jaw midline**

**Purpose:** To develop a dental CT reformating software for automatic correction of patient positioning error and detection of jaw midline for panoramic and cross-sectional reformations.

**A. Lo Casto, G. Petrucci, P. Gallo, P. Purpura, F. Barreca, G. La Tona; Palermo/IT**

**B-0814**

**To develop a dental CT reformatting software for automatic correction of patient positioning error and detection of jaw midline:**

**Purpose:** To develop a dental CT reformatting software for automatic correction of patient positioning error and detection of jaw midline for panoramic and cross-sectional reformations.
Conclusion: PET/CT artefacts.
MR patient images revealed a significantly improved visualisation of structures images in PET/CT after AC (only mild photopenia without AC). The analysis of PET/contrast, severe streaking artefacts in CT images translated into non-uniform PET from both PET/CT and PET/MR were evaluated visually and quantitatively (ROI-resembling the jaws. Phantom scans were performed on a clinical PET/CT (Bio-
able for 35/74 patients. Mann-Whitney, Wilcoxon Signed Rank Test and Spearman
thalamus (SIRs), were compared with those from 26 healthy subjects and with apparent diffusion coefficient (ADC), measured on all recti-muscles and normalised 4=severe impairment) was assigned to every rectus muscle. Signal intensities and were divided into inactive (CAS< 3) or active disease. A functional score (1=normal; to thalamus (SIRs), were compared with those from 26 healthy subjects and with apparent diffusion coefficient (ADC), measured on all recti-muscles and normalised 4=severe impairment) was assigned to every rectus muscle. Signal intensities and were divided into inactive (CAS< 3) or active disease. A functional score (1=normal; C. Godi, S. Bianchi Marzoli, G. Cammarata, A. Ambrosi, A. Falini, G. Scotti, L.S. Politi, S.C. Godi, G. Cammarata, A. Ambrosi, A. Falini, G. Scotti, L.S. Politi, M.K. Werner1, J. Wiegand1, J. Kupferschlaeger1, C. Loisi1, I. Bezukov1, H. Schmidt, C. Pfannenberg1, N. Schwenzer1, T. Beyer1, Tübingen/DE, Santiago de Compostela/ES (Matthias.Werner@med.uni-tuebingen.de)
Combined PET/MR imaging has the potential to provide diagnostic image quality of anatomical regions adjacent to dental implants, which cause intense artefacts in PET/CT and often handicap proper diagnosis. We evaluated PET/MR for head and neck imaging using a dental phantom and patient images.
Methods and Materials: The phantom (filled with uniform background) contained real human teeth, some with dental implants, and one tooth gap, in a plastic carrier resembling the jaws. Phantom scans were performed on a clinical PET/CT (Bio-
graph HiRez16) and integrated whole body PET/MR (Biograph mMR, Siemens). Images were reconstructed with and without CT- and MR (Ultrashort-Echo-Time UTE)-based attenuation correction (AC). Phantom data and five patient datasets from both PET/CT and PET/MR were evaluated visually and quantitatively (ROI-based analysis).
Results: MR-based attenuation correction using UTE sequences yielded significant inhomogeneities in MR images and, consequently, biased μ-maps with erroneous assignment of voxels to tissue electron densities. An enlarged photopic area around the location of the implants was detectable in PET/MR, regardless of prior AC. There were no additional artefacts after AC even with hampered μ-maps. In contrast, severe streaking artefacts in CT images translated into non-uniform PET images in PET/CT after AC (only mild photopenia without AC). The analysis of PET/ MR patient images revealed a significantly improved visualisation of structures such as the floor of the mouth and the submandibular regions usually affected by PET/CT artefacts.
Conclusion: Combined PET/MR head and neck imaging promises improved vis-
ibility and diagnosis for structures adjacent to dental implants compared to PET/CT.
Results: Patients had T2, T1Gad, ADC SIRs higher than healthy subjects (p < 0.001), with significant signal decrease from active, inactive disease to healthy controls (except of ADC, not different between active/inactive groups). T2 and T1Gad SIRs, but not ADC, showed good correlation with the muscle dysfunction and CAS levels in the affected subjects. In addition, T2 and ADC SIRs of patients’ normally functioning muscles were significantly higher than those of healthy con-
trols. All SIRs significantly reduced in muscles that had clinical improvement after therapy; interestingly, even in the group of clinically stable-functioning muscles, a significant reduction in MRI parameters was detected over time.
Conclusion: MRI shows even clinically silent muscle involvement and could be more sensitive than ophthalmologic scores to changes in muscle involvement.
Evaluation of a 32-channel versus a 12-channel head coil for MRI diagnostics in giant cell arteritis
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Purpose: To evaluate the diagnostic value of a 32-channel head coil in comparison with a 12-channel coil for evaluation of superficial cranial arteries’ inflammation in patients with giant cell arteritis (GCA).
Methods and Materials: We investigated 28 patients with suspected GCA underwent 3 T MR. 27 patients were examined with a 32-channel head coil first and a 12-channel head coil second, 28 patients in the other coil order. T1-weighted post-contrast images were evaluated by two blinded readers regarding image grading, artefact level and arteries’ inflammation. SNR measurements were performed for both coils in the brainstem, the cerebellum and the galeal tissue. Inter-observer agreement was measured with the Cohen k-test. Comparison between the two coils was calculated with Wilcoxon-rank test and t-test. Significant levels were p < 0.01.
Results: Both coils identified arteriess’ inflammation reliably, the inter-observer agreement was excellent (κ = 0.89 for 12-channel coil, κ =0.96 for 32-channel coil). We obtained a statistically significant higher SNR (p < 0.01) with the 32-channel coil independently of the coil order. Image grading and artefact level were significantly higher with the 32-channel coil in either examination order. Regarding the image grading, the inter-observer variability was moderate (κ = 0.5) for the 12-channel coil and substantial (κ =0.63) for the 32-channel coil.
Conclusion: The 32-channel head coil is superior to the 12-channel coil in depicting the superficial cranial arteries and, in general, image quality because of a higher SNR which is independent of coil order and delay of vessels’ contrast enhance-
ment. For GCA diagnosis, however, the 12-channel coil seems to be sufficient.
Comparison of true real-time MR imaging with radial k-space sampling to videofluoroscopy exams in the follow-up evaluation of velopharyngeal dysfunction treated by surgery
M.C. Larson1, M.J. Kerl1, R.W. Bauer1, T. Block2, S. Zhang3, R. Hammerstingl3, S. Zangos1, T.J. Vogl1, M.G. Mack1, Frankfurt am Main/DE, Erlangen/DE, Maycross.larson@web.de
Purpose: Velopharyngeal dysfunction can have many causes and is often treated by surgery. After surgery the resulting improved closure of the velopharyngeal port during speaking and swallowing is the manoeuvre of interest which is usually monitored by videofluoroscopy. The aim of our study was to show that rapid MRI protocols using equal temporal resolution to fluoroscopy (27 Hz) is as accurate as videofluoroscopy without exposure to x-rays.
Methods and Materials: With the approval of our institutional review board 26 patients (12 males, mean age 10.6 years) underwent 3.0 T MRI functional imaging and videofluoroscopy exams. Our approach concerning the MRI scan protocol was to use a fast low-angle shot (FLASH) gradient-echo sequence with radial k-space sampling and sliding-window reconstruction (5 subframes) for achieving an image update rate of 27 Hz (27 frames per second). Sagittal views with 8 mm slabs were obtained during speech with a TE of 1.97 ms, a TR of 3.95 ms, a flip angle of 20°, and a matrix size of 128 pixels. The closure of the velopharyngeal port during speaking was compared by 2 radiologists in both diagnostic methods.
Results: The obtained real-time MR cinematics were equal to the videofluoroscopic images to evaluate the closure of the velopharyngeal port during speaking and ses the postoperative results. Both radiologists rated the overall image quality in consensus as diagnostic.
Conclusion: Functional MRI is to consider equal to fluoroscopic imaging in the evaluation of the closure of the velopharyngeal port during postoperative follow-up exams without exposure to x-rays.
Abdominal Viscera

SS 1701
MRI of focal liver lesions

Moderators:
S. Bohata; Brno/CZ
P. Huppert; Darmstadt/DE

B-0818 10:30
Diffusion-weighted imaging of focal liver lesions: lesion size and image technique used have significant influence on diagnostic performance
P.A.T. Baltzer*, J. Schelhorn, M. Benndorf, W.A. Kaiser, M. Dietzel; Jena/DE,
Weimar/DE (pascal.baltzer@tmed.uni-jena.de)

Purpose: To compare diagnostic performance of two commonly available diffusion-weighted imaging (DWI) techniques for detection and differentiation of focal liver lesions (FLL) suspect for metastases.

Methods and Materials: This retrospective cross-sectional study investigated consecutive patients with suspected liver metastases. All patients underwent Gd-EOB-DTPA-enhanced liver MRI including two different DWI techniques: a spectrally fat saturated breath hold EPI sequence (DWIbh, time of acquisition (TA): 0:23 min), and a free breathing spectrally fat saturated EPI sequence (DWIfb, TA: 5:28 min). DWI images were analysed by two readers in consensus. In identified lesions, signal intensities (SI) at lowest and highest b-values were measured using a user defined region of interest. Subsequently calculated apparent diffusion coefficient (ADC) values were analysed by receiver operating characteristics (ROC) analysis.

The reference standard included histopathology and follow-up examinations.

Results: 37 of 45 included patients presented with 113 FLL (46 benign, 67 malignant). Of these, DWIbh detected significantly more malignant lesions compared to DWIfb (P=0.002). Lesion size ≤10 mm was significantly associated with malignant FLL (significance threshold p=0.05).

Conclusion: The difference in diagnostic performances is significantly higher with the use of DWIbh compared to DWIfb (P=0.669, P < 0.0113).

B-0819 10:39
Focal liver lesions in the right and left hepatic lobes on diffusion weighted MR imaging: is there a difference?
C. Schmid-Tannwald, F. Dahi, Y. Jiang, I. Sethi, A. Oto; Chicago, IL/US (christine.schmid-tannwald@med.uni-muenchen.de)

Purpose: To determine possible differences between ADC values of benign and malignant FLLs and normal liver parenchyma in the left vs. right hepatic lobes.

Methods and Materials: Thirty-six patients (16 males, 20 females, mean age: 56.8 years) with FLLs of the same aetiology in both the left and right lobes of the liver (13 patients with 26 benign FLLs and 23 patients with 46 malignant FLLs) who underwent 1.5 T MRI including DW-MRI (b-values of 0 and 800 mm²/s) were included in this HIPAA-compliant and IRB-approved study. ADC values of normal liver parenchyma and FLLs in each hepatic lobe were calculated and compared using Student’s t-test for paired data.

Results: ADC values of normal liver parenchyma, benign FLLs, and malignant FLLs were significantly higher (p < 0.001, p = 0.004, and p = 0.007, respectively) in the left hepatic lobe (1.74 x 10-3, 1.81 x 10-3, and 1.48 x 10-3 mm²/s, respectively) than in the right hepatic lobe (1.48 x 10-3, 1.54 x 10-3, and 1.24 x 10-3 mm²/s, respectively).

Conclusion: ADC values of benign and malignant FLLs and normal liver parenchyma are significantly higher in the left hepatic lobe compared with the right hepatic lobe. This is likely due to cardiac motion, and may limit the reliability and reproducibility of FLL ADC value estimates and the clinical usefulness of non-cardiac gated DW-MRI in characterising FLLs.
A comparison of three methods of apparent diffusion coefficient evaluation in assessing solid focal liver lesions with diffusion-weighted imaging (DWI)

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Purpose: To compare the performance in diagnosing solid focal liver lesions (FLLs) malignancy of the apparent diffusion coefficient (ADC) thresholding (ADC-T) method vs. two variants of the lesion-to-liver ADC ratio (ADC-R).

Methods and Materials: 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 carried out to establish a threshold for malignancy and to compare the area under the curve (AUC) values.

Results: The threshold for malignancy of ADC-T was ≤1.09 x10-3 mm2/sec. The PPV and NPV were 87.5% (95% C.I. 74.4-94.7) and 90.0% (95% C.I. 35.7-94.3) for ADC-T vs. 75.0% (95% C.I. 60.4-85.7) and 36.7% (95% C.I. 23.9-51.5) for ADC-R1 vs. 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 of 0.71 significantly higher (p < 0.05) than ADC-R1 (0.56), but not than ADC-R2 (0.61).

Conclusion: The NPV for FLLs assessment was low, regardless of the ADC evaluation method, while the PPV was high, especially by comparing lesion and parenchymal ADCs with the ADC-R2 method. However, the use of an ADC threshold provided higher diagnostic performance in terms of AUC.
The area under each ROC curve (AUC) was obtained. The ability of liver-specific phase imaging and ADC values to differentiate between the lesions was compared. Results: In both liver-specific phases, FNH CR was significantly higher than that of all other lesions (p < 0.01). Adenomas demonstrated significantly higher CR than haemangiomas (p < 0.01), but not HCC (p = 0.1). Haemangiomas demonstrated significantly lower CR (p < 0.005). ADC values allowed accurate differentiation between haemangiomas and all other lesions (p < 0.05), but the accuracy was in no case greater than that of liver-specific phase imaging. Neither adenomas and HCC nor FNH and HCC could be differentiated by ADC values.

Conclusion: Gd-EOB-DTPA outperforms ADC in the differentiation of hepatic lesions.

B-0827 11:51
Comparison of MR elastography and diffusion-weighted MR imaging for differentiating benign and malignant focal liver lesions
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Purpose: Comparative evaluation of MR elastography (MRE) and diffusion-weighted imaging (DWI) for differentiation of benign and malignant liver lesions.

Methods and Materials: MRE and DWI were performed in 74 patients with a total of 109 lesions (benign-44, malignant-65). The lesions were hepatomas-57, haemangiomas-24, focal nodular hyperplasia-15, cholangiocarcinoma-7, cyst-5 and gallbladder carcinoma-1. DWI was performed with a free breathing technique (TR/TE=5000-6000/91 ms, matrix 160 x 160, 5 mm thickness, b=0500). MRE was performed with modified gradient-echo sequence (TR/TE=100/27 ms, matrix 96 x 256, 5-10 mm thickness). The apparent diffusion coefficient (ADC) maps and elastograms were generated on workstation. Regions of interest (ROI) were placed on the focal lesions on the elastograms and ADC maps excluding large vessels, liver edges, and artefacts wherever possible. Mean stiffness values in kilopascals (kPa) and mean ADC values were derived for each lesion and tabulated. Receiver operating curve (ROC) analysis was performed to determine the area under curve (AUC) for accuracy of MRE and ADC for differentiation of benign and malignant lesions.

Results: ROC analysis showed that AUC/sensitivity/specificity for MRE (cutoff, > 4.54kPa) and DWI (cutoff, < 151 x 10-3 mm2/s) were 0.99/92.3%/95.5% (p < 0.001) and 0.85/78.5%/81.9% (p < 0.001), respectively, for differentiating malignant and benign lesions. The accuracy of MRE was significantly better than DWI (p=0.008). There was a negative correlation between size and stiffness (r=0.48, p < 0.0001) was seen.

Conclusion: Our study results show that MRE is more accurate than DWI for differentiation of benign and malignant focal liver lesions.

B-0829 10:39
Prognostic value of CT coronary angiography in subjects with suspected CAD: focus on severity of coronary artery disease and the presence of left main disease. Results from the CONFIRM Registry (coronary CT angiography: an international multicentre registry)
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Purpose: To examine the association of all-cause mortality with the computed tomography coronary angiography (CCT) evidence of coronary artery disease (CAD), with focus on the presence and severity of left main (LM) disease.

Methods and Materials: A total of 7700 patients (4120 men, age 57.5±11.9 years) without known history of CAD from an International multicentre CCT registry (CONFIRM Registry) met the inclusion criteria (total database 27125 patients). 12 coronary artery segments analysis were performed. Cox proportional hazard models with adjustment for risk factors and after stratification according to LM disease were developed to predict outcome.

Results: The prevalence of obstructive (>50%) CAD was 14.7%, whereas 33% of patients had non-obstructive CAD and 52.3% had normal coronary arteries. The presence of obstructive (>50%) and non-obstructive CAD in LM were, respectively, 0.9% (n=69) and 11% (n=845). A total of 95 deaths (1.2%) occurred after a mean follow-up of 29±14 months. Multivariable analysis showed that CAD severity (HR:1.3; 95% CI:1.8-5.9, p < 0.001) and the number of diseased segments (HR:1.13; 95% CI:1.05-1.22, p=0.002) were predictors of all-cause mortality with incremental prognostic value over Framingham risk and calcium score. Risk-adjusted survival showed that the presence of either non-obstructive or obstructive (cut-off > 50%) LM disease was not associated with a significantly worse prognosis. However, after considering a cut-off value > 70% for obstructive CAD, patients with LM disease fared the worst (p < 0.0001). Conclusion: LM coronary artery disease presence and severity as detected by CCT seems to be poorly associated with worse prognosis.

B-0830 10:48
Prognostic value of CT coronary angiography in subjects with suspected CAD: focus on severity of coronary artery disease and presenting symptoms. Results from the CONFIRM Registry (coronary CT angiography evaluation for clinical outcomes: an international multicentre registry)
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Purpose: The aim of this study was to examine the association of all-cause mortality with the computed tomography coronary angiography (CCT) evidence of coronary artery disease (CAD), with focus on the prognostic role of symptoms.

Methods and Materials: A total of 7700 patients (4120 men, age 57.5±11.9 years) without known history of CAD from the International CONFIRM CCT registry met the inclusion criteria. A 12 coronary artery segments analysis was performed. Survival analysis and Cox proportional hazard models with adjustment for risk factors according to presenting symptoms were developed to predict outcome. Results: 31.8% patients were asymptomatic, 48.5% had non-cardiac or atypical pain, 11.6% had typical pain and 8.1% had dyspnoea. The overall prevalence of obstructive (>50%) CAD was 14.7%, whereas 33% of patients had non-obstructive CAD and 52.3% had no CAD. A significant higher prevalence of obstructive CAD was observed among patients with typical pain with respect to other symptom
Conclusion:

CCT is a valuable tool for risk stratification. Severity of CAD and typical chest pain appear to be the strongest predictors of mortality within symptomatic groups.

B-0831 10:57

Coronary computed tomography angiography in the selection and evaluation of outlier patients: results from the international multicentre CONFIRM (coronary CT angiography evaluation for clinical outcomes: an international multicentre registry). E. Maffei1, F. Cademartini2, S. Settun1, J.K. Min3, M. Al-Mallah4, M.J. Buddoff5, T.G. Callister6, V. Cheng7, A. Delagou8, A. Monasteri di Treviso9, I. Genova10, I. Los Angeles, CA/US, Detroit, MI/US, Hendersonville, TN/US, Albany, NY/US (sarasettun@yahoo.com)

Purpose: To evaluate the presence and distribution of outlier patients with 64-slice coronary computed tomography angiography (CCT) in a large international multicentre registry (CONFIRM).

Methods and Materials: From a population of 27,125 consecutive patients (14,997 men, mean age 56±13 years) underwent CCT, we analysed patients with suspected coronary artery disease (CAD) for whom the complete cardiac risk profile were available. We selected patient outliiers in the fifth and sixth decades of life with the following criteria: a) risk factors and absence of CAD, zero to one risk factors and ≥5 diseased coronary segments. Diabetes was excluded because of the different impact on CAD.

Results: The population consisted of 14,966 individuals with suspected CAD (8,379 men, mean age 71±12.4 years). The prevalence of significant (≥50% stenosis) CAD was 19%. Patients with normal coronary arteries accounted for 46% of the total (3242 men, mean age 52±11.9 years): 2,189 were in the fifth and 1,517 in the sixth decade (1,443 men, age 58±6.6 years); of these, patients with a≥5 risk factors accounted for 3.7% of the total (men 186, women 370). Patients with ≥5 diseased coronary segments accounted for 15.4% of the total (1,623 men, age 65±10.3 years): 502 were in the fifth and 919 in the sixth decade (men 1,062, women 359); of these, patients with zero to one risk factors accounted for 2.1% of the total (309/14,966; men 253, women 56).

Conclusion: CONFIRM identifies outlier patients; this will enable dedicated trialed aimed at characterising biomarkers and genetics of protective/antiprotective factors with respect to CAD.

B-0832 11:06

Increased left atrial or left atrial appendage volume: an independent risk factor for cardioembolic stroke in patients without atrial fibrillation? Cardiac computed tomography study M. Taina, R. Vanninen, M. Hedman, P. Jakala, P. Sipola, K. Kuoppa (filippocademartiri@gmail.com)

Purpose: Intraatrial thrombus is an established high risk finding for cardioembolic stroke. We studied whether left atrium (LA) or left atrial appendage (LAA) volumes measured with cardiac computed tomography (cCT) provide additional information on risk factors in patients with suspected cardioembolic stroke without atrial fibrillation.

Methods and Materials: Consecutive patients (n=138, 94 males, mean age 60.2 years) with acute stroke of suspected cardioembolic origin underwent cCT. We calculated the control population constituted of 124 patients with low pre-test probability of coronary artery disease and <50% coronary artery stenosis in cCT. A pairwise comparison was performed with 56 patients and 56 controls matched for age and gender.

Results: Twenty-two patients proved to have established cardioembolic risk factors (cardiac or aortic thrombus, LV aneurysm or tumor) for stroke. In a comparison, both LA (83.8 ml vs. 61.6 ml; p<0.001) and LAA (11.1 ml vs. 6.3 ml; p<0.001) volumes were significantly larger in patients with suspected cardioembolic stroke than in control subjects. The upper limits (mean +2SD) for normal LA and LAA volumes were 97.5 ml and 10.8 ml in control subjects. By these criteria 76 (1%) patients had enlarged LA. Sixty-one of the 76 patients (80.3%) with LAA dilatation had none of the previously described established risk factors for stroke.

Conclusion: LA and LAA volumes in patients with suspected cardioembolic stroke are significantly increased. Enlarged LA and/or LAA volume measured with cCT may constitute an independent risk factor for cardioembolic stroke.

B-0833 11:15

Frequent and widespread vascular abnormalities in human STAT3 deficiency detected by whole body MR and cardiac CT scan A.A. Azarime, D. Chandross, C. Picard, E. Moussaux, P. Bourtjyrie, Z. Mailiat, A. Fischer, Paris FR (ashrih.azarine@egp.aphp.fr)

Purpose: To evaluate the prevalence and characteristics of cardio-vascular abnormalities in STAT3 deficiency, responsible for autosomal-dominant hyper-IgE syndrome.

Methods and Materials: We prospectively screened 21 adult STAT3-deficient patients (median age: 26 years; range 17 - 44) for vascular abnormalities. They were explored with whole body magnetic resonance imaging angiography, prospective coronary multislice computed tomography and echotracking-based imaging of the cardiac arteries.

Results: Brain abnormalities (white matter hyperintensities, lacunar lesions suggestive of ischaemic infarcts, atrophy) were found in 95% of patients. Peripheral and cerebral artery abnormalities were reported in 84% of patients, whereas coronary artery abnormalities were detected in 50%. The most frequent vascular abnormalities were ectasia and aneurysm. The carotid intima-media thickness was markedly decreased, with a substantial increase in circumferential wall stress indicating the occurrence of hypotrophic arterial remodelling in this STAT3-deficient population.

Conclusion: Coronary and peripheral vascular abnormalities are highly prevalent in STAT3-deficient patients.

B-0834 11:24

Anomalous coronary artery originating from opposite coronary sinus frequently reveals multiple high risk anatomy features M. Krugnosi, T. Miszaliski-Jarnika, B. Laskowicz, B. Róg, R. Banys, M. Urbańczyk-Zawadzka, M. Kostkiwicz, Krakow PL

Purpose: The aim of the study was to assess the prevalence of high risk anatomy features in patients with anomalous origin of coronary artery from opposite coronary sinus. High risk anatomy variants include interarterial course, narrowed slitlike orifice, acute angle of takeoff in 17, intramural course in 6 and hypoplasia in 6 individuals. Patients presenting obstructive coronary artery disease in anomalous segment had acute takeoff angle (p<0.02) and slitlike orifice (p<0.001) more frequently than others.

Conclusion: High risk anatomy is present in the majority of patients with anomalous origin of coronary artery at opposite coronary sinus and is often accompanied by obstructive coronary artery disease in the anomalous segment.

B-0835 11:33


Purpose: Cardiac CT (CCT) is an imaging modality that is becoming a standard in clinical cardiology. We evaluated indications, safety, and impact on patient management of routine CCT in a multicentre national registry.

Methods and Materials: During a period of 6 months, 42 centres in Italy, we enrolled patients undergoing CCT for any indication.

Results: A total of 2,554 consecutive patients were enrolled. CCT was performed mainly with 64-slice CT scanners (1754; 68.7%) and with retrospective-ECG-gating (1764; 69%). In 95.2% (2432) of the cases CCT was performed with IV contrast material. In 95.9% (1524) of the cases pharmacological management of heart rate was performed (heart rate during CCT = 61±10 bpm). Mean DLP was 753±483
Prevalence of MRI-detected unrecognised myocardial infarction and its relation to cerebral ischaemic lesions in both genders


Purpose: To investigate the prevalence of unrecognised myocardial infarction (UMI) detected with magnetic resonance imaging (MRI) and whether it is related to CAD, and the number of UMI in an elderly population-based cohort methods.

Methods and Materials: Cerebral MRI and cardiac late enhancement (LE) MRI were performed on 394 randomly selected 75-year-old subjects (188 women, 206 men). Images were assessed for cerebral ischaemic lesions and MI scars. Medical records were scrutinised. Subjects with MI scars, with or without a hospital diagnosis of MI were classified as RMI or UMI, respectively.

Results: UMIIs were found in 120 subjects (30%) and RMIs in 21 (5%). The prevalence of UMIIs (p=0.004) and RMIs (p=0.02) was greater in men than in women. Men with RMI displayed an increased prevalence of cortical and lacunar cerebral infarctions, whereas women with UMI more frequently had cortical cerebral infarctions (p=0.003).

Conclusion: MI scars are more frequent in men than in women at 75 years of age. The prevalence of RMI is related to that of cerebral infarctions. This might only apply to men, whereas women with UMI display an increased prevalence of cortical cerebral infarctions.

Further studies are needed to clarify gender-specific morbidity correlations and risks.

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Further studies are needed to clarify gender-specific morbidity correlations and risks.

Age- and sex-related differences in outcome based on coronary computed tomography angiography; preliminary results from the Italian National PROMED Registry

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Purpose: To assess the prognostic value of 64-slice coronary computed tomography angiography (CCTA) in relation to age and gender.

Methods and Materials: We evaluated a cohort of 1,163 patients without known CAD who underwent a 64-slice CCTA. The primary endpoint was the occurrence of myocardial infarction, hospitalisation for unstable angina and death from all causes. Univariable and multivariable Cox proportional hazards models were developed to assess potential predictors.

Results: 546 patients had ≥65 years (262 male) and the remaining 617 had < 65 years (399 male). The prevalence of normal coronary arteries was 42% (n=489), whereas the prevalence of non-significant (1%-49% stenosis) and significant (≥50%) CAD was 29% (respectively, n=339 and n=335). At a mean follow-up of 831.8±310 days, 62 events had occurred (5.3%). In risk-adjusted analysis, obstructive (p < 0.0001) and nonobstructive (p=0.04) CAD conferred increased risk compared with patients without evident CAD. The number of diseased segments (p=0.001), and the number of vessels (p=0.004) and vessels (p=0.003) with significant CAD were independent prognostic indicators. No significant differences in outcome were observed between male and female patients in each age categories (p or ≥65 years).

Significant CAD was an independent predictor of events for both patients with < 65 years and ≥65 years and in male, but not for female patients. For female patients independent predictors were the number of vessels (p=0.01) and segments (p=0.01) with significant CAD.

Conclusion: Presence of significant CAD is associated with a poor prognosis. CCTA has the potential to improve risk stratification according to age and sex.
B-0840 10:48
Erect chest radiograph in the setting of the acute abdomen: essential chest or waste of resources and unnecessary
Purpose: To review the quantity and quality of requests for emergency chest radiographs (CXR) in patients presenting with abdominal symptoms. The Royal College of Radiology (RCR) recommends a CXR with suspected viscous perforation to exclude air under the diaphragm but does not supersede a thorough clinical examination and should not be done routinely.
Methods and Materials: A retrospective analysis of all patients admitted to the Royal Glamorgan Hospital (UK) with acute abdominal pain was done for 12 months in 2004. Inclusion criteria: surgical admissions with abdominal pain, aged over 14. The requests and reports of the CXRs were evaluated and compared to nationally accepted guidelines produced by the RCR, to look at the appropriateness of the requests.
Results: 515 patients presented with acute abdominal pain. 65% had an erect CXR on admission. Of these 5% were clinically significant showing possible medical causes for the pain and altering management. Only 1% were surgically significant showing free gas under the diaphragm. It is argued that 314 (94% of 334) had unnecessary CXRs which contributed no new information towards treating the patient. In fact if no old radiology records were available this could have been misleading as 53 (16% of 334) had abnormal findings of which none were new.
Conclusion: Vast room to reduce unnecessary CXRs being ordered. Stricter adherence to the RCR guidelines. Limiting the CXR requests in the presence of abdominal pain unless there are very clear indications or unless first reviewed by general surgery. By implementing guidelines and trusting clinical findings can reduce the financial, radiation and time costs.

B-0841 10:57
Prediction of bowel necrosis extent basing on the degree of bowel dilatation detected by CT reconstructions
M. Moschetta, A.A. Stabile Ianora, F. Lorusso, A. Telegrafo, A. Scardapane, G. Angelelli, Bar/IIT (marco.moschetta@gmail.com)
Purpose: This study aims to correlate the degree of bowel dilatation detected by computed tomography (CT) and the extent of bowel necrosis in patients affected by mesenteric infarction.
Methods and Materials: Forty-seven patients affected by bowel infarction due to vascular obstruction were assessed by MDCT examination searching for pathognomonic signs of ischaemia and for the degree of bowel dilatation (subdivided into 4 groups: entire small bowel; >50% of SB; <50% of SB; large bowel only). Two blinded radiologists evaluated multiplanar and 3D transparent wall reconstructions. Cohen’s kappa statistics was used in order to assess inter-observer agreement.
CT findings were then correlated with the mortality rate.
Results: Arterial vascular obstruction was found in 66% of cases and venous thrombosis in the remaining 34%. The overall mortality rate was 64%, with a 90% value for arterial forms and 10% in case of venous infarctions. The entire SB dilatation or a >50% SB dilatation correlated with poor prognosis in all cases; a <50% SB dilatation correlated with poor prognosis in 87.5% of cases. A large bowel only dilatation did not show a significant prognostic value. Almost perfect agreement between the two readers was found (k=0.84).
Conclusion: Although bowel dilatation does not represent a specific sign of bowel ischaemia, when associated with other pathognomonic CT findings it can provide useful prognostic information, because a ≥50% SB dilatation correlates with higher extent of bowel necrosis and with poor prognosis.

B-0842 11:06
Findings of sigmoid volvulus at CT
A. Fusler, M.C. Julles, M. Zins, Paris/Fr (annelfusler@gmail.com)
Purpose: The objective of this study was to assess the features of sigmoid volvulus at CT.
Methods and Materials: This was a retrospective analysis of 18 cases of sigmoid volvulus in 13 men and four women, explored by CT within 24 hours before surgical (n=9) or endoscopic (n=13) treatment. In 14 cases, CT was associated with contrast enema. Two radiologists assessed in consensus the CT diagnostic signs and the topographical type of volvulus (organo-axial or mesenterico-axial). The clinical, radiological and evolutive features of the patients were correlated with the topographical type of volvulus (Fisher exact test and Mann-Whitney U test).
The CT signs of severity were correlated with ischaemic findings in endoscopy or pathology (Fischer exact test).
Results: 72% (n=13) of sigmoid volvulus had an organo-axial configuration with one transition point. The whirl sign was the most frequent diagnostic sign, seen in 100% of the cases using multiplanar reconstructions and stack mode viewing. There was no significative difference between the mesenterico-axial and organo-axial form in terms of clinical severity, mean age, sigmoid loop opacification by enema, resective rate after conservative treatment. Only parietal ischaemic signs (lack of enhancement, parietal thickening and pneumatosis intestinalis) were correlated with clinically proved ischaemia (p<0.04).
Conclusion: The most frequent configuration of sigmoid volvulus is the organo-axial type. The whirl sign is constantly found. Parietal ischaemic CT signs are associated with proved ischaemia.

B-0843 11:15
Abdominal CT in emergency: how to avoid the missed diagnosis of appendicitis
E. Paco, A. Filippone, R. Cianci, V. Bianco, G. Esposito, A. Cotroneo, Chieti/IT
Purpose: To establish the causes of missed diagnosis of appendicitis on multidetector-row CT (MDCT).
Methods and Materials: We included 21 patients with proven appendicitis, for whom the diagnosis was missed on preoperative MDCT. A control group of 43 patients with a correct MDCT diagnosis of appendicitis was selected for comparison. Two experienced radiologists, who were aware of the diagnosis of appendicitis, re-evaluated MDCT images of the case and the control groups. The case and control group features were compared using the Fischer’s exact test.
Results: Significant differences were found regarding the position of caecal pole (p=0.0001), appendicitis (p=0.0001), appendiceal inflammatory changes (p=0.0001), stranding of periappendiceal fat (p < 0.0001), fluid collection and/or gas bubbles (p=0.0001), small bowel obstruction or colonic diverticulosis (p<0.0001), amount of pericaecal fat (p=0.0001), and clinical history (p=0.0001).
Conclusion: Knowledge of the causes of incorrect diagnosis of appendicitis allows to avoid false negative CT reports.

B-0844 11:24
Acute bowel ischaemia: analysis of diagnostic error by primarily overlooked findings at multidetector CT angiography
M. F再生, A.A. Lemos, A. Marin, E. Contesti, A. Batt, G. Angelelli, Milan/IT (cristina@libero.it)
Purpose: To retrospectively evaluate the frequency and type of findings that were missed in the original report of multidetector CT angiography (MDCTA), in patients with suspected acute bowel ischaemia.
Methods and Materials: From January 2007 until March 2011, 35 patients (23 males, 12 females, mean age: 68.3 years) who underwent MDCTA (G.E. Light-Speed, Wisconsin, USA), and surgery, were included in the study. The reports of the initial CT were retrospectively compared to the discharge diagnosis and operation reports. Discrepent or missing findings were analysed for technical and/or diagnostic errors by reevaluating MDCTA images, and divided into (1) relevant, and (2) not relevant for the diagnosis.
Results: In 23/35 patients (67%), all findings were correctly diagnosed in the initial MDCTA. In the remaining 12/35 patients (33%) lesions that were not reported were present at surgery. In 10/12 (83%) patients, overlooked findings were relevant and subtle. In 21/12 (17%) patients with bowel dilatation and free fluid in whom the MDCTA overlooked findings were classified as non-relevant, bowel ischaemia was found at surgery. With retrospective image interpretation, almost all patients (83%) with bowel ischaemia were correctly identified, whereas the remaining patients (17%) with non-occlusive ischaemia at surgery showed non-relevant findings at MDCTA also at the retrospective analysis.
Conclusion: About 33% of relevant findings of bowel ischaemia were overlooked by the initial MDCTA interpretation; mostly were subtle findings. However, secondary reading of MDCTA revealed most of these findings and can serve to improve diagnostic performance.

B-0845 11:33
CT diagnosis of nature of bowel obstructions: morphological evaluation of the transitional point
M. Moschetta, T. Cosimo, F. Binetti, A. Scardapane, A.A. Stabile Ianora, G. Angelelli, Bar/IIT (marco.moschetta@gmail.com)
Purpose: This study aims to evaluate the morphology of the transitional point in defining the nature of bowel obstructions.
Methods and Materials: CT examinations of 95 patients affected by severe bowel obstruction (23 of neoplastic origin; 72 of non-neoplastic origin) were retrospectively evaluated and the morphology of the transitional point was considered.
Results: The transitional point was detected in 89 patients (94%) and its morphology was concave in 84 cases (68%); linear in 5 (5%); convex in 20 (21%), as compared with the proximal loop. A concave morphology of the transitional point indicated a non-neoplastic condition, with sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy values of 89%, 100%, 100%, 74% and 92%, respectively. A linear aspect presented almost the same incidence among neoplastic (60%) and non-neoplastic (40%) conditions. A convex aspect correlated with a neoplastic pathology with sensitivity, specificity, PPV, NPV and diagnostic accuracy values of 87%, 100%, 96% and 97%, respectively.

Conclusion: In case of bowel obstruction, the detection of the transitional point indicates the site of obstruction, while its morphological evaluation can contribute to define the nature. A concave morphology indicates a non-neoplastic condition with a high probability; a convex morphology correlates with a neoplastic pathology, while a linearity is not significant.

B-0846 11:42
Abdominal paediatric trauma: radiologic findings and managing in solid viscera injury
J. Guillemau Listan1, J.L. Ribó1, D. Gerona/ES, E. Esplugues del Llobregat/ES

Purpose: The study aimed to investigate the method of management and diagnosis of paediatric trauma with solid viscera injury, and determine the role of ultrasound and computed tomography imaging on it.

Methods and Materials: We undertook a 6-year retrospective audit of children admitted to the Sant Joan de Déu Hospital, Barcelona, Spain, with a hospital-coded diagnosis which included hepatic, splenic, kidney, pancreatic and adrenal injury between 2005 and 2010. Data included patient demographics, results of any acute computed tomography and/or ultrasound imaging of the organs related, results of any surgical findings and outcome.

Results: 121 (67%) of the patients (n=179) were males and 58 (33%) females; the mean age was 11.5 years (0-18 range). Ultrasound was the first-line examination in 161 patients (91%) and computed tomography in 18 (9%). 45 patients (25%) went to have a computed tomography after ultrasound evaluation, (free fluid as the only ultrasound finding), most of them with questionable no impact in therapeutic decision. The radiologic findings included spleen injury in 43.9% of children, 26.3% kidney, 24.5% liver, 3.5% pancreas, and 2.6% adrenal glands. Conservativa management was the choice in 172 cases, all they haemodynamically stable; 2 cases were undergoing acute intervention, both of the haemodynamically unstable. 17 cases had post-trauma complications such as urinoma and pancreatic pseudocysts.

Conclusion: Ultrasound is the first-line imaging in paediatric blunt abdominal trauma. The are no established guidelines to assess paediatric computed tomography, and most of the studies have questionable impact in therapeutic decision.

B-0847 11:51
CEUS usefulness in the characterisation of haemodynamic abnormalities associated with endoleak following endovascular treatment of abdominal aortic aneurysms
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Purpose: To reveal the usefulness of contrast-enhanced US (CEUS) in the detection and the characterisation of haemodynamic abnormalities associated with endoleak in patients previously submitted to endovascular treatment of abdominal aortic aneurysms (EVAR).

Methods and Materials: From January 2008 to July 2009, 88 consecutive patients (60 males and 28 females; mean age, 68.5 years old) underwent treatment of abdominal aortic aneurysms (EVAR). At diagnostic surveillance, both a multidetector computed tomography and/or ultrasound imaging of the organs related, results of any surgical findings and outcome.

Results: At MDCT, in 70/88 patients no complication was revealed, whereas in the remaining 18 cases the presence of a vascular complication was shown (a type II endoleak in 16/18 cases, and a type I endoleak in the remaining 2/18 cases). At MDCT, in 70/88 patients no complication was revealed, whereas in the remaining 18 cases the presence of a vascular complication was shown (a type II endoleak in 16/18 cases, and a type I endoleak in the remaining 2/18 cases). At CEUS, in 70 cases the presence of a vascular complication was shown (a type II endoleak in 55 chest and abdominal and to 80 kV in 5 scans; tube potential increased to 140 kV in one patient (both chest and abdomen). Overall CTDIvol was significantly lower for CarekV (8.5±2.9 mGy; 12.8±5.0 mGy) compared to 120 kV (9.6±2.1 mGy; 14±7.4 mGy; p < 0.01). None of the datasets was of non-diagnostic image quality. With CarekV, signal-to-noise-ratio was significantly lower for CarekV (8.5±2.9 mGy; 12.8±5.0 mGy) compared to 120 kV (9.6±2.1 mGy; 14±7.4 mGy; p < 0.01). None of the datasets was of non-diagnostic image quality. With CarekV, signal-to-noise-ratio was significantly lower for both chest and abdomen (p < 0.05), contrast-to-noise ratio significantly higher in the abdomen (p < 0.05) and similar in the chest (p=0.152).

Conclusion: As compared to a protocol with fixed 120 kV, use of the automated tube potential selection algorithm for thoraco-abdominal CT yields comparable image quality at a reduced radiation dose by 13-15%.
Reduction of effective and organ dose to the eye lens in cerebral MDCT scans using iterative image reconstruction

**Purpose:** To compare effective radiation dose and dose to the eye lens in MDCT brain examinations utilising either standard filtered back projection (FBP) technique or iterative reconstruction in image space (IRIS).

**Methods and Materials:** Of 400 MDCT adult brain examinations, 200 were performed using standard FBP and 200 using IRIS. All scans were performed on Siemens Somatom Definition AS+ system with parameters: tube voltage 120 kV (FBP&IRIS), reference mAs value 300 (FBP), and 200 (IRIS), pitch factor 0.65, rotation time 1.0 sec. Doses were calculated from CT dose index (CTDIdvol, mGy) and dose length product (DLP, mGy.cm) values utilising IMPACT software; the organ dose to the lens was derived from the actual tube current-time product value applied to the lens.

**Results:** The average CTDIdvol was 33.39 in FBP and 24.41 in IRIS, respectively (32.7% decrease). The average DLP was 589.7 (FBP) and 396.2 (IRIS), respectively (32.8% decrease). The average effective scan dose was 1.47±0.26 mSv (FBP) and 0.98±0.15 mSv (IRIS), respectively (33.3% decrease). The average organ dose to the eye lens decreased from 40.0±3.3 mGy (FBP) to 26.6±2.0 mGy (IRIS, 33.3% decrease). No significant change in diagnostic image quality was noted between IRIS and standard FBP (p=0.17).

**Conclusion:** Iterative reconstruction of cerebral MDCT examinations enables reduction of the effective dose by at least one third. Corresponding reduction of the organ dose to the lens is of high importance due to both lens radiosensitivity and the fact that the lens is commonly exposed to the primary beam in MDCT examinations.

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**B-0851**

Ultra-low radiation dose 64-row MDCT: multicentre clinical trial to assess the diagnostic feasibility of model-based iterative reconstruction (ultra-low VEO study)

**Purpose:** CT contribution to the collective radiation dose remains a dominant topic. Our purpose is to confirm the effectiveness of a full model-based iterative reconstruction (Veo) technique designed to significantly reduce radiation dose and improve image quality in patients.

**Methods and Materials:** The pilot study includes 120 patients from three institutions imaged in one of four anatomic arms: (1) anatomy/pathology in the posterior fossa, (2) lung cancer staging/restaging, (3) detection/characterisation of focal liver lesions, or (4) urolithiasis. For each patient, two datasets are acquired on the same scanner: (1) full-dose-iterative (FDI) and half-dose-iterative (HDI) reconstructions in patients with coronary stents require frequent follow-up, so that low radiation dose techniques are desirable. We compared diagnostic image quality for stent examination in full-radiation dose CT studies reconstructed with traditional filtered-back-projection (FBP) with studies at half the radiation dose using sinogram-affirmed-iterative-reconstruction (SAFIRE).

**Methods and Materials:** 15 implanted coronary stents were evaluated by 128-slice dual source CT (DSCT). Image data were reconstructed at full-dose with FBP and at half-dose with SAFIRE using corresponding kernels. Half-dose reconstructions were obtained from projection data from only one DSCT tube-detector configuration. In-stent signal-to-noise-ratio (SNR) was measured and image quality was graded on a five-point scale (5=excellent, 1=non-diagnostic). To objectively assess the effect on beam hardening artefacts, volumes of stents were measured using dedicated volume analysis software. Stent-lumen-attenuation-increase-ratio (SAIR) was calculated [(in-stent attenuation-vessel attenuation)/in-stent attenuation]. Statistical analysis used paired t- and chi-square testing.

**Results:** mean effective dose was 4.4±2.5 mSv. Significant in-stent stenoses were present in 2 stents, which were correctly identified with both reconstruction methods compared with coronary angiography. In-stent SNR was higher for half-dose SAFIRE compared with FBP (15.3±9.1 vs. 11.2±6.0; p < 0.01) while the SAIR was considerably lower (11.9% vs 29.3%; p < 0.01). In addition, image quality was found to be significantly (p < 0.01) better when iterative reconstruction was applied (4.1±0.8 vs. 3.9±0.8). Stent volumes tended to be lower when reconstructed with half-dose SAFIRE (170.1±110.1 mm³ vs. 183.7±115.9 mm³; p=0.11).

**Conclusion:** Despite using half-dose image data, iterative reconstruction improves evaluation of coronary stents by reducing image noise and beam-hardening artefacts and improving visualisation of the in-stent lumen.

**B-0854**

DNA damage repair kinetics from ionising radiation in the range of doses experienced in CT studies

**Purpose:** To quantify the kinetics of the cellular response to a range of low, CT-related doses of ionising radiation (IR) in mouse tumour infiltrating lymphocytes (TIL) in vitro.

**Methods and Materials:** TIL cells were placed in the centre chamber of the CDTI head phantom and irradiated with 10 mGy, 20 mGy, 40 mGy, 80 mGy or 170 mGy using a Siemens SOMATOM Sensation 64 CT scanner. Cellular kinetics of DNA damage and response were quantified by flow cytometric quantification of gammaH2AX foci at three time points (20 min, 1 hr and 2 hrs post-IR at room temperature). An non-irradiated control was included for each sample. Collected flow cytometry data, corrected for debris and dead cells using side and forward scatter gating, were analysed with CellQuest Pro Software. Fluorescence histograms were generated and the median fluorescence of each treatment sample was compared to its respective control and reported.
Results: In cells exposed to 80 mGy or 170 mGy gamma, AX signal reached a peak at approximately 1hr and then began to drop. In contrast, cells exposed to 10 mGy, 20 mGy and 40 mGy showed different repair kinetic patterns. Conclusion: Our results suggest DNA damage may be repaired by different mechanisms in a dose-dependent manner. This altered kinetic response could have marked biological effects for current radio-diagnostic procedures. Our study, therefore, underscores the importance of understanding the different repair mechanisms at different dose regions in order to accurately assess risk estimates and biological dose.

**B-0855** 11:33

Organ dose correlation with an attenuation-based patient size metric

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Purpose: Previous work (including AAPM Task Group 204) have described the effect of size on patient radiation dose from CT exams. The purpose of this study was to investigate the relationship between organ dose from CT with different patient size metrics, including one based on patient attenuation.

Methods and Materials: Using Monte Carlo simulation methods, patient radiation dose was computed for scan images from 10 randomly selected adult male and female patient models. These models were generated from tube current modulated abdomen/pelvis CT scans. Doses were tallied in three organs: liver, kidneys and spleen. For each patient, several size metrics were calculated, including: 1) the square root of the image attenuation area, perimeter, and maximum lateral width and A-P thickness. The correlation between normalised organ dose and each of these metrics was calculated and compared.

Results: For fixed tube current scans, the correlation with organ dose was greatest for image attenuation and perimeter (R2 = 0.75). However, for tube current modulated scans, image attenuation showed the best correlation with dose (R2=0.65), whereas perimeter, A-P thickness, and lateral width produced lower correlations (R2 of 0.4, 0.2 and 0.15, respectively).

Conclusion: An attenuation-based patient size metric can be used to estimate dose from both fixed and tube current modulated scans. It is a better patient size indicator for tube current modulated scans than perimeter due to its ability to take into account the attenuation of patients, which is also used in tube current modulating algorithms.

**B-0856** 11:42

The effect of CT dose reduction on performance of a diagnostic task


Purpose: Several studies have investigated tradeoffs between radiation dose and image quality (noise) in CT imaging. This study took the analysis a step further by investigating the tradeoffs between radiation dose and diagnostic performance in a clinical task (diagnosis of appendicitis).

Methods and Materials: This preliminary study was IRB approved and utilised data from 20 patients who underwent clinical CT exams for indications of appendicitis. Medical record review established true diagnosis of appendicitis, with 10 positives and 10 negatives. Original (100%) and simulated reduced dose levels (70%, 50%, 30%, 20% of original) were created with a validated software tool using raw projection data from each scan. An observer study was performed with 5 radiologists reviewing each case at each dose level in random order over several sessions. Readers assessed image quality and provided confidence in their diagnosis of appendicitis, each on a 5-point scale. ROC curves were generated for each dose level. AUC (area under curve) was calculated for each dose level.

Results: Interim results of the study showed that the AUC for each of the dose levels was 0.996, 0.982, 0.970, 0.965, and 0.963 for dose levels at 100%, 70%, 50%, 30% and 20%, respectively. Only 2 out of 480 readings received “unacceptable” image quality ratings (1 patient at 20% dose level).

Conclusion: This preliminary study demonstrated tradeoffs between radiation dose and diagnostic performance and indicated that: (a) even small dose reductions may affect diagnostic performance slightly and (b) large dose reductions may still allow acceptable performance levels.
B-0859 10:39

Voiding urosonography with a second generation contrast agent as a first step study for the diagnosis and grading of vesicoureteric reflux in children
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Purpose: To assess the efficacy of voiding urosonography (VUS) with a second generation contrast agent (CA) as a first step study for the diagnosis and grading of vesicoureteric reflux (VUR) in children.

Methods and Materials: Two hundred and ten consecutive children (86 boys, 124 girls, mean age 33.4 months) with 421 kidney-ureter-units (KUU) were evaluated with VUS to rule out (n=180) or follow-up (n=30) VUR. In all children VUS was performed with a contrast-specific-harmonic-imaging-mode and 1 ml of a second generation CA (Sonovue®, Bracco, Milan), according to ESPR working group recommendations. The VUS was recorded on digital cips and read twice by two blinded radiologists. The diagnosis in discordant cases was reached by consensus. The intraobserver and interobserver reproducibility was calculated by kappa coefficient.

Results: VUR was diagnosed in 178 KUU (42%) from 87 (41%) patients (34/84 boys and 53/126 girls). The rate of reflux was not significantly correlated with the sex, age, clinical indications and the presence or side of dilated pelvis. VUR was significantly more common in duplex than in single kidneys (p<0.001). The intraobserver and interobserver reproducibility was excellent for the detection of VUR (k=0.85) and moderate to excellent for the grading of VUR (k=0.75-0.84).

Conclusion: VUS with a second generation CA is an efficient first step study for the diagnosis and grading of VUR in children and it can reliably be used as an alternative radiation-free imaging method for this purpose.

B-0860 10:48

Contrast-enhanced voiding urosonography for diagnosis of vesicoureteric reflux in comparison to conventional methods: a meta-analysis
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Purpose: To assess the diagnostic performance of voiding urosonography (VUS) in vesicoureteral reflux (VUR) and urethral pathology detection compared to conventional methods published in medical literature.

Methods and Materials: Medline was searched by two independent observers for all possible articles published up to May 2011 on VUS in neonates-infants-children compared to VCUG or DRNC and performed with Levovist or SonoVue. The bivariate hierarchical model was chosen for statistical analysis. Individual study results were presented graphically by plotting estimates of sensitivity and specificity in receiver operating characteristics (ROC) and extended summary ROC. The 95% confidence intervals (CI) and the positive (LR+) and negative (LR-) likelihood ratios were calculated.

Results: 127 articles were found concerning ultrasound contrast VUS.30 comparative studies fulfilled the inclusion criteria: 26 VUS-studies in comparison with VCUG and 4 with DRNC, 26 performed with Levovist and 4 with SonoVue. Totally 2549 children with 5078 pelvo-ureteral-units were included for analysis. VUS compared to VCUG and DRNC had sensitivity 90% (CI: 85-93), specificity 92% (CI:89-94), LR+ 11.7, LR- 0.11. VUS performance was better compared to VCUG or DRNC and performed with Levovist or SonoVue.

Conclusion: VUS with a second generation CA as a first step study for the diagnosis and grading of VUR in children and it can reliably be used as an alternative radiation-free imaging method for this purpose.

B-0861 10:57

Diagnostic accuracy and clinical significance of magnetic resonance enterography of the small intestine in comparison with ileocolonoscopy in paediatric inflammatory bowel disease
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Purpose: To study the diagnostic accuracy of magnetic resonance enterography (MRE) in paediatric inflammatory bowel disease (IBD) in diagnosing intestinal inflammation and to evaluate the clinical significance of the MRE results on the management of paediatric IBD patients.

Methods and Materials: Forty prospective paediatric patients (median age 13.8 years, range 10.0-17.7) with suspected (n=35) or newly diagnosed (less than four weeks) confirmed IBD (n=5) were included and underwent gastrocolono-scoposcopy with biopsies followed by MRE (median interval 20 days, range 6-55). The MRE results were compared with macroscopic (gold standard-based Paris classification 2010) and microscopic assessment of the ileum. The clinical importance of the MRE results was registered based on prospective alteration in diagnosis and management.

Results: Crohn’s disease (CD) was diagnosed in 25 cases, ulcerative colitis (UC) in 12, and IBD unclassified (IBDU) in three. Macroscopic ileitis was detected in 15/25 (60%) of CD cases and in 2/12 (17%) of UC (backwash ileitis). Microscopic inflammation was found in another four CD cases and one IBDU patient. The discrepancy between standard gold and MRE was less than microscopy and gold standard. The sensitivity and specificity of MRI was 71% and 92%, respectively. MRE findings led to changes in diagnosis in 4/40 (10%) and treatment in 11/40 (28%).

Conclusion: MRE is a specific method for imaging of intestinal inflammation in paediatric IBD, and can be supportive or essential for clinical treatment decisions. MRE has lower sensitivity in patients with newly diagnosed IBD, perhaps due to less advanced changes.

B-0862 11:06

Multiphase contrast-enhanced MRI for control of subacute trauma of abdomen and chest in children
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Purpose: Traumatic damage of abdomen and chest organs in children (isolated as well as a part of multiple injuries) is not rare in radiological department of an emergency hospital. In order to control the trauma in subacute phase, we suggest multiphase contrast-enhanced MRI.

Methods and Materials: An MRI unit with 3.0 T was used in the research. We used T1 sequence e-THRIVE for pre- and postcontrast scans (Gd contrast agent, bolus). The scanning was of breath-hold type, with high spatial resolution (1x1 mm in plane, 1.7 mm slice thickness). Before contrast injection we used T2 sequences, MRCp, in synchronisation with breathing (Navigator method). 24 patients with subacute trauma scored from 9 to 50 on injury severity score (ISS) were examined.

Results: Examinations of subacute traumatic injuries in children revealed damages of parenchymal organs with various degrees of severity: liver (16 cases), kidneys (10), lungs (6), spleen (6) and pancreas (2). Eighteen patients (75%) had multiple injuries. All patients demonstrated positive dynamic recovery. Ability of the patient to hold his breath is needed, comprising one of major restrictions for using this method. The particular strength of this method is opportunity to overcome ultrasonography limitations (good performance in lungs, subdiaphragmatic region of liver etc).

Conclusion: Multiphase contrast-enhanced MRI is highly effective radiological method for control of recovery after chest and abdomen trauma in children. It reduces radiation exposure and may be suggested as a method of choice for children with major trauma undertaking treatment in an emergency hospital.

B-0863 11:15

The importance of advanced MRI techniques as the definitive diagnostic tool in the differentiation between osteomyelitis and osteonecrosis in children with sickle cell disease
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Purpose: Acute musculoskeletal pain due to marrow infarction is by far the most frequent clinical presentation for sickle cell, but symptoms can be similar to osteomyelitis. MRI has the highest sensitivity and specificity in detection of marrow and extramedullary changes in both infarction and infection. Although musculoskeletal changes are confidently detectable with MRI, they can be very similar. The purpose of this study was to illustrate the importance of MRI and the advanced protocols including unenhanced, dynamic-enhanced, multiphase subtraction and whole body DWI sequences.

Methods and Materials: We examined 22 children with sicklecell disease, acute musculoskeletal pain and noncharacteristic symptoms with our completed MRI protocol, and correlated our results with the clinical, microbiological and surgical details in order to determine the diagnostic value of our sequences.

Results: There was a significant correlation between our results and the clinical results, except few cases with clear diagnosis through unenhanced sequences, in most cases postcontrast dynamic, subtraction and DWI sequences were required for the diagnosis.
Conclusion: Whole body DWI sequences are the most effective for detecting hot spots in multifocal process, which is the nature of sickle cell disease. Although unenhanced sequences are helpful to determine the extent of a local process, in most cases the musculoskeletal abnormalities are either in osteomyelitis or in marrow infarction, similar and dynamic postcontrast and subtraction sequences are required for the definitive differentiation. Our results show that advanced MRI protocol is an ultimate diagnostic tool for confidently differentiating between marrow infarction and infection in children with sickle cell disease.

B-0864 11:24
Pixel-by-pixel analysis of DCE-MRI curve shapes in knees of juvenile idiopathic arthritis patients
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Purpose: To compare the relative number of time-intensity curve (TIC) shapes as derived from DCE-MRI in clinical active and clinical inactive juvenile idiopathic arthritis (JIA) patients.

Methods and Materials: DCE-MRI datasets of knees of JIA patients were prospectively obtained using an open-bore magnet (1T). Patients were classified into two clinical subgroups: active arthritis (n=8) and inactive disease (n=8). Every voxel with its TIC was classified into one of seven predefined TIC shape categories, which resulted in a colour-coded shape map. Spatial information of the synovial TIC shape distribution pattern and relative number of TIC shapes were calculated on a three-dimensional region of interest. Relative TIC shape numbers were compared using a nonparametric Mann-Whitney U test.

Results: No differences between active and inactive JIA patients were found regarding the relative number of type 2 TIC shapes (slow enhancement) and type 3 TIC shapes (fast enhancement followed by plateau phase) (p=0.645, p=0.600, respectively). However, a significant higher relative number of type 4 TIC shapes (fast enhancement followed by early washout phase) was seen in clinical active arthritis (p=0.052).

Conclusion: Our study showed a significant difference in the relative number of type 4 TIC shapes between clinical active and clinical inactive JIA patients.

B-0865 11:33
Permanent muscular sodium overload and muscle oedema in Duchenne muscular dystrophy: a possible contributor of progressive muscle degeneration

Purpose: To assess the presence and persistence of muscular oedema and increased myoplasmic sodium (Na+) concentration in Duchenne muscular dystrophy (DMD), probably contributing significantly to its progressive muscle degeneration.

Methods and Materials: We examined 11 DMD patients (mean age, 10.2±4.7 years) and 11 healthy volunteers (mean age, 10.5±3.2 years) on a 3-Tesla MR-image at baseline and at follow-up after washout phase. The myoplasmic sodium concentration was quantified by a muscular tissue Na+ concentration (TSC) sequence employing a reference tube for standardisation, containing 51.3mM Na+ with 5% agarose gel. With a novel inversion-recovery (IR) sequence, which is a unique subtraction technique for 23Na signals, for instance, from vasogenic oedema, we determined the sodium concentration in a 3 cm water surrounding to simulate surrounding tissue. X-ray-imaging was generated in ribs from cadavers of foetal and newborn lambs. Ribs were submerged in 0.77±0.13 mM Na+ solution. The fractures could only be detected by irregularities in the spongiosa and the cortex of the bone. The bone density was measured on a 3D-GE scanner at 0.7 T. A reference sample of lamellar bone was prepared to simulate bone density of 0.5 T. The rate of correctly detected fractures at 0.7 T and 0.5 T was compared. The rate of correct detections at 0.7 T vs 0.5 T was significantly higher (71.25% vs 61.25%, 80% vs 65%, 83.75% vs 70.625%).

Conclusion: The rate of correct diagnoses at 40 kV vs 60 kV was significantly higher than the value in the group with randomised mAs. The higher the effective dose was, the better SNR and CNR were. So, when we perform the paediatric abdomen CT with high mAs that does not consider their weights, the image quality was no longer sufficient for routine paediatric abdomen CT. For routine paediatric abdomen CT the effective dose of a MAs was higher in the group who were adjusted AEC than the value in the group with weight-based fixed mAs and lower in the group in which weight-based fixed mAs have been used. The higher the effective dose was, the better SNR and CNR were. So, when we perform the paediatric abdomen CT with high mAs that does not consider their weights, the image quality was no longer sufficient for routine paediatric abdomen CT.
Accuracy of computer-aided detection in detecting flat lesions in CT colonography.

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Purpose: To evaluate the performance of an independently trained computer-aided detection (CAD) system in detecting flat adenomas and carcinomas from a large multi-centre CT colonography (CTC) screening population. Previous CAD studies have reported low detection performance and involved compromised training/testing schemes.

Methods and Materials: A total of 1,948 patients with cathartic preparation from 32 medical centres were included. For CAD training, 1,211 patients were collected from two CTC screening trials involving 20 US medical centres. Faecal tagging was used in 36% of cases. The CAD was trained with the 1,211 CTC cases to detect lesions ≥10 mm and 16 were 6-9 mm. Per-lesion (per-patient) sensitivities of CAD were ≥10 mm and 16 were 6-9 mm. Per-lesion (per-patient) sensitivities of CAD were 

Results: There were 262 lesions, including 30 flat adenomas or carcinomas: 14 were ≥10 mm and 16 were 6-9 mm. Per-lesion (per-patient) sensitivity of CAD was increased risk of colorectal cancer were collected from a recent CTC screening trial involving 12 European centres. Iodine tagging without or with barium was used in 34% of cases. No intravenous contrast was administered. The pre-trained CAD system reviewed the 737 testing cases. Performance and per-patient detection sensitivities and false positives (FPs) per patient were assessed with bootstrapping for biopsy-proven colonoscopy-confirmed lesions.

Conclusion: Independently trained CAD can detect flat adenomas and carcinomas from unseen multi-centre CTC populations at clinically acceptable accuracy, comparable to that for polypoid lesions.

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

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Purpose: To investigate the clinical value of CT colonography (CTC) in the diagnosis and staging of colorectal cancer (CRC) and complicated diverticular disease, in order to properly plan the laparoscopic surgery.

Methods and Materials: From January 2009 until September 2010, 162 patients scheduled for surgery for CRC or 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 analysed. Accuracy of CTC in CRC staging was determined.

Results: A total of 113 CRC and 49 complicated diverticulitis were classified by CTC. OC was incomplete in 37/162 (23%) 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. Basing on CTC assessment, 5 cases of complicated diverticulitis were managed medically; 10 patients underwent conventional open surgery for CRC and 147 (103 CRC and 44 complicated diverticulitis) laparoscopic surgery. Sensitivity of CTC in TNM preoperative staging of patients with CRC resulted to be, respectively, 100%, 86% and 100%. In diagnosis of complicated diverticulitis 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 of major clinical relevance.

Conclusion: CTC provides accurate staging of colon cancer and detailed evaluation of complicated diverticular disease, allowing an appropriate management of patient and making the laparoscopic surgical planning more precise and safer.
findings of the other study. Chi-square test and kappa test were used to compare the findings on CTC and CC. Sensitivity and specificity on CTC for detecting pseudopolyps and granularity in a segment were also calculated.

**Results:** Good correlation was seen between CTC and CC for detection of granular appearance and pseudopolyps. Sensitivity and specificity on CTC for detecting pseudopolyps were 82.14% and 84.48%, respectively, and for granular appearance were 81% and 73.8%, respectively. Loss of haustural folds, pericolonic lymph nodes and wall thickening seen on CTC were found to correlate with intraluminal findings seen on CC. These can be used as additional markers of disease extent in association with intraluminal findings on CTC.

**Conclusion:** CTC can be used as an all-in-one technique for evaluating patients with ulcerative colitis who are in remission. It provides information about the bowel lumen, bowel wall and extraluminal abnormalities in these patients.

**B-0873 14:45**

Low-dose computed tomography to detect body packing: stepwise dose reduction in an animal model

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**Purpose:** To determine the value of low-dose computed tomography (CT) to detect body packing (ingested drug packet:%IC< 100%) as an alternative to plain radiographs in an animal model with stepwise CT-dose reduction.

**Methods and Materials:** Twelve packets containing cocaine (purity > 80%) were introduced into the intestine of an animal (crossbred pig, 21.5 kg), which was then repeatedly examined by abdominal CT with stepwise dose reduction (tube voltage, 80 kV; tube current, 10-30 mA; detector collimation, 64×0.625 mm; pitch, 1.5; rotation time, 350 ms; scan length, 35 cm). Three blinded readers independently evaluated the CT datasets (images reconstructed at 1.25 mm slice thickness; increment, 0.5) starting with the lowest tube current and noted the numbers of packets detected at the different tube currents used. One experienced reader determined the number of packets detectable on plain abdominal radiographs and ultrasound.

**Results:** The threshold for correct identification of all 12 drug packets was 100 mA for reader 1 and 125 mA for readers 2 and 3. Above these thresholds all 3 readers consistently identified all 12 packets. The effective dose of a low-dose CT scan with 125 mA (including scout view) was 1.0 mSv, which was below that of 2 conventional abdominal radiographs (1.2 mSv). The reader interpreting the conventional radiographs identified a total of 9 drug packets and detected 8 packets by abdominal ultrasound.

**Conclusion:** Extensive dose reduction makes low-dose CT a valuable alternative imaging modality for the examination of suspected body-packers and might replace conventional abdominal radiographs as the first-line imaging modality.

**B-0874 14:54**

Material decomposition of spectral CT: a new way in the prediction of response to chemotherapy in gastric carcinoma?

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**Purpose:** To investigate the use of the iodine concentration (IC) derived from material decomposition of spectral CT as a response indicator in patients with gastric carcinoma treated with chemotherapy.

**Methods and Materials:** Twenty-two patients with gastric cancer were scanned on a GE Discovery CT 750HD using spectral imaging mode, before and 2-4 months after chemotherapy. Patients were divided into the good-response group (GoodR) and poor-response group (PoorR) according to RECIST criteria. The iodine-water basis material decomposition images and monochromatic images on arterial and venous phase covering the entire stomach were reconstructed. An oval regions-of-interest (ROI) was placed on the highest enhanced region of gastric carcinoma. The iodine concentrations (IC, mg/I) in ROIs were recorded, and the decrease rate of IC was computed by the formula: %ΔIC= ICbefore - ICafter / ICbefore ×100%. The decrease rates of IC between two groups were compared using independent t test.

**Results:** We recorded a positive correlation between %ΔIC and the shrinkage rate of tumour size on both phases (arterial phase: r=0.698, P < 0.001; venous phase: r=0.760, P < 0.001), There were 9 cases of GoodR and 13 cases of PoorR. Statistical difference of %ΔIC was demonstrated between GoodR and PoorR at arterial phase (Z = -2.771, P = 0.004), but not at arterial phase (Z = 1.302, P > 0.05).

**Conclusion:** Our findings suggest that iodine concentration derived from spectral CT imaging could provide clinical information for the treatment evaluation of gastric carcinoma. Prospective studies with large samples are needed to test its reproducibility and to determine the diagnostic threshold.

**B-0875 15:03**

The accuracy of pre-operative CT in the assessment of the acute abdomen

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**Purpose:** While there is a lot of data on the accuracy of CT in diagnosing specific causes of an acute abdomen, there is very little information on the accuracy of CT in the acute general surgical admissions workload. We look at the diagnostic accuracy of CT in patients presenting with an acute abdomen who ultimately required laparotomy.

**Methods and Materials:** Patients who underwent emergency laparotomy from 2008 to 2010 at our hospital with a pre-operative CT on the same admission were included. The CT report was compared with the laparotomy and pathology findings, and where a discrepancy existed, the original scans were reviewed by a senior consultant blinded to the original report and laparotomy findings.

**Results:** 196 emergency laparotomies were performed over the 2-year period with 112 patients undergoing a preoperative CT. 15 patients were excluded due to missing notes. In the remaining 97 patients, 80 CT reports correlated with the final operative diagnosis giving a diagnostic accuracy of 82%. Of these, the oncall registrar was the initial reporter in 37 CTs with a diagnostic accuracy of 78%. On review of the CT scan by a second consultant this increased to 90 correlations yielding an accuracy of 93%. Delay between CT scan and operation did not significantly alter diagnostic accuracy, nor was there any statistically significant reduction in accuracy in reports issued by oncall registrars.

**Conclusion:** On first reporting CT misses 18% of diagnosis that ultimately require operative intervention. Reducing the threshold for obtaining a second consultant radiologist review significantly improves the diagnostic accuracy to 93%.

**B-0876 15:12**

Quantitative imaging biomarkers from PET-CT as potential correlates for angiogenesis and hypoxia in colorectal cancer

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**Purpose:** Integrated PET-CT systems allow measurements of tracer uptake on PET to be combined with quantitative biomarkers from CT. This study aims to identify histopathological correlates for fluorodeoxyglucose (FDG) uptake, CT attenuation and CT heterogeneity in colorectal cancer.

**Methods and Materials:** 18 FDG-PET was performed prospectively in a series of 53 patients with colorectal cancer. FDG uptake (maximal standardised uptake value: SUVmax), CT attenuation and CT heterogeneity for unenhanced images were quantified in a region of interest (ROI) encompassing the primary tumour. Heterogeneity was expressed as the standard deviation (SD) of pixel values in CT images with and without filtration to highlight image characteristics ranging from fine to coarse features (as determined by the filter value). Using the Spearman-rank method, all imaging parameters were correlated with tumour microvessel density (MVD) and expression of vascular endothelial growth factor (VEGF) and Glut-1 on histological examination of resected tumours.

**Results:** Histological data were available in 32 cases. CT heterogeneity (filter value 2.0) was the best correlate for MVD (rs = 0.47, P = 0.006). SUVmax correlated significantly with expression of VEGF (rs = 0.42, P = 0.017) but not Glut-1 (rs = 0.35, P = 0.053). The ratio of SUVmax to CT heterogeneity (filter value 2.5) was the best correlate for expression of VEGF (rs = 0.45, P = 0.009) and Glut-1 (rs = 0.42, P = 0.018).

**Conclusion:** Addition of CT-based biomarkers has the potential to increase the utility of PET-CT by enhancing the imaging correlates for angiogenesis and hypoxia in colorectal cancer.
Purpose: To compare the diagnostic potential of DCE-MRI to differentiate malignant vs. normal prostate and prostatic tissue with special regard to different field strengths of 1.5 vs. 3 Tesla.

Methods and Materials: 68 patients with biopsy and/or prostatectomy of the prostate were included in the study. MRI was performed at 1.5 T in 32 patients with biopsy-proven prostate cancer (PC) and in 8 patients with prostatitis; at 3 T, MRI was performed in 27 patients before prostatectomy after histologically proven PC and in 11 patients with prostatitis. MRI was performed with combined body and endorectal coil protocol in all patients, using a 2D TurboFLASH T1W GRE sequence to calculate plasma flow (PF) and mean transit time (MTT) values. Results: PC showed higher PF (p < 0.0001) and shorter MTT (p < 0.0001) at 3 T as well as at 1.5 T (p < 0.0001 for PF and p=0.0016 for MTT) compared to normal tissue. PC demonstrated higher PF than prostatitis (p=0.018) and shorter MTT (p=0.0006) at 3 T, but only shorter MTT (p=0.0034) at 1.5 T without significantly higher PF values (p=0.3604). In comparison with normal tissue, prostatitis had a statistically significant higher PF at 1.5 T (p=0.0156) but not at 3 T (p=0.1748) and no significantly shorter MTT values both at 3 T (p=0.1595) and 1.5 T (p=0.25).

Conclusion: Both field strengths are capable to differentiate PC vs. normal tissue. Using 3 T, PC can be better delineated from prostatitis compared to 1.5 T. Nevertheless, the results are equivocal for differentiation of prostatitis and normal tissue.

Purpose: To assess contrast-enhanced MRI for detection of microscopic extra-capsular extension (ECE) (associated with vessel permeability) as well the DWI parameters (according to the intravoxel incoherent motion (IVIM) model) perfusion fraction f and diffusion constant D in patients with osteoporosis and multiple myeloma.

Results: Among the 40 patients (23 with osteoporosis and 17 with multiple myeloma), a significantly increased diffusion constant D was found in patients with multiple myeloma (p < 0.001, Wilcoxon Rank Sum Test). No significant difference was found for the perfusion fraction f (p=0.07, Wilcoxon Rank Sum Test). Conclusion: DCE-MRI and DWI may assist in differentiating benign osteoporosis from malignant bone disease caused by multiple myeloma.

Purpose: To develop a robust methodology using MRI for predicting radiation dosimetry borders of the tumour beyond the area of enhancement for radiation treatment planning.

Methods and Materials: We retrospectively identified 88 consecutive glioblastoma multiforme patients (2005-2010) who had (presurgical, post-surgical, pre-radiation, and relapse) MRI studies and undergone radiation treatment (RT). 3D Slicer software 3.6 (slicer.org) was used for image analysis, manipulation and segmentation. Two neuroradiologists (RRA, FAJS) reviewed the images in consensus. Three structures were segmented (oedema/invasion, enhancing tumour, and necrosis). Subsequently, the models/quantitative volumes of oedema, tumour and necrosis were calculated. MR perfusion (MRP) scans (N=40) were registered to segmented images and quantitative perfusion parameters obtained. These were then registered to the radiation planning CT images and the dosimetry curves superimposed.

Results: Accurate registration (within 2 mm) occurred among the images and the radiation planning CT images. 23/40 patients demonstrated increases in perfusion (reflective of tumour infiltration) beyond the border of enhancement and corresponding to the regions of subsequent recurrence, suggesting that radiation planning to include those abnormal regions seen on advance imaging techniques (not on conventional MRI) might result in better tumour treatment and control of recurrence. Conclusion: We present a robust image analysis methodology/platform for accurate registration of conventional and advanced MRI sequences and with the radiation planning CT images. MR perfusion abnormalities seen outside the area of enhancement predict regions of subsequent recurrence and thus registering and including these regions in the RT and dosimetry planning system can be expected to decrease tumour recurrence and increase survival.
FDG tumour at baseline PET-CT were excluded. Clinical re-staging was repeated pre-operatively. Tumoral metabolic response was assessed according to EORTC criteria. Histopathological response was assessed qualitatively by T-downstaging and quantitatively by grading of tumour regression induced by pre-operative chemotherapy according to Becker’s criteria.

Results: Twelve LAGC resectable patients (7 F/5 M; mean age: 63±9 years) were included. Five patients (42%) were classified as metabolic responders (reduction of ≥5±10% in tumoral SUVmax) and seven patients (58%) as metabolic non-responders (increase of ≥6±16% in tumoral SUVmax). All metabolic responders showed T-downstaging with 3 partial, 1 subtotal and 1 minimal tumour regression. All metabolic non-responders did not show T-downstaging and tumour regression analysis showed 6 minimal responses and 1 partial response. Additionally, 3 metabolic responders were ypN0 while 6 metabolic non-responders were ypN2-3.

Conclusion: FDG PET-CT could be a reliable modality to predict histopathological response at an early stage of the pre-operative treatment in LAGC patients, thus allowing a change in the treatment for metabolic non-responders patients.

B-0882 14:45
ADC maps: differentiation of metastatic from non-metastatic lymph nodes in patients with endometrial cancer
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Purpose: To evaluate the usefulness of diffusion-weighted images with body background suppression (DWIBS) and apparent diffusion coefficient (ADC) to discriminate between metastatic and non-metastatic pelvic lymph nodes in endometrial cancer.

Methods and Materials: This prospective study included 32 patients with histologically proven endometrial cancer who underwent MR examination including T2-weighted, dynamic T1-weighted and diffusion-weighted images with background suppression (DWIBS) with b-values of 0 and 1000 s/mm². Then all patients underwent total hysterectomy and pelvic lymphadenectomy. All identifiable lymph nodes on DWIBS (n=94) were evaluated and for each lymph node mean ADC values, short- and long-axis diameters were measured and compared. Histopathological findings served as the reference standard.

Results: Mean (+SD) ADC values (10-3 mm²/s) of metastatic lymph nodes (n=12; 0.83±0.134) were significantly lower than those of non-metastatic lymph nodes (n=82; 1.062±0.157) (p-value<0.001). Long- and short-axis diameters of metastatic vs non-metastatic lymph nodes were 13.6 ± 2.4 mm vs. 12.6 ± 3.1 mm and 9 ± 4.3 mm vs. 8 ± 2.5 mm, respectively.

Conclusion: In endometrial cancer patients, ADC measurements of pelvic lymph nodes allow to discriminate between metastatic and non-metastatic nodes.

B-0883 14:54
Multimodality quantification of tumour perfusion in diffusion-weighted MRI and dynamic PET in a rodent model

Purpose: Development of new parameters of acquisition and treatment for the assessment of tumour perfusion using diffusion-weighted MRI and dynamic PET/CT with 18F-FDG, in a rodent model.

Methods and Materials: Experiments were made on two models of epidermoid head and neck carcinoma implanted in nude rats, FaDu a highly vascularised tumour and A253 a poorly vascularised tumour. DW-MRI was performed with an acquisition of 20 different b values (0-2000), for which a “clinical ADC” (using only b=1000), a mono-exponential and a bi-exponential analysis of ADC and perfusion parameters (f, D*) were calculated. Dynamic PET/CT was performed, with visual analysis of enhancement curves, and a Patlak and compartmental analysis. All data were correlated pathology with semi-quantitative evaluation of vascularity, necrosis, inflammation and haemorrhage.

Results: DW-MRI data with bi-exponential analysis, allowed separation of two components, with a perfusion fraction f greater for FaDu than A253 (21.5 vs. 11.8; p=0.004), consistent with pathology. There was also a significant difference in perfusion between the tumour types (Dr 1.00 vs. 0.78; p=0.013) but which did not correlate a specific pathological characteristic. Enhancement curves in dynamic PET showed an accumulation of tracer in the tumour starting from the first minute. Perfusion parameters extracted using Patlak or compartmental analysis did not yield a significant difference between the two groups.

Conclusion: Our study allowed optimisation of data acquisition and analysis for the evaluation of tumour perfusion using multi-b DW-MRI and dynamic PET.

B-0885 15:03
MRI-based liver segmentation for quantification of functional liver volume: evaluation of a threshold-based method facilitated by hepatobiliary contrast media (Gd-EOB)
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Purpose: Knowledge of the exact tumour volume is relevant in various oncological scenarios (assessment of tumour load, radioembolisation dosimetry, future liver remnant before major surgery). Purpose was the evaluation of this approach compared to manual segmentation with CT as reference.

Methods and Materials: A total of 20 patients (10 gastro-intestinal primary malignancies, 10 hepatic primary tumours) were examined before selective internal radioembolisation with computed tomography and Gd-EOB (Primovist, BayerSchering)-enhanced MRI of the liver within one week. T1w 3D-sequences (THRIVE) were acquired in the hepatobiliary phase. The liver volume was measured by manual segmentation of the liver silhouette excluding intrahepatic tumour masses in the CT and MR dataset and by manually adjusted thresholding of the MR dataset followed by removal of extralobar structures. Mean absolute error, reproducibility and duration of each segmentation procedure by a threshold-based volumetry and manual slice segmentation were quantified.

Results: A MRI-based liver volumetry underestimated the calculated volume based on CT data with mean of 4.0% (maximum, 7.8%) for a manual segmentation, 5.8% (maximum, 7.5%) for the threshold-based method. For a MRI-based volumetry segmentation times between 2.5 and 5 minutes, mean 3.5 minutes with a manual slice segmentation, between 2.0 and 4.0 minutes, mean 3.0 minutes for the threshold-based method were observed. Segmentation times for a CT-based liver volumetry ranged between 4 and 8 minutes, mean 5.5 minutes.

Conclusion: With a small mean absolute error and the reduced segmentation time compared to manual segmentation, Gd-EOB volumetry offers quick and convenient segmentation of functional liver volume.

B-0886 15:12
Fusion of dynamic CE-MRI mammography at 3.0 Tesla with FFD MRI: pilot study using a dedicated semi-automatic registration software
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Purpose: Image-fusion of x-ray mammography and MR-mammography (XR-M/MR-M) allows correlation of pathologic findings between these imaging-modalities (e.g. microcalcifications, architectural distortions, focal enhancements, etc). Thus, it has the potential to optimise diagnostic accuracy and clinical workflow of breast imaging. This pilot study evaluates the accuracy of a dedicated semi-automatic image fusion of XR-M and high-resolution/high-field MR-M.

Methods and Material: MR-M were acquired on a high-field scanner (3.0 Tesla: T1-weighted 3D-VIBE: a Gadolinium). XR-M were obtained with state-of-the-art full-field digital systems. Patients with clearly delineable mass lesions > 10 mm in XR-M and MR-M were enrolled (exclusion criteria: previous breast surgery; surgical intervention between XR-M/MR-M). MR-M and XR-M were matched using our in-house developed software allowing semi-automatic non-linear deformation of MR-M. Based on the MR-M a “virtual 2D Mammogram” was calculated to identify registration-errors (RE; with and w/o Gadobamide/Gd) and compared to the corresponding XR-M. To quantify the geometrical centre of the lesion in the virtual vs. conventional mammogram were subtracted. Robustness of registration was quantified by registration of X-MRs to both MR-Ms with and w/o Gadobamide.

Results: Image registration was performed successfully for all patients (n=7). Overall RE was 8.2 mm (w/o Gd: confidence-interval/CI: 2.0-14.4 mm) vs. 8.9 mm (1st minute after Gd: CI: 4.0-13.9 mm). Mean difference between pre- vs. post-contrast scans was 0.7 mm.

Conclusion: Semi-automatic image registration of high-field MR-mammography with x-ray mammography is feasible. For this study applying a high-resolution protocol at 3.0 Tesla, the registration was robust and the overall registration error was sufficient for clinical application.
ONSD measurements correlate with invasive and noninvasive ICP in injured patients with elevated intracranial pressure (ICP). We evaluated whether the optic nerve sheath diameter (ONSD) may be increased in brain-injured subjects.

**Purpose:**
The optic nerve sheath diameter (ONSD) measurement may be increased in brain-injured subjects.

**Methods and Materials:**
First, validation of DSDE DWI was attempted by comparing with conventional EPI DWI. Five healthy volunteers were imaged using a DSDE DWI sequence and an EPI sequence. For both methods, a motion-probing gradient was applied in one direction (A-P) with b values of 0 and 500 s/mm². The imaging voxel size was 1.5x1.5x1.5 mm³ for the DSDE and 1.5x3x3.0 mm³ for the EPI. The apparent diffusion coefficient (ADC) measured by the two methods in 15 regions (6 in grey matter and 10 in white matter) were compared using a Pearson's correlation coefficient. Then, the ADC in the pituitary anterior lobe was measured in 7 volunteers using the DSDE DWI sequence, and compared with those in the pons and cerebellum using the t-test.

**Results:**
ADC from the two methods showed good correlation (r = 0.88), confirming the accuracy in ADC measurement with the DSDE sequence. The ADC in the normal pituitary gland was 1.32±0.11 x10⁻³ mm²/s. This was significantly higher than that in the pons (0.96±0.18 x10⁻³ mm²/s) and in the cerebellum (0.84±0.14 x10⁻³ mm²/s) (P < 0.05, respectively).

**Conclusion:** We demonstrated that DSDE DWI is feasible to assess ADC in the pituitary gland.

**B-0888**
Sonographic evaluation of the intracranial pressure in adult brain injury

**Purpose:**
The optic nerve sheath diameter (ONSD) may be increased in brain-injured patients with elevated intracranial pressure (ICP). We evaluated whether ONSD measurements correlate with invasive and noninvasive ICP measurements in brain-injured adults.

**Methods and Materials:**
We examined 106 brain-injured patients and 67 control subjects without intracranial pathology. Brain-injured patients were evaluated using Glasgow coma scale (GCS) and a semiquantitative (l-VI) neuroimaging scale (Marshall Scale, MS), and were divided into moderately (MS I-IV and GCS≤6, n=35) and severely (MS=V-II and GCS≤8, n=71) brain-injured subjects. Measurements of the ONSD and noninvasive ICP (eICP), using optic nerve sonography and transcranial Doppler sonography, respectively, were performed upon admission in controls and moderately brain-injured subjects, and three times during hospitalisation in severely brain-injured patients. Upon admission, 32 severely brain-injured patients also underwent invasive ICP measurement.

**Results:**
In severely brain-injured patients, the ONSD correlated with the MS (r=0.76-0.82) and the eICP (r=0.53-0.80) in all three evaluations, whereas ONSD and eICP were significantly increased (6.2±0.7 mm and 27.5±6.9 mmHg) as compared with moderately brain-injured subjects (4.2±0.9 mm and 12.3±3.7 mmHg) and controls (3.5±0.8 mm and 9.9±3.7 mmHg). (P < 0.001). Invasive ICP measurements also correlated with ONSD measurements (r=0.68, P=0.002). The best cut-off ONSD value for predicting elevated ICP was 5.7 mm (sensitivity=74%, specificity=100%).

**Conclusion:** ONSD measurements correlate with invasive and noninvasive ICP measurements, and with neuroimaging findings in brain-injured adults. Optic nerve sonography could alert clinicians to the presence of elevated ICP, whenever invasive ICP evaluation is contraindicated and/or is unavailable.

**B-0899**
The human eye after lens replacement surgery

**Purpose:**
Today lens replacement is a basic method of cataract treatment. The evaluation of postoperative changes, especially in the area of the posterior circumference, is often inadequate using ophthalmologic standard methods such as ultrasonic or optical coherence tomography. High-field magnetic resonance imaging (MRI) enables evaluation of the structures of the anterior eye segment before and after cataract surgery with high resolution and free of distortion.

**Methods and Materials:**
Ten pseudophakic human eyes (cataract surgery) were examined ex vivo with ultra-high-field MRI (7.1 Tesla, ClinScan, Bruker BioScan) using a small surface coil and T2-weighted spin echo sequences. Different biometrical distances of the pseudophakic situation were measured and correlated with the crystalline lens situation.

**Results:**
Ultra-high-field MRI at 7.1 Tesla provided excellent visualisation of anterior segment details especially in the area of the posterior circumference of the lens. It was possible to evaluate the postoperative changes after lens replacement without distortion and with high spatial resolution.

**Conclusion:**
Our results suggest that MR microscopy has the potential to image small anatomical structures and to evaluate the results of surgical interventions. 7.1 T MRI provides an extremely high spatial resolution under absence of distortion artefacts. While our study was performed ex vivo, we expect that, with wider availability, ultra-high-field MR microscopy will evolve into an essential tool for both experimental studies and daily routine.
somewhat high signal but otherwise normal, 3 if large and deformed, 4 if small and deformed, 5 if deformed and high signal, and 6 if not definitely identified. Subjective score was compared with volume using linear regression.

**Results:** The better and worse bulbs were 39 ± 18 cm³ and 37±31 cm³/n volume, respectively. Subjective scoring in T2 FSE and FIESTA images did not correlate significantly with the better olfactory bulb volume. Subjective scoring in FIESTA images correlates significantly with the worse olfactory bulb volume (p=0.002). There were, respectively, 2, 17, 3, 2, 1 lesions within categories 0, 3, 4, 5, and 6.

**Conclusion:** A small deformed olfactory bulb is the most frequent findings in post-trauma anosmia. Subjective assessment of the olfactory bulb correlates well with objective measurement in the more severely injured bulb.

**References:**


**B-0895** 15:03

**T1-weighted gradient-echo vs spin-echo sequences in gadolinium-enhanced brain imaging at 3 T comparison in terms of image quality, flow artefacts and depiction of vessels**

- **Purpose:** With 3 T MR units, T1-weighted gradient echo sequences, such as FLASH are often used instead of spin-echo (SE) sequences for brain imaging due to well-known disadvantages of SE sequences at this field strength. The purpose of this study was to evaluate contrast-enhanced FLASH vs. SE sequences in terms of image quality, flow artefacts in arterial and venous cerebral vessels, and depiction of small vessels.

**Methods and Materials:** In 50 patients, axial FLASH as well as SE sequences were acquired after gadolinium administration. Two radiologists assessed the following parameters in both sequences: Image quality, flow artefacts, and quality of depiction in large arteries, small arteries and dural sinuses, resp., cerebral veins (each assessed with a 5-tier scale).

**Results:** In all cases, overall image quality of FLASH sequence was superior to SE. In the depiction of larger arteries, FLASH was assessed superior to SE in 96% of cases whereas in the depiction of small vessels, SE was superior in 96%. Flow artefacts were completely absent in FLASH whereas SE demonstrated flow artefacts in 94% and 64%, respectively. In the visualisation of sinuses and cerebral veins, FLASH was found to be equal or superior to SE in 90%. Equally to arteries, flow artefacts were rarely found in FLASH (18% vs. 100% of cases).

**Conclusion:** At 3 T, T1w-GRE sequences demonstrate improved overall image quality and better depiction of large cerebral arteries and sinuses in comparison to SE sequences, while small vessels are significantly better seen with SE sequences.

**References:**

Radioembolisation with Y-90 glass microspheres: do we really need SPECT-CT to identify extrahepatic shunts?

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Purpose: To evaluate the reliability of elastography, a new ultrasonographic method, for delineating thermal lesion boundaries in porcine liver tissue by comparing lesion dimensions determined by real-time elastography with the findings of hepatic thermal lesions: first results

Methods and Materials: A total of 15 thermal lesions with diameters ranging from 17 to 60 mm were created using radiofrequency ablation (RFA). The new LOGIQ E9 elastography imaging technology (GE Healthcare, Wauwatosa, WI) was used with a 6-15 MHz high frequency linear transducer. Lesions were examined using B-mode and real-time elastography (RTE). Lesion detection, delineation and size were assessed using B-mode and RTE immediately after each thermal ablation. Measurements of the sections representing the same image plane used for elastography were taken at pathologic examination and compared with the measurements obtained from the elastograms.

Results: In our sample a statistically significant correlation in vitro between RTE and pathological measurements with respect to the lesions’ principal axis and area (r² = 0.9338 long axis, r² = 0.8989 short axis, and r²=0.9676 area). Overall, elastography slightly underestimated the lesion size, as judged by the digitalised pathologic images.

Conclusion: These results support that RTE outperforms conventional B-mode ultrasound and could potentially be used for routine assessment of thermal therapies.

Radioembolisation with Y-90 glass microspheres: do we really need SPECT-CT to identify extrahepatic shunts?

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Purpose: To compare the angiographic and pathological features with hydrocoils and fibered coils at 24 hours and 7 days in terms of mechanism of occlusion and inflammatory response.

Methods and Materials: Six sheep had both internal iliac and renal arteries randomly embolised using fibered coils or hydrocoils. Renal arteries were embolised using 0.018 coils and internal iliacs using 0.035 coils. The number of coils and time to complete occlusion was recorded. Three animals were sacrificed after 24 hours and 3 after 7 days. Pathological evaluation consisted in characterising the mechanism of occlusion: percentage of the lumen occluded by the embolic (platinum + dacron fibres vs hydrogel) and thrombus, presence of inflammatory cells.

Results: No difference was found between hydrocoils and fibered coils for the number of coils and time to achieve vascular occlusion. At angiography, 75% of iliac arteries embolised with hydrocoils were occluded vs 67% of those embolised with fibered coils (NS). Recanalisation of the renal artery was observed in both groups. The percentage of thrombus was significantly lower for hydrocoils than for fibered coils at the 2 time points. For fibered coils, at pathology thrombus accounted for 69% of the occlusion vs 42% for hydrocoils. The presence of inflammatory cells was more frequent with fibered coils than with hydrocoils (71% vs 30%).

Conclusion: The percentage of thrombus was significantly less with hydrocoils as compared to fibered coils. Markedly lower inflammatory cell response was seen with hydrocoils. Both differences may translate into less long-term recanalisation. Further investigation is needed.
Scientific Session

B-0902 14:45
Portal vein ligation alone compared with portal vein and hepatic artery ligation in a rodent model
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Purpose: Our study compared the volume change and reparative capacity of portal vein ligation (PVL) and heterochronous PVL with hepatic artery ligation (HAL) in a rodent model.

Methods and Materials: Animals were separated into three groups. For group I, ligation of the left lateral and median portal vein branches was performed. For group II, ligation of the portal vein was completed, followed by ligation of the same branches of the hepatic artery after 48 h. For group III (control group), a laparotomy without ligation (sham operation) was performed. At least 5 rats from each group were sacrificed at 1, 3, 5, and 7 days after surgery. Liver volume change was measured and a liver function test performed. Using excised rat livers, we performed immunohistochemical analyses of c-kit and MBP-5. Histologic features were analysed.

Results: The volume of the nonligated lobe increased most in group II initially, but there was no significant difference at days 5 and 7. Mean AST and total bilirubin levels were significantly higher in group II and albumin levels were high in group I. C-kit positive cells were more present on days 1 and 3 in group I, versus group II, which was statistically significant. MBP-5 stained cells were more numerous in group I. on days 1, 3, and 5. Necrotic changes in the ligated lobes were shown in large number of group II.

Conclusion: PVL alone is safe and effective for compensatory liver regeneration. Performing both PV and HA ligation does not result in additional benefit.

B-0903 14:54
Microwave ablation of the kidney: evaluation of cooled antegrade pyeloperfusion for protection of the collecting system in an in vivo porcine model
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Purpose: To evaluate the effect of antegrade-cooled pyeloperfusion for the protection of the renal collecting system during microwave ablation.

Methods and Materials: CT-guided nephrectomy was performed in one kidney in each of 14 female house pigs using a 6 F pigtail nephrostomy catheter. Pyeloperfusion was performed using a cooled 5%-glucose solution that was infused via the nephrostomy catheter at 10 ml/sec (100 drops sec). Meanwhile microwave ablation was performed at 45 watts for 10 minutes in the irrigated and the non-irrigated kidneys with cooled fibers. When both procedures were performed at 45 watts for 10 minutes in the irrigated and the non-irrigated kidneys were complete response with no residual lesions after both procedures. All liver metastases and all HCC lesions ≤2.0 cm had complete response with no residual tumours. In group 2, 11/15 HCC lesions (73%) showed complete response, 3/12 lesions (25%) had residual tumours. In group 2, 11/15 HCC lesions (73%) showed complete response, 3/12 lesions (25%) had residual tumours. In group 2, 11/15 HCC lesions (73%) showed complete response, 3/12 lesions (25%) had residual tumours.

Conclusion: Microwave ablation compared with radiofrequency ablation for breast tissue in an ex vivo bovine udder model
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Purpose: To compare the effects and outcome of radiofrequency (RFA) and microwave (MWA) ablation therapy in the treatment of primary and secondary liver malignancy.

Methods and Materials: In this prospective study approved by the institutional review board 57 patients with 63 lesions were treated with RFA and MWA. In the RFA group (21 patients), 10 patients suffered from HCC (12 lesions) and 11 patients from liver metastases (11 lesions). In the MWA group (36 patients) 40 lesions (15 HCC and 25 liver metastases) were documented. Response criteria, recurrence rate (RR) and survival indices were assessed after both procedures.

Results: In group 1, 9/12 HCC lesions (75%) showed complete response, 3/12 lesions (25%) had residual tumours. In group 2, 11/15 HCC lesions (73%) showed complete response, 4/15 lesions (26.6%) had residual tumours. Liver metastases showed complete response with no residual lesions after both procedures. All HCC lesions ≤2.0 cm showed complete response with no residual lesions in both groups. There was no significant difference in rates of residual HCC lesions > 2 cm between both groups (P=0.15, Log-rank test). Time-to-progression (TTP) in all patients treated with RFA compared with MWA was 5.6 versus 4.7 months and RR at 3, 6, 12 months were 0.0%, 16.7%, 25% versus 13%, 20%, 26.7%, respectively (P=0.005).

Conclusion: HCC lesions treated with RFA and MWA had statistically similar complete response rates of residual tumours, recurrence rate and survival indices. All liver metastases and all HCC lesions ≤2.0 cm had complete response with no residual tumours in both groups.

B-0904 15:03
An experimental study on multimodal visibility (angiography, CT and MRI) of embolisation particles performed in porcine kidneys
C.M. Sommer1, U. Stampfl1, N. Bellemann1, M. Holzschuh2, N. Kortes1, A. Kueller1, J. Bluemmel1, B.A. Radeleff1, H.U. Kauczon1, 1Heidelberg/DE, 2San Antonio, TX/US (cmonsmmer@gmx.com)

Purpose: To analyse multimodal visibility of embolisation particles on angiography, CT and MRI in porcine kidneys.

Methods and Materials: As an evolution of the current available embolisation particles (Embozene© Microspheres, CeloNova BioSciences, USA), those particles were modified, that additional embedding of dense X-ray materials should result in good visibility on angiography and CT as well as additional embedding of magnetic substances should result in good visibility on MRI. Three different prototypes (Intensity A, B and C) as well as current available Embosphere© Microspheres with sizes of 100±25µm and 700±50µm were tested. Without using any contrast material, renal arteries of four pigs were catheterised and each kidney was embolised with one milliliter of one type of particle. Subjective and objective particle visibility was evaluated on angiography, CT and MRI.

Results: On angiography, intensity A, B and C of 100±25µm particles as well as intensity B of 700±50µm particles were definitely visible. Current available Embozene© Microspheres given as control group were definitely not visible. On CT and MRI (T1 and T2), intensity A, B and C of 100±25µm particles as well as 700±50µm particles were definitely visible. On CT, signal-to-noise ratio for intensity A, B and C increased significantly (e.g. intensity A, 100±25µm particles: +6.5±23.7, P<0.05). On MRI (T1 and T2), signal-to-noise ratio for intensity A, B and C decreased significantly (e.g. intensity B, 700±50µm particles, T1: -73±8.9, P<0.05).

Conclusion: Modification of the current available Embosphere© Microspheres was successful with multimodal visibility on angiography, CT and MRI.

B-0905 15:12
Ablation therapy of hepatic malignancy: a comparative study between radiofrequency and microwave ablation techniques
T.J. Vogl, A. Darvishi, P. Farshid, A. Azizi, B. Bazazfarnaz, N.N.N. Naqib, N.E. Nour-Eldin, S. Zhangos, J. Trojan, Frankfurt/DE (t.vogl@em.uni-frankfurt.de)

Purpose: To compare the effects and outcome of radiofrequency (RFA) and microwave (MWA) ablation therapy in the treatment of primary and secondary liver malignancy.

Methods and Materials: In this prospective study approved by the institutional review board 57 patients with 63 lesions were treated with RFA and MWA. In the RFA group (21 patients), 10 patients suffered from HCC (12 lesions) and 11 patients from liver metastases (11 lesions). In the MWA group (36 patients) 40 lesions (15 HCC and 25 liver metastases) were documented. Response criteria, recurrence rate (RR) and survival indices were assessed after both procedures.

Results: In group 1, 9/12 HCC lesions (75%) showed complete response, 3/12 lesions (25%) had residual tumours. In group 2, 11/15 HCC lesions (73%) showed complete response, 4/15 lesions (26.6%) had residual tumours. Liver metastases showed complete response with no residual lesions after both procedures. All HCC lesions ≤2.0 cm showed complete response with no residual lesions in both groups. There was no significant difference in rates of residual HCC lesions > 2 cm between both groups (P=0.15, Log-rank test). Time-to-progression (TTP) in all patients treated with RFA compared with MWA was 5.6 versus 4.7 months and RR at 3, 6, 12 months were 0.0%, 16.7%, 25% versus 13%, 20%, 26.7%, respectively (P=0.005).

Conclusion: HCC lesions treated with RFA and MWA had statistically similar complete response rates of residual tumours, recurrence rate and survival indices. All liver metastases and all HCC lesions ≤2.0 cm had complete response with no residual tumours in both groups.

B-0906 15:21
Microwave ablation compared with radiofrequency ablation for breast tissue in an ex vivo bovine udder model
P. Isfort1, T. Tanaka1, T. Penzkofler1, P. Bruners1, T. Braunschweig1, K. Kichikawa2, T. Schmitz-Rode1, C.K. Kuhl1, A.H. Mahnken1, 1Aachen/DE, 2Nara/JP (isfort1@ukachen.de)

Purpose: To compare the effectiveness of microwave (MW) ablation with radiofrequency (RF) ablation for treating breast tissue in ex vivo bovine udder tissue.

Methods and Materials: MW ablations were performed at power outputs of 25 W, 35 W, and 45 W using a 915-MHz frequency generator and a 2-cm active tip antenna. RF ablations were performed with a bipolar RF system with 2- and 3-cm active tip electrodes. Tissue temperatures were continuously monitored during ablation.
Results: The mean short-axis diameters of the coagulation zones were 1.34 ± 0.14, 1.45 ± 0.13, and 1.74 ± 0.11 cm for MW ablation at 25 W, 35 W, and 45 W. For RF ablation, these values were 1.16 ± 0.09 and 1.26 ± 0.14 cm with electrodes having 2- and 3-cm active tips, respectively. The highest tissue temperature was achieved with MW ablation at 45 W (p < 0.05). On historical examination, the ablation zone in MW ablations was less affected by tissue heterogeneity than in RF ablations.

Conclusion: MW ablation appears to be advantageous with respect to the volume of ablation and the shape of the margin of necrosis compared with RF ablation in 2- and 3-cm electrodes, respectively. MW ablations at 35 W and 45 W achieved significantly longer short-axis diameters than RF ablations (p < 0.05). The highest diagnostic performance for SLAP tears compared with 2D standard MR sequences.
with a t-test. Inter- and intra-reader agreement as well as correlation of widths of joint spaces with angles and volume of contrast was evaluated with a Pearson test.

Results: The study group consisted of 27 subjects of which 17 were positive and 10 negative for hip laxity at surgery. The mean width of the anterior joint space was significantly different (p < 0.0001) in the laxity group (6 mm) and in the group without laxity (5 mm). There was no difference in the mean femoral neck/shaft angles between the groups (p=0.3), mean volume of contrast (p=0.2). There was no correlation between the angle/volume to the widths of the joint spaces (r=0.001-0.1). Inter- and intra-reader agreement was high (r=0.78-0.9).

Conclusion: Distention of the anterior and posterior joint space was greater with hip laxity, independent of intra-articular contrast volume and hip rotation.

B-0912 14:45
MR-traction arthrography of the hip in femoroacetabular impingement
E. Schmaranzer, M. Kögler, M. Reichenkinder, P. Vavron; St. Johann/AT (schmaranzer@khsj.at)

Purpose: The central compartment of the hip is usually difficult to assess by direct MR arthrography. Mostly a sufficient interface between acetabular and femoral cartilage is not achievable with traction procedures described in the literature. We therefore developed a dedicated device in analogy to the traction system for hip arthroscopy.

Methods and Materials: This dedicated traction device consists of a mobile aid made of chromium-nickel steel, not directly connected to the MR table, provided with an integrated deflection pulley for a cable winch (weight 15 to 18 kg) and a supporting plate for the contralateral lower extremity. A total of consecutive 35 patients (mean age 38 years; 18 women) were investigated after arthrography without and with traction on a 1.5 Tesla unit.

Results: Without traction the labrum was sufficient assessable in 31 patients (91.7%). The acetabular and femoral cartilage were not assessable in 2 patients (5.88%). Using traction an adequate separation of femoral and acetabular cartilage, with an average continuous interface of 2.6 mm (range 0.7 to 6.7 mm), was achieved in 34 patients. And therefore the labrum, femoral and acetabular cartilage were sufficient detectable. Only in one case we were unable to differentiate femoral from acetabular cartilage. Excluding this patient chondral defects and labral lesions were accurately assessable.

Conclusion: These preliminary results show that the use of this traction system markedly improves diagnostic studies of the hip. The exact location of labrum and cartilage lesions is very significant as regards prognosis and of decisive importance for selection of therapy.

B-0913 14:54
Metal artefact reduction in MR-imaging at 1.5 Tesla in comparison to 3 Tesla using innovative sequence strategies

Purpose: The aim of this study is to show the feasibility of metal artefact reduction in MRI at 1.5 Tesla in comparison to 1.5 T using innovative sequence strategies.

Methods and Materials: State-of-the-art techniques for metal artefact reduction including VAT and SEMAC were evaluated. T1, T2, PD and STIR images were acquired on a 1.5 T system as well as on a 3 T system. Anatomic correlations with the normal anatomical features of the TMJ as well as the dynamics of the joint. The exact location of labrum and cartilage lesions is very significant as regards prognosis and of decisive importance for selection of therapy.

Results: The mean OFAAS-score improved significantly (P=0.001) for both groups (MACK: 48.8±20.4 to 83.6±9.7; MFX: 44.3±16.5 to 77.6±13.2). No differences in the AOFAS (P=0.327) and MOCART (P=0.720) score were observed between MACT and MFX postoperatively. DWI distinguished between healthy cartilage and cartilage RT in the MFX group (P=0.022), but not after MACT treatment (P=0.208). Correlation was found between MOCART score and DWI (Pearson: -0.461; P=0.041) and a trend for a correlation between BMI and DWI (Pearson: 0.435; P=0.055). Conclusion: Whereas conventional scores reveal a similar outcome after MACT or MFX treatment in the non-arthritic joint, DWI was able to distinguish between different RT qualities, as reported histologically for these diverse surgical procedures.

B-0914 15:03
The accuracy of dynamic magnetic resonance imaging in evaluation of internal derangement of the temporomandibular joint: comparison with arthroscopic findings
M.F. Amin, A.M. Hassan, K.L. Barakat, Elinnya/EG (Mohammed.amir6@yahoo.com)

Purpose: To evaluate the correlation between dynamic MRI and arthroscopic findings in internal derangement of the temporomandibular joint.

Methods and Materials: The current prospective study was conducted on twenty-five patients of (28 TMJs), eighteen females and seven males their age ranging from 20 to 42 years (mean 31 years). A control group of 10 adult volunteers (7 females and 3 males) - their age ranged from 22 to 46 years - was used to study the normal anatomical features of the TMJ as well as the dynamics of the joint. MRI was used to assess disc position, disc morphology, disc mobility, bone marrow oedema, condylar translation and joint effusion. Main outcome measures: Qualitative data were presented as frequencies and percentages.

Results: Concerning disc position, MR examination revealed 24 TMJs out of 28 (85.7%) with anteriorly displaced disc, while 4 TMJs (15.3%) showed normal disc position. Type of displacement was considered. MRI revealed 8 TMJs (28.6%) with ADDWR, while 16 TMJs (57.1%) with ADDWARD. MRI assessment of disc mobility revealed 12 out of 28 TMJs (42.8%) with limited arthroscopic movements, while 3 TMJs (10.7%) with stuck disc, and 13 TMJs (46.4%) with normal mobility. Conclusion: Both arthroscopy and dynamic MRI are statistically correlated to each other in detecting TMJ internal derangement. Nevertheless, reviewing the results highlighted the advantages of MRI augmented by dynamic protocol over arthroscopy in diagnosing disc position and mobility and hence we recommend using MRI as a first line diagnostic modality when internal derangement is suspected.

B-0915 15:12
Assessment of articular cartilage repair tissue after matrix-associated autologous chondrocyte transplantation or the microfracture technique in the ankle joint using diffusion-weighted imaging at 3 Tesla
S.A. Apprich1, S. Trautning1, G.H. Welsch2, I.M. Noebsauer-Huhmann3, S. Dumayer1; 1Vienna/AT, 2Erlangen/DE (sebastian.apprich@meduniwien.ac.at)

Purpose: The purpose was to compare patients after matrix-associated autologous chondrocyte transplantation (MACK) and microfracture therapy (MFX) of the talus using diffusion-weighted imaging (DWI), with morphological and clinical scoring.

Methods and Materials: Twenty patients treated with MACT or MFX (ten per group) were examined using 3 T MRI at 48±2.15 and 59.6±23 months after surgery, respectively. For comparability, patients from each group were matched by age, body-mass index, and follow-up. AOFAS score served as clinical assessment tool pre- and postoperatively. DWI was obtained using a partially balanced, steady-state gradient-echo pulse sequence, as well as the MOCART score, based on a 2D-PDW-TSE-sequence and a 3D-iso-TrueFisp-sequence. Semi-quantitative diffusion quotients were calculated after ROI analysis of repair tissue (RT) and healthy control cartilage, and compared among the groups.

Results: The mean AOFAS-score improved significantly (P<0.001) for both groups (MACK: 48.8±20.4 to 83.6±9.7; MFX: 44.3±16.5 to 77.6±13.2). No differences in the AOFAS (P=0.327) and MOCART (P=0.720) score were observed between MACT and MFX postoperatively. DWI distinguished between healthy cartilage and cartilage RT in the MFX group (P=0.022), but not after MACT treatment (P=0.208). Correlation was found between MOCART score and DWI (Pearson: -0.461; P=0.041) and a trend for a correlation between BMI and DWI (Pearson: 0.435; P=0.055). Conclusion: Whereas conventional scores reveal a similar outcome after MACT or MFX treatment in the non-arthritic joint, DWI was able to distinguish between different RT qualities, as reported histologically for these diverse surgical procedures.

B-0916 15:21
Feasibility of gagCEST imaging on a clinical 3 T MRI system: initial results and comparison with sodium imaging at 7 Tesla
B. Schmitt, G.H. Welsch, S. Zbyn, S. Goed, S. Trattnig; Vienna/AT (benjamin.schmitt@meduniwien.ac.at)

Purpose: Evaluation of feasibility to perform gagCEST imaging on a clinical 3 T MRI system in nine patients with knee pain and three healthy volunteers.

Methods and Materials: Morphological MRI and gagCEST imaging were performed on a clinical 3-T-TmTrio. Sodium imaging was carried out on a Siemens 7-T whole body system using a modified GRE sequence. Signal distributions in healthy cartilage of volunteers were determined as a reference for pathological changes. Sodium imaging and gagCEST performed in patients were compared...
with respect to cartilage signal intensities from ROIs in healthy cartilage (NT) and ROIs adjacent to apparent morphological lesions (AT; minimum distance: 3 mm). Evaluation was performed separately by two readers. Statistical relations between techniques were assessed using non-parametric tests.

**Results:** Absolute gagCEST values from ROIs in various cartilage areas of the volunteers significantly followed Gaussian distributions and exhibited positive mean values in the order of 3 to 5%. Patients exhibited consistently lower average gagCEST signals in AT (0.49±1.79%) compared to NT (2.76±2.93%). These results were confirmed by sodium imaging, where a mean signal intensity of 458.2±124.69 was measured in NT and 415.28±124.69 in AT. Intra-class correlation between readers yielded R² = 0.852 for gagCEST values and R² = 0.990 for sodium signal intensities.

**Conclusion:** We demonstrated that it was possible to obtain 3D gagCEST datasets in reasonable scan time with the presented technique. The results of this study, especially the strong correlation of gagCEST with sodium imaging, clearly suggest the feasibility of gagCEST imaging in a routine clinical setting.

**14:00 - 15:30 Room E2**

**Paediatric Neuro and fetal imaging**

**Moderators:** J.F. Chatel; Bordeaux/FR  J. Geiger; Freiburg/DE

**B-0917 14:00**

**Effect of x-ray tube parameters and iodine concentration on radiation dose and image quality in paediatric and adult brain CT angiography: a phantom study**

A.E. Papadakis, K. Perisakis, M. Raissaki, J. Damilakis; Iraklion/GR

**Purpose:** To study the effect of orbital bismuth shielding combined with ATCM on craniocerebral trauma.

**Methods and Materials:** Four anthropomorphic phantoms (ATOM phantoms, CIRES Inc., Norfolk), representing the average head of newborn, 1, 5, and 10-year-old were scanned on a Siemens Somatom Sensation 16 scanner a) with fixed tube current b) with ATCM c) with ATCM and a shield on orbits before scout acquisition. Noise was measured as SD of HU by drawing 0.5 cm3 regions of interest in homogeneous-appearing areas at both orbits, temporal, frontal, parietal lobes for each scan.

**Results:** CDTs were 20.21 mGy/100 mAs in all scans. Current reduction over the eyes was 5-43.5% (mean 22.5) and overall 20-46.4% (mean 32.2) with the neonate-equivalent scans benefiting most from ATCM. Noise exhibited a statistically significant increase when AEC was employed compared to fixed mA with or without shielding. Noise exhibited further significant increase when shields were positioned after scout acquisition.

**Conclusion:** ATCM is a requisite during paediatric head CT and when employed, tube current is not affected by bismuth shield placement. Shields cause increase in image density over the eyes especially in neonates, irrespectively of fixed or reduced current. Brain density is minimally affected by shield placement.

**B-0919 14:18**

**A local dose survey of cranial CT in children: comparison with different European DRL levels and possibilities for dose optimisation**

T.H.E. Mulkens, P. Bellinck, R. Salgado; Liege/BE (tom.mulkens@scarlet.be)

**Purpose:** To compare the dose level of our cranial CT protocols in children with recent European DRL levels of 5 different European countries and propose objectives for dose optimisation.

**Methods and Materials:** Cranial CT is the most common CT examination in children. Although dose reduction and optimisation of CT in children is mandatory, there are, compared with adult CT, no established European dose reference levels (DRL). We reviewed the dose values of our cranial CT protocols in children of 2010 (n=124), according to age. They were compared with the mean DRL levels of 5 different European countries, published in the last years (2003-2009).

**Results:** Following mean cranial dose levels of CT in children were obtained: <1 year (n=14): CTDI vol of 11.34 mGy, DLP of 177.86 mGy.cm and effective dose: 1.96 mSv, 1-5 year (n=37): CTDI vol of 19.12 mGy, DLP of 330.19 mGy.cm and effective dose 2.21 mSv, 5-10 year (n=31): CTDI vol of 27.37 mGy, DLP of 492.45 mGy.cm and effective dose of 1.97 mSv and 10-15 year (n=32): CTDI vol of 43.08 mGy, DLP of 755.48 mGy.cm and effective dose of 2.27 mSv. Compared with the mean DRL level of 5 different European countries our protocols showed following dose reduction: <1 year: 62%, 1-5 year: 49%, 5-10 year: 28% and 10-15: 9%.

**Conclusion:** Our local dose survey showed that dose reduction is possible in cranial CT of children, especially in younger children.

**B-0920 14:27**

**Evaluating the diagnostic accuracy of ultrasound in craniosynostosis among infants under 1 year**

N. Naimi; Tehran/IR

**Purpose:** Various imaging modalities have been studied for accurate diagnosis of craniosynostosis. Ultrasound is a non-invasive, available, low-cost modality, and above all is free of side effects (complications). The current study has been performed to assess the diagnostic accuracy of ultrasound compared to CT scan as a gold standard in the diagnosis of craniosynostosis.

**Methods and Materials:** Forty four infants under 1 year were included in the study. All of the infants were clinically suspected to have craniosynostosis and were referred to department of radiology in Tehran children medical centre. Data were gathered from 2007 to 2008. Infants were first sonographically examined by a paediatric radiologist and were later referred to another paediatric radiologist to examine CT scan with 3D reconstructed images of skull as gold standard modality. The second radiologist was blinded to results of the ultrasound.

**Results:** Seventeen girls and 27 boys were included in the study. There was no difference in head circumference and age between boys and girls. Sensitivity, specificity, positive and negative predictive values of ultrasound versus CT scan were 96.9%, 100%, 100%, and 92/3%, respectively. There was no significant difference in diagnostic accuracy of ultrasound between boys and girls, and between infants under 6 months and infants older than 6 months.

**Conclusion:** The high specificity of ultrasound helps to correctly rule out craniosynostosis in clinically suspected cases and thus can prevent unnecessary exposure of healthy infants to CT scan ionising radiation.
Impairment of the branches of the deep cerebellar veins on neonatal germinal matrix haemorrhage using susceptibility-weighted imaging

T. Niwa, N. Aida, Y. Fuji, T. Okabe, K. Nozawa, Y. Tachibana, J. Shibasaki; Yokohama/JP

Purpose: Germinal matrix haemorrhage (GMH) occurs with a hypoxic-ischaemic insult in preterm infants. The purpose of this study was to assess the relationship between GMH grade and the visualisation of the branches of the deep veins in infants using susceptibility-weighted imaging (SWI).

Methods and Materials: Thirty-three infants (gestational age, 23-36 weeks; corrected age at MRI, 32-46 weeks) with GMH, who underwent SWI, were retrospectively assessed. GMH was graded with associated findings: grade I, no intraventricular haemorrhage; II, GMH extending into the ventricle; III, intraventricular haemorrhage with ventricular enlargement; VI, parenchymal haemorrhage. Visualisation of each branch of the deep veins (i.e., anterior septal, anterior caudate, thalamostriate, medial and lateral atrial, internal cerebral, and basal veins) on SWI was rated using a four-point scale by two experienced paediatric neuroradiologists. GMH grade was compared to the score of the visualisation of the each deep vein branch. Interobserver agreement was also assessed.

Results: The grade of GMH included I in 12, II in 9, III in 2, and IV in 10. There was a significant difference in the score of visualisation of the thalamostriate vein among the infants according to the GMH grades (reader 1, 2; r=0.02, 0.04, respectively); the visualisation of the vein in infants with GMH-grade IV was significantly impaired compared to that with GMH-grade I (reader 1, 2; r=0.01, 0.01, respectively). Interobserver agreement was moderate to excellent (intraclass correlation coefficient, 0.63-0.86).

Conclusion: GMH with parenchymal haemorrhage may be accompanied with more frequent impairment of the branches of the deep veins.

Fractional anisotropy of the foetal midbrain and myelination

R. Wolk, G. Kasprian, M. Weber, P.C. Brugg, D. Prayer; Vienna/AT (ramona.wolke@meduniwien.ac.at)

Purpose: In rat-pups diffusion anisotropy imaging has been shown to demonstrate postnatally increasing white matter myelination of the brainstem more sensitively than other conventional imaging modalities (Prayer D, Neuroradiology 1997). We investigated whether diffusion tensor imaging (DTI) in foetuses with normal CNS development is capable of showing changes in fractional anisotropy (FA) or apparent diffusion coefficient (ADC) in the midbrain correlated with gestational age. An increasing FA would point to ongoing prenatal myelination as myelin constrains development is capable of showing changes in fractional anisotropy (FA) or apparent diffusion coefficient (ADC) in the midbrain correlated with gestational age. An increasing FA would point to ongoing prenatal myelination as myelin constrains development is capable of showing changes in fractional anisotropy (FA) or apparent diffusion coefficient (ADC) in the midbrain correlated with gestational age. An increasing FA would point to ongoing prenatal myelination as myelin constrains development.

Methods and Materials: During clinically indicated MRI (1.5T) in 63 foetuses (17-38 GW, normal CNS development) T2W-FSE sequences in three orthogonal planes of the foetal brain and an axial, single-shot, echo planar diffusion tensor sequence (32 non-collinear diffusion gradient encoding directions) perpendicular to the long axis of the foetal brainstem were acquired. After coregistering T2W-FSE axial images with axial FA colour-coded maps a region of interest (ROI) was drawn in the midbrain to calculate FA and ADC.

Results: A significant positive correlation between gestational age (GA) and FA was found (r=0.503, p<0.001) but no significant correlation was found between GA and ADC (r=-0.209, p=0.103).

Conclusion: We could show a significant positive correlation of GA with FA but not with ADC in the foetal midbrain. Increasing GA during gestation can be explained by increasing myelination. Therefore, FA measurements are capable of demonstrating prenatal myelination in foetuses with normal CNS development and might serve to investigate (ab-)normal myelination or brainstem compression in hydrocephalus or Chiari II malformations.

MR lung volume assessment at different times of gestation for prediction of survival, need for ECMO-therapy and development of chronic lung disease in fetuses with congenital diaphragmatic hernia

A. Wallen, A. Debus, S. Kehl, C. Weiss, S.O. Schönberg, T. Schable, K.A. Buesing, K.W. Neff; Mannheim/DE (anna.wallen@umm.de)

Purpose: The purpose of the study was to investigate the prediction of survival, need for extracorporeal membrane oxygenation (ECMO) and development of chronic lung disease (CLD) in patients with congenital diaphragmatic hernia (CDH), regarding a classification in three different times of gestation (<28, 28-32, >32 weeks gestation), by assessing the observed/expected MR fetal lung volume (o/e MR FLV).

Methods and Materials: 226 foetuses with CDH were included for data analysis. MRI was performed at different times of gestation (56 foetuses < 28, 50 foetuses 28-32, 120 foetuses > 32 weeks gestation), using T2-weighted half-Fourier acquired single-shot turbo spin echo (HASTE) imaging. Receiver operating characteristic curve (ROC) analysis was applied to investigate the prognostic quality of the assessment of the o/e MR FLV at different times of fetal growth.

Results: For all reviewed times of gestation the o/e MR FLV yielded almost equivalent statistically significant differences for neonatal survival and nonsurvival (p=0.0029), need for ECMO therapy (p=0.0195) and development of CLD (p=0.0084) or not. Correlations were the results by high prognostic accuracy for early likelihood for later times of gestation. ROC analysis showed the highest area under the curve (AUC) for neonatal survival.

Conclusion: In patients with CDH the o/e MR FLV is a valuable prognostic parameter to predict neonatal mortality, morbidity represented by the development of CLD and need for ECMO therapy already in early gestation (<28 w.g), as well as in later times of gestation with no statistically significant differences.
**B-0926 15:21**

**Utilisation of neonatal brain MRI: experience, variation and implications: a survey study of UK level 3 neonatal units**

C. Sawyer1, L. Vitta; *Brighton/UK, *Hove/UK

**Purpose:** To compare the use, experience and variation of MRI for neonatal brain imaging in level 3 neonatal units in England, UK.

**Methods and Materials:** An electronic questionnaire was sent to neonatologists working in all level 3 units. Participants were asked 21 questions relating to their experience of MRI, indications for its use, practical aspects (sequences, timing, access and wait), procedure for reporting images and use of MRI in comparison to other tests.

**Results:** 34% (n = 71) of the survey population, representing all 44 separate units, responded. 49.3% had no local/regional guidelines. A significant number (19.3%) claimed that lack of clear guidelines contributes to prolonged wait for MRI. Ultrasound is still used as the first line in the majority of units. MRI is frequently second line based on scanner location, staffing issues and cost. 45% consider prolonged waiting times to be a problem. There is a significant association between MRI availability and lack of guidelines with a failure to utilise the optimal sequences and timing as recommended in the literature.

**Conclusion:** This important survey highlights a considerable variation in practice and availability. This may be resulting in delayed imaging in cases where MRI is vital for diagnostic and prognostic information as well as suboptimal use of a modality that has been well established in the research literature. It is vital to establish a more uniform and robust neonatal neuroimaging pathway and this work is a powerful tool for understanding current practice and working towards a set of national guidelines for the UK.

**14:00 - 15:30**

**Room F1**

**Genitourinary**

**SS 1807**

**GU gems and jewels**

Moderators:
- M.A. Cova; Trieste/IT
- D. Yakar; Nijmegen/NL

**B-0927 14:00**

**Testis cancer: MDCT staging with histopathological correlation**

A.M. Osborne1; D. Halpenny1; P. Burke1, D.W. Good1; W.C. Tomeggiandi1; *Dublin/IE, *Limerick/IE (osbornea@tcd.ie)

**Purpose:** To assess whether testis cancer metastasises to specific sites using MDCT according to specific primary histopathological diagnosis.

**Methods and Materials:** A ten-year retrospective database was created including patients who underwent orchietomy for testicular tumour in a single institution. All patients underwent MDCT thorax, abdomen, pelvis. The histology of the primary tumour and the location of any metastases present on MDCT were categorised and recorded. Data are presented as median (interquartile range: IQR) and logistic regression analysis was used to identify risk factors.

**Results:** 255 patients were identified. The median (IQR) age was 32 (26-37) years. 23.9% of patients had nodal metastases at the time of diagnosis with 5.1%, 21.6% and 2.7% having pelvic, abdominal and supra-diaphragmatic nodal metastases, respectively. 5.5% had solid organ metastasis at diagnosis. Independent risk factors for abdominal nodal metastasis included having a teratoma (HR: 3.04, 95% CI: 1.31-7.06, P = 0.009) and having an LDH over 500 at diagnosis (HR: 3.83, 95% CI: 1.68-8.78, P = 0.001). Independent risk factors for supra-diaphragmatic nodal metastasis included having a mixed tumour (HR: 4.62, 95% CI: 1.02-21.06, P = 0.048) and having a β-HCG over 10 mL/mL at diagnosis (HR: 4.40, 95% CI: 1.04-17.67, P = 0.044).

**Conclusion:** Results indicate that the pattern of metastasis can vary according to pathological subtype and staging of tumour. Results suggest that patients who present with mixed testis tumours and patients with a serum β-HCG over 10 mL/mL should undergo CT thorax as part of staging of disease.

**B-0928 14:09**

**Diffusion-weighted magnetic resonance imaging in patients selected for radical cystectomy: detection rate of pelvic lymph-node metastases**

R. Cazzago1, R. Del Vecchovo1, E. Faiella1, F. D’Agostino1, R. Francesco Grasso1, B. Becomone Zobel; Rome/IT

**Purpose:** To evaluate whether DW-MRI improves the detection rate of pelvic lymph node metastases in a cohort of patients with muscle invasive bladder cancer selected for radical cystectomy.

**Methods and Materials:** Nineteen consecutive patients with muscle invasive bladder cancer were enrolled between April and September 2010. Patients preoperatively underwent 1.5-T MRI using conventional sequences combined with DW-MRI. Radical cystectomies with extended lymphadenectomy were performed in all patients. Diagnostic accuracy of DW-MRI was compared with the histopathologic findings according to a chart where the following nodal stations were recorded: right- and left-side common, internal and external iliac vessels, right- and left-side obturator stantion, presacral station.

**Results:** The mean ADC value was 0.85 * 10^-3 mm/sec in the nodal meta-static group and 1.00 * 10^-3 mm/sec in the nodal non-metastatic group (P = 0.02, standard error, 0.06; 95% CI, 0.022 to 0.270). The ADC cut-off value, obtained by the ROC curve in order to show the best separation between metastatic and non-metastatic lymph nodes was 0.85* 10^-3 mm/sec. With this threshold value the patient-based sensitivity, specificity, PPV and NPV of the Dw-MRI were 71%, 90%, 86% and 79%, respectively.

**Conclusion:** DW-MRI may be used to differentiate metastatic from non-metastatic lymph nodes in patients with high grade bladder cancer.

**B-0929 14:18**

**Does USPIO-enhanced diffusion-weighted MRI enhance the diagnostic accuracy of lymph-node staging in normal sized lymph nodes of patients suffering prostate or bladder cancer?**

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**Purpose:** To prospectively determine whether diffusion-weighted MRI (DW-MRI) after the administration of ultrasmall paramagnetic iron oxide nanoparticles (USPIO) increases the diagnostic accuracy for the detection of metastases in normal sized lymph nodes in patients with bladder and/or prostate cancer.

**Methods and Materials:** Seventy-five patients (66.66; mean age 64) with bladder (n=18), prostate cancer (n=49) or both (n=8) were examined peroperatively on a 3 T MRI unit before and after administration of USPIO (Sinereum, Guerbet). T1- and T2-weighted 3D TSE Space sequences of the entire pelvis were performed besides axial EPI-DWI-MRI with 3 b-values (0.500, 1000sec/mm2) after spasmolysis with 1 mg iv glucagon. Suspicious hypertensive structures on the post-contrast high b images were correlated with morphological pre-contrast images to check whether they corresponded to lymph nodes. Each visualised lymph node depending on its morphology was rated as malignant or benign. Readings were performed by three independent blinded readers and compared to histopathology.

**Results:** In 75 patients, 2993 lymph nodes (mean number 40/patient) were resected. 54 positive lymph node metastases were detected in 20 patients with 43 nodules beyond a short-axis diameter of 3 mm. Readings on a patient level yielded a mean sensitivity of 70%, specificity of 93.9%, positive predictive value of 80.8%, negative predictive value of 89.6% and diagnostic accuracy of 87.6%. No metastasis above a short-axis diameter of 5 mm was missed.

**Conclusion:** USPIO-enhanced DW-MRI allows for higher diagnostic accuracy in the detection of metastases in normal sized lymph nodes in patients with bladder and/or prostate cancer.

**B-0930 14:27**

**Ultrasound particles of iron oxide-enhanced MR-imaging of ischaemic acute renal failure in a rat model on a clinical 3 T scanner**

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**Purpose:** To assess if the novel ultrasmall-particle-of-iron-oxide (SPIO) can be used to visualise ischaemic acute renal failure (IARF) in a rat model.

**Methods and Materials:** In this IRB-approved study 10 Lewis-rats underwent transient surgical clamping of the left renal artery for 45 min. 36 h after the surgical procedure the rats were injected 516 μmol/kg P904 (Guerbet) and MR-imaging was performed another 3h after the P904-injection. Imaging was performed on a clinical 3 T scanner (Siemens TimTrio) with a dedicated 8-element rat coil (Rapid-Biomedical) with T2w-TSE sequences in coronal (TR/TE 2000/114 ms, acquisition time:2:33 min) and axial (3090/115 ms, 3:47 min) orientation with identically acquired
Spatial resolution of 0.3x0.3x1.0 mm³. Signal-to-noise measurements (SNR) were performed in the cortex, medulla and pyelon of the IARF-kidney and the contra-lateral kidney as internal control. Immediately after the MR-exam the rats were sacrificed for histology and immunolabelling.

Results: Apparent differences between the IARF-kidneys and controls were encountered. Signal drop was mainly seen in the medulla of the IARF-kidneys. The SNR of the IARF vs. control: cortex 19.6 vs. 11.3 (p=0.007), medulla 4.5 vs. 21.3 (p = 0.001) and pyelon 14.6 vs. 34.0 (p=0.03). In all IARF-kidneys the histology confirmed the predominantly medullary presence of abundant iron and ED1-positive macrophages and typical changes of IARF while being normal in the control group.

Conclusion: P904 seems to be a suitable contrast agent to non-invasively detect IARF in a rat model with good correlation to histology. This suggests that P904-enhanced MR-imaging holds promise for non-invasive assessment of renal parenchymal diseases.

B-0931 14:36
Sonoelastography in patients with endometriosis of different location
N.A. Veronchkov, V.E. Gazhonova, S.O. Churkina, E.B. Savinova, I.A. Ponomarenko, A.V. Zubarev; Moscow/RU

Purpose: The aim of this study was to assess the usefulness of SE (sonoelastography) in local staging of endometriosis.

Methods and Materials: 80 consecutive pts (with pelvic pain, dysmenorrhoea, urinary symptoms) range 18-45years with suspected diagnosis of endometriosis were referred for SE. All patients underwent conventional US and SE on HI VISION Preius with an endovaginal transducer (6-7 MHz frequency) and linear transducer (frequency 5-7.5 MHz). We used modified Tsukuba SE classification for evaluation of the SE data. 15 diagnostic biopsy, 39 diagnostic laparoscopies, 26 separate diagnostic scraping were performed with morphological study of the received material. US data (conventional B-mode, US angiography and SE) were assessed by comparing the findings with surgery results and MRI data. US data were retrospectively reviewed by 2 radiologists. Inter-observer agreement for endometriosis SE score, location of endometriosis (uterine, ovary, cervix, urinary bladder’s wall, soft tissue), endometriosis location by walls of the uterus, MRI data.

Results: Pathomorphological examination revealed 32/endoemetriotic cysts, 7/ endometriosis the uterine wall, 26/ endometrial polyps, 4/endometriosis of urinary bladder’s wall, and 1/endometrial infiltrations of pelvic soft tissue. Endometriosis was characterised by reversed score 1, score 3 and score 5 of Tsukuba classification for lesions on SE. SE showed good to moderate inter-observer agreement for endometriosis evaluation by scoring (κ=0.83, 0-6, 95), for endometriosis locations by walls of the uterus (κ=0.78-0.94), for locations of endometriosis by organs (κ=0.74-0.87), poor to moderate inter-observer agreement for endometriosis evaluation by MRI data (κ=0.21-0.35).

Conclusion: SE with US offers a new possibility for definition of endometriosis.

B-0932 14:45
Possibilities of real-time sonoelastography in local staging of endometriosis
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Purpose: Possibilities of sonoelastography (SE) in local staging of endometriosis.

Methods and Materials: 42 pts with proven EC underwent real-time sonoelas- tography before surgery (age range 37-72 y). US exams were performed on HI VISION Preius and HI VISION 900 (Hitachi Medical Corporation). We used FIGO classification for local staging EC. US data were compared with final histopathology. The study was recorded and evaluated by 2 independent readers. Inter-observer agreement for tumour’s location by walls (anterior, posterior, fundus, right, left), myometrial invasion (less than ½, more than ½), cervical and capsular involvement were studied. Sensitivity of SE in local staging was established.

Results: All patients have been operated (17 total hysterectomies, 25 radical hysterectomies with lymph node dissection). Histopathology revealed 17/stage IA, 15/stage IB, 5/stage IIA, 3/IIIAB stage, 2/IIIAstg. The sensitivity of SE for local staging of EC: 89% - stage IA, 90% - stage IB, 84% - stage IIA, 94% - stage IIB, 93% - stage IIIA. The Kappa value between SE and location by walls was poor (κ ranged from 0.3 to 0.5), between SE and myometrial invasion was good (κ ranged from 0.76 to 0.84) and between SE and cervical invasion was poor (κ = 0.4-0.66). SE increased the sensitivity of US (from 83% to 92.5%) and specificity (from 81% to 90.3%) in local staging EC.

Conclusion: Inclusion of SE in complex ultrasound scanning may help to evaluate myometrial invasion in pts with EC.

B-0933 14:54
Real-time compression elastography of the peripheral zone prostatic cancer: the impact in improving the diagnostic approach
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Purpose: To evaluate the performance of real-time compression elastography (RTCE) in the diagnostic approach of the peripheral zone prostatic cancer.

Methods and Materials: Sixty-three male individuals were examined with both b-mode TransRectal Ultrasound (TRUS) and RTCE using a Hitachi/Preius machine. Elastographic results of the peripheral zone by the US with and without compression, normal tissue, 2, inhomogeneous/inconclusive, 3, focal lesions of increased stiffness. The TRUS findings were categorised as 1. no focal lesion, 2. ill-defined focal lesion and 3. definite focal lesion. In 43 patients 10-12 core biopsies were taken. The rest 20 patients had 6-8 core biopsies. Ultrasound findings were compared to the results of the core biopsies.

Results: Nineteen of 63 patients (30%) were found with positive specimens for prostatic cancer. Sensitivity of prostate cancer detection was 84%(16/19) for the RTCE and 68%(13/19) for b-mode TRUS. RTCE score1 was found in 39 patients of whom none found with cancer; score2 was detected in 4 patients of whom 3 had cancer and scored AML in 20 patients of whom 16 had cancer. In-determinate score2 TRUS cases were found in 11 patients of whom 9 had RTCE score1 and negative core biopsy for cancer.

Conclusion: RTCE considerably improves the diagnostic yield of TRUS in detecting peripheral zone prostatic cancer.

B-0934 15:03
Diagnostic role of CT perfusion in the management of patients affected by prostate cancer
M. Osimari, D. Belini, D. Caruso, D. Gianante, A. Laghi; Latina/IT

Purpose: To define the role of CT perfusion in the evaluation of patients with probable prostate cancer.

Methods and Materials: All 80 patients enrolled underwent CT perfusion exam, followed by radical prostatectomy and histopathological analysis of prostate. In 4320 prostatic areas available, we calculated numerical values of perfusion indices (blood flow, blood volume, mean transit time and permeability surface area product) by perfusion analysis, and the type of lesion in each areas by immunohistological assessment. Then, we had correlated the data, we had defined the threshold val- ues for each perfusion index, and we had obtained values of diagnostic accuracy. Results: Among the areas affected by cancer, and non-neoplastic areas, we ob- tained statistically significant differences in BV and PS (< 0.05). The analysis re- vealed that for the threshold values considered, CTp has bought high specificity (Sp) and negative predictive value (NPV). Sp of 88% and NPV of 91% for PS> 27 mL/min 100 g. Sp of 82% and NPV of 89% for BF> 24 mL/min100 g; Sp of 94% and NPV of 90% for BV> 11 mL/100 g; Sp of 77% and NPV of 91% for MTV> 21 (sec). Conclusion: Results obtained demonstrated that CTp can be used for the exclu- sion of prostate cancer in doubtful areas (high NPV and Sp).

B-0935 15:12
Selective arterial embolisation of symptomatic giant renal angiomylipoma: efficacy, complications and long-term outcomes
M. Abou El-Qanah, A. El-Asmy, H. Refae, T. El-Diasty; Mansoura/EG (maboelghar@yahoo.com)

Purpose: To assess the efficacy, complications and long-term outcome of selective arterial embolisation (SAE) for treatment of giant angiomylipoma (AML) > 10 cm.

Methods and Materials: The surgical records of 13 patients with giant AML man- aged by SAE between 1990 and 2010 were reviewed. Data collected included pre- and post-treatment AML size, creatinine level, technical success, complications and long-term clinical success.

Results: Our study included 4 men and 9 women, 6 of them (46.2%) had tuber- ous sclerosis (TS) complex. The tumour was bilateral in 53.8% and mean size of AML lesions was 14.8 cm. Indications of SAE were preoperative to avoid risk of haemorrhage during nephrectomy in 4 patients and to stop severe haematuria in the remaining 9. Among 9 patients with preserved kidneys; early complications occurred in 55.5% including post-embolisation syndrome in 1 patient, recurrent haematuria necessitating nephrectomy in 3 and acute renal failure in 1. Eventu- ally, 5 (55.5%) patients preserved their kidneys with mean follow-up period of 2 years. During follow-up radiology showed decrease in size of the lesions in 60% of cases, remained stable in 20%, and increased in another 20%. During follow-up 60% of patients had recurrent haematuria which managed conservatively and all 5 patients had a stable serum creatinine.

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Conclusion: SAE of giant renal AMLs can be done safely to stop bleeding in many cases. Additional treatment may be necessary in 1/3 of patients and preservation of involved kidneys is amenable in 1/2 of cases.

B-0936 15:21

Purpose: To compare dynamic contrast-enhanced MR urography (DCE-MRU) and renal scintigraphy for determination of the split renal function (SRF) in chronic and intermittent urinary obstruction (UO).

Methods and Materials: 369 children and adults presenting with chronic or intermittent UO were included in 14 centres. DCE-MRU consisted of a dynamic coronal T1-weighted sequence repeated for 10 minutes after administration of diuretics and Gd-chelate (0.1 ml/kg). Dicretic renal scintigraphy was performed within two months. MRF and scintigraphy data from 295 patients were judged in a blind review by a panel of 12 practitioners then 3 experts of each specialty: radiology and nuclear medicine. For DCE-MRU, signal intensity-time curves were obtained from ROIs on renal parenchyma and aort. SRF was calculated successively by the area under the curve (AUC) and Patlak-Rutland (PR) methods, after normalisation by parenchymal volume. Reproducibility was assessed for intra- and interobserver agreement.

Results: Reproducibility was good to excellent for both methods, with k values ranging from 0.75 to 0.90 for scintigraphy and 0.72 to 0.81 for DCE-MRU, and improved with the expert review. At the group level, equivalence between DCE-MRU and scintigraphy was demonstrated for calculation of SRF with both PR (p < 0.001) and AUC (p=0.029) methods. The distribution of differences followed a Gaussian law 95%CI [-26.2;+30.2]. Underestimation of SRF by DCE-MRU was observed in severe hydronephrosis.

Conclusion: SRF estimated by DCE-MRU in obstructed kidneys was reproducible and equivalent to that one measured by renal scintigraphy at the group level, but with individual differences. DCE-MRU provides both morphologic and functional information in UO.

14:00 - 15:30 Room F2
Breast
SS 1802 MRI: diagnosis and surgical settings
Moderators: M. Lobbes; Maastricht/NL, R. Salvador; Barcelona/ES

B-0937 14:00

Purpose: Even upon core biopsy, accurate classification of benign intraductal-papillomas (IP) can be difficult. Accordingly, IP are still frequently surgically resected. Therefore, accurate assessment of IP by MR-mammography would potentially optimise patient management. However, the few investigations assessing MR-mammography of IP included small patient-collectives and overall-accuracy of this modality regarding the differential-diagnosis of IP is still unknown. We performed this investigation to analyse morphologic and dynamic MR-mammography profiles of IP in depth and to identify the overall-accuracy of MR-mammography for differential-diagnosis of IP from malignant breast-lesions.

Methods and Material: Consecutive patients receiving standardised MR-mammography (standardised-scanning protocols: dynamic-T1w-GRE before/after Gd-DTPA [0.1 mmol/kgBW]; T2w-TSE) with subsequent surgico-pathological verification were enrolled. For the detailed assessment of morphologic and dynamic profiles two experienced radiologists (> 500 examinations; blinded to surgico-pathological verification) performed prospective evaluation of MR-mammography in consensus applying 17 predefined MR-mammography descriptors. Out of this database all patients showing IP (n=63) or malignant breast-lesions (n=648) upon surgico-pathological verification were further evaluated statistically: Univariate- (association of single-descriptors with IP/breast-cancer: contingency-tables-statistics) as well as multivariate analyses were performed to identify accurate descriptor-combinations (Chi-squared-Automatic-Interaction-Detection [CHAI]) and overall-accuracy of MR-mammography for differential-diagnosis of IP vs. malignant breast-lesions (logistic-regression; receiver-operating-characteristics [ROC], area-under-the-ROC-curve [AUC]).

Results: 82.4% of MR-mammography descriptors were significantly associated with IP (n=14; P < 0.05). Accuracy of single-descriptors (odd-ratio [OR]; ±0.6) could be further increased by descriptor-combinations (doublecombination: ORs12.7; triple-combination: ORs15.0); With AUC=0.91 (95%-confidence-interval: 0.88-0.94; P < 0.001) logistic-regression identified high overall-accuracy of MR-mammography for the differential-diagnosis of IP.

Conclusion: Detailed assessment of MR-mammography allows precise characterisation of benign intraductal-papillomas and accurate differentiation from malignant breast lesions.

B-0938 14:09

Purpose: Accurate classification of benign lesions in MR-mammography (MRM) can be challenging and further descriptors might help to solve this problem. We performed a retrospective case-review and identified “constant-sharpness” (CS) as a useful new MRM-descriptor to predict benignity: Positive CS is defined as a lesion with smooth and sharp margins which are consistently present during the whole dynamic-series from the first to the last scan. Then, we conducted a prospective cross-sectional investigation to analyse diagnostic accuracy of CS for differential diagnosis of benign vs. malignant lesions.

Methods and Materials: 1014 consecutive patients (exclusion: breast-therapy ≤ 12months before MRM) with histologically verified breast-lesions imaged by MRM according to standard-protocols (dynamic GRE-T1w scans after contrast-agent [0.1 mmol/kgbw Gd-DTPA] at 1-minute-intervals over 7 minutes). All MRM were read prospectively by two experienced (> 500 MRM) and blinded readers in consensus. Finally, CS was correlated with histology results (cross-tables, χ²-test).

Results: CS was a significant predictor of benignity (P> 0.001). It was typically associated with fibroadenomas and papillomas (63.1%, 45.8%). False negative cases were rare and CS accumulated within invasive-papillary (50%) and invasive-mucinous cancers (16.7%) as well as low-grade tumours (G1: 9.7%). Overall accuracy revealed sensitivity of 41.5% (95%-confidence-interval: CI: 37.0-46.2%), high specificity (93.2%; CI: 91.0-94.9%), odd-s-ratio (9.7%; CI: 6.6-14.0) and positive-likelihood ratio (L+: 6.1; CI: 4.5-8.3).

Conclusion: “Constant-sharpness” sixfold increases the likelihood of benignity in MRM. This accurate MRM-descriptor is typically seen in fibroadenomas and papillomas, whereas false-positives are uncommon and include rare histopathologies (invasive-papillary/mucinous carcinoma) and low-grade cancers (G1).

B-0939 14:18
Magnetic resonance imaging for assessing axillary lymph node status in breast cancer patients. E. Bull, M. Costantini, P. Belli, G.G. Giardina, P. Rinaldi, G. Franceschini, R. Masetti, L. Bonomo; Rome/IT (reagandus@alice.it)

Purpose: Although magnetic resonance imaging (MRI) is indicated for pre-operative breast cancer staging, assessment of the axilla is not routinely performed. Our aim was to investigate the ability of MRI in predicting axillary lymph node status in breast cancer patients.

Methods and Materials: Written informed consent and board approval were obtained. A retrospective analysis of breast cancer patients undergoing MRI before surgery from January 2009 to June 2011 was performed. Two experienced radiologists, blinded to the histopathologic findings, analysed size (short axis, longest axis-to-shortest axis ratio) and morphologic features (presence/absence of fatty hilum, abnormal cortex) of axillary lymph nodes. Patients were divided into two groups according to the final pathologic axillary status: presence/absence of lymph nodes metastases. Sensitivity, specificity, positive and negative predictive value of MRI in predicting lymph node status were obtained.

Results: Out of 615 breast cancer patients, 168 were enrolled. Histopathologic results revealed 104 node-positive patients. Lymph node involvement was suspected
in 86 out of 168 cases. There were 75 true positive observations, 11 false positive, 29 false negative and 53 true negative. The MRI sensitivity, specificity, positive predictive value and negative predictive value in predicting axillary metastases were 72.1%, 82.8%, 87.2% and 64.6%, respectively. The MRI positive predictive value reaches 100% if we consider the association of at least two findings as suspicious for nodal involvement.

Conclusion: Although pathologic evaluation of lymph nodes still remains mandatory in all patients at risk for nodal involvement, MRI may be useful in predicting axillary lymph node metastases.

**B-0940 14:27**

**Potential role of MRI in assessing the need for sentinel lymph node biopsy in patients undergoing contralateral prophylactic mastectomy**

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**Purpose:** To evaluate accuracy of MRI in detecting otherwise occult breast malignancy in women undergoing contralateral prophylactic mastectomy (CPM).

**Methods and Materials:** With IRB approval, Institutional database review was performed to identify patients with newly diagnosed unilateral breast carcinoma who underwent CPM in 2004-2010. Sixty patients met inclusion criteria that were restricted to cases used mammography and breast MRI performed not more than six months before CPM. Retrospective review of MRI studies was performed by two experienced readers. Accuracy of MRI in detecting otherwise occult breast malignancy was evaluated. MRI specificity and negative predictive values (NPV) were calculated.

**Results:** The median patient age at the time of prophylactic mastectomy was 49 years (range 28-76 years). Breast carcinoma was diagnosed in 5% of patients (3 of 60). There was one case of invasive ductal carcinoma and two cases of ductal carcinoma in-situ (DCIS). The invasive cancer was 6-mm T1N0 tumour and it was confidently identified retrospectively by both reviewers. MRI in both cases of DCIS was negative. Specificity of MRI for detection of malignancy was 77% and NPV was 96%. MRI NPV for invasive disease was 100%.

**Conclusion:** MRI may be a reliable test in excluding contralateral invasive breast carcinoma in patients undergoing CPM. Based on the very high NPV of MRI in our series, an yield of sentinel lymph node biopsy in patients undergoing CPM should be re-evaluated.

**B-0941 14:36**

**Breast MRI as a potential new biomarker to assess the axillary tumour load in patients with newly diagnosed breast cancer: initial data using computer-assisted diagnosis (CADx)**


**Purpose:** To stratify the individual risk of patients with newly diagnosed breast cancer, numerous prognostic factors have been proposed. Presence of axillary lymph-node metastases has been shown to be one of the most important prognostic-factors. Yet, it can be further improved, if the total number of metastatic lymph-nodes is addressed. This is usually done using the axillary-lymph-node-ratio (ALNR), being defined as the quantity of metastatic-nodes divided by the quantity of resected-nodes. Accordingly, we designed this prospective-cross-sectional investigation to investigate the potential of breast MRI to non-invasively assess axillary tumour load and to predict ALNR using dedicated semiautomatic software.

**Methods and Materials:** Consecutive patients with primary invasive breast-cancer receiving preoperative breast-MRI at our institution were enrolled (IRB-approval). Reference-standard was surgico-pathological staging (breast, axilla) and ALNR was identified. Breast-MRI protocols were standardised according to EUSOBI-recommendations (T1w gradient-echo before and after [n=7] application of Gd-DTPA, flow: 0.3 ml/s; dosage 0.1 mmol/kg). For breast-MRI analyses a commercially available CAD-system was used (computer-assisted-diagnosis), providing semiautomatic/semiquantitative analysis of breast-cancer enhancement profiles. Multiple-regression analysis was used to assess possible correlation of such enhancement-profiles with the reference-standard (ALNR).

**Results:** 107 patients were enrolled (mean-age 57 years; range 30-87 years). Mean ALNR was 0.28 (range 0.02-0.97). Multiple-regression identified significant metastatic burden of breast-MRI to predict axillary tumour load (P = 0.05; r2: 0.18).

**Conclusion:** According to our data, CADx-based interpretation of breast MRI correlates with axillary tumour load. As the latter is amongst the most powerful prognostic factors in breast-cancer, such findings add further knowledge to the application of breast-MRI as a non-invasive prognostic biomarker.

**B-0942 14:45**

**Detection of incidental vertebral fractures by MR-localiser in breast imaging**

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**Purpose:** Vertebral fractures (VF) are the hallmark of osteoporosis, and the diagnosis of a VF may be essential in the assessment of women bone health status. Our purpose was to retrospectively evaluate MR-localiser (MRI-loc) of breast MRI examinations at a potential tool in the detection of osteoporotic VF.

**Methods and Materials:** MRI-loc sagittal images of 536 breast MRI were reviewed by three expert skeletal radiologists with a semiquantitative diagnostic approach to detect VFs. Anamnesis and data of patients were collected as well as MRI original reports were read at the end of the MRI-loc evaluation. Other available imaging exams were investigated to assess potential metastatic involvement of bone in all patients.

**Results:** 49/536 (9.6%) female patients undergoing MRI for oncologic reasons, and 45/536 (8.4%) for non-oncologic aims were recruited in the study (age 55 ± 12.2 year-old). 38/536 (7.1%) MRI-loc were considered to be inadequate for diagnostic purpose and these were excluded from the analysis. In 49/536 (92.9%) patients MRI-loc allowed the evaluation of vertebral bodies between T4 and the upper lumbar spine (1-13). MRI-loc was able to detect VFs in 38/498 (7.8%) patients. VFs were neither reported nor previously known in the clinical history of 34/39 (87.2%) patients. Moreover, no mention of VFs was found in all MRI breast reports. In 3/498 (0.6%) patients MRI-loc could also identify vertebral metastases, as documented by other appropriate imaging methods.

**Conclusion:** In the female population submitted to breast MRI, a systematic evaluation of MRI-loc can be proposed to offer additional clinical information in order to prevent unrecongised VFs.

**B-0943 14:54**

**Are mammographic follow-up findings indeed more pronounced after intraoperative radiotherapy for breast cancer? Subgroup analysis of a randomised trial (TARGET A)**

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**Purpose:** Intraoperative radiotherapy (IORT) is increasingly used for breast-conserving therapy (BCT) offering a safe alternative to conventional BCT for selected patients with breast cancer. As using IORT increases structural changes in the tumour bed as previously observed in non-randomised patient groups, we aimed to further validate these results for the first time in a randomised subgroup of patients from the initial international TARGET-A trial.

**Methods and Materials:** Including 48 patients, 27 patients received BCT with IORT (low-energy x-rays) and 21 patients had BCT with standard whole-breast radiotherapy served as controls. 258 follow-ups of postoperative mammograms (median follow-up 4.3 years, range 3-8) were retrospectively evaluated by two radiologists in consensus focusing on circumscribed changes and calcifications in the tumour bed.

**Results:** In patients after IORT fat necrosis was significantly more frequent (75% vs. 24%, p-value 0.0269) and larger (8.7 vs. 1.6 sqcm, median) than in controls. Scar calcifications were also significantly more frequent after IORT (63% vs. 19%, p-value 0.0023) and specified as dystrophic in 37% vs. 14% and eggshell-like (i.e., typical for oil cyst) in 41% vs. 14%.

**Conclusion:** The study confirms the high incidence of circumscribed findings after IORT, especially large fat necrosis. The higher incidence of calcifications in the tumour bed after IORT represents a new finding which requires further attention.

**B-0944 15:03**

**Radiological findings in mammary autologous fat injections: a multimodality evaluation**

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**Purpose:** Autologous fat injection (lipopfilling) has recently been employed in breast plastic surgery. Our aim is to evaluate mammographic, sonographic and magnetic resonance imaging normal and pathological findings in breast lipopfilling.

**Methods and Materials:** Informed consent and institutional review board approval were obtained. 25 patients underwent breast lipopfilling from January 2008 to December 2010 at our institution. Site and amount of autologous fat injections were known. Mammography (MX), ultrasonography (US) and magnetic resonance imaging (MRI) were performed on all patients at 1, 3, 6 months and yearly from then on. The radiologic findings observed were described in the patients’ medical files.

**Results:** Among 25 patients, 7/25 were male and 18/25 were female. Mean age ± standard deviation was 45.6 ± 12.4 years. The mean follow-up was 26.3 ± 12 months. The radiologic findings were classified into four categories: 1. Postoperative changes; 2. Immediate changes; 3. Late changes; 4. Unusual findings.

**Conclusion:** Autologous fat injection is a safe and effective treatment for breast augmentation. The radiologic findings observed in this study are reassuring and consistent with previous reports. However, long-term follow-up is necessary to further assess the safety and efficacy of this procedure.
B-0945 15:12
Breast-conserving surgery for non-palpable breast cancer: relationship of lumpectomy resection margins measurements between remote perioperative ultrasound and postoperative histopathology
C. Lutchmaya-Flick, F. Becce, L. Alamo, J.-F. Delaloye, R. Meuli, J.-Y. Meuwly; Lausanne/CH
Purpose: Tumour-free resection margins (RMs) are mandatory in breast-conserving surgery. On-site intraoperative ultrasound (US)-guided tumour resection with ex-temoraneous histopathological assessment of RMs has been described. Remote intraoperative US assessment of RMs is an alternative. The purpose of this study was to evaluate the relationship of lumpectomy RMs measurements between remote intraoperative US and postoperative histopathology.
Methods and Materials: In a retrospective IRB-approved review of 100 consecu-tive lumpectomy performed between October 2009 and April 2011 for presumed non-palpable breast cancer, 71 women (mean age 63.8years) were included. Twenty-nine patients were excluded because of absence of cancer at histopa-thology and/or incomplete data. Measurements of lumpectomy minimal RMs and tumour maximal diameter obtained on remote intraoperative US and postoperative histopathology were compared.
Results: Minimal RM were 0.35±0.32 (mean±SD) and 0.35±0.32 cm on remote intraoperative US and postoperative histopathology, respectively. No significant difference was found between these measurements (p=0.37). Tumour maximal diameter was 1.02±0.51 (mean±SD) and 1.33±0.74 cm on remote intraopere-ative US and postoperative histopathology, respectively. US measurements were significantly smaller (p < 0.001). The 71 breast carcinoma (CA) consisted of: invasive canalar (n=49), invasive lobular (n=11), in situ (n=3) and other types of CA (n=12). While 16 patients were re-operated due to insufficient histopathological RMs (12 without residual CA).
Conclusion: Good correlation of minimal RMs between remote intraoperative US and postoperative histopathology warrants use of both techniques in a complementary manner. Remote intraoperative US is helpful in taking rapid decision of re-excision and maintaining low operation rate after breast-conserving surgery for non-palpable cancer.

B-0946 15:21
Tumour to breast volume ratio as measured on MRI: a possible predictor of breast conservation surgery versus mastectomy
R. Faermann, F. Spitzer, S. Schneebaum, D. Barsuk, Tel Aviv/IL, rfaermann@gmail.com
Purpose: The surgical approach to breast cancer has changed dramatically in the past 20 years. Nowadays the surgical objective is to remove the tumour with negative margins and good cosmetic results. MRI of the breast has become an important imaging tool before surgery, proving to diagnose additional tumours, and to assess the tumour extent. Tumour to breast volume ratio is an important predictor of breast conservation, but was never accurately measured. MRI enables this ratio to be measured. Our purpose was to measure this ratio and to analyse if it can help in the planning of breast cancer surgery.
Methods and Materials: We conducted a retrospective hospital-based study of women diagnosed with breast cancer who underwent pre-surgery MRI. Breast volume was calculated with the AW software application. Tumour volume was calculating with the help of CAD software and the AW application. Tumour volume was calculated including 10 mm margins. Afterwards the ratio between the volumes was calculated.
Results: 75 patients were included in our study. 63 patients had breast preserving surgery and 12 patients underwent mastectomy. Average tumour to breast volume ratio in the mastectomy group was 0.29 (29%). In the lumpectomy group, average tumour to breast volume ratio was 0.05 (5%).
Conclusion: Tumour to breast volume ratio as measured on MRI is an accurate measuring tool that can help the surgeon in the decision whether to perform breast conserving surgery or mastectomy. This tool should be introduced in the surgical planning of patients diagnosed with breast cancer.

B-0947 14:00
The tibiofibular syndromic injury in acute ankle fracture: CT evaluation
Y. Kim, Y. Choi, M. Im, K. Lee, Y. Lee, J. Kim; Seoul/KR (yunni21@eulji.ac.kr)
Purpose: To measure normal tibiofibular syndromes by CT and identify CT param-eters that could aid in the diagnosis of syndromic injury after acute ankle fracture.
Methods and Materials: The study group comprised 50 patients with acute ankle fracture (mean age: 43 years) who underwent ankle CT and had syndromic tear along with 100 normal subjects (mean age: 38 years). The tibiofibular clear space (TFCS) and tibiofibular overlap (TOF) on the AP radiograph were measured. In the axial CT image, four parameters were measured, including the anterior tibiofibular width (ATFW), posterior tibiofibular width (PTFW), tibiofibular angle (TFA), and tibiofibular interval (TFI). We compared CT measurements between both groups and determined the optimal cut-off values for detecting syndromic injury.
Results: The mean TFCS and TFO were 3.8 mm and 5.1 mm for the normal group, 4.1 mm and 4.3 mm for the patient group, respectively. The mean ATFW was 3.2 mm, the PTFW was 6.1 mm, the TFA was 4.3 degrees, and the TFI was 3.3 mm for the normal group, while they were 4.9 mm, 10.4 mm, 13.7 degrees, and 5 mm for the patient group. The optimal cut-off values for syndromic injury were: ATFW 3.5 mm (42% sensitivity, 80% specificity), PTFW 8 mm (94% sensitivity, 99% specificity), TFA 7.2 degrees (92% sensitivity, 95% specificity), and TFI 4.2 mm (60% sensitivity, 91% specificity), respectively (p < 0.05).
Conclusion: CT measurements of PTFW and TFA aid in the diagnosis of syndromic rupture, which is difficult to detect by plain radiography in acute ankle fracture.

B-0948 14:09
Detection of bone marrow lesions with dual energy CT virtual noncalcium technique is not affected by dose reduction
G. Pacheco, S. Bulla, P. Blanke, T. Baumann, M. Langer; Freiburg/DE (gregor.pachec@uniklinik-freiburg.de)
Purpose: To evaluate if dose reduction alters detectability of posttraumatic bone marrow lesions (BML) of the knee with dual energy (DE) CT virtual noncalcium technique (VNCa).
Methods and Materials: In this prospective, institutional review board approved study 50 patients with an acute knee trauma underwent DE-CT (Somatom Definition, Siemens) with either standard (group A) or with a dose equal to that of a single energy CT scan (group B, 28% dose-reduction) and MRI as the standard of reference. Calcium was virtually subtracted from the images (LiverVNC, Syngo Dual-Energy, Siemens). Presence of fractures was noted and presence of abnormal soft-tissue like attenuation in the bone marrow was rated on a 4-point scale for 6 femoral and tibial regions, each by 2 radiologists. HU measurements were performed in the same regions. Image ratings and HU values were subjected to ROC analysis. Visual rating revealed overall AUC-values of 0.983 and 0.979 for observers 1 and 2, respectively. Visual judgement was superior over attenuation measurements for femoral regions regardless of the dosage applied. Anova-analysis of all CT values revealed a significant influence for the presence of oedema (p < 0.001) but no differences for the radiation dose used (p=0.424). Interobserver agreement was excellent (k-value: 0.944).

SS 1810b
Truma and vertebroplasty
Moderators: J. Raposio; Lisbon/PT
A. Viera, Porto/PT

B-0945 14:00
The tibiofibular syndromic injury in acute ankle fracture: CT evaluation
Y. Kim, Y. Choi, M. Im, K. Lee, Y. Lee, J. Kim; Seoul/KR (yunni21@eulji.ac.kr)
Purpose: To measure normal tibiofibular syndromes by CT and identify CT param-eters that could aid in the diagnosis of syndromic injury after acute ankle fracture.
Methods and Materials: The study group comprised 50 patients with acute ankle fracture (mean age: 43 years) who underwent ankle CT and had syndromic tear along with 100 normal subjects (mean age: 38 years). The tibiofibular clear space (TFCS) and tibiofibular overlap (TOF) on the AP radiograph were measured. In the axial CT image, four parameters were measured, including the anterior tibiofibular width (ATFW), posterior tibiofibular width (PTFW), tibiofibular angle (TFA), and tibiofibular interval (TFI). We compared CT measurements between both groups and determined the optimal cut-off values for detecting syndromic injury.
Results: The mean TFCS and TFO were 3.8 mm and 5.1 mm for the normal group, 4.1 mm and 4.3 mm for the patient group, respectively. The mean ATFW was 3.2 mm, the PTFW was 6.1 mm, the TFA was 4.3 degrees, and the TFI was 3.3 mm for the normal group, while they were 4.9 mm, 10.4 mm, 13.7 degrees, and 5 mm for the patient group. The optimal cut-off values for syndromic injury were: ATFW 3.5 mm (42% sensitivity, 80% specificity), PTFW 8 mm (94% sensitivity, 99% specificity), TFA 7.2 degrees (92% sensitivity, 95% specificity), and TFI 4.2 mm (60% sensitivity, 91% specificity), respectively (p < 0.05).
Conclusion: CT measurements of PTFW and TFA aid in the diagnosis of syndromic rupture, which is difficult to detect by plain radiography in acute ankle fracture.

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G. Pacheco, S. Bulla, P. Blanke, T. Baumann, M. Langer; Freiburg/DE (gregor.pachec@uniklinik-freiburg.de)
Purpose: To evaluate if dose reduction alters detectability of posttraumatic bone marrow lesions (BML) of the knee with dual energy (DE) CT virtual noncalcium technique (VNCa).
Methods and Materials: In this prospective, institutional review board approved study 50 patients with an acute knee trauma underwent DE-CT (Somatom Definition, Siemens) with either standard (group A) or with a dose equal to that of a single energy CT scan (group B, 28% dose-reduction) and MRI as the standard of reference. Calcium was virtually subtracted from the images (LiverVNC, Syngo Dual-Energy, Siemens). Presence of fractures was noted and presence of abnormal soft-tissue like attenuation in the bone marrow was rated on a 4-point scale for 6 femoral and tibial regions, each by 2 radiologists. HU measurements were performed in the same regions. Image ratings and HU values were subjected to ROC analysis. Visual rating revealed overall AUC-values of 0.983 and 0.979 for observers 1 and 2, respectively. Visual judgement was superior over attenuation measurements for femoral regions regardless of the dosage applied. Anova-analysis of all CT values revealed a significant influence for the presence of oedema (p < 0.001) but no differences for the radiation dose used (p=0.424). Interobserver agreement was excellent (k-value: 0.944).
Cone beam CT for quantitative assessment of bone defect healing: an animal study
P. Kroepil, A.R. Hakimi, C. Rieger, C. Rubbert, R.S. Lanzman, A. Scherer, P. Jungbluth, G. Antoch, M. Hakimi; Düsseldorf/DE (Patric.Kroepil@med.uni-duesseldorf.de)

Purpose: Cone beam CT (CBCT) is a rapidly expanding imaging modality for visualising osseous structures in the oral and maxillofacial (OMF) region. This study was done to evaluate CBCT beyond the OMF region for monitoring of tibial bone defect healing in an animal model.

Methods and Materials: Circumscribed tibial bone defects were created in 16 mini-pigs. Imaging of the tibia was performed on day 42 using a modern CBCT-scanner with flat-panel detector (PaX-Duo3D, Vatech, Korea). The extent of osseous consolidation was measured quantitatively by a CBCT-volumetry tool using commercially available imaging software (OsiriX, Pixmeo, Switzerland). Volumes of the entire defect (including all pixels), areas of osseous consolidation (density values > 2350) and non-consolidated areas (density values < 2350) of the defect were determined. The extent of bone consolidation was calculated and a correlation with histomorphometric reference standard was performed. Independently, a visual semiquantitative CBCT-score was applied to assess bone defect healing.

Results: The mean extent of osseous consolidation in CBCT-volumetry was 63.4±17.6% (range 14-92%). A significant positive correlation was found between the extent of osseous consolidation on CBCT-volumetry and histologically visible newly formed bone (r=0.74-0.79, p<.001). There was significant negative correlation between bone consolidation on CBCT and histological areas of persisting defect (r=-0.82, p<.001). The visual score matched with the volumetric results in 75% of the cases.

Conclusion: CBCT-volumetry allows for reliable, non-invasive quantitative monitoring of bone defect healing and correlates significantly with histological reference standard. CBCT is a promising technique for imaging of peripheral bones beyond the OMF region.

Seemingly isolated greater trochanter fractures do not exist
D. Dunker1, J.H. Gothlin1, M. Geijer2; 1Gothenburg/SE, 2Lund/SE (dennis.dunker@vgregion.se)

Purpose: To assess the frequency and extent of seemingly isolated greater trochanteric fractures as well as observer agreements in radiography, computed tomography (CT) and magnetic resonance imaging (MRI) of such fractures.

Methods and Materials: A review with interobserver variance was performed in 373 patients with suspected hip fracture with initial equivocal or negative radiography followed by CT (n=232) or MRI (n=170). Three reviewers scored extracapsular fractures as either complete trochanteric, avulsion of the greater trochanter with incomplete trochanteric extension, or isolated avulsion from the greater trochanter. Observer variation was quantified using linear weighted Kappa statistics.

Results: There was total agreement between three observers in 77% of the cases for radiography, 90% for CT, and 95% for MRI in classifying the cases as definite fracture, suspect or equivocal, or no trochanteric fracture. When classifying the cases as having a greater trochanteric avulsion fracture with or without a trochanteric extension there was 82% agreement for radiography, 93% for CT, and 84% for MRI. Agreements between the modalities ranged for the three observers between substantial and near-perfect (k=0.61, - 0.92). When classifying cases as isolated trochanteric avulsions there was 100% agreement on no fractures with MRI.

Conclusion: Seemingly isolated avulsion fractures of the greater trochanter always have a trochanteric extension, CT and radiography are often adequate in diagnosing fractures of the greater trochanter but not always the extension. MRI reveals the intertrochanteric complexity but with uncertain clinical value as it may overestimate the need for internal fixation and thus an unnecessary procedure.

Operative management of intra-capsular femoral fracture: is the requirement for additional imaging a barrier to operating within the 48-hour target?
R.G.E. Clement, Z. Davis, F. Perks; Edinburgh/UK (rhysclement@googlemail.com)

Purpose: Delay in management of patients with a femoral neck fracture of over 48 hours doubles mortality. The incidence of occult fractures that are not evident on plain radiography is up to 4.2%. Either CT or MRI can be used for further imaging but it has been suggested that waiting for these is the principle cause for delaying surgery.

Methods and Materials: Patients undergoing CT or MRI for suspected occult hip fractures at a major University hospital were identified during a one-year period. Timing of the patient admission, CT/MRI request, imaging and surgery were all recorded.

Results: 64 patients with suspected occult hip fracture were referred for further imaging during the study period. 32 underwent CT and the other 32 underwent MRI. The average wait from admission to MRI was 3.9 days with a delay from the request of 0.9 days. By comparison the average wait for CT from admission was 2.2 days with the average delay from request of 0.5 days. MRI identified 10 femoral fractures of which 2 were operated on within the 48-hour target. CT identified 12 femoral fractures of which 6 were operated on within 48-hours.

Conclusion: Over 50% of patients requiring additional imaging for suspected femoral fracture failed to be operatively managed within 48 hours. Radiology department delay is not often the cause for this and therefore clinicians should be encouraged to request additional imaging promptly.

Seemingly isolated greatertrochanterfracturesdonotexist
Circumscribed tibial bone defects were created in 16 mini-pigs. Imaging of the tibia was performed on day 42 using a modern CBCT-scanner with flat-panel detector (PaX-Duo3D, Vatech, Korea). The extent of osseous consolidation was measured quantitatively by a CBCT-volumetry tool using commercially available imaging software (OsiriX, Pixmeo, Switzerland). Volumes of the entire defect (including all pixels), areas of osseous consolidation (density values > 2350) and non-consolidated areas (density values < 2350) of the defect were determined. The extent of bone consolidation was calculated and a correlation with histomorphometric reference standard was performed. Independently, a visual semiquantitative CBCT-score was applied to assess bone defect healing.

Conclusion: CBCT-volumetry allows for reliable, non-invasive quantitative monitoring of bone defect healing and correlates significantly with histological reference standard. CBCT is a promising technique for imaging of peripheral bones beyond the OMF region.

CT-guided minimally invasive musculoskeletal procedures augmented by a novel optical navigation system
Y. Appbaum1, A. Hirschhorn1, L. Appelbaum1, Y. Libson2, J. Sosna1; 1Jerusalem/IL, 2Ra’anana/IL (avivh@hadassah.org.il)

Purpose: We employed an optical navigation system which uses video and 3-dimensional software to provide real-time needle position guidance during bone biopsies/RFA. We aimed at assessing system accuracy and safety in orthopaedic CT-guided procedures.

Methods and Materials: IRB was obtained and each patient signed informed consent. Eight percutaneous biopsies and 7 RFA of osteoid osteomas were conducted on 15 patients with lesions in the pelvis (6), spine (6), femur (2), and shoulder (1). The ActiSight (ActiViews, Haifa, Israel) guidance system was used for all cases. The system is a stereotactic accessory for CT-guided procedures which determines needle location in relation to the 3-D space of the CT images by registering a video image with the CT image. Procedure-related data, including accuracy, time to reach lesion, number of scans, and complication rates, were compiled.

Results: Patients were 19-82 of age, median 49.5. Technical success was achieved in 100% of cases. Lesion diameter ranged 4 mm-41 mm (mean 10 mm). Average distance skin-target was 64 mm (STD=25 mm) and navigation-based ranged between 0 and 10 mm (average 1.5 mm). Mean time for correct needle placement was 15 minutes (19 min for RFA and 14 min for biopsy). Total number of CT scans for needle placement averaged 3.6 (range 1-10). No complications occurred.

Conclusion: The use of the optical needle guidance system in CT-guided bone procedures is safe and accurate. Clinical relevance: The use of a stereotactic guidance system may improve the success rate in CT-guided procedures of bones; reduce time, complications and radiation associated with this procedure.

Is there any preoperative MRI predictor in patients with degenerative lumbar stenosis?
B. Alicoglu1, B. Yilmaz2, N. Bulukbasi1, C. Copuroglu2, E. Yalintz2, B. Aykac2; 1Lefkosa-North Cyprus/TR, 2Edirne/TR (alicoglu.b@gmail.com)

Purpose: To identify any MRI predictor for surgical outcomes of patients with degenerative lumbar spinal stenosis (DLSS) having instrumented posterior de-compression (IPD) surgery.

Methods and Materials: 70 patients with DLSS, who underwent IPD, were reviewed retrospectively. The clinical score of each patient were assessed using Japanese Orthopedic Association Scoring (JOAS) system, which is mainly based on the subjective symptoms and physical signs of the patients before (JOAS-I) and after (JOAS-II) surgery. Healing rate was calculated as: [(JOAS-II)-(JOAS-I)]x100/ [15-(JOAS-II)]. The HR greater than 50% was considered as clinical improvement.
At the laminectomy level the degree of disc degeneration, thecal sac compression, nerve root compression, foraminal stenosis, facet degeneration were graded from 0 to 3; the presence of alignment disorders, flaval ligament thickening were determined by MRI. The results of patients with/without clinical improvement were compared.

Results: Mean age was 59.4±7.9 (40-81), the duration of symptoms was 6.0 years. JOAS-I (5.3±3.8) was significantly different from JOAS-II (11.2±3.2)(p<0.001). Mean HR of the improved patients (n=39) was 81.94 ± 17.41; HR of the unimproved patients (n=31) was 34.75 ± 16.2, the difference was statistically significant. There was no statistical difference between the two groups by means of sex; the presence of alignment disorders; age and duration of complaints before the surgery; and radiologic stenosis parameters.

Conclusion: Although the degree of radicular stenosis did not show any prediction about the surgical outcomes of patients having IPD, it does not mean that patients with severe stenosis will not benefit from decompression surgery.

B-0954  15:03

Percutaneous vertebroplasty with 3D-rotational fluoroscopy imaging vs CT with mobile C-arm fluoroscopy guidance
A. Cannavale, F. Fanelli, M. Corona, M. Allegritti, P. Lucatelli, R. Passariello; Rome/IT (alessandro.cannavale@hotmail.com)

Purpose: The development of rotational angiographic units (RAU) with flat detectors has markedly increased anatomic visualisation capabilities for interventional radiology procedures. We evaluated the reliability of RAU as a single technique to guide percutaneous vertebroplasty (PVP) vs CT with mobile C-arm fluoroscopy (CT-Carm).

Methods and Materials: Fifty consecutive patients (72 vertebral bodies, 40 lumbar and 32 thoracic) were treated under RAU-Artis zee with 2D/3D rotational acquisitions (N=25) and CT coupled with mobile C-arm fluoroscopy (N=25). We compared the two techniques about imaging quality, fluoroscopy time, patient and operator exposure dose, technical success, mean procedure time, mean number of rotational acquisitions and complications.

Results: RAU allowed a safe access and an accurate control of the bone-cement injection in all cases even at the thoracic levels and in case of vertebra plana. No cement leakages were encountered. The mean procedure time was 35.2 (RAU) vs 57 minutes (CT-Carm) p=0.02. Median fluoroscopy time was 14.58 (RAU) and 4.58 min (CT-Carm) p=0.02. Mean number of rotational acquisitions was 5 (RAU) and 10 (CT-Carm). Mean patient dose was 6 mSv (RAU) vs 9 mSv (CT-Carm). Mean operator dose (body/hands) was 0.004/0.3 mSv (RAU) vs 0.003/0.2 mSv (CT-Carm) p<0.02.

Conclusion: Rotational fluoroscopy combines the most valuable interventional features of CT and fluoroscopy into one technology. It allows real-time visualisation of interventional procedures using 3D CT-like images. PVP with 3D-fluoroscopy with rotational acquisitions is a reliable and feasible technique reducing time of the procedure and allowing fast and cost-effective procedures with high rate of success.

B-0955  15:12

Coblation vertebroplasty as a means of treating high risk painful vertebral compression fractures
D.J. Wilson, S.E. Owen, R.A. Corkill; Oxford/UK (dwillson@herald.ox.ac.uk)

Purpose: It has become apparent that there are many cancer patients who would benefit from spinal cement augmentation to prevent pain and also to prevent catastrophic collapse despite the risk associated with posterior wall defect. A technique has been developed allowing the destruction of the tumour itself by cold ablation vapourising the tumour tissue and creating a cavity. This cavity can then be filled with cement to produce a solid Supporters block.

Methods and Materials: We have now completed twenty-seven procedures. These include 5 patients with myeloma; 13 with malignancy, 8 with osteoporosis and 1 with trauma. Review of the outcome measures was based on routine baseline and post-procedure pain and disability scores using visual analogue pain scale and the Roland Morris 29 point disability score.

Results: The technique adds 10 to 15 minutes to the procedure time. The equipment necessary painful movements for the patients and shorten the radiation exposure for the radiologist.

Conclusion: Coblation vertebroplasty is a means of treating high risk painful vertebral compression fractures.
B-0958 14:09
Liver iron concentration quantification by MRI: are recommended protocols accurate enough for clinical practice?
J.M. Alustiza1, A. Castiella1, J.I. Emparanza1, E. Zapata1, B. Costero1, M.I. Dez1, E. Salvador1,2; 1San Sebastian/ES, 2Mendaro/ES, 3Alcalá de Henares/ES

Purpose: To assess the quantification of liver iron concentration (LIC) by MRI using the Rennes University (URennes) model.

Methods and Materials: The LIC calculated by the URennes model in 171 patients were compared to LIC obtained by chemical measurement in liver biopsies.

Results: According to the biopsy, 107 patients had no overload (<37 µmol Fe/g), 38 had moderate overload (37-79 µmol Fe/g), and 26 had high iron overload (HIO) (>79 µmol Fe/g). There is a correlation between the LIC estimated with MRI and the measurement obtained with a biopsy (r=0.86). LIC correctly classified 105 patients in the various levels of LIC. Diagnostic accuracy is 61.4%, with a tendency to overestimate: 43% of patients with no overload were diagnosed as overloaded, and 44.7% of patients with moderate overload were diagnosed as having HIO. The sensitivity of the URennes method for HIO is 92.3%, and the specificity for absence of overload is 57.0%. The estimated concentrations >170 µmol Fe/g revealed a PPV for HIO of 100%; estimated values <60 µmol Fe/g had a NPV of 100% for HIO. The 44 patients with intermediate values remain in uncertainty.

Conclusion: The URennes model is able to correctly diagnose and rule out HIO in about 70% of patients with very specific cut-off points of 60 and 170 µmol Fe/g. For intermediate values the diagnosis is not as clear and an additional test to measure LIC or an empirical treatment should be evaluated.

B-0960 14:18
New regions of interest in body composition analysis by dual energy x-ray absorptiometry: liver “adiposity”
D. Diano, A. Andreone, G. Garzillo, G. Filogni, C. Sassi, U. Albinsini, G. Battista, E. Salizoni, A. Bazzocchi; Bologna/IT (giacomo.filogni@gmail.com)

Purpose: Hepatic steatosis is an increasing worldwide metabolic disease and the earliest biomarker for the liver fibrosis development. Thus, its detection and quantification during non-invasive examinations should be always considered as clinically relevant. Our aim was to test new designed regions of interest (ROIs) on whole body images acquired by dual energy x-ray absorptiometry (DXA) in comparison with DXA conventional ROIs and ultrasoundography (US) in order to evaluate predictive values on liver steatosis detection and grading.

Methods and Materials: Ninety-nine subjects directed to body composition assessment by DXA were prospectively enrolled. All patients were submitted to whole body DXA scan (Lunar IDXA, software enCORE 12.0) and underwent US evaluation on the same day to assess hepatic steatosis (mild-moderate-severe). On every DXA image three new liver-suited ROIs were manually created by a skilled radiologist. Fat mass (FM) and FM percentage (FMp) were investigated on whole body and regionally (android and new ROIs). FM and FMp results were correlated with US.

Results: Of 99 patients, 70 (70.7%) resulted affected by liver steatosis on US evaluation (32/70=45.7% mild, 32/70=45.7% moderate and 67/70=9.6% severe). FM and FMp of all ROIs were significantly correlated with presence and grading of steatosis. However, they were able to predict and to distinguish steatosis absence from moderate and severe grade, but not mild. FMp of one among the new liver-suited ROIs showed the best predictive value for liver steatosis.

Conclusion: New ROIs should be included in whole body DXA examinations to provide additional information and higher predictive value on liver steatosis.

B-0961 14:27
Reproducibility of two-point DIXON technique for measuring hepatic fat fraction
A.M. Chow, G.G. Lo, J.K.F. Chan, S. Lau, E. Wong, S.K. Yu; Happy Valley/HKH (apinlcmlk@gmail.com)

Purpose: To evaluate the reproducibility of two-point DIXON (2PD) technique for measuring hepatic fat fraction (HFF) in healthy subjects.

Methods and Materials: 15 healthy subjects (9M/6F, age = 30±8.3 years; BMI = 25±3.0 kg/m²) were included. All MRI examinations were performed on a 1.5 T scanner (MAGNETOM Aera, Siemens). Breath-hold 2PD was performed axially using a gradient echo sequence with TE = 2.38/4.76 ms (out-of-phase (OP) and in-phase (IP), respectively). HFF maps were calculated as (SIin-SIout) / (2 × SIin) × 100%. Proton magnetic resonance spectroscopy (MRS) was also performed using breath-hold STEAM over a 2x2x3 cm³ voxel with TR/TE = 2000/20 ms and 4 averages. After T2 correction, HFF was then calculated as arealipid/(areawater+arealipid)×100%. Duplicate measurements were acquired after repositioning. Reproducibility was assessed using coefficient of variation (CV), repeatability coefficient (RC) and intraclass correlation coefficient (ICC).

Results: HFF measured using 2PD and MRS for all subjects were 5.5±6.09% and 4.86±6.62%, respectively (r = 0.92; p < 0.001). CV for HFF using 2PD (5.2±4.3%) was significantly lower (<0.01, two-tailed Wilcoxon matched pairs test) than that using MRS (19.1±17.4%). Similarly, RC of 2PD (0.39±0.37%) was significantly lower (<0.01) than that of MRS (1.55±2.56%). Moreover, ICC for 2PD (1.00±0.00) was significantly higher (>0.01) than that for MRS (0.98±0.06).

Conclusion: 2PD shows higher reproducibility than MRS in measuring HFF non-invasively. Without extensive post-processing analysis, 2PD may offer promise as a robust tool to measure HFF for the entire liver reproducibly in diagnosis, treatment and follow-up of hepatic steatosis at clinical field strength within a single breath-hold.

B-0962 14:36
Early hepatic artery thrombosis after liver transplantation: the impact of onset and additional risk factors in a matched case-control study
J. Bekker1, V. Fidler2, K.P. de Jong2, 1Rotterdam/NL, 2Groningen/NL (jasbekker@hotmail.com)

Purpose: In this study, we tested the hypothesis that early detection of eHAT and revascularisation of the graft is associated with a better graft survival. We analysed graft survival and patient survival in patients with intraoperative HAT (iHAT) and patients treated during transplantation - versus those with postoperative HAT. Additionally, we identified risk factors for eHAT by comparing eHAT patients with non-eHAT patients and by performing a case-control study in which patients were matched for the two most important risk factors for eHAT, transplantation in children and retransplantation.

Methods and Materials: Between January 2000 and August 2007, data of 376 liver transplantations in 304 patients were retrieved from our prospective database. HAT was present in 34 of 376 (9.0%) transplantations.

Results: The success rate of revascularisation attempts was comparable in the intraoperative HAT group (8/11; 73%) and the postoperative HAT group (3/11; 27%; P=0.4). Multivariate risk factors associated with an increased incidence of early hepatic artery thrombosis after liver transplantation were children, retransplantation and reduced size grafts. Independent risk factors for eHAT were: (CMV) mismatch (donor + recipient- combination), a lower prothrombin time, and a higher level of haemoglobin.

Conclusion: This suggests that early detection does not result in a better outcome of eHAT in terms of a lower retransplantation rate. As an additional potential risk factor for eHAT, we identified a high haemoglobin level in the immediate postoperative period.

B-0963 14:45
Body composition changes after liver transplantation
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Purpose: The aim of the study was to evaluate body composition changes in patients undergoing orthotopic liver transplantation (OLT).

Methods and Materials: Twenty-three patients (12 males and 11 females; mean age 51.5, range 21-67 years) submitted to OLT were prospectively enrolled in the study. Patients started immunosuppressive therapy with different combinations of tacrolimus, azathioprine and steroids. In all patients a body composition analysis was performed by a new dual energy x-ray absorptiometry equipment (Lunar IDEXA, GE Healthcare) before and after transplantation (1, 3, 6, 9 and 12 months). Fat mass (FM), non-bone lean mass (LM), bone mineral content and density were assessed in a three compartment whole body and regional model.

Results: All patients concluded the follow-up program. Four out of 23 (17.4%) patients presented with diabetes before OLT, and 11/23 (47.8%) were diabetic after surgery. Total and android FM/LM showed a slight decrease at 3 months, but raised again in the subsequent months with statistically significant differences between 12-month values and baseline (p = 0.035 for total-body, 0.014 for android region). Android/gynoid index of fat distribution did not show any significant change after transplant. Insulin treatment did not significantly affect any body composition parameter, while steroid dosage was inversely correlated with android FM/LM ratio (p=0.004).

Conclusion: Body composition assessment is essential in the understanding of physiopathology and metabolic-related disorders and DXA is a valid tool at this aim. Patients submitted to OLT showed significant changes of their body composition that might be related to different metabolic destinies.
B-0964 14:54
Preoperative lymph node staging in patients with rectal cancer using dynamic magnetic resonance imaging: initial results
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Purpose: To evaluate the accuracy of dynamic MRI for preoperative lymph node staging in rectal cancer using computerised analysis.

Methods and Materials: 19 patients received preoperative dynamic MRI (1.5 T system, VIBE-sequences in 1-minute intervals for a total of 6 minutes), identifying 51 lymph nodes located in the mesorectal fat. Contrast enhancement characteristics of identified lymph nodes were evaluated using computer-aided analysis software. The program analyses time-intensity curves voxelwise within a manually set volume of interest and summarises the percentual distribution of the different enhancement patterns in a profile map. All patients underwent rectal resection with total mesorectal excision. Identified lymph nodes on MRI were compared those from histopathologic examinations.

Results: 14 lymph nodes demonstrated metastatic involvement at histopathological examination, 37 lymph nodes were free of metastasis. Mean percentual distribution of enhancement patterns in malignant lymph nodes showed rapid initial enhancement followed by decrease in the late phase ("washout") in 23.5%, and rapid enhancement followed by flattening ("plateau") or by increase in the delayed phase ("persistent") in 14.6 and 61.2%, respectively. In comparison, distribution of enhancement patterns in negative lymph nodes demonstrated washout pattern in 56.8% (P<0.05), plateau pattern in 17% (P=0.37) and persistent pattern in 28.1% (P<0.05).

Conclusion: Dynamic magnetic resonance imaging with computerised evaluation of enhancement characteristics might increase diagnostic accuracy in differentiating positive from negative lymph nodes in rectal cancer.

B-0965 15:03
Standardised cineloop in abdominal ultrasound yields high reliability of sonographic findings
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Purpose: To compare abdominal grey-scale ultrasound findings of immediate bedside reading by performing radiologist with independent offline reading by a non-performing radiologist.

Methods and Materials: Over a six-month period, three radiologists performed dynamic ultrasound examinations in 43 outdoor patients. Examination protocols were standardised with predefined probe position and sequences of short cineloops of the liver, gallbladder, pancreas, kidneys and urinary bladder, covering the organs completely in two plans. The studies were reviewed and read out immediately by the performing radiologist. Offline reading was performed blinded by a radiologist who had not performed the examination. Image quality was registered from 1 (no diagnostic value) to 5 (excellent cineloop quality). bedside and offline reading were compared with each other and with consensus results.

Results: In 140 examinations, consensus reading revealed 21 cases with renal disorders, 17 cases with liver and bile pathology and 4 cases with bladder pathology. Overall interobserver agreement was 0.73 (95% CI 0.61-0.91), with lowest agreement for findings of the urinary bladder (0.36) and highest agreement in liver examinations (0.90). Disagreements between the two readings were seen in nine kidneys, three bladder examinations, two pancreas and bile system examinations each and in one liver, giving a number of mismatches of 11%. Nearly all cases of mismatch were of minor clinical significance. The median image quality was 3 (2-5). Bedside-consensus discrepancies did not differ significantly from offline-consensus discrepancies.

Conclusion: Standardised dynamic cineloop technique in abdominal ultrasound yields high reliability of findings. Image interpretation can be performed independently from performing bedside-examination.

B-0966 15:12
Characterisation of adrenal masses using single-phase dual energy CT
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Purpose: To evaluate the diagnostic accuracy of dual energy CT-based attenuation measurements in the characterisation of adrenal masses.

Methods and Materials: We retrospectively identified 55 patients with adrenal masses who had undergone single-phase adrenal contrast-enhanced dual energy CT (80 or 100 kVp / 140 kVp) on a dual source scanner (Siemens Somatom Definition/Definition Flash) for various indications. Using dedicated post-processing techniques, virtual nonenhanced and colour-coded iodine overlay images were generated which allow direct measurement of pre- and post-contrast density on a single phase acquisition. Diagnosis of adrenal adenoma was made if CT density in the virtual nonenhanced image was lower than 10 HU. Long-term follow-up, noncontrast CT in- and opposed phase MRI served as the standard of reference.

Results: Based on follow-up imaging, 47/55 (85%) of the adrenal masses were benign adrenal adenomas. At a cut-off value of 10 HU virtual nonenhanced images allowed for correct diagnosis in 39 of 47 cases (83%), whereas 8 adrenal adenomas were lipid poor with a density higher than 10 HU.

Conclusion: Virtual nonenhanced images from dual energy CT allow for accurate characterisation of adrenal masses. DECT therefore helps to avoid unnecessary follow-up imaging (noncontrast CT, MRI).

B-0967 14:00
Contrast-enhanced ultrasound: errors and artefacts
M. Jedrzejczyk, K.T. Szopinski; Warsaw/PL (kszopinski@uw.edu.pl)

Purpose: Contrast-enhanced ultrasound (CEUS) is technically demanding, and many factors can influence the quality of the examination. A retrospective analysis was performed to assess the frequency and severity of errors and artefacts in CEUS examinations.

Methods and Materials: The films of 1690 CEUS examinations of the liver, kidneys, bowel, breast, thyroid, lymph nodes, soft tissue tumours and muscles were reviewed retrospectively. The examinations were performed with low mechanical index technique, using the SonoVue (Bracco/Altana) contrast agent (CA). The errors and artefacts were subdivided into: machine settings-related (incorrect machine settings), CA-related (preparation and administration of the contrast medium), patient-related (large body habitus, patient preparation, cooperation with the patient), examination technique-related, and archiving and interpretation errors. A serious error was defined as the one which could adversely affect the diagnosis or require a repeat examination.

Results: In 1690 reviewed files, 212 errors were detected (12.4% of examinations). Among the errors, 147 were serious (8.7% of the examinations, 69.3% of all errors). Most errors were machine settings related (81) and patient-related (62). However, the greatest percentage of serious errors was noted in CA-related (95%) and examination technique-related (83.3%) errors.

Conclusion: The errors and artefacts are common in CEUS. Often they can impair the final diagnosis. They have to be recognised, and taken into account, since the proportion of serious errors is substantial.

B-0968 14:09
Bolus versus continuous infusion of microbubble contrast agent for liver US using an automatic power injector
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Purpose: To prospectively assess if continuous infusion of sulphur hexafluoride-filled microbubbles can prolong the duration of hepatic enhancement at ultrasonography over bolus injection.

Methods and Materials: 20 patients (15 males and 5 females; mean age ± SD, 65 ± 10) received two injections - one bolus injection (2 mL/sec) and one continuous infusion (0.5 mL/min) - with the same dose (2.4 mL) of sulphur hexafluoride-filled microbubbles injected through a forearm or antecubital vein through an 18-gauge intravenous catheter using an automatic power injector. One unenhanced baseline sweep scan (mechanical index of 0.2) of the right liver lobe was acquired on the longitudinal plane followed by contrast-enhanced sweeps after bolus injection and continuous infusion. Each sweep was saved as DICOM cine-clip and analysed by a dedicated software which calculated the grade of contrast enhancement expressed as the percentage increase of echo-signal intensity in gray-scale levels over baseline scan.

Results: Duration of enhancement was prolonged by continuous infusion from 4.3 minutes ± 2.5 at bolus injection to 8.3 minutes ± 2.0 (P <0.05). No difference in the maximal parenchymal enhancement was observed on bolus vs continuous
microbubble infusion, 50% increase over baseline ± 15% (bolus injection) and 45% increase over baseline ± 20% (infusion, P <.05). Conclusion: Continuous infusion of sulphur hexafluoride-filled microbubbles, performed through automatic power injector, prolongs the hepatic enhancement without modifying the maximal parenchymal enhancement over the baseline.

**B-0969** 14:18
Prospective evaluation of vascular alterations in liver transplantation by intraoperative CEUS compared to conventional Doppler US: a pilot study
N. Leo, E. Vibtet, O. Ciacio, L. Ricca, R. Adam, D. Castaing, M. Lewin; Villejuif/FRA (ustre@yahoo.it)

**Purpose:** To evaluate diagnostic performance of intraoperative microbubble contrast material-enhanced ultrasonography (CEUS) for assessment of vascular alterations in liver transplantation (LT), compared with intraoperative conventional Doppler ultrasonography (US).

**Methods and Materials:** Twenty patients were included (14 males, 6 females, average age: 48 years old). LT patients underwent both intraoperative conventional Doppler US and CEUS vascular examinations using an Aloka Alpha 7 device and intravenous microbubbles as a contrast agent.

**Results:** In two patients, Doppler US was normal while the CEUS was not: in one case CEUS showed flow reduction in hepatic veins and the other showed artery flow alteration due to a symptomatic arcuate ligament. These results had immedi- ate medical and surgical implications. In another two patients Doppler US failed to visualise hepatic artery flow while this flow was shown by CEUS. Thus, Doppler US was wrong in 20% of patients (4/20).

**Conclusion:** Intra-operative CEUS clearly improves the relevance of vascular imagery in LT patients as compared to conventional Doppler US. This technique should be recommended for a better management of these patients.

**B-0970** 14:27
Evaluation in vitro of new polymeric contrast microbubbles using Contrast software
V. Migalëddu, V. Sanna, D. Scanu, G. Pintus, D. Sirigu, S. Uzzau, M. Marzo, M. Sechi, G. Virgilio; Sassari/IT (migaledd@smirg.org)

**Purpose:** To evaluate in vitro, using ultrasound, the reflectivity of new prototypes of microbubbles (MBs) containing air, with the shell of different biocompatible and biodegradable copolymers: poly-lactic acid (PLA), poly-glycolic acid (PLGA), and PGLA conjugated with poly-ethyleneglycol (PGLA-PEG).

**Methods and Materials:** Using an experimental model of degassed and deoxygenated water, each sample of MBs was evaluated with a 5.4-5 MHz transducer (Sequioa Acuson-Sixemens). Ultrasound imaging was obtained using a contrast-specific software (Cadence Contrast Pulse Sequencing). A quantitative analysis of the echoes intensity was performed through the specific Contrast software (Advanced Medi- cal Imaging Development, Bracco, Italy), selecting manually a region of interest.

**Results:** The intensity of signal produced by the different MBs has been compared to that of water. Each MBs prototype demonstrated a signal related to coating composition. Signal intensity increased in the order PLA < PLGA < PLGA-PEG, in particular 15±0.08%, 18±0.9% or 34±1.8%, respectively, obtaining a significant statistical correlation (p <.05).

**Conclusion:** MBs with shell of PLGA-PEG resulted the most effective in terms of reflectivity after exposure to ultrasound. So they might be further optimised and used as potential carriers for selective drug delivery.

**B-0971** 14:36
The efficacy of contrast protocol in liver dynamic CT: multicentre prospective study in community hospitals in Japan

**Purpose:** To compare the effects of contrast material (CM) with four different injection techniques on the conspicuity of hypervascular hepatocellular carcinoma (HCC) in patients with liver cirrhosis.

**Methods and Materials:** The survey was conducted in 91 institutions as postmar- keting surveillance, and liver dynamic CT data of 415 patients (HCC ≤ 3 cm) were obtained. Four injection protocols (A: body weight (BW)-tailored dose of CM (300 mgI/mL of Iohexol), fixed injection duration (30s), fixed arterial phase (AP) scan timing, B: BW-tailored dose of CM, fixed injection duration (30s), AP scan timing adjusted by bolus tracking, C: BW-tailored dose of CM, fixed injection flow rate, AP scan timing adjusted by bolus tracking, D: 100 mL constant of CM at any BW, fixed scan timing) were used. Enhancement of the aorta and liver, and tumour-to-liver contrast (TLC) at AP and at equilibrium phase (EP) were compared between these protocols.

**Results:** Three hundred and forty of 415 patients had hypervascular HCC. The rate assessed “good or better” as TLC at AP were A: 81.3%, B: 79.6%, C: 80.7%; and D: 76.9%. In patients with higher BW (> 80 kg), qualitative TLC at AP and quantitative aortic enhancement in protocol A-C were significantly higher than those in protocol D, whereas quantitative TLC at AP in protocol A-C was significantly lower than that in patients with lower BW (≤50 kg). Enhancement of liver and TLC at AP showed no significant difference between 4 protocols.

**Conclusion:** In patients with higher BW (> 80 kg), protocols of BW-tailored dose of CM and/or fixed injection duration should be employed to diagnose hypervas- cular HCCs.

**B-0972** 14:45
Diagnostic utility of double-contrast MRI (DC-MRI) for evaluation of treatment response of hepatocellular carcinoma to ablative treatments (TACE, PEI, RFA)
A. Centola1, L.P. Stoppino, G. Bistrogianis, G. Santangelo, P. Mil lion, P. Lupo, R. Vinci, L. Macarini; Foggia/IT (annarita.centola@fastwebnet.it)

**Purpose:** To assess recurrence of disease in hepatocellular carcinoma (HCC) nod- ules after loco-regional treatment by sequential use of superparamagnetic iron oxide (SPIO) and the gadolinium-diethyletriaminepentaacetic acid (Gd-DTPA) contrast agents compared with unenhanced MRI and SPIO-enhanced MRI (SPIO-MRI).

**Methods and Materials:** We enrolled 31 consecutive patients affected by hepatic cirrhosis with a total of 45 HCC nodules treated by loco-regional treatments. 6 patients were treated with transarterial chemoembolisation (TACE), 8 patients with radiofrequency ablation (RFA) and 17 patients were treated with percutaneous ethanol injection (PEI). DC-MRI study was performed one month after treatment.

**Results:** A viable HCC was found in 7 of 9 nodules (77.7%) treated by TACE, in 15 of 24 nodules (62.5%) treated by PEI and in 4 of 12 nodules (33.3%) treated by RFA. In all these cases DC-MRI technique clarified the MR picture, improving the possibility to diagnose the presence or absence of viable HCC within post-treatment liver fibrosis as well as an early detection of 12 dysplastic nodules by comparing unenhanced MRI, SPIO-enhanced and DC-MR images.

**Conclusion:** The combined use of two contrast agents (negative and positive) improved the diagnosis of viable tumour in treated HCC within post-treatment liver fibrosis.

**B-0973** 14:54
Magnetic resonance imaging contrast of brain tumours at 7 Tesla compared to 3 Tesla: enhancement after half and full routine contrast agent dose
I.-M. Noebauer-Huhmann1, P. Szomolanyi, V. Juras, C. Knonrerwetter, M. Schmook, D. Payer, S. Tratting; Vienna/AT (iris.noebauer@medunivien.ac.at)

**Purpose:** To compare the diagnostic efficacy of a half and a full dose of gadolinium- based MR contrast agent in primary brain tumours at 7 Tesla MR versus 3 Tesla. Results: 11 patients: (6m, 5f, mean age 55 years, range, 25-78) with malignant primary brain tumours were examined on both a 7 Tesla and a 3.0 Tesla MR whole body unit. Before and after intravenous administration of Gadobenate dimeglumine in a dosage of 0.05 mmol/kg and 0.1 mmol/kg body weight, a sagittal 3D GRE sequence with magnetisation preparation (MP-RAGE) with TR/TE/TI 4680/3.55/1700 msec at 7 Tesla, and TR/TE/TI 2190/3.02/1300 ms at 3 Tesla were performed. Signal intensities by region of interest measurements in the lesion and the contralateral normal white and grey matter were assessed, and the background noise was measured. The tumour-to-brain contrast was cal- culated. For statistical analysis two-way ANOVA tests for repeated measures and paired t-Tests were used.

**Results:** The mean tumour-to-brain contrast after contrast agent administration was significantly higher at 7 Tesla than at 3 Tesla for both half the dose (85.4±48.4 vs.43.3±24.3), and the full routine dose (118.5 ±60.1 vs. 69.5± 32.85) (p <.05). The difference between half and full dose at each field strength was also statisti- cally significant (p <.001). There was no difference between half the dose at 7 Tesla and the full dose at 3 Tesla (p= 0.66).

**Conclusion:** The results suggest that it is possible to reduce the contrast agent dose in the examination of brain tumours at 7 Tesla.
Methods and Materials: We produced a physiological pharmacokinetic model of a contrast enhancement simulation of the aorta based on a 7-compartment model using software. We fixed the cardiac index as 3.5 l/min/m². Simulated time-enhancement curves of CTA and peak CT attenuation values for body weights 30-120 kg were analysed using three different protocols: fixed iodine flux (1.11 g/sec), iodine flux based on body weight (17.35 mg/sec/kg), and iodine flux based on BSA (652 mg/sec/m²). A contrast agent at 370 mg/ml was postulated to be injected for 20 seconds in these two examinations.

Results: Unlike past studies, we excluded the effects of variable cardiac function by fixing the cardiac index. In this method, the protocol adjusted to BSA demonstrated the least uneven time-attenuation curve at different body weights and the least variation in enhancement peak of the three protocols, showing statistical differences.

Conclusion: The contrast material injection protocol adjusted to BSA provided aortic enhancement in patients with a wide variety of body weights more consistently than the other two protocols.

14:00 - 15:30 Room N/O

Vascular

SS 1815

Carotid arteries

Moderators:

E. Esteban, Alzira/ES
A. Spinelli, Rome/IT

B-0977 14:00

Characterisation of neovascularisation in carotid atherosclerotic plaques with contrast-enhanced ultrasound

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Purpose: To evaluate the use of contrast-enhanced ultrasound in the neovascularisation within carotid atherosclerotic plaques.

Methods and Materials: 35 patients with known atherosclerotic plaques in the carotid artery were examined with contrast-enhanced ultrasound to rule out the features of neovascularisation within this plaque. Additionally, these plaques were analysed and correlated with plaque size and echogenicity. For contrast-enhanced ultrasound we injected 2.4 cc of SonoVue (Bracco, Italy) i.v. The examinations were performed using the S 5000 or Sequia 512 (Siemens / Acuson, Mountain View) with an 9.15 MHz or 17 MHz probe using the CPS-software.

Results: There were 41 atherosclerotic plaques, 27 of which (19 soft and 8 mixed) enhanced after injection of SonoVue. The enhancement occurred from the carotid wall to the center of the plaque with a short-line pattern in 15 plaques, whereas 12 plaques enhanced from both the carotid wall and the carotid lumen, with just a little spot pattern. The arrival time of contrast was later in the plaques than in the carotid artery and the time to peak was longer in the plaques than in the carotid lumen. Among the 14 unenhanced plaques, 4 were hard, 3 were calcified, 2 were soft, and 5 were mixed. The unenhanced plaques had a thickness of < 2.7 mm.

Conclusion: In our small patient population, contrast-enhanced ultrasound allows the dynamic evaluation of neovascularisation within carotid plaques and neovascularisation may correlate with plaque morphology.

B-0978 14:09

Characterisation of atherosclerotic plaque of carotid arteries: high-resolution multisequence MR imaging vs colour Doppler ultrasonography (US)

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Purpose: To investigate whether high-resolution multisequence MR Imaging of the vessel wall carotid arteries can differentiate at-risk soft plaque from solid fibrous plaque more accurately than colour Doppler ultrasonography (US).

Methods and Materials: This study included 55 carotid plaques in 52 consecutive patients who underwent carotid endarterectomy. MRI (1.5 T with neurovascular array coil) was performed using multiple sequences: diffusion-weighted imaging, fat-suppressed T1-weighted; first-pass CE-MRA; steady-state 3D T1 high-resolution (HR). Carotid plaques were grouped into three categories based on MR signal intensity and US pattern: at-risk soft plaque with large lipid-necrotic core (LC); complex fibrocalcificated including a segment of lipid-liquid component (B); hard plaque without soft content (C). Additional vulnerable plaque features like Intraplaque haemorrhage (IPH) and ulceration were registered. MRI and US
findings were compared with findings of endarterectomy specimens considered as gold standard.

Results: Four patients were excluded from the study due to MR artefacts or because not US-assessable. Intraoperative findings and macroscopic examination of endarterectomy specimens revealed 15 at-risk soft plaques, 23 complex and 13 hard plaques. HR-MRI correctly classified 73%, 30% and 100% of plaques of group A, B and C; US identified 53%, 52% and 84% of group of A, B and C, respectively. In 20/51 patients MR pinpointed 15 ulcerated plaques (8 of them identified by US) and 14 cases of IPH.

Conclusion: In patients undergoing CE-MRA, MR plaque characterisation could have a potential to more accurately diagnose soft plaque with large LNC or plaque diameter stenosis with 64-slice CT: role of cross-sectional area versus percent comparison of 3 different evaluation criteria of carotid artery.

**B-0980 14:27**

Comparison of 3 different evaluation criteria of carotid artery stenosis with 64-slice CT: role of cross-sectional area versus percent diameter stenosis

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Purpose: Aim of the study is to verify which of the daily used quantitative method of carotid stenosis evaluation (Common carotid artery (CCA), NASCET, ECST) better correlates with carotid stenosis area indexed to body surface area (Ai) of the patient, that is the real parameter of the blood flow in the carotid vessels

Methods and Materials: 112 patients underwent 64-slice CT (GE VCT) with evaluation of diameter and area, respectively, of common carotid artery (CC), carotid bulb and internal carotid (CI) at the site of stenosis and beyond the bulb. Stenosis degree was measured using, respectively, as reference diameter and area of CC (CC-d, CC-A), ECST method (ECST-d, ECST-A), and NASCET method (NASCET-d, NASCET-A) and correlated with Ai using Pearson test

Results: 179 carotid plaques were detected. Quantitative analysis showed mean Ai=7.6±6.0 mm². Stenosis degree using the 3 different methods was: CC-d: 58%±17, CC-A: 71%±19; ECST-d: 55%±16; ECST-A: 62%±23; NASCET-d: 39%±18; NASCET-A: 66%±25. The agreement between Ai and each of the three different methods was: CC-A (r=0.82), ECST-A (r=0.75), NASCET-A (r=0.82).

Conclusion: CC-A method and NASCET-A method better correlates with Ai. Less agreement results between Ai and ECST method, maybe because of low reproducibility of the measurements at the site of carotid bulb due to anatomical changes related to atherosclerosis.

**B-0981 14:36**

Time-of-flight images: a viable alternative to contrast-enhanced MR angiography and fat suppressed T1w images for the diagnosis of cervical artery dissection

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Purpose: To compare the diagnostic performance of a non-enhanced time-of-flight sequence (TOF-MRA) with fat suppressed axial/coronal T1-weighted images and contrast-enhanced angiography (standard MRI) for the diagnosis of cervical artery dissection (CAD).

Methods and Materials: 26 consecutive patients (9 women, 17 men, age 24-66 years) with proven CAD on standard MRI had an additional TOF-MRA (3.0 T Siemens Verio) using dedicated surface coils (Machnet, Netherlands) within 7 days. Sensitivity (SE), specificity (SP), positive and negative predictive value (PPV, NPV) and accuracy of TOF-MRA were calculated using the standard protocol as gold standard. Image quality and diagnostic confidence were assessed by two raters in consensus decision on a 4-point scale. A p-value of < 0.05 was considered statistically significant.

Results: There was excellent agreement between TOF images and the standard protocol for the presence/absence of CAD, with a Cohen’s kappa value of 0.96 (p < 0.001). On TOF images, 1 CAD in the V1 segment of the vertebral artery was missed. In addition, 1 CAD was found on TOF images which were not seen with the standard protocol. This resulted in a SE, SP, PPV, NPV and accuracy of 97%, 98%, 97%, 98% and 98%, respectively. Image quality did not differ significantly between the two methods. However, diagnostic confidence of the TOF sequence was rated significantly higher compared to the standard protocol (3.5 vs. 2.7, p < 0.001).

Conclusion: Findings of this study suggest that TOF imaging is a viable alternative to the standard contrast-enhanced protocol for the diagnosis of CAD.

**B-0982 14:45**

Head-to-head comparison of CTA and 3 T blood-black MRI for identification of symptomatic carotid plaques

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Purpose: The purpose of this prospective study was to compare multi-detector CT angiography (MDCTA) with black-blood 3 T-MRI (bb-MRI) with respect to their ability to identify symptomatic carotid plaques.

Methods and Materials: 22 patients with unilateral symptomatic carotid disease who underwent extensive clinical workup at our stroke unit to exclude other causes of ischaemic stroke underwent standard MDCTA and bb-MRI with TOF, pre- and post-contrast IsT1w, IsT2w- and fsPDw-sequences within 7 days of symptom onset. Both symptomatic and contralateral asymptomatic sides were evaluated. By MRI, plaque morphology and composition and prevalence of complicated type VI lesions (AHA-LT6) with haemorrhage, thrombus and/or ruptured fibrous cap were evaluated. By MDCTA, plaque type (soft, mixed, hard), plaque density in HU and presence of ulceration and thrombus were evaluated. Sensitivity (SE), specificity (SP), positive and negative predictive value (PPV, NPV) were calculated using a four-by-four table.

Results: To distinguish between symptomatic and asymptomatic plaques AHA-LT6 was the best MRI variable and presence/absence of plaque ulceration was the best CT variable, resulting in a SE, SP, PPV and NPV of 80%, 80%, 80% and 80% for AHA-LT6 as assessed by bb-MRI, 40%, 95%, 65% and 71% for plaque ulceration as assessed by MDCTA and 90%, 80%, 78 and 94% for the combination of both MDCTA and bb-MRI.

Conclusion: Bb-MRI delivered a better sensitivity, NPV and PPV compared to MDCTA at identifying the symptomatic side, while MDCTA offered an excellent specificity. Best results were obtained using both techniques.

**B-0984 14:54**

Pulse pressure as risk factor for MRI-detected intraplaque haemorrhage in the carotid arteries: the Rotterdam study

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Purpose: Intraplaque haemorrhage (IPH), a high-risk characteristic of the vulnerable plaque, is considered to be an important predictor for ischaemic stroke. Yet, risk factors leading to plaque vulnerability and in specific IPH are unknown. We studied whether haemodynamic parameters are associated with presence of IPH.
Methods and Materials: Within the framework of the Rotterdam study, the carotid arteries of 1000 healthy participants 45 years and older and with wall thickening (>2.5 mm) on ultrasound were imaged with a 1.5-T MRI scanner. IPI has been defined as a hyperintense signal on the 3D-T1w-GRE MR sequence. Generalised estimation equation analysis, adjusted for sex, age, intima-media thickness and other cardiovascular risk factors (smoking, diabetes, cholesterol, BMI) was used to assess the association between the main blood pressure parameters and IPI.

Results: MR imaging of the carotid arteries revealed presence of IPI in 44/1866 (24%) plaques. Adjusted for age and sex, IPI was significantly associated with systolic blood pressure (SBP) and pulse pressure (PP). After adjustment for other cardiovascular risk factors, PP yielded the strongest association. The risk of IPI increased with 22% per SD increase in PP (85% CI 0.97-1.40, p=0.004) versus 13% per SD in SBP (95%CI 0.99-1.28, p=0.07). Furthermore, only PP remained significant after additional adjustment for other blood pressure components.

Conclusion: Pulse pressure proved to be the strongest determinant for intraplaque haemorrhage independent of other blood pressure parameters and traditional cardiovascular risk factors. This association between pulsatile flow and IPI might provide novel insights into the aetiology of the vulnerable plaque.

B-0985 15:03
MRI-based quantification of adventitial contrast dynamics for the carotid artery as a marker for neovascularization in atherosclerosis: comparison of symptomatic and asymptomatic patients
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Purpose: To compare contrast dynamics in adventitial tissue of the common and internal carotid artery between symptomatic and asymptomatic patients with atherosclerosis, calculated from time-resolved contrast-enhanced MRI datasets.

Methods and Materials: 20 symptomatic patients (ischaemic stroke with DWI restriction on brain MRI with atherosclerotic plaques on carotid ultrasound) were included between 72th of symptomatic onset. 20 asymptomatic patients with familial hypercholesterolemia served as a control group. All patients were scanned on a 3 T-MRI system using a dedicated surface-coil. Contrast kinetics were recorded on 2 representative axial slices at the level of the common and internal carotid artery with a temporal resolution of 1.8s for a total of 5 min. ROIs with a thickness of 2-3 pixels were positioned around the vessel wall, yielding time-dependent functions of signal. These were then fitted to a 2-compartment exchange-model and the parameters plasma-flow, plasma-volume, plasma-mean-transit-time (PMTT), extraction-flow (EF) and interstitial-mean-transit-time (IMTT) calculated.

Results: Contrast dynamics were analysed for 75 and 77 carotid segments in the symptomatic and asymptomatic group, respectively. The remaining 8 were excluded due to insufficient image quality. For symptomatic patients, significantly higher values for plasma-volume (6.5 vs. 4.2, p < 0.001), extraction-flow (3.4 vs. 2.7, p=0.02) and IMTT (304 vs. 450s, p=0.04) were observed. There was a strong tendency for higher PMTT (11.4 vs. 9.1, p=0.05) and higher plasma-flow (41 vs. 35s, p=0.18).

Conclusion: MRI-based quantitative assessment of contrast dynamics in the adventitial layer of the carotid artery reveals highly significant differences between symptomatic and asymptomatic patients. Further studies are needed to analyse the predictive value for future ischaemic cerebral events.

B-0986 15:12
Reproducibility and differentiation of cervical arteriopathies using in vivo high-resolution MRI
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Purpose: To evaluate the potential of high-resolution black-blood cervical magnetic resonance imaging (hr-bb-cMRI) to differentiate the most common cervical arteriopathies and to evaluate inter-observer reproducibility.

Methods and Materials: To evaluate the potential of high-resolution black-blood cervical magnetic resonance imaging (hr-bb-cMRI) to differentiate the most common cervical arteriopathies non-invasively with excellent inter-reader reproducibility.

Results: On a per-vessel-level, agreement between both readers was excellent with a Kappa of 0.86 (p < 0.01). Compared to the gold standard both readers missed one patient with moderate atherosclerosis but correctly identified all cases of severe atherosclerosis, dissection and vasculitis. By consensus reading the correct diagnosis was made in 42 of 43 cases. Only one patient with moderate atherosclerosis was classified as disease-free. For the presence of disease this resulted in a sensitivity, specificity, PPR and NPR of 0.97, 1.0, 1.0 and 0.88.

Conclusion: This study demonstrates that hr-bb-cMRI is able to differentiate between the most common cervical arteriopathies non-invasively with excellent inter-reader reproducibility.

B-0987 14:00
CT image quality improvement using adaptive iterative dose reduction with wide-volume acquisition on 320-detector CT
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Purpose: To evaluate the impact of adaptive iterative dose reduction (AIDR) on image quality and radiation dose in phantom and patient studies.

Methods and Materials: A phantom was examined in volumetric mode on a 320-detector CT at different tube currents from 25 to 550 mA.s. CT images were reconstructed with AIDR and with FBP reconstruction algorithm. Image noise, contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) and spatial resolution were compared between FBP and AIDR images. AIDR was then tested on 15 CT examinations of the lumbar spine in a prospective study. Again, FBP and AIDR images were compared. Image noise and SNR were analysed using a Wilcoxon signed-rank test.

Results: In the phantom, spatial resolution assessment showed no significant difference between FBP and AIDR reconstructions. Image noise was lower with AIDR than with FBP images with a mean reduction of 40%. CNR and SNR were also improved with AIDR. In patients, quantitative and subjective evaluation showed that image noise was significantly lower with AIDR than with FBP. SNR was also greater with AIDR than with FBP.

Conclusion: Compared to traditional FBP reconstruction techniques, AIDR significantly improves image quality and has the potential to decrease radiation dose.

B-0988 14:09
Frequency‐combined extended 3D reconstruction for multiple circular cone-beam CT scans
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Purpose: In circular cone-beam CT a single circle-scan often does not cover the complete z-range of interest. If this is the case, two or more circle-scans are acquired. The standard combination of the separate reconstructions has two disadvantages: 1) The reconstructable volume is smaller than possible, thus dose remains unused and the noise level is higher than necessary. 2) The cone-beam artefacts are increased at the edges of the partial volumes which have a large distance to the midplanes.

Methods and Materials: To overcome these disadvantages we developed a method that simultaneously reconstructs all circle-scans and thereby is able to reconstruct larger segments from each circle scan and furthermore that reduces cone-beam artefacts by combining the segments in frequency domain. The proposed method was evaluated using a simulation study as well as measured data from different flat-panel cone-beam CT scanners, as for example the Varian OBI scanner.

Results: In the example geometry the maximal reconstructable z-range can be increased by 25% and our approach additionally leads to a noise reduction of about 30% in the overlap region. Regarding the cone-beam artefacts, we were able to reduce the artefact level to a value as low as achievable by more complex...
algorithms that perform a voxel-wise weighted backprojection to favours voxels seen under small cone-angles.

**Conclusion:** The proposed algorithm is able to significantly improve the reconstruction of sequence scans while the reconstruction time is kept equivalent to the standard approach. We further demonstrate that the method can be used in clinical practice.

**B-0989** 14:18

**Beam-hardening and scatter removal with empirical cupping correction for primary modulation (ECCP)**

R. Grimm1, R. Fahrig2, W. Hinshaw2, H. Gao3, M. Kachelriess1, 1Erlangen/DE, 2Palo Alto, CA/US (rainer.grimmer@imp.uni-erlangen.de)

**Purpose:** x-Ray CT measures the attenuation of polychromatic x-rays through an object. The x-ray spectrum may vary as a function of the detector position, e.g. due to the heel effect, or a bowtie, or a primary modulator is used to modulate the primary intensity. We propose a new approach that allows handling all these effects.

**Methods and Materials:** Our ECCP corrects for artefacts, such as cupping artefacts or ring artefacts, that are induced by non-linearities in the projection data due to spatially varying filtration of the x-rays. To do so, ECCP requires nothing but a simple scan of a homogeneous phantom of arbitrary shape. Based on this information, coefficients of a polynomial series are calculated and stored for later use to precorrect patient data. We combine ECCP with the primary modulation scatter correction (PMSC) [IEEE TMI 25 (12):1573-1587.2006] to demonstrate the ECCPs ability of correcting for spatially varying x-ray spectra, and to show that PMSC+ECCP is a highly efficient method to correct for scatter artefacts.

**Results:** ECCP is applied to measurements and completely removes cupping artefacts due to spatially varying filtration of the x-rays. To do so, ECCP requires nothing but a simple scan of a homogeneous phantom of arbitrary shape. Based on this information, coefficients of a polynomial series are calculated and stored for later use to precorrect patient data. We combine ECCP with the primary modulation scatter correction (PMSC) [IEEE TMI 25 (12):1573-1587.2006] to demonstrate the ECCPs ability of correcting for spatially varying x-ray spectra, and to show that PMSC+ECCP is a highly efficient method to correct for scatter artefacts.

**Conclusion:** ECCP is highly effective pragmatist approach to compensate for strong detector channel-dependent changes of the detected spectrum. In combination with PMSC we achieve image results nearly free of scatter and beam-hardening artefacts.

**B-0990** 14:27

**Exposition in CT-angiography: the impact of the new OPED algorithm in CT-angiography (CTA) - a phantom study**

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**Purpose:** The aim of this phantom study was to compare the quality of stenosis quantification for the novel OPED (orthogonal polynomial expansion on the disk) computed tomography reconstruction algorithm, which overcomes the radial decrease of image quality of the filtered back projection algorithm (FBP) with FBP.

**Methods and Materials:** To mimic stenosed abdominal vessels, acrylic tubes (inner diameter: small=4.0; large=6.5 mm) were filled with plastic material to create different degrees of stenosis and plaque composition (calcified (>1000 HU), soft (<50 HU), inhomogeneous [50-1000 HU]). Lumen was filled with water-diluted contrast material (Iomeprol, Bracco) to enhance the lumen to 330 HU. Vessel phantoms were inserted in an anthropomorphic Alderson phantom and imaging was conducted on a 64-slice MDCT (Sensation 64, Siemens; collimation 12x0.6 mm, tube voltage: 120 kV, effective tube current: 210 mAs). Images were reconstructed using OPED and the standard kernel B31f. Agreement of measured (2 readers in consensus) stenosis area was correlated to the known value using KappaLin-Test (xLin).

**Results:** A total of 428 stenosis measurements were performed. Correlation of the OPED algorithm was superior to FBP. In large vessels, correlation was perfect for both reconstruction algorithms (OPED=0.97; FBP=0.91). In comparison, correlation was perfect for small vessels (OPED=0.82; FBP=0.81; substantial). Overall, best correlation was observed in calcified plaques (OPED=xLin=0.91; FBP=xLin=0.90) compared to soft (OPED=xLin=0.79; FBP=xLin=0.75) and inhomogeneous (OPED=xLin=0.81; FBP=xLin=0.75) plaques.

**Conclusion:** In large vessel phantoms, representing pelvic and renal arteries, the dose efficiency is higher with the OPED reconstruction compared to the standard filtered back projection. In smaller vessel phantoms, representing intestinal arteries, quality of luminal delineation is already limited due to the spatial resolution.

**B-0991** 14:36

**Radiation dose and image quality at high-pitch CT angiography of the aorta: intra-individual and inter-individual comparison with conventional CT angiography**

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**Purpose:** Latest generation CT systems enable acquiring the entire torso at high-pitch. We evaluated radiation dose and quantitative image-quality parameters at high-pitch CT-angiography (CTA) of the entire aorta, compared to conventional CTA.

**Methods and Materials:** 110 patients (65 males, mean age 64±15 years) with CTA of the entire aorta were retrospectively included. All patients underwent CTA on a 2nd-generation dual source CT system, 50 of which in high-pitch mode. Main indications were suspected aortic syndrome (n=12), follow-up of aneurysm (n=37) or dissection (n=20), or post-aortic-repair (n=35). Mean arterial attenuation, signal-to-noise-ratio (SNR), contrast-to-noise-ratio (CNR), and figure-of-merit (FOM) were calculated at multiple aortic levels. A figure-of-merit (FOM) was computed to normalise the noise and CNR for each protocol to effective dose. Additionally, radiation exposure was compared.

**Results:** All studies were rated of diagnostic quality. At high-speed CTA, mean kV and mAs were 118±7 and 197±7, compared to 120±1 and 258±7 for conventional CTA (p < 0.05). Mean volume-CT-dose-index, dose-length-product, and dose-length-product index (DLP/L) were significantly lower in the high-pitch mode (p < 0.01), while the FOM was non-significantly higher. 20 patients underwent both high-pitch and conventional CTA. Radiation dose was reduced by 45% (p < 0.001).

**Conclusion:** High-pitch CTA of the aorta yields up to 50% reduction of radiation exposure as well as contrast medium savings with maintained vessel attenuation.

**B-0992** 14:45

**A temporal resolution improvement method for cardiac CT using 120º of projections: initial patient experience**


**Purpose:** To evaluate the effect of a temporal resolution improvement method (TRIM) for cardiac CT on diagnostic image quality for coronary artery assessment.

**Methods and Materials:** The TRIM-algorithm employs an iterative approach to reconstruct images from less than 180º of projections and uses a histogram constraint to prevent the occurrence of limited-angle artefacts. This algorithm was applied in 11 obese patients (7 men, 67.2±9.8 yrs) who had undergone 2nd generation dual source cardiac CT with 120 kV, 175-426 mAs, and 500 msec gantry rotation time. All data were reconstructed with a temporal resolution of 250 msec using traditional filtered-back-projection (FBP) and of 200 msec using the TRIM-algorithm. Contrast attenuation and contrast-to-noise-ratio (CNR) were measured in the ascending aorta. The presence and severity of coronary motion artefacts was rated on a 5-point scale (1=no motion, 5=non-diagnostic).

**Results:** Mean body-mass-index was 35.1±4.3 kg/m2. Average heart rate was 60±9 bpm. Mean effective dose was 13.5±4.6 mSv. When comparing FBP- and TRIM-reconstructed series, the attenuation within the ascending aorta (392±70.7 vs. 396.8±70.1 HU, p=0.182) and CNR (13.2±3.2 vs. 11.7±3.1, p=0.05) was not significantly different. A total of 11 coronary segments were evaluated. All studies were deemed overall diagnostic; however, there was a significant (p=0.002) difference in the occurrence and severity scores of coronary motion artefacts between FBP (mean=2.5) and TRIM (mean=2.0) reconstructions.

**Conclusion:** The TRIM-algorithm evaluated here allows clinically acceptable imaging of the coronary arteries despite 500 msec gantry rotation. Possible applications include improvement of cardiac imaging on slower gantry rotation systems or mitigation of the trade-off between temporal resolution and image noise in obese patients.

**Scientific Session**

**European Congress of Radiology 2012**
Full field image reconstruction in high-pitch dual source CT
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Purpose: The field-of-view (FOV) in high-pitch DCT is limited by the size of the second detector. The goal of this study is to develop and evaluate a full FOV image reconstruction technique for high-pitch DCT.

Methods and Materials: For reconstruction beyond the FOV of the second detector, raw data of the second system are extended to the full dimensions of the first system, utilising the partly existing data of the first system in combination with a very smooth transition weight function covering 50 detector channels. During the weighted filtered backprojection the data of the second system are applied with an additional weighting factor. This was tested for different pitch values from 1.5 to 3.5 on a simulated phantom and on 25 high-pitch DCT data-sets acquired at pitch values of 1.6, 2.0, 2.5, 2.8 and 3.0. (Definition, Siemens, Forchheim, G).

Results: Image quality was assessed by two radiologists using a 5-point Likert scale.

Conclusion: With this new image reconstruction technique full FOV images should be used up to a pitch of 2.0.

Detection of vascular map asymmetry in breast cancer using novel functional infrared imaging technique
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Purpose: Increased vascularity of the breast detected by MRI has been suggested as a marker for malignancy. Obtaining a breast vascular map requires contrast-enhanced injection during the examination. Here, we examined a non-invasive method for assessing vascular map density using a novel infrared imaging technique.

Methods and Materials: Ten patients with clinically proven cancer and 10 healthy volunteers were examined using a prototype system (RUTH Image, Real Imaging Ltd). Multiple 3D image series were acquired. Computerised image processing generated 3D vascular maps. A special algorithm was developed to assign a score function in infrared imaging technique.

Conclusion: The new IR RUTH imaging system is a promising tool for evaluating breast vascularity. Further trials should study more normal volunteers and patients as well.

Cardiac imaging: miscellaneous

Purpose: Coronary artery calcifications (CAC) represent a cardiac risk factor, with relevant diagnostic implications, occasionally discovered on non-gated multidetector chest CT. Despite their clinical importance, they are very often not recognised and correctly reported by radiologists. The aim of this study is to evaluate the possible detection of CAC on non-gated chest CT studies not performed for coronaries or cardiac evaluation, and also to analyse their reporting rate.

Methods and Materials: We retrospectively reviewed 500 non-gated chest CT (16 multidetector-CT unit; conventional dose protocol) performed from January to December 2010 in our hospital. As a first approach, the four main coronary arteries were evaluated with a visual score to assess the presence and size of CAC. Then, radiological reports were checked to evaluate if CAC were reported and if the correct lesions site was indicated.

Results: In all patients (223 females and 277 males; mean age 52±10 years old) the evaluation of CAC was feasible. We recognised the presence of CAC in 215/500 comparative reconstructions were produced using the standard filtered back-projection (FBP) algorithm.

Results: EST reconstruction with S12 projections has a signal-to-noise ratio comparable to FBP reconstruction with 2000 projections. No resolution or contrast degradation between tumour and normal glandular tissue is observed. Radiologist assessments blinded to the reconstruction parameters confirmed that the EST S12 reconstruction is superior to FBP. The mean glandular dose was estimated to be 2.3 mGy for the full volume EST reconstruction, which is less than the average dose in a dual-view screening routine exam.

Conclusion: Our results suggest that the EST method enables to reduce the radiation dose in phase contrast CT by 75% without sacrificing image quality. This study is an important step towards the clinical implementation.

Human medical imaging with reformed x-ray interferometry using a practical x-ray tube: a preliminary study with normal volunteers
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Purpose: To evaluate the image characteristics in normal volunteers obtained by reformed x-ray interferometry which uses a practical x-ray tube.

Methods and Materials: Reformed x-ray Talbot interferometry following the theory of Lau in which a practical incoherent x-ray source is used, i.e., Talbot-Lau interferometry was created based on a design with wave-optic simulation. In this system, source grating which consists of multiple slits of 10 μm or less in width, arranged periodically, is placed immediately after an incoherent x-ray source. Each slit emits coherent x-ray and if the pitch of the grating is set appropriately, an x-ray source with coherent light and enough power can be achieved due to the Lau effect. Since this system does not require either a synchrotron or a microfocus x-ray tube, the medical application of x-ray interferometry may be feasible. After confirming that the system worked with parts of human cadaveric bodies, we started to image parts of normal volunteers, such as the finger and hand under the approval of the university ethics committee. The resulting images were correlated with known macroscopic anatomical findings.

Results: Certain components of the finger and hand, such as ligaments, tendons and cartilage, which are scarcely seen by conventional x-ray imaging, were clearly depicted by this new system as expected through the ongoing work with human cadavers.

Conclusion: This new imaging technology may become clinically applicable. Further trials should study more normal volunteers and patients as well.
Progression of coronary artery calcifications during the first year after renal transplantation
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Purpose: Cardio-vascular disease (CVD) is the most common complication after kidney transplant (KTx) and coronary artery calcifications (CAC) are claimed to play a key role. Scanty and contradictory results have been produced on this topic. In the present study, we looked at the CAC progression, evaluated according to Sevrukov’s criteria, during the first year after KTx.

Methods and Materials: 86 consecutive KTx patients were evaluated within 3 months after KTx for CAC evaluation with CT. In 79 patients we repeated the CAC evaluation after 1 year. In 8 patients who did not perform the second control because of any clinical reason. The Agatstone score (AS) values and changes were put into relationship with the main biochemical and clinical variables, using univariate (UA) and multivariate analysis (MA).

Results: At basal evaluation 48/86 (56%) had significant AS values. The basal AS values were related only to the age of the patient, at either UA or MA (p < 0.0001). After 1 year, 8/79 (10.1%) patients significantly worsened their AS values, while the remaining 71 did not. No significant relationship was found between any clinical, instrumental or laboratory data and worsening of AS, nor there was any relationship of worsening in AS with any change in renal function.

Conclusion: The presence of CACs is a frequent finding at time of KTx. A worsening of CAC is also observed. However, the clinical meaning of this finding is equivocal and we need larger studies before deciding whether the CAC assessment is worth-doing on a routine basis.

B-0998 14:18

Sport category is an important determinant of cardiac adaptation: an MRI study

Purpose: Physiologic cardiac adaptation in athletes is influenced by body surface area, gender, age, training intensity and sport type. This study assesses the influence of sport category and provides a reference framework for physiologic limits by sport category and gender.

Methods and Materials: 381 subjects (mean age 25±5 years, range 18-39, 61% men) underwent a cardiac MRI (CMR) investigation: 114 healthy non-athletes (≤3 hours weekly exercise) and 267 healthy elite athletes (mean 17±6.6 hours weekly exercise). Athletes performed either low dynamic-high static (LD-HS, n=42), high dynamic-low static (HD-LS, n=144) or high dynamic-high static sports (HD-HS, n=81).

Results: The left ventricular (LV) end-diastolic volume (EDV) (ml/m²) for non-athletes/LD-HS/LD-LS/HD-HS, respectively, was 47/49/57/69 for males and 34/38/42/51 for females. Athletes’ EDV/EDDM ratios were not larger than in non-athletes, disproving selective ventricular wall thickening. LV/RV EDV ratios were similar in all groups (males/females range 0.90-0.92/0.90-1.01). Multivariate linear regression demonstrated a highly significant contribution of sport category with coefficients larger than that of training hours, gender and age (p < 0.01, LV EDV/EDDM coefficients for sport category LD-HS 6.0/7.5, HD-LS 16.7, HD-HS 21.17).

Conclusion: This study demonstrates balanced cardiac adaptation for all sport categories, with preserved ratios of LV volume/LV wall mass and LV/RV volume. Sport category has a large impact on cardiac adaptation. HD-HS sports show the largest changes, whereas LD-HS sports show dimensions similar to non-athletes. This study’s results can serve as a reference in clinical practice.
diffusion of water molecules in biological tissues. In this work, we present a multi-scale visualisation technique based on DT-MRI streaming capable of uncovering additional properties of the architectural organisation of the heart.

Methods and Materials: We selected the John Hopkins University (JHU) Canine Heart Dataset, where the long axis cardiac plane is aligned with the scanner’s Z-axis. Their equipment included a 4-element array coil emitting a 1.5 T. For DTI acquisition, a 3D-FSE sequence is applied. We used 200 seeds for full-scale tractography, while we applied a MIP mapping technique for simplified tractographic reconstruction. In this case, we reduced each DTI 3D volume dimensions by order-two magnitude before streamlining.

Results: Our simplified tractographic reconstruction method keeps the main geometric features of fibres, allowing for an easier identification of their global morphological disposition, including the ventricular basal ring. Moreover, we noticed a clearly visible helical disposition of the myocardial fibres, in line with the helical myocardial band ventricular structure described by Torrent-Guasp. Finally, our simplified visualisation with single tracts identifies the main segments of the helical ventricular architecture.

Conclusion: DT-MRI makes possible the identification of a continuous helical architecture of the myocardial fibres, which validates Torrent-Guasp’s helical myocardial band ventricular anatomical model.

B-1005 15:12
Non-invasive cardiac vein mapping: role of MDCT-CA
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Purpose: Coronary venous anatomy is of primary importance when implanting a pacemaker or a defibrillator device because coronary sinus can be enlarged or stenosed depending on chronic heart failure. The aim of this study is to evaluate the usefulness of MDCT-CA in describing the coronary venous tree and in particular the coronary sinus and detecting main venous system variants.

Methods and Materials: 301 consecutive patients (196, mean age 63.74 YO) studied for coronary artery disease with 64 slice MDCT-CA were prospectively examined. The cardiac venous system was visualised using 3D, MPR, cMPR and MIP post-processing reconstructions on an off-line workstation. For each patient image quality, presence and calibre of the coronary sinus (CS), great cardiac vein (GCV), middle vein (MV), anterior interventricular vein (AIV), lateral cardiac vein (LCV), posterior cardiac vein (PCV), small cardiac vein (SCV) and presence of variant of the normal anatomy were recorded.

Results and Conclusion: CS, GCV, MV and AIV were visualised in 100% of the cases. The LCV was visualised in 25/301 (84%) patients, the PCV in 248/301 (83%) patients and the SCV in 69/301 (23%) patients. Mean diameter of the CS was 8.69 mm in 276/301 (91.7%) patients without chronic heart failure and 9.93 mm in 25/301 (8.3%) patients chronic heart failure.

B-1006 15:21
Accelerated cine imaging of the heart in mice at 9.4 T: comparison of retrospectively self-gated and prospectively triggered FLASH sequences
P. Fries, J. Streoder, A. Mueller, A. Masemann, R. Seidel, G. Schneider, A. Buecker; Hamburg/DE (dpeterfries@googlemail.com)

Purpose: To compare prospectively triggered FLASH (PT) with retrospectively self-gated (RSG) and accelerated retrospectively self-gated FLASH (accRSG) cine sequences for the assessment of cardiac function in mice at 9.4 T.

Methods and Materials: 10 C57/Bl6 mice were examined on a 9.4T animal scanner (Bruker Biospec, Germany). We acquired 6 consecutive 1 mm short axis slices covering the left ventricle (LV) using a PT (TR/TE=5.7/1.1, α=20°, FOV=2.5x2.5cm, matrix=256x256, frames=20, PI=1), a RSG (TR/TE=5.6/1.5, α=20°, FOV=2.5x2.5cm, matrix=256x256, frames=20, PI=1), and an accRSG (TR/TE=5.6/1.6, α=20°, FOV=2.5x2.5cm, matrix=160x160, cardiac frames=20, PI-GRAPPA=2). Two readers independently evaluated the different datasets in a blinded manner (twice, separated by 6 weeks) regarding LVEDV, LVEVF, SV, EF, cardiac output (CO) and myocardial mass (MyoM). Total acquisition times (TA) for the complete examination of the heart were assessed for each sequence. Statistical analyses included a one-way ANOVA with Bonferroni multi-comparison test (p < 0.05) and Bland-Altman analyses for the assessment of intra- and inter-observer variability.

Results: There were no statistically significant differences between the different imaging approaches for all cardiac parameters (LVEDV (PT/RSG/accRSG (mean): 49.13/52.44/49.71 ml, p=0.06), LVEVF (18.18/18.13/16.88%, p=0.26), SV (30.75/34.31/32.86%, p=0.06), EF (63.16/66.96/60.0%, p=0.07), CO (12.9/14.2/14.3 ml/min, p=0.07) and MyoM (67.66/68.28/8.4 mg, p=0.08). TA was significantly reduced for accRSG (8.00±0.05 min, p=0.001) compared to PT (mean/SD: 19.24±4.41 min) and RSG (16.45±4.10 min).

Conclusion: Cine MRI with accRSG allows for an assessment of cardiac function in mice within 8 min while providing the same quantitative data as conventional PT and RSG FLASH sequences. This approach allows an expedition of MR studies in cardiovascular disease models.
S363

V.A. Dussaux, P. Boiron; from the cloud: the greater Paris area experimentation RIS, PACS and archiving of images services and beyond delivered in breast MRI: systematic investigation identifies high potential to stratify survival outcome in primary breast cancer

M. Dietzel, A. Dietzel, R. Zoubi, O. Camara, M. Bogdan, W.A. Kaiser, P.A.T. Baltzer; †Jena/DE, ‡Tübingen/DE (dietzelmattiasf@gmail.com)

Purpose: Application of breast-MRI as a prognostic-biomarker remains challenging due to the multitude and complexity of information provided by one single examination. Machine-learning is a potential method to classify such data. Accordingly, we designed this investigation to systematically evaluate the potential of machine-learning algorithms to predict overall-survival of breast-cancer patients based on breast-MRI findings.

Methods and Materials: Patients receiving breast-MRI (standardised protocol: T1w-FLASH; 0.1 mm/kgBW, Gd-DTPA) before surgery (Bi-RADS IV-VI; no secondary/recurrent-cancer) were enrolled, treated and followed-up at our breast-cancer-centre. “Disease-related death” was defined as endpoint. A commercially available CAD-system (computer-assisted diagnosis) was used to semi-automatically evaluate 14 enhancement-parameters of the primary breast-cancer upon breast-MRI. Three machine-learning algorithms (artificial-neural-networks, k-nearest-neighbour, support-vector-machines) were optimised to predict the endpoint based on such enhancement-parameters. Predictions of the endpoint were compared with conventional-statistics (logistic-regression). To automatically optimise and validate (5-fold-crossvalidation) these classification-algorithms an in-house developed framework was used.

Results: 338 patients with primary invasive breast-cancer were enrolled (mean-age: 57.7 years). During a mean follow-up interval of 42 months “disease-related death” was defined as endpoint. A conventional-statistics and shows high specificity and negative-predictive-value (artificial-neural-networks: 94.3%, k-nearest-neighbour: 94.3%, support-vector-machines: 89.7%). Machine-learning showed particularly high specificity (artificial-neural-networks: 94.1%, k-nearest-neighbour: 94.3%, support-vector-machines: 89.7%).

Conclusion: Machine-learning is a promising method for the individual risk-stratification of patients with primary breast-cancer. According to our results, it is superior to conventional-statistics and shows high specificity and negative-predictive-value to stratify the endpoint “disease-related death”.

B-1007 14:00

Combination of machine learning and computer-assisted diagnosis in breast MRI: systematic investigation identifies high potential to stratify survival outcome in primary breast cancer

B-1008 14:09

RIS, PACS and archiving of images services and beyond delivered from the cloud: the greater Paris area experimentation

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Purpose: The “Région Sans Film” (“Filmless Region”) programme was launched in 2009 by the French Ministry of Health in order to help the generalisation to all healthcare structures, such as hospitals or general physician practices of PACS, RIS and systems of archiving of medical images. Recent achievements prove the concept of the delivering of such services from the cloud, after that both building of the platform of services and pilot phases of the program were completed. Moreover, new services of sharing of information are proved possible.

Methods and Materials: The services are delivered by means of a platform whom building and running has been confided to an industrial consortium. This platform implements the latest technologies of medical image processing and of cloud computing. It is built in order to support service-oriented enterprise architecture.

Results: The platform is innovative being the first one containing all the materials for the implementation of PACS services in the cloud, allowing for each healthcare structure to open these services beyond its borders. The platform has just been validated by the health structures involved in the pilot phase and the programme has entered industrial deployment phase. Additionally, new SuperPACS-like services are proposed, including access to the images produced in hospitals to the GPs and sharing of radiological advices services/workflows.

Conclusion: This also opens new opportunities for the implementation of new business processes/services such as teleradiology. By these means, the exercise of real filmless radiology can be more widely achieved.

B-1009 14:18

Are you keeping up to date? Over half of important radiological research is published in non-radiological journals

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Purpose: It is important for radiologists to practice evidence-based medicine, and identifying the latest research is crucial. With the growth in medical journals and the body of knowledge, radiologists need to be aware of strategies to identify up-to-date publications. We perform a bibliometric analysis to determine the range of journals where radiological research is published.

Methods and Materials: The 20 radiological journals with the highest impact factors were identified through the 2010 Journal Citation Reports. Systematic reviews over a 6-year period were retrieved and the primary studies constituting the systematic reviews were compiled to provide a database of high-quality unique publications. These were classified into four categories: 1. radiology journals 2. clinical sub-speciality journals 3. general medical journals 4. others.

Results: 101 systematic reviews were analysed and 1750 primary studies retrieved. These were classified as follows: 775 (45%) were published in radiological journals, 881 (50%) in clinical sub-speciality journals, 56 (3%) in general medical journals, and 38 (2%) in other journals. Amongst radiological journals, radiology had the highest number of original studies cited, with 179 (10%).

Conclusion: More than half of important radiological research is published in non-radiological journals. This can be explained by some clinical specialty journals having impact factors higher than radiology journals, collaboration between referring physicians and radiologists, and increasing involvement of referring physicians in directly acquiring imaging studies. The scatter of radiological research across a broad range of journals means that browsing selected radiological journals is not sufficient to keep up to date.

B-1010 14:27

Evaluation of pulmonary nodules on chest CT using iPad2®: preliminary experience

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Purpose: To evaluate the effectiveness of the iPad2® as a mobile device for 2D reading of chest CT datasets for the assessment of pulmonary nodules.

Methods and Materials: We retrospectively reviewed 28 chest CT examinations performed in patients with pulmonary nodules, for a total of 325 nodules sized between 2 mm and 34 mm. CT images had been acquired using a 64-row CT and 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 (Mac® 3.06GHz) connected to our hospital PACS and running OsiriX 3.9. Two experienced raters read CT datasets independently on the iPad2® and on the iPad®. Detection rate and segmental localisation of lesions were recorded for each dataset, as well as the time needed for complete reading of each chest CT examination. Image quality was also visually assessed using a three-point scale (1=poor, 2=fair, 3=good).

Results: All nodules detected on the iPad® were also identified on the iPad2®, and their segmental localisation was correctly assessed in 100% of cases. Image quality was good with both devices and image reading time was comparable between them (4.72±2.33 minutes for the iPad2® vs 5.14±2.56 minutes for the iPad®; p>0.05).

Conclusion: The iPad2® can be successfully used for preliminary 2D reading of chest CT datasets in patients with pulmonary nodules, as well as for image sharing with non-radiology specialists and for teaching purposes.

B-1011 14:36

An ontology of magnetic resonance imaging sequences

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Purpose: The goal of this ontology is to improve the semantic interoperability for MRI sequences. Indeed every constructor has his own sequence name that could be unknown by radiologists or even PACS.

Methods and Materials: Concepts and definitions of MRI sequences had been extracted from domain experts, DICOM standard, DICOM headers and literature. DICOM headers had been extracted with OSIRIX. All those data had been organised with Protégé 4 owl2. The linkage between concepts had been made with relations and formal definitions.
Scientific Session

B-1012 14:45

Considerations for sharing radiology reports and images on a national level in Luxembourg

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Purpose: The exchange of radiology reports and images on a national level demands, in comparison to the exchange in ordinary in-house systems, additional and higher security requirements concerning data protection. In any case the communication should rely on current standards. The problem that has to be faced is the identification of gaps in these standards that arise from the shift into the national context.

Methods and Materials: Communication with the national platform will be mainly based on the IHE XDS/XDS.I and PIX profiles, using document repositories for the storage of the reports and image-manifest files and a registry service for the storage of document references plus additional meta data. To protect data inside the repository against intentional or accidental misuse, it needs to be stored encrypted.

For the protection of the document references and meta-data, this information has to be stored de-identified. A trusted third party provides the de-identification. It allows the separation of demographic data from its pseudonym, which is never known in the in-house systems. If data are accessed, the trusted third party will also act as a rekey service for the individually used encrypted encryption keys.

Conclusion: The proposed national exchange platform combines the use of IHE profiles with additional security features like de-identification and encryption through the use of an additional connector component.

B-1013 14:54

Dedicated workflow solution to facilitate consistent, reproducible, and efficient patient monitoring in oncological trials and routine

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Purpose: We introduce a new and dedicated software system to manage oncological workflows. The working concept has been developed from ground up and optimised conducting clinical studies, automated overall response evaluation, and criteria adaptation among radiologists. Improved training in reporting during the radiology training did not alter the result. Radiologists still preferred the prose reporting style, citing familiarity with this style of reporting. Most clinicians preferred itemised radiology reports as they felt that these reports were clearer and easier to comprehend. 80% of radiologists vs 58% of clinicians were satisfied with the itemised format of the radiology report and contents.

Methods and Materials: Questionnaires were sent out to all clinicians from various departments and radiologists practicing within Khoo Teck Puat Hospital, Singapore. The participants were invited to rank a variety of hypothetical ultrasound and computed tomography scan reports according to their level of satisfaction and provided reasons for their choices. Demographic information regarding the participants was obtained in the questionnaire.

Results: A total of 30 radiologists and 92 clinicians responded. 75% of clinicians vs 50% of radiologists were satisfied with the itemised report for an abnormal ultrasound scan (p < 0.05). 80% of radiologists vs 58% of clinicians were satisfied with the prose report for an abnormal ultrasound scan (p < 0.05). In general, most radiologists still preferred the prose reporting style, citing familiarity with this style of reporting. Most clinicians preferred itemised radiology reports as they felt that these reports were clearer and easier to comprehend.

Conclusion: Itemised reports are more popular with referring clinicians due to clarity. Prose reports foster a lack of standardisation of content among different radiologists. A shift in paradigm to itemised reporting will make for faster, more consistent radiology reports that facilitate complete documentation of information and measurements. Changing the way radiology reports are structured requires adaptation among radiologists. Improved training in reporting during the radiology training residency is de rigueur to familiarise radiologists with a new style of reporting.

B-1014 15:03

Managing IT services in a completely digitised radiological department with an in-house departmental IT group: a 7-year follow-up experience

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Purpose: To evaluate the performance of a departmental information technology (IT)-group compared to hospital-IT and system manufacturer’s support in a completely digitised radiological department based on seven years of experience. The potential to reduce manufacturer’s service and to manage unknown IT-problems were investigated.

Methods and Materials: The departmental IT-group maintains the radiology information system (RIS) and picture archiving and communication system (PACS) using an intranet-based reporting system. IT-problems are specified according to urgency, responsibility and affected system. New RIS/PACS and a speech recognition system were installed. The performance and mean time for troubleshooting by the different providers were evaluated.

Results: In 90 months, 14681 IT-problems emerged, 96.5% were solved by the departmental IT-group (82.6% within the time limit), with high solution rates for breakdowns of the clinical information systems (81.4%), standard hard- (84.1%), and software (including RIS, 91.9%) and acceptable solution rate for PACS (78.0%) and imaging devices (58.7%). 1073 cases (7.3%) required a troubleshooting within 2h (40.6% solved within 30 min by departmental IT-group). In 6.7% of the cases manufacturer’s support was indispensable. Over time the total amount of IT-problems decreased by up to 73.2% for emergency and very urgent problems but increased for problems of lower urgency. The implementation of new RIS/PACS led to a short increase in the total number of IT-problems though those problems mostly were of low priority.

Conclusion: A departmental IT-group provides fast troubleshooting, solving a considerable proportion of occurring and even new IT-problems, necessitating manufacturer’s support only in a small number of cases.

B-1015 15:12

Itemised or prose radiology reports? A survey of hospital clinicians and radiologists’ preferences

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Purpose: To determine clinicians’ and radiologists’ preferences regarding the format of the radiology report and contents.

Methods and Materials: Questionnaires were sent out to all clinicians from various departments and radiologists practicing within Khoo Teck Puat Hospital, Singapore. The participants were invited to rank a variety of hypothetical ultrasound and computed tomography scan reports according to their level of satisfaction and provided reasons for their choices. Demographic information regarding the participants was obtained in the questionnaire.

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B-1016 15:21

A web-based documentation system with exchange of DICOM RT data for multicenter clinical studies in particle therapy

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Purpose: Conducting clinical studies is rather difficult because of the large variety of voluminous datasets, different documentation styles, and various information systems, especially in radiation oncology.

Methods and Materials: We developed a web-based documentation system for transnational and multicenter clinical studies in particle therapy. 550 patients
have been treated at the Heidelberg Ion Therapy (HIT) centre from November 2009 to August 2011. Protons, carbon ions or a combination of both, as well as a combination with photons were applied. To date, 12 studies have been initiated and more are in preparation.

Results: It is possible to immediately access all patient information and exchange, store, process, and visualise text data, any DICOM images and multimedia data. Accessing the system and submitting clinical data are possible for internal and external users. Security and privacy protection is ensured with the encrypted https protocol, client certificates, and an application gateway. Furthermore, all data can be pseudonymised. Integrated into the hospital environment, data are imported via interfaces over HL7-messages and DICOM. Several further features replace manual input and ensure data quality and entirety. Studies can be individually designed to fit specific needs. By including all treated patients (also non-study patients), we gain the possibility for overall large-scale, retrospective analyses.

Conclusion: Having recently begun documentation of our first 300 patients in six clinical studies, it has become apparent that the benefits lie in the simplification of research work, better study analyses quality and ultimately, the improvement of treatment concepts by evaluating the effectiveness of particle therapy.