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Angaben sind im Einzelfall auf ihre Richtigkeit zu
überprüfen.

Comparison of islet rejection rate in syngeneic, allogeneic and xenogeneic grafts in rat using quantification of iron oxide labelling by 3D radial dUTE MRI

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Purpose: In-vivo 3D difference ultra-short echo time (dUTE) imaging gives quantitative positive contrast images for serial examination of iron-oxide labeled islet cells transplanted in rat to enable quantification of rejection.

Methods and materials: Rats had syngeneic (Sprague-Dawley, n = 12), allogeneic (Lewis/Wistar, n = 5) or xenogeneic (Lewis/Human, n = 7) grafts after either normal cell incubation, or magnetofection, with ferucarbotran. 3D UTE imaging gives high signal from all species, including very short T2* cells. A second echo is subtracted (after short T2* decay) resulting in positive contrast from cells and nulled liver signal. Image parameters: Siemens 3T clinical scanner, wrist coil, baseline (day after surgery) up to 146 days, isotropic resolution 0.35 mm, 120 mm FOV, 35000 projections, TE(1)/TE(2)/echo-spacing/FA = 0.07 ms/5.7 ms/9.6 ms/10°, respiratory triggering via pressure pad and input (SA Instruments Inc., USA), trigger delay 150 ms, 6 min scan. Quantitative assessment included automatic segmentation of islet clusters. Exponential fit of data for each graft type was normalized to the initial scan.

Results: Both allogeneic (rate constant 0.03) and xenogeneic (rate constant 0.05) grafts show significant cell loss over 42 days (R2 >0.9), unlike stable syngeneic grafts, as expected from rejection mechanisms. Rate of decay does not depend on number of islets. After normalization, decay rates for each graft are significantly different (p <0.03).

Conclusion: The success of islet grafts, effect of labeling techniques and loss of islets can be quantified and monitored using 3D radial UTE. This shows promise for monitoring islet graft survival and the effect of immunosuppression in animal models and is directly applicable to clinical protocol.

Does quantification of T2 SNR decrease after USPIO administration allow differentiation between benign and malignant normal sized pelvic lymph nodes?

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Purpose: Lymphotropic USPIO visualized by signal decrease occurring on T2/T2* sequences may improve detection/differentiation of metastatic lymph nodes in patients with prostate/bladder cancer. The aim was to quantify lymph node signal decrease to assess whether a cut-off value might be defined to differentiate benign from malignant normal sized pelvic lymph nodes.

Materials and methods: 52 patients with histological proven bladder/prostate cancer were examined on a 3T MR-unit (Siemens TRIO) before and 24–36 hours after USPIO. Lymph node signal intensity (SI) quantification was performed on a 3D-T2w-TSE SPACE sequence (TR = 640 ms, TE = 47 ms, bandwidth = 465 Hz/pixel, isotropic voxels = 1 mm³) on pre- and post-contrast images. Mean signal-to-noise ratios (SNR) were measured three times choosing the largest diameter in axial orientation. Extended lymphadenectomy was performed in all patients allowing histopathological correlation.

Results: A total of 2060 lymph nodes were resected. 320 of these (57 inguinal; 263 iliacal) were assessed for their respective signal decrease. In proven malignant lymph nodes signal intensities (1 ± 14.5%) and SNR (2.5 ± 21%) remained unchanged, while benign lymph nodes presented a mean SI-decrease of 20% ± 23.8% (inguinal) and of 24.4 ± 31.3% (iliacal). SNR-decrease differed significantly (p = 0.038) between inguinal (3.4 ± 55.4%) and iliacal (24.8 ± 14.5%) benign lymph nodes. No minimal cut-off value for signal-decrease allowing attribution of malignancy could be defined. Overlap of SNR changes depended on lipomatosis, partial-volume effects, histiocytosis and focal hyperplasia within lymph nodes.

Conclusion: Quantification of SNR/SI-decrease qualifying uptake of lymphotropic USPIO is not sufficient for staging of normal sized lymph nodes. Additional criteria such as morphology, fatty content or localisation of lymph nodes must be considered.

Qualitative and quantitative evaluation of liver fat content on IP/OP- and fat-only-images derived from single-breathhold 3D liver MRI compared to histopathology

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Purpose: To evaluate a single-breathhold 3D spoiled gradient-dual-echo (3D SPGR-DE) magnetic resonance imaging (MRI) sequence in the quantification of liver fat content (LFC) in patients with the suspicion of fatty liver disease using histopathology as the reference standard.

Methods and materials: Thirty-four patients (15 women; mean age, 67 ± 13 years) underwent hepatic 1.5-Tesla 3D SPGR-DE imaging yielding for in-/out-of-phase (IP/OP) as well as fat-signal-only images. All patients underwent subsequent biopsy with histopathological measurement of total and macrovesicular LFC. Two radiologists independently classified LFC visually using a 4-point grading scale for IP/OP and fat-only images. Additionally fat signal fractions (FSF) were calculated from measured signal intensities on IP/OP (FSFip/op) and fat-only images (FSFfat-only). Inter-reader agreement (kappa-statistics) was performed. Relationship between FSF and LFC as measured by histopathology was analysed by Pearson correlation analyses and student's t-test.

Results: Histopathology revealed steatosis in 29/39 (74%) segments in 15/23 patients (65%) with total LFC ranging from <5 to 90%. Inter-reader agreement for visual steatosis grading was moderate (k = 0.53) regarding IP/OP imaging and good for fat-only images (k = 0.68). FSF calculated from IP/OP and fat-only images were significantly correlated with LFC measured with histopathology. Significant difference was found between both FSF measurements and total LFC, whereas no significant difference was found between FSFfat-only and macrovesicular LFC.

Conclusion: FSFfat-only and FSFip/op derived from single-breathhold 3D SPGR-DE MRI allow for the discrimination of healthy and fatty liver, whereas both mostly reflect the macrovesicular as opposed to the total LFC from histopathology. Consideration of fat-only images may improve interreader-agreement in visual steatosis grading.

Long-term results of MR-guided radiofrequency ablation of liver metastases

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Purpose: In this retrospective study survival of patients with colorectal liver metastases (CRLM) treated by percutaneous radiofrequency ablation (RFA) was analyzed.

Methods and materials: In 32 patients (22 male, 10 female; age: 61 ± 11 years) with 63 CRLM an MR-guided RFA was performed using an open 0.2T MR-System (Magnetom Open, Siemens, Erlangen, Germany). For RFA, either a MR-compatible cluster needle (Covidien, Valleylab, Boulder, CO, USA; Celon AG, Teltow, Germany) or an expandable needle electrode (Angiodynamics, Queensbury, NY, USA) was used. Chemotherapy or surgical resection of liver metastasis was performed in 29 and 22 patients respectively. The technical success of RFA, diameter of metastases and median survival after initial diagnosis was assessed.

Results: Overall, 52 of 63 metastases (DM 3.4 ± 1.9 cm) were treated with RFA. A median of 1 (range 1–4) therapy sessions was conducted per patient. Of 52 treated metastases, 38 (73%) showed complete necrosis. After 1st, 2nd, 3rd and 4th ablation session 25 of 32 (78%), 9 of 11 (82%), 4 of 7 (57%) and 0 of 2 (0%) metastases showed complete necrosis. Minor sideeffects were observed in 9/32 patients. In 9/32 patients a residual tumour, and in 10/32 patients a local recurrence was observed. A recurrent primary tumour was observed in 2/32 patients, 12/21 patients were tumour-free at last available follow-up. Mean survival after initial diagnosis was 50.5 ± 26.5 months (median 44.2; range 14.8–108.0 months).

Conclusion: Combined with resection of liver metastasis and chemotherapy, percutaneous MR-guided RFA of CRLM is an effective therapy that provides prolonged survival as compared to historic controls.

Validation of software assisted small bowel motility analysis

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Purpose: MR analysis of motility is a new technique to identify and localize functional pathologies of the small bowel. Besides visual analysis, quantification of motility has been suggested to describe various gastrointestinal pathologies. The aim of this study was to validate a newly developed software prototype (Motasso) permitting semi-automatic measurement of small bowel diameter over time thus displaying motility.

Methods and materials: 52 consecutive clinical patients with a total of 110 bowel sections were included in this retrospective analysis. All patients were referred for the evaluation of small bowel pathologies. The preparation consisted of an oral uptake of 1000 ml of 3% Mannitol. MRI was performed on a 1.5-Tesla MR-system using a coronal 2D trueFISP cine-sequence (TR/TE 2.84/1.9; matrix 256 × 256, slice thickness 10 mm, repetition time 500 msec). Manual small bowel peristalsis measurements were compared with results from the Motasso software using the paired Student's t-Test.

Results: In 110 segments both the measurements by hand and by computer were exploitable. Overall 97/110 (88.2%) of the motility curves were in agreement with each other with 86/110 (78.2%) presenting a parallel shifting of both curves. No significant difference ($p = 0.65$) was found for the peristaltic frequencies with mean values of 4.06/min (manually) and 4.09/min (semi-automatic), while the amplitudes differed significantly ($p = 0.011$) with 4.58 mm (± 3.22) manually and 5.03 mm (± 3.45) using the software.

Conclusion: Motasso software is a valuable tool for fast, standardized and accurate quantitative measurement of small bowel motility. Feasibility could be proven for various small bowel loops without significant differences between the analysis by hand and computer.

Optimizing CT-urography: Split-bolus technique and coughing prior to acquisition

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Purpose: To systematically evaluate the impact of coughing, compression and coughing and compression combined on ureteral opacification and distension in split-bolus CT-urography with nephrographic and late phase imaging.

Methods and materials: 60 consecutive patients were prospectively enrolled and split up into 3 groups (coughing prior to scan, external compression, coughing + external compression). 7 patients had to be excluded. 4.5 min and 10 min post contrast media injection a multislice CT was performed in all patients. 2 experienced radiologists reviewed excretory images and performed quantitative measurements of urinary tract distension and qualitative measurements of urinary tract opacification.

Results: Coughing during nephrographic phase provided significantly better opacification of the proximal and distal ureter compared to combined coughing/compression and compression alone (each $p < 0.01$), furthermore coughing during nephrographic phase yielded slightly higher values than all techniques in late phase but not statistically significant. On the other hand combined coughing and compression showed slightly higher distension values in both phases though these results were not significant ($p > 0.5$) either. Interobserver agreement was generally high with 0.96 for opacification and 0.90 for distension.

Conclusion: Coughing combined with split-bolus CT-urography provides improved ureteral opacification already during the nephrographic phase with the additional benefit of reduced radiation exposure as late phase imaging is not necessary.

The value of diffusion weighted MR-imaging for the characterisation of the sonographically indeterminate adnexal mass

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Purpose: To prospectively evaluate the utility of diffusion weighted MR-imaging (DWI) for the characterisation of indeterminate adnexal masses at transvaginal ultrasound.

Methods and materials: 40 gynaecological patients with 61 indeterminate adnexal masses at ultrasound were preoperatively referred for MRI of the pelvis. MRs including DWI were performed on a 1.5T Siemens Avanto scanner. Qualitatively the signal of solid and cystic components of the tumours were evaluated on T2w- and b = 800 DWI. In addition, quantitative apparent diffusion coefficient (ADC) measurements were obtained by placing a region of interest (ROI) on ADC maps in solid and cystic areas of the indeterminate lesions. For better anatomic correlation, DWI images were fused with the T2w sequences using MR Fusion software. Where available, results were compared with histopathology.

Results: 7 lesions were diagnosed as malignant and 41 as benign. 13 masses were excluded secondarily due to lack of ADC values or histological correlation. Diagnostic accuracy of MRI attained 97%; sensitivity 97% and specificity 100%. ADC values differ significantly between malignant ($n = 7$) and benign adnexal tumours ($n = 4$; 923 ± 126 vs. $611 \pm 167 \times 10^{-5}$ mm²/s; $p = 0.03$). ADC values of benign teratomas were significantly lower than those of malignant lesions (922 ± 16 vs. $111 \pm 21 \times 10^{-5}$ mm²/s; $p = 0.04$). Both fibrothecomas ($n = 6$; 871 ± 154 ; $p = 0.013$) and teratomas ($n = 6$; 597 ± 154 ; $p = 0.00072$) yielded significantly lower ADC values compared to all other benign lesions ($n = 29$; 1847 ± 167).

Conclusion: DWI combined with conventional MRI provides additional information for characterization of adnexal masses and thus improves radiologist's confidence in image interpretation.

Non-invasive detection of prostate cancer using conventional T2-weighted MRI combined with diffusion-weighted MRI

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Purpose: To evaluate the diagnostic accuracy of T2-weighted MRI in comparison with diffusion-weighted MRI (DW-MRI) in the detection of prostate cancer.

Methods and materials: Thirty seven male patients (median age: 62 years) with biopsy-proven prostate cancer were examined preoperatively on a 3T MR-unit. High resolution T2-weighted images and EPI DW-MRI with 3b-factors (0, 500, 1000 sec/mm²) were acquired. Image analyses based on qualitative (visibility on T2-/DW-MRI using a 3-point scale) and quantitative criteria (ADC-measurement) were performed by two readers in consensus. Tumour was defined as hypointense lesion compared to the surrounding tissue on T2-weighted images and on ADC-maps. An ADC-threshold value of 1.10×10^{-3} mm²/s was used to differentiate benign from malignant lesions. Tumour localization was evaluated on T2-weighted images and DW-MRI separately and correlated with histopathology. Sensitivity was evaluated for both methods, while specificity was calculated for DW-MRI.

Results: T2-weighted MRI allowed correct tumour localization in 26/37 patients (70.3%), whereas DW-MRI corroborated in 33/37 patients (89.2%), respectively. The combined approach permitted tumour localization in 36/37 patients. A mean ADC-value of 0.84×10^{-3} mm²/sec was assessed for suspicious lesions resulting in a specificity of 97.3% using the predefined threshold value. Tumour visibility was qualified significantly ($p < 0.01$; two-tailed Mann-Whitney-U-Test) better on DW-MRI (91.9% rated as good) compared to T2-w MRI (56.8%). Direct comparison of image quality was better on DW-MRI in 81.1% of cases. **Conclusion:** DW-MRI increases the sensitivity of tumour detection in comparison to T2-weighted images. Further improvement of sensitivity and specificity for detection of prostate cancer may be achieved using the combined approach.

Comparison of SPACE and 3D-TSE-MRCP regarding image quality and diagnostic certainty in patients in a routine clinical setting

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Basel

Purpose: MRCP based on 3D SPACE (Sampling Perfection with Application optimized Contrasts) has already been reported superior to conventional 3D-TSE-MRCP regarding image quality in healthy volunteers. We herein report our retrospective comparison with respect to imaging quality and diagnostic certainty in patients undergoing MRCP in a routine clinical setting at our institution.

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.

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 vs. 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. As we report in this study, it should be used as the MRCP-Sequence of choice in clinical routine.

SGR-CARDIOVASCULAR IMAGING

Low dose high-pitch 128-slice dual-source computed tomography for the evaluation of coronary artery bypass grafts

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Purpose: To assess the performance of prospectively ECG-synchronized dual-source computed tomography (DSCT) in high-pitch spiral acquisition mode for the evaluation of coronary artery bypass grafts (CABG) in short- and long-term follow-up after surgery without heart rate control.

Methods and materials: 50 consecutive patients (47 men, age 69.6 ± 9.6 years) underwent 128-slice DSCT angiography of the chest after CABG surgery in a prospectively ECG-synchronized high-pitch spiral acquisition mode (pitch factor 3.2; 100 kV tube voltage, 0.28s rotation time). 25 patients were evaluated within 3 months after surgery (median 6 days; range, 2–75 days) and 25 patients >1 year after surgery (median 7 years; range, 1–16 years). No heart rate control was performed. Image quality of the proximal anastomosis, graft body, distal anastomosis, and native post-anastomotic coronary artery were graded by two independent readers on a 3-point scale (1 = excellent, 2 = good, 3 = poor/non-diagnostic). Effective radiation dose was calculated.

Results: Mean heart rate was 76 ± 19 bpm. Median scan time was 0.9s (range, 0.76–1.17s). 125 CABG (54% arterial grafts) and 465 vessel sections were analyzed. 12 grafts were occluded. Diagnostic image quality was obtained in 462/465 (99.4%) sections. Image quality was excellent in 397 (85.4%), moderate in 65 (14.0%) and non-diagnostic in 3 (0.6%) sections. All 3 non-diagnostic sections were distal anastomoses impaired by motion artifacts. Effective radiation dose was 2.3 ± 0.3 mSv.

Conclusion: High-pitch prospectively ECG-synchronized thoracic CT angiography provides excellent image quality for the evaluation of CABG in patients without heart rate control at a low radiation dose of 2.3 mSv.

and accuracy of both CTCA groups were determined using conventional catheter angiography (CCA) as reference standard. Radiation dose values were calculated.

Results: Both groups were comparable regarding gender, body weight, cardiovascular risk profile, severity of CAD, mean heart rate, heart rate variability, and Agatston score (all p > 0.05). There was no significant difference in the rate of non-assessable coronary segments between group 1 (1.6%, 24/1404) and 2 (1.4%, 19/1385; p = 0.77); non-diagnostic image quality was significantly (p < 0.001) more often attributed to stair step artifacts in group 1. Segment-based sensitivity, specificity, PPV, NPV, and accuracy were 98%, 98%, 88%, 100%, and 100% among group 1; 96%, 99%, 90%, 100%, and 98% among group 2, respectively. Parameters of diagnostic performance were similar (all p > 0.05). Mean effective radiation dose of prospectively ECG-gated CTCA (2.2 ± 0.4 mSv) was significantly (p < 0.0001) smaller than that of retrospectively ECG-gated CTCA (8.1 ± 0.6 mSv).

Conclusion: Prospectively ECG-gated CTCA yields similar image quality, performs as accurately as retrospectively ECG-gated CTCA in patients having heart rates ≤ 70 bpm while being associated with a lower mean effective radiation dose.

Low dose dual-source CT coronary angiography: Accuracy and radiation dose of the high-pitch and the step-and-shoot mode

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Purpose: To compare the diagnostic accuracy and radiation doses of two low-dose protocols for coronary artery imaging with second generation dual-source computed tomography (CT) in comparison with catheter angiography (CA).

Methods and materials: One-hundred patients with suspicion of coronary artery disease underwent 128-slice dual-source CT and CA. Patients were randomly assigned to two different low dose CT protocols (each 100 kV/320 mAs): In group A (n = 50), CT was performed using a prospectively electrocardiography (ECG)-gated step-and-shoot mode (SAS); in group B (n = 50), CT was performed using a prospectively ECG-gated high-pitch mode (HP; pitch 3.4). All coronary segments were evaluated by two blinded and independent observers with regard to image quality and for the presence of significant coronary stenosis. CA served as standard of reference.

Results: There was no significant difference in age (p = 0.72), BMI (p = 0.41), and HR (p = 0.66) between both groups. Diagnostic image quality was obtained in 98.4% (651/660) of segments in group A and in 98.9% (642/649) in group B, with no significant differences between groups. Sensitivity, specificity and positive and negative predictive values were 94%, 91%, 85%, and 97% per-patient in group A, and 94%, 93%, 89%, and 97% per-patient in group B (no significant differences). The effective radiation dose in group B (0.9 ± 0.1 mSv) was significantly (p < 0.01) lower than that in group A (1.4 ± 0.4 mSv).

Conclusion: Both the high-pitch and the SAS mode for low-dose CT coronary angiography provides high accuracy for assessment of significant coronary stenoses, while the high-pitch mode significantly lowers radiation dose to below 1 mSv.

Prospective and retrospective ECG-gating for CT coronary angiography perform similarly accurate at low heart rates

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Purpose: To compare, in patients with suspicion of coronary artery disease (CAD) and low heart rates, image quality, diagnostic performance, and radiation dose values of prospectively and retrospectively electrocardiography (ECG)-gated dual-source computed tomography coronary angiography (CTCA) for the diagnosis of significant coronary stenoses.

Methods and materials: Two-hundred consecutive patients with heart rates ≤ 70 bpm were retrospectively enrolled; 100 patients undergoing prospectively ECG-gated CTCA (group 1) and 100 patients undergoing retrospectively-gated CTCA (group 2). Coronary artery segments were assessed for image quality and significant luminal diameter narrowing. Sensitivity, specificity, positive (PPV), negative predictive values (NPV),

Lowering heart rate with an optimized breathing protocol for prospectively ECG-triggered CT coronary angiography

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Purpose: To prospectively characterize the effect of the level of breath-hold on heart rate in computed tomography coronary angiography (CTCA) with prospective electrocardiogram (ECG)-triggering and its impact on coronary artery attenuation.

Methods and materials: Two-hundred-sixty patients (86 women, mean age 59 ± 11 years) underwent 64-slice CTCA using prospective ECG-triggering. Prior to CTCA heart rates were recorded during 15 seconds of breath-hold in three different levels of inspiration (normal, intermediate and deep). The inspiration level with the lowest heart rate was chosen for actual CTCA scanning. Coronary artery attenuation was measured, and the presence of backflow of contrast material into the inferior vena cava (IVC) (as an indicator of increased intrathoracic pressure) was recorded.

Results: Mean heart rate at breath-hold was significantly different for the three inspiration levels (normal: 60 ± 8 bpm, intermediate: 59 ± 8 bpm, deep: 57 ± 7 bpm; $P < 0.001$). The maximum heart rate reduction in each patient at breath-hold averaged 5.3 ± 5.1 bpm, and was observed at normal inspiration depth in 23 patients (9%), at intermediate inspiration depth in 102 patients (39%) and at deep inspiration in 135 patients (52%). Overall there was no association between the level of breath-hold and coronary vessel attenuation ($P = n.s$). However, backflow of contrast material into the IVC ($n = 26$) was found predominantly at deep inspiration levels ($P < 0.001$), and when it occurred, it was associated with reduced coronary attenuation compared to patients with no backflow ($P < 0.05$).

Conclusion: The breath-hold level best reducing heart rate for CTCA should be individually assessed prior to scanning, as a mean heart rate reduction of 5bpm can be achieved.

Morphological and functional 3-T MRI of saphenous vein coronary artery bypass grafts using velocity encoded phase-contrast imaging and MR angiography with intravascular contrast medium: Preliminary results

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Purpose: Low postoperative coronary artery bypass graft (CABG) flow can be a major issue potentially causing postoperative complications such as myocardial infarction. Purpose of the present study was to perform morphologic and functional postoperative saphenous vein CABG evaluation using 3.0 Tesla MRI including MR-angiography (MRA) and velocity encoded phase-contrast flow measurements.

Methods and materials: CABG assessment was performed in 10 patients with saphenous vein grafts. All patients underwent intraoperative flow measurements and MR imaging (MAGNETOM Verio 3.0 Tesla, Siemens, Erlangen, Germany) using velocity encoded phase-contrast flow measurements and MRA with intravascular contrast agent (Vasovist, gadofosveset trisodium) to determine graft patency and flow.

Results: In eight patients with completed MRA, the proximal bypass anastomosis was depicted in seven CABGs and the distal anastomosis in five. A non-significant stenosis of less than 50% was found in one patient in the mid-portion of a saphenous vein CABG from the aorta to the right coronary artery. No significant stenosis was detected. MRI flow measurements demonstrated a mean flow of 54.9 ± 34.9 ml/min (confidence interval 29.9 to 79.9). The intraoperative flow results demonstrated a mean flow of 54 ± 28.5 ml/min (confidence interval 33.6 to 74.4). The linear correlation between intraoperative flow measurements and postoperative MRI flow measurements was $r = .49$ ($P = 0.08$).

Conclusion: MR imaging may be a useful non-invasive technique to postoperatively follow-up of CABGs for patency assessment and flow quantification. The use of intravascular gadolinium-based contrast agents is proposed to further enhance MRA results in future studies.

Cardiac computed tomography for the differentiation between bicuspid and tricuspid aortic valves: Comparison with echocardiography

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Purpose: To evaluate the diagnostic performance of cardiac computed tomography (CT) for the differentiation between tricuspid (TAV) and bicuspid aortic valves (BAV) in comparison with echocardiography.

Methods and materials: 47 patients with TAV and 47 with BAV underwent transthoracic echocardiography (TTE) and retrospectively electrocardiography-gated dual-source CT. From the 47 patients with BAV, 7 (15%) had no raphe, whereas 40 (85%) had a raphe. Two independent and blinded observers assessed image quality (IQ) using a 4-point score, determined the cardiac phase providing the best IQ of the aortic valve, differentiated between TAV and BAV using CT, and assessed for the presence or absence of a raphe. Diagnostic performance of CT was determined using TTE as reference standard. **Results:** Diagnostic IQ was found in all patients and was rated excellent in 82% (77/94), good in 17% (16/94), and moderate though diagnostic in 1% (1/94). In patients with TAV, best IQ for the assessment of aortic valve morphology was found in all 47 patients during diastole. In patients with BAV, best IQ was found in 70% (33/47) in diastole, in 4% (2/47) in systole, and in 26% (12/47) when combining both diastolic and systolic reconstructions. In 3 BAV patients with raphe, the valve was misclassified as TAV with CT. The sensitivity, specificity, positive and negative predictive value of CT for the diagnosis of BAV were 94%, 100%, 100%, and 94%.

Conclusion: CT is highly accurate for the differentiation between TAV and BAV. For BAV without raphe, diastolic reconstructions are sufficient, whereas in BAV with raphe, additional reconstructions in systole are required.

Imaging the thoracic aorta: Contrast-enhanced 3D-MRA versus 3D-TrueFISP with multiple image reconstruction using CLAWS

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Basel

Purpose: Magnetic Resonance angiography (MRA) is widely used for imaging of the thoracic aortic, but contrast enhanced 3-dimensional angiography CE-3D-MRA is hampered by motion artefacts, particularly at the aortic root. This limitation has been overcome by ECG- and respiratory-gated MRA. This technique, however, can be very time consuming. Recently a new ECG- and respiratory gated 3D-TrueFISP sequence with multiple image reconstruction using CLAWS (3D-TrueFISP-CLAWS) compensating for changes of respiratory pattern has become available. The purpose of this study was to compare standard CE-3D-MRA with 3D-TrueFISP-CLAWS with respect to image quality and acquisition times.

Methods and materials: 10 patients (32–76 years) were imaged on a 1.5 Tesla scanner. For analysis, acquisition times and image quality for the 3D-TrueFISP-CLAWS and the CE-3D-MRA were compared. Image quality of different parts of the thoracic aorta and its branches was scored on a scale from 1 (structure not visible) to 5 (excellent visibility).

Results: The acquisition times for 3D-TrueFISP-CLAWS and CE-3D-MRA were 12 min 38 s and 5 min 7 s, respectively. Visibility of the aortic anulus, sinus, sinutubular junction and proximal coronaries was better on 3D-TrueFISP-CLAWS as compared to CE-3D-MRA (3.4/2.2; 4.0/2.6; 4.0/2.9; 3.7/1.7). Visibility of aortic arch and supraaortic vessels, on the other hand, were similar with both techniques (4.0/3.9; 4.6/4.7).

Conclusion: Compared to standard CE-3D-MRA, 3D-TrueFISP-CLAWS requires no contrast material and provides superior image quality of the aorta and its branches in structures adjacent to the heart but acquisition time is still longer.

Magnetisation transfer steady state free precession imaging

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Basel

Purpose: To identify and characterise myocardial injury with Magnetisation Transfer (MT) balanced steady state free precession (SSFP) Magnetic Resonance (MR) imaging (1, 2).

Methods and materials: Twenty four patients with suspected myocardial injury such as infarct ($n = 13$), myocarditis ($n = 6$), or other ($n = 5$) were subjected to cardiac MR (1.5 Tesla with phased array body

coil) comprising precontrast SSFP, Magnetisation Transfer SSFP (MT-SSFP) and delayed contrast enhanced (0.1 mmol/kg Gd-chelate) Inversion Recovery Fast Low Angle Shot (LE) images. Signal intensities (SI) were measured in blood, skeletal muscle, normal and injured myocardium. MT ratio was calculated as (SISSFP -SMT-SSFP)/SISSFP \pm standard error of the mean.

Results: MT ratios in blood, skeletal muscle, normal and injured myocardium were 0.03 ± 0.01 , 0.3 ± 0.01 , 0.31 ± 0.03 , 0.21 ± 0.06 , respectively. Moreover, injury that was visible on LE images was identified on MT images in 13 patients with a trend to lower MT ratios in subacute injury and higher MT ratios in chronic injury.

Conclusion: Different MT ratios can be measured in blood, normal and injured myocardium with MT Magnetic Resonance imaging. Moreover, MT imaging may enable further characterisation of myocardial injury with respect to age and nature of the lesion.

High time-resolved cardiac functional imaging with temporal regularization in mouse on a clinical 3T scanner

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Purpose: Small animal functional cardiac imaging on clinical scanners allows effective contribution to translational medicine. However, hardware limits the space and time resolution compared to dedicated

instrumentation. Here, we propose a novel method to reach parameters comparable to the ones obtained with dedicated scanners in the context of mouse stress studies.

Methods and materials: Experiments were performed on a clinical 3T scanner. The reference sequence is a segmented turboflash cine with a minimal time resolution TR = 13ms. The proposed sequence repeats twice the classical sequence where the second repetition has a trigger delay (= TR/2) added. Combination of both repetitions reduces the TR to half of the hardware TR (6.5 ms). The main difficulty encountered is a flickering effect that is not in phase with repetitions. To reduce this, we perform a regularization (l1-minimization) in the temporal Fourier domain for each pixel. Our method was validated by artificially lengthening the TR to compare with the reference sequence, and then applied to acquire fast time-resolved cine in mouse.

Results: Experiments were performed on healthy and pathological mice (n = 4). The regularization took only 2s. for a 432 x 432 x 20 stack of images in Matlab[®]. The visual improvement due to regularization is quite striking and decreases the flickering by an average factor of 5.0 ± 1.4 (p = 0.04).

Conclusion: The proposed method achieves an effective TR = 6.5 ms and deals effectively with the flickering artifact generated by combining both repetitions. The method does not prevent the use of parallel imaging acceleration approaches commonly used in clinical environment to further reduce acquisition time.

SGR - CHEST AND BREAST

Dose reduction with digital mammography in patients with dense and fatty breasts

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Basel

Purpose: To evaluate the potential for dose reduction with digital mammography in patients with fatty breasts (Breast density category 1 according to BI-RADS[™]).

Methods and materials: A total of 50 Patients with known fatty breast tissue in screening mammography and without asymmetries; know breast disease or previous breast surgery were included in this study. Patients received digital mammography in MLO and CC-view: one breast with standard dose and automatic exposure, the other breast with mAs reduced to 50% while all other imaging parameters were constant. Images were compared according to: overall image quality, contrast, sharpness, calcifications and evaluated on a 7 point scale (-3 to 3).

Results: For 8 Patients in MLO and 10 Patients in CC-view images with reduced dose appeared normal at the mammography unit, but were extremely bright after post-processing. As raw data could not be transferred to the review workstation, these images were considered not to be of acceptable quality, despite equivalent sharpness. These images were excluded. The remaining 42/40 images showed no significant difference in image quality, contrast, sharpness or detection of calcifications.

Conclusion: Especially in fatty breasts, digital mammography could decrease dose by up to 50%, without significant reduction in image quality. As visibility of lesions is excellent in fatty breasts, minor reductions in image contrast and signal to noise ratio are less relevant. Problems with image post-processing should be addressed by the manufacturer.

Methods and materials: Forty consecutive patients underwent clinically indicated thoracic-abdominal 128-slice DSCT angiography consisting of an unenhanced, an arterial, and a venous contrast phase acquisition. The acquisitions were performed in a HPM during breathing (group A), a HPM without breathing (group B), and at a standard pitch (pitch 0.8) without breathing (group C) randomly assigned to the three phases in each patient. Two blinded readers independently evaluated among the three CT acquisitions the image quality of 5 areas of the lung parenchyma using a 4-point-scale, the lung volume, and the size of pulmonary nodules.

Results: A total of 400 lung areas in each acquisition phase were evaluated. Inter-observer agreement for image quality ratings was excellent ($\kappa = .91$). Average lung volume in group A (ie. during breathing) was $75\% \pm 15$ of that in deep inspiration. Image quality other than excellent or good was found in 2.5% (5/200) of evaluated lung areas in group A, 1.5% (3/200) in group B, and 5.5% (11/200) in group C. Image quality impairment in group C was mainly due to cardiac pulsation artifacts. There was no significant difference in the size of pulmonary nodules among the three acquisitions (p = 0.94).

Conclusion: DSCT examinations in the HPM during breathing provide diagnostic visualization of the lungs superior to that achieved in standard pitch CT during breath-hold.

Does 3D-stereoscopy improve distance approximation?

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Purpose: To evaluate if the use of 3D-stereoscopic display improve the approximation of distances concerning accuracy and confidence.

Methods and materials: A model of different sized blocks was build and scanned. 31 readers (17 radiologists (group 1), 14 non-radiologists (group 2)) were asked to estimate without additives 9 defined distances on the virtual model with (3D-stereo) and without 3D-stereoscopy (3D-mono), with (moved) and without moving (static), and on native model (model). Gold-standard was the measured distances. The readers had to note the degree of confidence on a visual analogue scale. The mean total error (error) and mean confidence (confidence) for all modalities were compared among each other in both groups (t-test).

Results: Group 1 showed a higher mean error compared to group 2 for 3D-mono-static (p = 0.009), 3D-mono-moved (p = 0.045), 3D-stereo-static (p = 0.087), and model (p = 0.038). No significant error difference

Depiction of lung parenchyma by high pitch dual-source CT in patients breathing during acquisition

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Purpose: To prospectively investigate the diagnostic accuracy of DSCT in the high pitch mode (HPM, pitch 3.2) for the assessment of pulmonary parenchyma with and without breathing during CT acquisition.

was found in both groups comparing 3D-stereo-moved to model ($p = 0.17$ (group 1) and $p = 0.406$ (group 2)). Group 1 showed a significant error difference between 3D-mono-moved and 3D-stereo-moved ($p = 0.044$). Group 2 showed significant error differences between 3D-mono-static and all other modalities ($p = 0.001–0.042$), and between 3D-mono-moved and 3D-stereo-static to model ($p = 0.008$ and $p = 0.014$). Group 1 had an increase of confidence comparing

3D-mono and 3D-stereo to model ($p = 0.001$ and $p = 0.002$). Group 2 had an increase of confidence comparing static to moved for both modalities ($p = 0.002–0.006$).

Conclusion: 3D-stereoscopic display has a limited impact on accuracy of distance approximation although there is an increase in user confidence.

SGR – MUSCULOSKELETAL RADIOLOGY

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

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

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

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

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

whereas DWIBS provided higher Clbm than T2w-STIR in group 2. The mean ADC in group 1 ($1.41 \pm 0.60 \times 10^{-3} \text{ mm}^2/\text{s}$) was significantly higher than in group 2 (0.91 ± 0.35).

Conclusion: DWIBS improves the conspicuity of focal lesions in newly diagnosed MM-patients and patients during acute relapse with high paraprotein burden compared to standard T1w-TSE and T2w-STIR sequences. ADC calculation provides additional information on the lesions' biology and may be useful for treatment monitoring.

Accessory tendinous slips arising from the extensor carpi ulnaris (ECU) tendon: MRI appearance, prevalence and association with ECU tenosynovitis and tendinopathy

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Purpose: To report the MRI features of ECU accessory tendinous slips, assess their observable prevalence and evaluate a potential link between this anatomical variation and ECU tenosynovitis or tendinopathy.

Methods and materials: Institutional review board approved this retrospective study, with waiver of patient informed consent. One hundred sixty wrist MRI studies from 158 patients (85 females, 73 males, mean age 45.6 years, range 14–86) performed between March 2008 and February 2009 on a 1.5-T unit were included. MR images were analyzed by two radiologists in consensus. The observable prevalence of ECU accessory tendinous slips was assessed and their origin, diameter and insertion sites were noted. The presence of ECU tenosynovitis and/or tendinopathy was also evaluated.

Results: The observable prevalence of ECU accessory tendinous slips was 21.9% (35/160). The origin was always seen: 8 were at the level of, and 27 distal to the ECU subsheath. The slip median diameter was 0.67 mm (range 0.43–0.88). The insertion was seen in 17.1% (6/35): 2 were on the fifth metacarpal bone, 4 on the extensor apparatus of the fifth finger. ECU tenosynovitis (20%), tendinopathy (5.7%) as well as concomitant tenosynovitis and tendinopathy (25.7%) were more frequently encountered in the patients with the anatomical variation than in the control patients group (0.8%, 3.2% and 9.6% respectively). Differences were statistically significant for tenosynovitis ($p = 0.0001$) and concomitant tenosynovitis and tendinopathy ($p = 0.02$) of the ECU.
Conclusion: ECU accessory tendinous slips are frequent and visible on 1.5-T wrist MRI studies. ECU tenosynovitis and tendinopathy are more frequent in patients bearing this anatomical variation.

Signal behavior of focal myeloma lesions in T1w-TSE, T2w-STIR and Diffusion Weighted Imaging with Background Suppression (DWIBS)

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Basel

Purpose: To analyse the potential of DWIBS in multiple myeloma diagnostics by evaluating the apparent diffusion coefficient (ADC), contrast-to-noise-ratio (CNR) and bone-marrow-to-lesion-contrast (Clbm) of focal bone marrow lesions provided by T1w-TSE, T2w-STIR and DWIBS in correlation with the serum concentration of M-component (cMC).

Methods and materials: 72 consecutive studies in 59 patients were analysed retrospectively. Coronal T1w-TSE and T2w-STIR, and coronal or axial DWIBS-sequences ($b = 0$ and $800 \text{ s}/\text{mm}^2$) were applied. Signal and ADC of focal lesions in the lumbar spine and pelvis were determined respecting a maximum of 3 lesions per patient. Clbm and CNR were calculated separately for patients with low cMC ($<10 \text{ g/l}$, group 1) and high cMC ($>10 \text{ g/dl}$, group 2) and were compared using a double sided unpaired t-test.

Results: The mean CNR and Clbm of T2w-STIR and T1w-TSE were significantly higher in group 1 (T2: $\text{CNR} = 90 \pm 65/\text{Clbm} = 2.0 \pm 1.2$; T1: $9.0 \pm 7.0/0.3 \pm 0.2$) than in group 2 ($39 \pm 38/1.1 \pm 0.9$; $4.7 \pm 3.8/0.2 \pm 0.1$). The mean CNR and Clbm of DWIBS ($b = 800$) showed no significant variation between the two groups ($34 \pm 25/1.4 \pm 1.1$ and $30 \pm 28/1.7 \pm 1.2$). T2w-STIR provided higher Clbm than DWIBS in group 1

Anterior cruciate ligament reconstruction using bioabsorbable cross-pins: MR imaging findings at follow-up examinations

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Purpose: To determine the frequency of imaging findings and complications related to cross-pins on follow-up MRI examinations in patients who had undergone anterior cruciate ligament (ACL) reconstruction with bioabsorbable cross-pin fixation.

Methods and materials: Follow-up MR imaging studies of 222 ACL reconstructions with bioabsorbable cross-pin fixation were retrospectively reviewed by two musculoskeletal radiologists in consensus. Fracture, resorption and migration of the cross-pins as well as posterior cortical breach and prominence at the lateral femoral

condyle were recorded. The relationship between the angle (pin angle) formed by the transepicondylar axis and the cross-pins and the presence of cross-pin fractures was investigated on axial images by using the Pearson Chi-Square test. The integrity of the ACL graft was determined.

Results: Forty-nine fractured cross-pins were seen in 37/222 (16.7%) patients. In 40 out of 49 fractured pins, the posterior femoral cortex was the site where the fracture occurred. The posterior femoral cortex was breached by either the superior or lower cross-pins in 63/222 (28.4%) patients with an average length of the protruded portion of 9.5 mm. The fractured cross-pins had migrated in 19 patients over an average distance of 5.4 mm. Partial and total resorption of cross-pins was observed in 7/222 (3%) and 28/222 (12.6%) patients, respectively. Prominent cross-pins were present in 6/222 (2.7%) patients with a mean length of the prominent portion of 3.9 mm. There was a significant relationship ($P < .05$) between the pin angle and the occurrence of cross-pin fractures. A partial and complete tear of the ACL graft was present in 3/222 (1.4%) and 4/222 (1.8%) patients, respectively.

Conclusion: Fractures and posterior cortical breaches of cross-pins are commonly seen in follow-up MRI examinations.

Ligaments and plicae of the elbow: Normal MR imaging variability in 60 asymptomatic volunteers

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Purpose: To prospectively evaluate the normal variability of ligaments and plicae on standard MR images of the elbow in asymptomatic volunteers.

Methods and materials: The study was approved by the IRB. Informed consent was obtained. MR imaging was performed on a 1.5T scanner in 60 asymptomatic volunteers (30 women, 30 men; age range 22–51 years, median age 32.8 years). Visibility and signal intensity (SI) characteristics were analyzed for elbow ligaments and plicae. The thickness of these structures was measured.

Results: The anterior ulnar collateral ligament (aUCL) and radial collateral ligament (RCL) were completely visible in all 60 volunteers (100%). The posterior ulnar collateral ligament (pUCL), lateral ulnar collateral ligament (LUCL), and the annular ligament (AL) were completely visible in 97% (58/60), 85% (51/60), and 98% (59/60), respectively, and only partially visible in all other volunteers. Increased SI on fluid sensitive sequences was found in the aUCL (15%; 9/60), pUCL (7%; 4/60), RCL (2%; 1/60), LUCL (10%; 6/60), and the AL (2%; 1/60). Median thickness (and 90th percentile) were 2.5 mm (3.5 mm) for the aUCL, 1 mm (1.7 mm) for the pUCL, 1.9 mm (2.8 mm) for the RCL, 2.3 mm (3.8 mm) for the LUCL, and 1 mm (1.3 mm) for the AL. A posterolateral plica was found in 98% (59/60) while a posterior plica could only be detected in 33% (20/60) with median dimensions of 4.3x1.9x3.9 mm and 1.8x1.4 mm, respectively.

Conclusion: The elbow ligaments and the posterolateral plica are consistently visible on standard MR images of asymptomatic volunteers. The normal thickness of the ligaments is below 4 mm, and plicae are usually smaller than 3 mm.

SPECT-CT imaging in the assessment of non-specific foot and ankle pain

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Basel

Purpose: To test precision and accuracy of SPECT-CT imaging in the assessment of non-specific foot and ankle pain.

Methods and materials: 86 patients with non-specific foot and ankle pain were subjected to Tc99m-scintigraphy and SPECT-CT. Scintigraphic / SPECT, CT- and SPECT-CT-images were repeatedly evaluated by four independent readers for 14 pathologic entities. Imaging modalities were evaluated separately and combined. Anatomic localization was performed on the basis of a 10 compartment model. A Fleiss' Kappa variant was used to measure inter-rater-reliability for each method.

Results: A total of 122 diagnoses were found in 86 patients, whereof 22 diagnoses were obtained by combined SPECT/CT only. In 43 cases the correct diagnosis could be made either with scintigraphy or CT as stand alone modalities. The separate evaluation of scintigraphic and CT images yielded relevant additional information in 21 cases. 36 diagnoses were found exclusively by scintigraphy or CT. Inter-observer

agreement did not differ significantly with highest value of 0.98 for SPECT-CT.

Conclusion: A combined scintigraphy, CT- and SPECT-CT with separate and combined image evaluation in the evaluation of non-specific foot and ankle pain is recommendable. In case of osteoarthritis in multiple localizations, scintigraphic images proved valuable in the detection of active regions, whereas CT allowed precise localization and visualization of osseous defects. In a significant number of cases the correct diagnosis could solely be made with combined SPECT-CT imaging. Inter-observer agreement was generally high.

Synovitis maps for the assessment of inflammatory diseases of the hand

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Purpose: To evaluate the diagnostic accuracy of synovitis maps derived from 3D-fast low angle shot (FLASH) sequences, usually used for MR angiography, to assess synovitis and tenosynovitis of the hand.

Methods and materials: 80 hands in 40 patients (mean age, 48 years; range, 15–72 years; 14 male) were assessed on conventional MR images (transverse T1w, coronal intermediate weighted, transverse and coronal T1w with fat saturation after i.v. gadobutrol) and synovitis maps derived from a FLASH sequence for the presence or absence of synovitis by two readers independently. Reader1 (R1) was a fellowship trained musculoskeletal radiologist, reader2 (R2) a staff rheumatologist. Reporting times and diagnostic confidence (scale: 1 = least, 5 = most confident) for the assessment of synovitis were measured. Results from an assessment of a panel of senior staff musculoskeletal radiologists using all imaging and clinical data served as the standard of reference for data analysis.

Results: Sensitivity and specificity for the detection of articular synovitis was 0.91/1.00 (R1) and 1.00/0.67 (R2) on conventional MRI and 0.87/0.75 (R1) and 0.91/0.45 (R2) on synovitis maps. Sensitivity and specificity for the detection of tenosynovitis was 0.95/0.63 (R1) and 0.67/0.79 (R2) on conventional MRI and 0.67/0.89 (R1) and 0.38/1.00 (R2) on synovitis maps. Mean review times (conventional MRI / synovitis maps, sec) were 142/37 (R1) and 167/25 (R2). Mean diagnostic confidence (conventional MRI / synovitis maps) was 3.7/3.4 (R1) and 3.2/3.5 (R2) for articular synovitis and 4.0/4.0 (R1), 3.3/3.7 (R2) for tenosynovitis.

Conclusion: Synovitis maps may be used for a fast overview of all locations with synovitis and tenosynovitis of the hand.

CT-guided cervical foraminal injection: Is a direct foraminal approach still necessary?

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Purpose: Cervical foraminal injection performed with a direct foraminal approach may induce serious neurologic complications. We describe a technique of CT-guided cervical facet joint (CFJ) injection as an indirect foraminal injection, including feasibility and diffusion pathways of the contrast agent.

Methods and materials: Retrospective study included 84 punctures in 65 consecutive patients presenting neck pain and/or radiculopathy related to osteoarthritis or soft disc herniation. CT images were obtained from C2 to T1 in supine position, with a metallic landmark on the skin. CFJ punctures were performed by MSK senior radiologists with a lateral approach. CT control of the CFJ opacification was performed after injections of contrast agent (1 ml), followed by slow-acting corticosteroid (25 mg). CFJ opacification was considered as successful when joint space and/or capsular recess opacification occurred. The diffusion of contrast agent in foraminal and epidural spaces was recorded. We assessed the epidural diffusion both on axial and sagittal images, with a classification in two groups (small diffusion or large diffusion).

Results: CFJ opacification was successful in 82% (69/84). An epidural and/or foraminal opacification was obtained in 74% (51/69). A foraminal opacification occurred in 92% (47/51) and an epidural opacification in 63% (32/51), with small diffusion in 47% (15/32) and large diffusion in 53% (17/32). No complication occurred.

Conclusion: CT-guided CFJ injection is easy to perform and safe. It is most often successful, with a frequent epidural and/or foraminal diffusion of the contrast agent. This technique could be an interesting and safe alternative to foraminal cervical injection.

Ultrasonographic evaluation of femoroacetabular CAM deformity: Assessment and diagnostic performance of qualitative criteria and alpha angle measurement

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Purpose: To develop and assess a technique to evaluate femoroacetabular impingement (FAI) of the cam type using ultrasonography (US).

Methods and materials: Fifty consecutive patients were prospectively included. US images of the anterior and anterosuperior contour of the femoral neck were obtained and analyzed independently by two blinded radiologists. Non-spherical shape of the head-neck junction (cam deformity), bony protuberances at the femoral neck, shape of the femoral neck (waist deficiency), and alpha angle were assessed. MR arthrography served as standard of reference. Diagnostic performance and receiver operating characteristics (ROC) curves were calculated.

Results: Based on MR images twenty-eight patients had cam type FAI. At ultrasonography, a cam deformity was seen anteriorly in 29/18

(Reader 1/Reader 2) patients (sensitivity 68%/50%, specificity 55%/82%), and anterosuperiorly in 40/44 patients (sensitivity 93%/89%, specificity 36%/14%). A bony protuberance was found anteriorly in 17/8 patients (sensitivity 39%/21%, specificity 73%/91%), and anterosuperiorly in 23/13 (sensitivity 71%/32%, specificity 86%/82%). A waist deficiency was seen anteriorly in 19/35 (sensitivity 50%/89%, specificity 77%/55%), and anterosuperiorly in 7/24 (sensitivity 25%/54%, specificity 100%/59%). The mean anterior alpha angle was 66.2°/61.4° with FAI, and 63.1°/51.5° without. The anterosuperior alpha angle was 73.2°/74.1° with FAI, and 64.9°/71.0° without. ROC analysis for alpha angle measurements demonstrated areas under the curve of 0.581/0.665 ($p = 0.328/0.047$) anteriorly and 0.688/0.588 ($p = 0.023/0.291$) anterosuperiorly.

Conclusion: At US to evaluate cam FAI the presence of an anterosuperior cam deformity is sensitive, and the presence of anterosuperior bony protuberances and waist deficiencies are specific. Alpha angle measurements are not helpful to establish the diagnosis.

SGR – NEURORADIOLOGY

Functional organization of the primary motor cortex in congenital paraplegia

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Purpose: In congenital chronic paraplegic patients with myelomeningocele (MMC) only little is known about the functional organization of the primary motor cortex (M1). The neural tube defect in myelodysplastic patients occurs early in embryonic development and is typically associated with dysplastic changes in the brain and with hydrocephalus. This is the first study to assess the somatotopic organization of M1 in MMC patients using fMRI.

Methods and materials: Ten right-handed MMC patients with complete paraplegia (ASIA-Score grade A) due to thoracic spinal lesions underwent standardized BOLD-fMRI (executed tongue and finger movements, imagined foot movements) at 1.5 T or 3.0 T to study M1-somatopy. Patient data were processed and evaluated on an individual basis using BrainVoyager® and compared to normative data obtained from healthy volunteers.

Results: Individual anatomico-functional correlations in all MMC patients revealed normal somatotopic organization of M1 for the cortical tongue and finger representations. Foot representations were abnormal with a marked cranio-ventro-lateral shift of 3.1 mm (z-axis), 17.6 mm (y-axis), and 9.2 mm (x-axis) in the right hemisphere and 2.8 mm (z-axis), 11.8 mm (y-axis), and 9.0 mm (x-axis) in the left hemisphere (statistical means). In 50% of the patients unilateral imagined toe movements resulted in bilateral M1 activations.

Conclusion: Patients with congenital paraplegia activate M1 during imagined toe movements. Foot representations are shifted compared normal controls, but the basic principle of somatotopic representations in M1 is preserved. Bilateral M1 activations from unilateral imagined toe movements most likely represent some patient's inability to imagine toe movements separately for each side.

Results: In Broca relevant tumours a statistical significant ($p = 0.017$) decrease of the language lateralisation was detected using word generation. In Wernicke relevant tumours significant ($p = 0.007$) decrease in language lateralisation was found using sentence generation.

Conclusion: Brain tumours affecting both Broca's and Wernicke's language areas induce plastic changes in neuronal language networks, as indicated by a significant decrease in lateralisation index. Two mechanisms may underlie neuroplasticity: A marked decrease in BOLD activation in the affected hemisphere and/or a compensatory increase of language related brain activation in the unaffected hemisphere. This should be taken into account when fMRI is used preoperatively to determine language dominance.

Intraoperative DSC-MRI in brain tumours. Technical considerations and feasibility

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Purpose: Intraoperative MRI is used as resection control and to update neuronavigation. Dynamic susceptibility contrast MRI (DSC-MRI) is also feasible intraoperatively despite technical drawbacks (susceptibility artefacts of a resection cavity, restricted selection of head coils, time constraints). The purpose of this study was to compare perfusion ratios obtained by iDSC-MRI with DSC-MRI acquired preoperatively.

Methods and Materials: Prior to surgery all patients underwent MRI. During performance of a T2*-weighted EPI GE sequence (TR / TE = 17 / 8 ms) a bolus of 20 ml contrast agent (Gd-DTPA) was administered intravenously after an initial rest period. Maps for regional cerebral blood volume (rCBV) and flow (rCBF) were created using the nordiclice software (NordicNeuroLab, Bergen, Norway). For intraoperative imaging a flexible sterile-draped two-channel surface coil system is used. Seven patients with histologically proven glioblastoma multiform (GBM) were enrolled, in whom residual tumour tissue was depicted intraoperatively by the time of iDSC-MRI. Data was coregistered with preoperative acquired data and ratios for rCBV and rCBF were compared between imaging sessions.

Results: Ratios for rCBV and rCBF did not differ significantly between pre- and intraoperative acquired data (paired t-test), additionally there was a high correlation (Pearson correlation; R2rCBV = 0.86, $p = 0.013$; R2rCBF = 0.88, $p = 0.009$). Residual tumor tissue could be removed in all cases.

Conclusion: Data obtained pre- or intraoperatively is interchangeable. Despite brain shift physiologic information can be obtained intraoperatively using iDSC-MRI. Furthermore iDSC-MRI may also play an important role in non-enhancing lesions and thus assist complete resection.

Modulation of cortical language networks by brain tumours

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Purpose: The aim of this trial was to determine the language dominant hemisphere using BOLD functional MRI in right-handed patients suffering from brain tumours localised in left hemisphere affecting Broca's (B) or Wernicke's (W) area.

Methods and Materials: 57 consecutive patients with brain tumours affecting the left inferior frontal gyrus (B, $n = 19$) or the left superior temporal and/or supramarginal gyrus (W, $n = 38$) were investigated with standardized preoperative BOLD fMRI based on sentence and word generation paradigms. Success rates for localising language relevant areas and lateralisation index were calculated (Stippich C et al., Radiology 2007). Tumour associated modulations of language lateralization were assessed by statistical correlation of lateralisation indices in patients with normative data obtained from healthy volunteers.

How to handle incidental findings in neuroimaging research?

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Purpose: In fundamental research functional neuroimaging studies are usually performed in young healthy volunteers. According to the literature, incidental findings are thought to be occurring in 2–8%.

Methods and materials: We prospectively analyzed additional performed FLAIR and T1-weighted (MPRage) images being part of the imaging protocol. Incidental findings were depicted and reported by 2 neuroradiologists in consensus and the principle investigator of the study was informed. Based on our institutional guidelines these subjects were seen in the out-patient clinic and further diagnostic work-up was initialized as needed.

Results: Among these 206 cases we found incidental findings in 39 (19%). 21 required further diagnostic work-up. Among these we found pituitary abnormalities in 12, large cysts of the pineal gland in 5 and vascular malformations in 4 (2 cavernoma, 2 AVMs). None of these required immediate treatment.

Conclusion: Incidental findings are much more common than currently estimated. However, the clinical relevance remains low. Standardized procedures should be established to guarantee a responsible management.

Early changes in brain tumour perfusion following brachytherapy

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Purpose: Dynamic susceptibility contrast MRI (DSC-MRI) is commonly used for differential diagnosis of brain tumours and to distinguish recurrent disease from radionecrosis.

Methods and materials: A C6-glioma model was used in 14 Wistar rats. 106 glioma cells were stereotactically injected into the basal ganglia of the rats inducing a rapid aggressive tumour growth. 16 days after injection of the cells an MRI was performed using a 3T Scanner and a dedicated solenoid coil (Philips, Best, The Netherlands) including T1- and T2-weighted sequences to define tumour size prior to therapy. 7 rats were irradiated using HDR Afterloading remote Machine (VariSource iX, Varian Medical Systems, Charlottesville, Inc., VA, USA) for 5 days (2 Gy per fraction) followed by another MRI including a

DSC-MRI using a T2*-weighted EPI PRESTO sequence (TR/TE = 30/14 ms, matrix 64 x 64). Ratios of rCBV and rCBF were created using the Nordiclice Software (NordicNeuroLab, Bergen, Norway).

Results: Tumour size did not differ between groups. rCBV was significantly reduced ($t = 1.95$; $p = 0.038$, one-tailed t-test). A trend for this effect was also found for rCBF ($t = 1.73$, $p = 0.055$, one-tailed t-test).

Conclusion: Our results demonstrate that early changes in tumour perfusion occur already after 5 days of radiation therapy and can be monitored using DSC-MRI. The chosen tumour model resembles the human glioblastoma multiform. DSC-MRI is a powerful tool in assessing early response to treatment, distinguishing residual tumour after therapy, and possible treatment failure.

Dampening of blood flow pulsatility along the intracranial internal carotid artery: A 4D PC MRI study

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Purpose: This study was designed to evaluate arterial blood flow patterns at inflow and outflow of the parasellar internal carotid artery (ICA) in order to detect possible changes in arterial pulsatility along the structure of the carotid siphon.

Methods and materials: Arterial flow patterns of the large intracranial arteries were analyzed using ECG-gated, flow-sensitized 4-D MR imaging at 3 T in 17 healthy volunteers. Time resolved blood flow velocities were extracted from the data at the C4 and C7 segment of the ICA. We calculated pulsatility index (PI), resistance index (RI) and peak acceleration (PA) values using time resolved flow volume. A linear mixed effects model was applied to compare values at C4 and C7. Furthermore 3D blood flow visualization was performed for all 34 internal carotid arteries.

Results: PI, RI and PA were significantly lower at the C7 segment compared to the C4 segment of ICA ($p < 0.0001$). Helical flow patterns were observed in 5 internal carotid arteries of 4 subjects.

Conclusion: The significant decrease in arterial pulsatility along the relatively short distance from C4 to C7 suggests a high vascular compliance of the intermediary arterial segment. A loss of vascular compliance along the carotid siphon may be related to cerebral disease patterns related to increased arterial pulsatility.

SGR – PEDIATRIC RADIOLOGY

Structural brain lesions in adolescents with congenital heart disease

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Purpose: Children with congenital heart disease (CHD) requiring open-heart surgery frequently manifest neurodevelopmental impairment. Cerebral lesions and delayed brain maturation has been shown in newborns with CHD, but no study so far has examined the long-term neuroanatomic changes in these children.

Objective: To describe incidence/spectrum of brain lesions assessed by conventional magnetic resonance imaging (MRI) in adolescents with CHD.

Methods and materials: Prospective cohort study of 53 adolescents (mean age 13.6 y) who underwent cardiac surgery at a mean age of 2.3 y and were followed since school-age. Children with chromosomal anomalies or genetic syndromes were excluded. Neurodevelopmental testing included the Zurich Neuromotor Assessment, the Rey Figure and a standardized neurological examination. Conventional cerebral MRI was done on a 3.0 T MR system using T2-weighted and 3D T1-weighted sequences.

Results: 53 patients (46 % male, 40% cyanotic CHD) and 41 controls (no differences between cases and controls with respect to age at MRI, sex or socioeconomic status) were analyzed. Two (4%) patients were diagnosed with cerebral palsy and 6 (10%) had a learning disability (IQ 70-85). MRI abnormalities were detected in 11 (21%) patients. The majority consisted of acquired abnormalities ($n = 9$: mild white matter changes, cortical and paraventricular volume loss or brain atrophy) Two patients showed pathologies of other etiology (1 aqueduct stenosis and hydrocephalus, 1 suspected neurocytoma).

Conclusion: In adolescents with operated CHD and mild neurocognitive impairments, MRI abnormalities can be detected in a significant proportion of these patients. These abnormalities consist of mainly ischemic lesions that may be acquired in the neonatal period.

Iterative statistical reconstruction method: A new way to reduce dose in pediatric cardiac CT

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Purpose: Although several approaches have been already used to reduce radiation dose, CT doses are still among the high doses in radio-diagnostic. Recently, General Electric introduced a new imaging reconstruction technique, adaptive statistical iterative reconstruction (ASIR), allows to taking into account the statistical fluctuation of noise. The benefits of ASIR method were assessed through classic metrics and the evaluations of cardiac structures by radiologists.

Methods and materials: A 64-row CT (MDCT) was employed. Catphan600 phantom acquisitions and 10 routine-dose CT examinations performed at 80 kVp were reconstructed with FBP and with 50% of ASIR. Six radiologists then assessed the visibility of main cardiac structures using the visual grading analysis (VGA) method. **Results:** On phantoms, for a constant value of SD (25 HU), CTDIvol is divided by 2 (8 mGy to 4 mGy) when 50% of ASIR is used. At constant CTDIvol, MTF medium frequencies were also significantly improved. First results indicated that clinical images reconstructed with ASIR had

a better overall image quality compared with conventional reconstruction. This means that at constant image quality the radiation dose can be strongly reduced.

Conclusion: The first results of this study shown that the ASIR method improves the image quality on phantoms by decreasing noise and improving resolution with respect to the classical one. Moreover, the benefit obtained is higher at lower doses. In clinical environment, a dose reduction can still be expected on 80 kVp low dose pediatric protocols using 50% of iterative reconstruction. Best ASIR percentage as a function of cardiac structures and detailed protocols will be presented for cardiac examinations.

CT imaging of the temporo-mandibular joint: Size, shape and growth related changes of 420 mandibular condyles during childhood

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Purpose: To determine size, shape and age related changes of the mandibular condyle in children of all age.

Methods and materials: 420 mandibular condyles of 210 asymptomatic children (mean age 7 years; range 0–7 years; 81 girls) were analyzed on transverse multidetector computed tomography (MDCT) images between December 2008 and August 2009. The greatest left-right diameter (LRD), the greatest anterior-posterior diameter (APD) and the anteversion angle (AA) of the mandibular condyles were measured by two readers independently. An APD/LRD ratio was calculated. The shape of the condyle was graded into 4 types on reconstructed sagittal images by both readers. Parameters were compared using unpaired t-tests and correlated with the children's age using Pearson correlation analyses.

Results: Mean LRD was 14.1 ± 2.4 mm (range, 8.2–22.3), mean APD was 7.3 ± 1.0 mm (4.9–11.8), resulting in a mean LRD / APD ratio of 1.9 ± 0.3 (1.1–3.3). Mean AA was 27 ± 7 degrees (3–49). The sagittal types correlated significantly with the children's age (R1: $r = 0.55$, $p < 0.05$; R2: $r = 0.69$, $p < 0.05$). The LRD ($r_{LRD} = 0.70$, $p < 0.01$), APD ($r_{APD} = 0.56$, $p < 0.01$), and ratio ($r_{rat} = 0.28$, $p < 0.01$) increased significantly while the anteversion angle decreased ($r_{antang} = -0.26$, $p < 0.001$) significantly with the children's age. All parameters were transferred to percentile rank tables in respect to sex and age.

Conclusion: The mandibular condyle is subject to significant growth related changes in size and shape during childhood. As the size of the condyles increases with age, the anteversion angles decrease and the shape of the condyle turns from round to oval.

MRI findings of *Kingella kingae* osteoarticular infections in children

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Purpose: *Kingella kingae* is an emerging pathogen that is currently recognized as the first bacteria responsible for osteo-articular infections (OAI) in young children. The main objective of this prospective study is to describe the specific MRI features of osteo-articular infection caused by this germ.

Methods and materials: 20 patients admitted for OAI due to *K. kingae* were included in this study. In all the cases, specific qPCR assays of joint fluid aspiration or of bone aspirate specimens yielded to the microbiologic diagnosis. For comparison purposes, the MRI features noted in children with *K. kingae*'s OAI were compared to those of 20 children of the same age with *S. aureus* infection. MRI was interpreted independently by a board-certified radiologist experienced in pediatric radiology and by a senior pediatric orthopaedist.

Results: Among the 20 studied patients, 10 presented signs of arthritis on MRI, 3 of osteoarthritis, 2 of osteomyelitis, 2 of chondritis and 3 of spondylodiscitis. Soft tissue reaction, bone reaction and presence of subperiosteal abscess were also evaluated.

Infection implying the chondroepiphysis was markedly more frequent in patients with OAI due to *K. kingae*, whereas bone edema and subperiosteal abscess were less severe compared to gram positive microorganisms OAI.

Interobserver agreement for subperiosteal abscess was good, satisfactory for bone reaction and bad for soft tissue reaction.

Conclusion: Although not specific, MRI findings provide useful information to differentiate between *K. kingae* OAI and OAI due to

gram-positive microorganisms. In correlation with clinical features, MRI investigation may improve diagnosis and also the management of children with *K. kingae* OAI.

Prediction of postnatal outcome in fetuses with pulmonary hypoplasia by fetal-MRI: Comparison between lung volumetry and pulmonary signal intensity values

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Purpose: Pulmonary hypoplasia is a determinant parameter for extra-uterine life. In the last years, MRI appears as a complement to US in order to evaluate the degree of pulmonary hypoplasia in fetuses with congenital anomalies, by using different methods - fetal lung volumetry (FLV), lung-to-liver signal intensity ratio (LLSIR)-. But until now, information about the correlation between the MRI prediction and the real postnatal outcome is limited.

Methods and materials: We retrospectively reviewed the fetal MRI performed at our Institution in the last 8 years and selected the cases with suspicion of fetal pulmonary hypoplasia ($n = 30$). The pulmonary volumetry data of these fetuses were collected and the lung-to-liver signal intensity ratio (LLSIR) measures performed. These data were compared with those obtained from a control group of 25 fetuses considered as normal at MRI. The data of the study group were also correlated with the autopsy records or the post-natal clinical information of the patients.

Results: As expected, the control group showed higher FLV and LLSIR values than the problem group at all gestational ages. Higher values of FLV and LLSIR were associated with a better post-natal outcome. Sensitivity, specificity, positive and negative predictive values and accuracy for the relative LLSIR and the relative FLV showed no significant differences.

Conclusion: Our data show that not only the FLV but also the relative LLSIR inform about the degree of fetal lung development. This information may help to predict the fetal outcome and to evaluate the need for neonatal intensive care.

Ectopic thymus – a differential diagnosis of unilateral cervical mass

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Purpose: Cervical ectopic thymus tissue, presenting as a unilateral neck mass, is rare in neonates. In the literature, almost 100 cases have been described, less than 10% in infants. To avoid a complete thymectomy, and associated adverse effects on the immune system, this entity should be considered as a differential diagnosis of an unclear cervical mass.

Methods and materials: We present a case of a five-week-old boy with an asymptomatic cervical mass, which was incidentally found during a MRI investigation of the skull. We performed ultrasound to verify our differential diagnosis.

Results: We give an overview on embryology, pathophysiology, imaging and possible management of ectopic cervical thymus.

Conclusion: To avoid a complete thymectomy, and associated adverse effects on the immune system, this entity should be considered as a differential diagnosis of an unclear cervical mass.

Extended field-of-view (panorama) ultrasound in pediatric musculoskeletal disorders

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Purpose: Pictorial essay of different pediatric musculoskeletal pathologies imaged with panoramic ultrasound.

Methods and Materials: The radiology archive database was searched for musculoskeletal ultrasound in children with panoramic views. 7 Patients were found with different musculoskeletal pathologies and panoramic views. Additional imaging (MRT, radiographs) were compared when available.

Results: Extended field-of-view (panoramic) ultrasound was an easy accessible, non invasive method to diagnose musculoskeletal disorders such as erysipelas, subperiosteal abscess, osteomyelitis or necrotic

fasciitis. The extension of the lesion was best imaged in the upper and lower extremities.

Conclusion: Extended field-of-view ultrasound is a reliable technique which adds important information to a normal B-mode and M-mode ultrasound, Doppler technique and compression technique in musculoskeletal pathologies. It is important to include the transition zones from normal soft tissue to the pathology. Extremities are prone for this technique. Compared with MRI there is no sedation needed in younger children.

Illustration of the use of 3D MRI sequences in children musculoskeletal pathologies

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Purpose: Illustration of the advantages of two osteo-articular 3D MRI sequences in children: diagnosis and understanding of the physiopathological process when combined to “traditional” sequences.

Methods and materials: Focusing on TRUFISP, and SPACE IR (1.5T Siemens Avanto MRI), we retrospectively selected four explicit cases including also SE T1, SE T2, and DP acquisitions. Reconstructions were done using Osirix DICOM software. The above sequences were compared with “traditional” sequences SE and DP in order to highlight their complementarity and specificities, selecting reconstructed planes from the 3D data sets.

Results: The TRUFISP sequence appeared more suitable to demonstrate a long calcaneal beak; calcaneo-scapoidian diastasis, nature, and related bone oedema evaluation was better than with traditional supramillimetric slices. Looking at the knee osteochondritis, the ability to reconstruct in the anatomical structures’ plane enabled us to perform a finer analysis of the osseous fragments but also of articular spaces and surfaces, ligaments, and menisci. The wide FOV of the SPACE sequence enabled better localisation of the pathological process, while offering better analysis of the osseous and peripheral extension in our two cases of suspected osteomyelitis in the younger child.

Conclusion: The higher spatial definition and nature of the TRUFISP and SPACE IR 3D sequences, including MPR reconstruction, may enhance the demonstration and analysis of musculoskeletal anomalies thus giving essential additional clues on the nature and extent of lesions.

HRCT and radiographic appearances of mucus plugging in children and young adults with cystic fibrosis

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Purpose: The aim of the study is to describe the characteristics and distribution of mucus plugging in children and young adults with CF and to compare chest radiography with HRCT.

Methods and materials: Between January 2007 and December 2008 HRCT was performed on 31 CF patients (13 boys, range 6–18 years) followed at CF centre of Milan (334 patients under 18 years). HRCTs were scored with Brody score and the score for mucus plugging was extrapolated for each lobe. Two radiologists re-evaluated chest radiography performed around the time of the HRCT (within 10 days) focusing only on the detection and location of mucus plugging. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of plain radiography in detecting mucus plugging was calculated using the HRCT findings as the reference standard.

Results: 26/31 patients showed evidence of mucus plugging on HRCT according to Brody’s score: 39.7% of lobes involving the “central lung” (finger-in-glove sign) and 66.7% of lobes involving the “peripheral lung” (centrilobular nodules), with a predominance in the right upper lobe (83.9%). Mucus plugging in peripheral lung was not detectable on chest radiography. The sensitivity, specificity, PPV and NPV of chest radiography for mucus plugging in large airways was 55%, 89%, 86% and 62% respectively.

Conclusion: HRCT appears to be the most sensitive modality for the detection of mucus plugging, especially when present in peripheral lung. Chest radiography is very poor in detecting peripheral mucus plugging whereas its sensitivity for central mucus plugging is better when HRCT score is high.

SGR-SGNM – HYBRID IMAGING MODALITIES

Diffusion-weighted MRI in metastatic gastrointestinal tumours (GIST): A pilot study on the assessment of treatment response in comparison with 18F-FDG PET/CT

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Purpose: To evaluate the clinical potential of diffusion-weighted MR imaging with apparent diffusion coefficient (ADC) mapping for the assessment of gastrointestinal stromal tumor (GIST) response to targeted therapy in comparison with 18F-FDG PET/CT.

Methods and materials: Five patients (3W/2M, aged 56 ± 13 y) with metastatic GIST underwent both a 18F-FDG PET/CT (Discovery LS, GE Healthcare) and a MRI (VIBE T1 Gd, DWI [b = 50,300,600] and ADC mapping) before and after change in therapy. Exams were first analyzed blindly, then PET/CT images were coregistered to T1 Gd MR images for lesion detection. SUVmax and ADC were measured for the six largest lesions on MRI. The relationship between SUVmax and ADC was analyzed using Spearman’s correlation.

Results: Altogether, 24 lesions (15 hepatic and 9 non-hepatic) were analyzed on both modalities. Three PET/CT lesions (12.5%) were initially not considered on ADC and 4 lesions on the second PET/CT were excluded because of hepatic vascular activity spillover. SUVmax decreased from 7.2 ± 7.7 g/mL to 5.9 ± 5.9 g/mL ($P = 0.53$) and ADC increased from 1.2x10⁻³ mm²/s ± 0.4 to 1.4x10⁻³ mm²/s ± 0.4 ($P = 0.07$). There was a significant association between SUVmax decrease and ADC increase ($\rho = -0.64$, $P = 0.004$).

Conclusion: Changes in ADC from diffusion-weighted MRI reflect response of 18F-FDG-avid GIST to therapy. The exact diagnostic value

of DWI needs to be investigated further, as well as the effect of lesion size and time under therapy before imaging. Furthermore, the proven association between SUVmax and ADC may be useful for the assessment of treatment response in 18F-FDG non-avid GIST.

Performance assessment of FDG-PET image segmentation techniques in pharyngolaryngeal squamous cell carcinoma: Validation with surgical specimen

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Purpose: This study presents the performance assessment of various FDG-PET segmentation methods in Pharyngolaryngeal Squamous Cell Carcinoma where the surgical specimen served as reference.

Methods and materials: Various PET image segmentation techniques were evaluated: manual delineation, Fixed thresholding of 40% of the maximum SUV (Th₄₀), Signal-to-Background Ratio (SBR)-based adaptive thresholding, Region growing (RG), and three variants of a automated fuzzy clustering-based segmentation technique, namely FCM, FCM-S, and FCM-SW. Segmentation results were then compared to the 3D (Gross Tumour Volume) GTV defined by histology on PET images of seven patients with T3–T4 laryngeal squamous cell carcinoma who underwent a total laryngectomy. The algorithms were also evaluated using simulated data of the NCAT phantom incorporating heterogeneous lesions modeled from clinical head and neck PET/CT studies.

Results: The GTVs estimated using the various segmentation methods are summarized in table 1. SBR overestimates the average tumour volume. The same applies to Th_40 and manual delineation techniques. Automated techniques including region growing, FCM and FCM-S underestimate the mean volume. FCM-SW provides a more accurate estimate of the tumour volumes. The results obtained using simulated studies seem to indicate an underestimation of the tumour volumes when using Th_40, RG, and SBR techniques.

Conclusion: The GTVs delineated using the automated FCM technique (FCM-SW) was the most accurate segmentation technique and approximates closely the 3D GTV defined on the surgical specimen.

Table 1

Method	Mean GTV ± SD (cc)	Relative mean error	GTV overlap index (CI 95%)	p value
<i>Histology</i>	14.79 ± 10.4	–	–	–
Manual	21.17 ± 10.0	74.55 ± 71.2	0.53 (0.40–0.66)	0.04
SBR	23.57 ± 12.7	81.13 ± 59.6	0.50 (0.36–0.64)	0.013
Th_40	22.10 ± 12.4	75.18 ± 62.0	0.49 (0.39–0.59)	0.08
RG	12.43 ± 7.1	6.61 ± 81.5	0.44 (0.34–0.54)	0.509
FCM	10.31 ± 6.4	–21.70 ± 22.0	0.52 (0.43–0.61)	0.038
FCM-S	10.40 ± 6.5	–21.27 ± 22.8	0.52 (0.44–0.61)	0.040
FCM-SW	14.56 ± 8.5	8.81 ± 28.4	0.58 (0.50–0.66)	0.842

MR/PET image fusion: Feasibility and utility in the loco-regional assessment of head and neck cancer

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Purpose: The purpose of our study was to evaluate the feasibility and potential clinical utility of MR/PET image fusion in the loco-regional assessment of head and neck cancer.

Methods and materials: Sixty-five consecutive head and neck cancer patients who had undergone both MRI and PET/CT were included in this retrospective study. MR and PET images were fused together using a dedicated program which correlates anatomic landmarks from the CT of the PET/CT scan with anatomic MR landmarks. The fusion was made between PET data and post-contrast T1-weighted sequences. Two experienced readers evaluated the MR/PET and the MR images separately. The results were then compared with the surgical and clinical follow-up data.

Results: Image fusion was feasible in 55 patients (85%) with good anatomic correlation above and fair correlation below the hyoid bone. Unsuccessful fusion was caused by patient movement during either imaging modality. In 38 patients (69%) there was no difference between MR/PET and MR images regarding the primary tumour and the nodal status, whereas in 12 cases (22%) the fused MR/PET images were superior to MR images alone due to their ability to detect small nodal metastases and subtle tumour spread. In 5 cases (9%), MR/PET images were less accurate than MR images alone due to false positive assessments or underestimated tumour spread.

Conclusion: Image fusion of PET and MR is feasible in patients with head and neck cancer. The fusion of the two modalities may provide additional information that is not obvious from the two modalities alone in 22% of cases.

Limited added value of delayed FDG PET/CT images in the differential diagnosis of pulmonary lesions in patients with a high prevalence of active inflammations

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Purpose: Dual-time point FDG PET/CT is reported to be helpful to discriminate between benign and malignant pulmonary lesions. The aim of this study was to evaluate the value of this technique in patients with a high prevalence of active pulmonary inflammations.

Methods and materials: We retrospectively analyzed 18 consecutive patients undergoing dual-time point FDG PET/CT for characterization of pulmonary lesions. PET acquisitions of the thorax were performed at 60min and at 120min after injection of the radiopharmaceutical. SUVmax and the retention index (RI: Δ SUV (%)) were calculated for both time points and statistically compared (Student's t-test) between

benign and malignant lesions. Histology, clinical and/or radiological follow-up served as gold standard.

Results: A total number of 30 lesions (14 malignant, 16 benign) were analyzed. The overall results are summarized in the table. Using cutoff values of 2.5 for SUVmax1, and 3.0 for SUVmax2, sensitivities of 86% and 93%, respectively, could be obtained, whereas specificity was constantly low (44% and 50%, respectively).

Mean values	SUVmax1±SD	SUVmax2 ± SD	RI
malignant	8.69 ± 7.62	12.08 ± 11.98	36.6 (–13.4 to 120.4)
benign	2.92 ± 1.45	3.83 ± 2.21	34.99 (–23.5 to 122.4)
p (t-test)	0.015	0.024	0.922

Conclusion: In this collective with high prevalence of active inflammatory pulmonary lesions, dual time point PET/CT was of only limited value. Discrimination between benign and malignant pulmonary lesions was only obtained using absolute SUVmax values; in contrast to the literature, the retention index was not helpful. A multivariate analysis of a greater cohort including radiological findings and lesion size is subject of ongoing research.

Detection of malignant lesions by whole body DWI and MRI in comparison with PET/CT: Additive value of image fusion for diagnostic accuracy

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

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

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

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

Lesion detectability on 18F-Fluoro DOPA PET/CT studies of neuroendocrine tumors: Which contrast-enhanced CT series are most useful?

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Purpose: F18-DOPA PET/CT recently emerged as a technique for the detection of neuroendocrine tumours (NET). Aiming to decrease the radiation burden during this exam, we assessed the added diagnostic value of specific series (arterial, venous and delayed phases) of contrast-enhanced CT (ceCT) to F18-DOPA PET/CT interpretation.

Methods and materials: We investigated 14 patients with a clinical suspicion of a NET. F18-DOPA PET/CT findings were compared with a gold standard of octreotide scintigraphy, MRI, histology and clinical

follow-up. PET and ceCT were interpreted independently by a nuclear medicine physician and a radiologist.

Results: In 8 of 14 patients we found a total number of 20 PET positive lesions, 13 of which were confirmed as true positive. The 7 false positive PET findings included focal uptake in the liver (3), pancreas (1), retroperitoneum (2, 1 ceCT positive) and adrenal gland (1). CeCT allowed the identification of 11 additional lesions, 6 of which confirmed by follow-up data (4 hepatic and 2 peripancreatic lesions), all clearly visible with venous enhancement.

Conclusion: Simultaneous CeCT and F18-OPA-PET/CT allowed for detecting additional lesions in the liver and in the peripancreatic region, areas with a high or noisy physiological uptake that might impair PET image interpretation. Additionally, 6 out of 7 PET false positive findings were ceCT negative. Venous enhancement was sufficient to visualize ceCT positive lesions. Our findings suggest that whole-body F18-DOPA PET combined with venous phase contrast CT of the abdomen provides the best combination for improving diagnostic accuracy while minimizing the effective radiation dose administered to the patient.

Characterizing adrenal FDG uptake by dynamic enhanced CT in combined PET/CT scanner

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Purpose: To investigate the role of dynamic enhanced CT in characterizing adrenal FDG uptake detected upon oncologic PET studies.

Methods and materials: Fifteen patients with lung cancer (n = 12), esophageal carcinoma (n = 2), and gynecological tumour (n = 1) who displayed abnormal FDG accumulation in their adrenal glands were prospectively enrolled. Abnormal FDG uptake was classified into grade I (less than liver parenchyma), grade II (equal to liver parenchyma), and grade III (more than liver parenchyma). Dynamic adrenal CT protocol included a native acquisition, portal phase, and delayed phase at 10 minutes. Absolute enhancement loss of contrast media was calculated for all patients and the results of both modalities were correlated with histological analysis and radiological follow-up.

Results: Among the studied 15 lesions, adrenal metastases were proven in 8, whereas, 7 lesions turned out to be of benign origin. Grade I FDG uptake was recorded in 2/7 benign lesions. No metastatic lesions presented with grade I uptake. On the other hand, 3 out of 5 lesions

with grade II uptake were of benign origin and 2/5 were metastatic. The remaining 8 lesions with grade III uptake were proven to be metastatic (n = 6) and benign (n = 2). Using an absolute enhancement loss threshold of <50% for metastatic lesions and of ≥50% for benign lesions, dynamic enhanced CT successfully characterized all lesions yielding an accuracy of 100%.

Conclusion: Dynamic enhanced CT is a useful diagnostic adjunct in characterizing FDG avid adrenal lesions. This algorithm has the potential to stratify patients according to their need to undergo further invasive procedures to establish histopathological diagnosis.

Retrospective study about the role of 18F-FDG-PET and SUV in the management of non-small cell lung cancer: Evaluation of response to treatment and prognosis of 135 patients in different stages (I-IV)

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Purpose: To evaluate the correlation between SUVmax and clinical outcome in patients with NSCLC in stage I-II undergoing surgery and in patients with NSCLC in stage III-IV undergoing chemotherapy.

Methods and materials: 135 patients (49 stage I-II, 86 stage III-IV), underwent at least 2 FDG-PET whole body and for each one SUVmax and dimension of the primary neoplastic lesion were recorded. In the group of patients in stage I-II SUVmax and clinical outcome were put in relationship by Student-t test, and the optimal cut-off value of SUVmax to predict prognosis was calculated. The probability of Disease-Free Survival was investigated through the univariate analysis of Kaplan-Meier. In the group of stage III-IV patients we looked for a possible correlation between SUVmax and best response, and for the most significant cut-off value of SUVmax to predict prognosis.

Results: Stage I-II patients with SUVmax >9 (cut-off value) and diameter of lesion >30 mm (cut-off value) reported the worst prognosis. In stages III and IV, no reliable cut-off value of SUVmax was found in correlation with prognosis and response to therapy.

Conclusion: In stages I and II of NSCLC SUV provides useful information regarding the prognosis and an important correlation exists between responses according to CT and FDG-PET. In stages III and IV SUV loses most of its prognostic significance.

SGR-SSR - POSTER PRESENTATIONS / ABDOMINAL AND PELVIC IMAGING

Dual-energy CT with tin filter technology for the discrimination of blood, protein and contrast content within renal cysts. An experimental phantom study

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Purpose: To assess the performance of dual-energy CT with a new tin filter technology to differentiate protein, blood, contrast agent and saline solution in simulated renal cysts.

Methods and materials: 70 proxies containing saline, albumine, fresh blood and iodinated contrast solutions were placed in a kidney phantom containing non-enhanced (NE; 100HU@120kV) and contrast-enhanced (CE; 250HU) beef. Albumine, fresh blood and contrast agent solutions were titrated to CT numbers of 20 HU and 40 HU. DECT was performed at 140/80kV without (protocol A, pA) and with tin filter (protocol B, pB). Two readers (R1, R2) measured the CT number (NCT) of each lesion twice in each energy spectrum. A ratio between 140kV and 80kV (R80/140) results was calculated.

Results: Intra- and interobserver agreements were excellent (r = 0.93–0.97; p <0.001). NE phantom: The R80/140 was significantly different between both protocols for protein (p <0.01). In the CE phantom all NCT were significantly higher than in the NE phantom (p <0.05) with an average increase of 12.5 ± 3.6HU, while there was no significant difference of the R80/140 between the NE and CE phantom (each p >0.05). Significant differences were found between the R80/140 of protein/blood compared to contrast agent in the NE and CE phantom

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(each p <0.05). The R80/140 of protein and blood was significantly different in pB (p <0.05) but not in pA (p >0.05).

Conclusion: DECT is able to discriminate proteinaceous or hemorrhagic cysts from contrast enhancing renal masses at 140kV and 80kV. A further discrimination of proteinaceous and hemorrhagic cysts is possible with the tin filter technology.

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Use of additional beam filtration to increase the ability of dual-source dual-energy CT to discriminate between different urinary stone compositions

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Purpose: To investigate the performance of dual-energy (DE) computed tomography (CT) to discriminate between UA-containing and non-UA-containing uroliths using an additional beam filtration (BF) to increase spectral separation.

Methods and materials: 110 stones (4.2 mm ± 3.0 mm) of 15 different compositions were examined in an ex-vivo phantom using latest DECT scanner (Siemens Flash, Germany). Scanner was operated in two different DE modes (with additional BF by tin filter) at two tube voltage settings (3 groups; e.g., 80–140 kVp with and w/o BF as well as 100–140 kVp with BF). Tube current time products were adapted to yield constancy in CT dose indices (CTDIvol = 18.84 mGy, 18.95 mGy, and 18.90 mGy). CT numbers of stones and image noise (IN) were

measured. Stones were classified as UA-containing or non-UA-containing. Diagnostic performance was calculated using crystallographic analysis as reference.

Results: 65/110 stones (60%) were non-UA-containing; 45 stones (40%) were UA-containing. DEI was greatest at 80kV and 140 kV when using the SPS (DEI80kV/140 BFkVp = 0.038 vs. DEI80kV/140 kV = 0.028, DEI100kV/140BFkV p = 0.025; p <0.005). DEI of UA-containing urinary stones were significantly (p <0.001) lower as compared to non-UA-containing stones. IN of high kVp acquisitions were similar (p = 0.15), whereas IN of low kVp acquisitions were significantly (p <0.001) different being lowest using 100kVp. Diagnostic performance with all settings was 100% (95%CI: 97–100%).

Conclusion: DECT with BF and 80–140 kVp tube voltage settings significantly improves the discrimination between UA-containing and non-UA-containing uroliths as compared with DECT without using BF. 100–140 kVp setting with BF is associated with lower IN but demonstrates similar discrimination abilities as compared to former 80–140 kVp setting without BF.

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

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

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

Results: Mean FVFHISTO was 10.3 ± 11.5% (1.0–36.0%). FVFMRI derived from in/out-of-phase (r=0.88) and fat-only images (r = 0.89) were significantly (p <0.001) correlated with FVFHISTO. Mean measurement biases of FVFMRI and FVFHISTO were 6.1% ± 7.6% for in/out-of-phase and 5.1% ± 8.5% for fat-only images, respectively. The mean measurement bias of FVFMRI from fat-only images was significantly (p <0.01) reduced as compared to FVFMRI from in/out-of-phase images.

Conclusion: Absolute liver fat content can be quantified accurately by FVFMRI with surface-coil sensitivity correction compared to FVFHISTO. Fat-only images significantly reduce the measurement bias as compared to in/out-of-phase images.

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Hysterosalpingography in the work-up of female infertility: Indications, technique and diagnostic findings

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Purpose: Due to recent advances of reproductive medicine, hysterosalpingography (HSG) has become a commonly performed examination. All HSG examinations performed 2006-9 were reviewed. The spectrum of diagnostic findings, the value for the characterization of the cause of female infertility and the influence on subsequent patient care was investigated.

Methods and materials: Patients were filtered out from our PACS. Further information, i.e. laparoscopic findings, was retrieved from the gynaecological case histories. All studies were performed using a standardized protocol; images were re-evaluated. Indications for referral, technical success and diagnostic findings were analyzed. Pathologic findings were correlated with further diagnostic work-up.

Results: 207 of the total of 364 (57%) HSG examinations were normal. 2 examinations (0,5%) were not diagnostic (venous filling of the uterine plexus). 93 examinations (26%) showed mild findings, e.g. abnormality of uterus positioning (35). 62 examinations showed one or more pathologies. Tubal abnormalities included occlusion of one/both tubes (19/6), sactosalpinx (2) and salpingitis isthmica nodosa (4). 32 examinations showed a uterine pathology. Further diagnostic work-up was recommended in 23 examinations (6%).

Conclusion: HSG remains an important procedure in the investigation of infertility. The radiologist should therefore be aware of the spectrum of diagnostic findings and its implications for further work-up.

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PET/CT scans compared to CT scans for detecting colorectal liver metastases: A systematic review

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Purpose: Colorectal liver metastases can be treated with surgical resection; however, recurrence is seen in 58% of patients. Positron emission tomography/computed tomography (PET/CT) may better detect extra-hepatic disease prior to surgery to more accurately identify eligible candidates for surgery and may improve patient prognosis. The objective of this paper is to review diagnostic accuracy of PET/CT for colorectal liver metastases

Methods and materials: We conducted a comprehensive systematic review on adults with colorectal liver metastases who received PET/CT and CT scans to detect metastases. The gold standard to confirm the diagnosis was histology. Study selection, quality assessment, and data extraction were completed independently by two investigators. Pooling of results was not feasible due to heterogeneity. A qualitative summary of results is presented.

Results: From 1083 citations, we identified six studies (440 patients) for the review. For extra-hepatic lesions (3 studies; 178 pts), PET/CT was more sensitive than CT, but specificities were similar (PET/CT sensitivity (SN) = 75–89% and specificity (SP) = 95–96% versus CT SN = 58–64% and SP = 87–97%). For hepatic lesions (5 studies; 316 patients), PET/CT had higher SN and SP than CT (PET/CT SN = 91–100% and SP = 75–100%; CT SN = 78–94% and SP = 25–98%). For local recurrence (3 studies; 206 patients), PET/CT also had better accuracy than CT with SN = 93–100% and SP = 97–98% versus SN = 0–100% and SP = 97–98%.

Conclusion: Based on this systematic review, we conclude that PET/CT has a higher accuracy for detection of extra-hepatic and hepatic colorectal metastatic disease than CT alone. However, the results are based on a small number of studies and should be interpreted cautiously.

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

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Purpose: To prospectively investigate the technical feasibility and diagnostic accuracy of fusion data from whole-body diffusion-weighted-imaging (wbDWI) and computed tomography (CT) for detection of metastatic malignancy with positron emission tomography (PET)/computed tomography (CT) as reference standard.

Methods and materials: 33 patients (mean age 63 ± 12 years; 10 women) with different malignant tumour disease were examined by PET/CT for clinical reasons and consented to undergo additional wbDWI at 1.5 Tesla. DWI was performed using a diffusion-weighted single-shot echo-planar-imaging sequence with short-tau Inversion-Recovery based fat-suppression under free-breathing. Images at b = 0 and 700 s/mm² were acquired and ADC maps were generated. Two radiologists independently assessed wbDWI without CT as well as wbDWI with fused wbDWI/CT images using a two-point visual scoring system to evaluate the probability of malignant tumour disease. Final diagnosis based on both methods was made by consensus of two the readers. PET/CT examinations were used as reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy for tumour detection were performed.

Results: In PET/CT 181 malignant lesions in 30 patients were identified. Whole-body DWI/CT image fusion was technically successful and yielded diagnostic image quality in all examinations. Interobserver agreement for evaluation of wbDWI alone was k = 0.69 and for wbMRI/DWI fused images k = 0.67. Sensitivity, specificity, PPV, NPV, and accuracy of wbDWI/CT with image fusion were 81%, 97%, 91%, 93%, and 93%, respectively.

Conclusion: Whole-body DWI/CT image fusion is technically feasible in a clinical setting and allows assessment of malignant tumour disease with good sensitivity and excellent specificity.

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Dual-source dual-energy CT accurately identifies uric acid containing urinary stones in patients

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Purpose: To investigate prospectively in patients with the suspicion of urinary stone disease the diagnostic performance of dual-energy (DE) computed tomography (CT) for the differentiation between UA-containing and non-UA-containing urinary stones.

Methods and materials: Data was acquired in 180 patients who were referred with the suspicion of urinary stone disease. DE CT scans were performed using dual-source CT scanner in a dual-energy mode (tube voltages 80 kVp and 140 kVp). The stones were classified as UA-containing or non-UA-containing. Sensitivity, specificity, positive predictive and negative predictive values were calculated using the crystallographic stone analysis as the gold standard.

Results: Of the 180 patients, DE CT depicted 101 patients (56%) with urinary stone disease. In 53 patients, stones were sampled. Forty-four out of 53 stones (83%) were non-UA-containing; and nine stones (17%) were UA-containing. The software automatically mapped 52/53 (95%) stones. One non-UA-containing stone (UA, 2 mm) was missed. One UA-containing stone was misclassified by software analyses. The sensitivity for the detection of UA-containing stones (8/9) was 89% (95%CI: 52–100%), the specificity (43/44) was 98% (95%CI: 88–100%), the positive predictive value (8/9) was 89% (95%CI: 52–100%), and the negative predictive value (43/44) was 98% (95%CI: 88–100%).

Conclusion: The differentiation between UA-containing and non-UA-containing stones can accurately be performed in-vivo using dual-source dual-energy CT which may impact therapeutic decision making.

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A new MDCT technique for the investigation of ureterovaginal and urethrovaginal fistulas

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Purpose: Ureterovaginal and vesicovaginal fistulas are rare pathologies caused mostly by surgical trauma after gynaecological procedures. The investigation of the exact anatomy and the trajectory of these fistulas is indispensable for the surgeon and the decision of surgical versus conservative treatment is based on clinical as well as imaging findings. Our purpose is to review the role of CT in this domain and to present a new technique combining CT cystography and endovaginal negative contrast agent.

Methods and materials: We reviewed all cases of ureterovaginal and vesicovaginal fistulas that were investigated by CT in our hospital between October 1999 and October 2009. Furthermore we initiated a new protocol combining CT cystography and endovaginal negative contrast agent. There were in total 7 cases (5 patients) that underwent CT investigation with the clinical question of ureterovaginal versus vesicovaginal fistulas. 4 of them were examined only with an intravenous contrast agent in the secretory phase. 2 of them were examined with the addition of intravesical positive and endovaginal negative contrast agent.

Results: We confirmed the presence of an ureterovaginal fistula in 3 of the 6 cases. In 1 of the 2 patients that were scanned with intravesical and endovaginal contrast a very subtle ureterovaginal fistula was confirmed and its trajectory and localisation were precisely demonstrated.

Conclusion: In this didactic poster we will discuss about ureterovaginal and vesicovaginal fistulas, which are rare pathologies investigated by MDCT. We propose a new technique for their CT exploration, reporting an excellent demonstration of the localisation and the extension of the fistulous trajectory.

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Differences in clearance of Ferucarbotran and Ferumoxide from the liver quantified by MRI signal loss

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Purpose: To compare clearance from the liver of two clinically-approved iron-oxide nanoparticles, ferucarbotran (Resovist®) and ferumoxide (Endorem®). These agents, suitable for islet cell labeling, have similar size, magnetic and toxicity properties, but different coatings. Although cell uptake and persistence is an important property for labeling, for tracking, clearance on rejection is crucial.

Methods and materials: Sprague-Dawley rats (n = 6) were injected with SPIO in concentration and volume identical to cell transplantation. Imaging, from day 0–125, used a clinical 1.5T MRI scanner (Philips Achieva) and 4.7 cm-diameter circular coil. To visualize SPIO induced signal loss in the liver, a T1 weighted fast field echo (T1w FFE) was performed (slices 2 mm, FOV 150 mm, TE/TR/FA 5.1 ms/500 ms/50°, reconstructed resolution 0.15 mm, averages 2). 60 mm saturation bands were placed above and below the imaging plane to reduce artifacts. To calculate T2 decay, a 16 echo spin-echo acquisition was obtained (TEs/TR/FA 5.9, 11.8... 94.4 ms/333 ms/90°, slices 3 mm, FOV 75 mm, reconstructed resolution 0.3 mm, averages 4).

Results: After 10 days, the ferucarbotran (carboxydextran coating) livers show no significant difference (p = 0.05) from normal signal levels (intensity >1.2; day 1 signal loss intensity <0.2). For ferumoxide (dextran coating) at 125 days, the liver signal is only half way recovered.

Conclusion: Despite the similar size and magnetic properties of these agents, the difference in coating has a significant effect on their clearance from the liver. Ferumoxide is not cleared efficiently, reducing its suitability for longitudinal studies of cell rejection. Ferucarbotran would therefore be the agent of choice for such applications.

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Serum creatinine measurements: Evaluation of a questionnaire according to the ESUR guidelines

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Basel

Purpose: Serum creatinine measurements (SCM) are proposed by the ESUR to select patients with reduced renal function and therefore with a higher risk of CMIN and/or NSF. The objective was to find out the portion of patients with an elevated creatinine level (ECL) according to a questionnaire before contrast media injection.

Methods and materials: Between April and July 2009 a questionnaire was completed in 623 patients (f = 332, m = 291, mean age: 63 y) before contrast administration (CT/MRI = 167/456). SCM were performed when one or more questions concerning previous renal diseases (including surgery), renal diseases in relatives, diabetes, proteinuria, hypertension, gout and analgetic medication were positive.

Results: 232 patients (37%) gave one or more positive answers to the questionnaire. Of these 23 (10%) had an ECL, five (2%) of above 150 µmol/l. In one patient (0.4%, 292 µmol/l) we waived the contrast agent administration. Only the question concerning a previous renal disease showed a significant relation to an ECL (p = 0.0026, OR = 4.3). Comparing the groups with completely negative responses/at least one positive response/elevated serum creatinine levels we found a significant age difference (51 ± 16 y, 60 ± 13 y, 72 ± 10 y, p <0.0001). In the study of Choyke et al. the portion of patients with an ECL who gave complete negative responses to a similar questionnaire did not differ significantly from the portion of patients who gave positive answers in our study (8%/10%, p = 0.4983).

Conclusion: Taking all results into account we propose to limit the questions to previous renal diseases (including surgery) and considering the patient age prior to contrast media injection.

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Is intraoperative liver CT feasible?

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Basel

Purpose: Cross-sectional imaging based on navigation and virtual reality planning tools are well established in orthopaedic surgery and neurosurgery. Transferring these methods from static organs to liver surgery is challenging due to intraoperative organ shifting and movement. The purpose was to demonstrate that intraoperative liver CT is feasible in diagnostic quality and liver lesions are detectable.

Methods and materials: 11 consecutive patients (f = 4, m = 7, median age 67 y (range 54–80 y)) with liver metastasis of colorectal cancer (n = 9) and hepatocellular carcinoma (n = 2) were included. Multiphase liver MSCT was performed prior to inclusion and partial liver resection was planned. After complete mobilization and exposure of the liver in a "multifunctional image-guided therapy suite" a liver MSCT in the portal-venous phase was acquired under aseptic conditions. For avoidance of artifacts from metallic devices a carbon retractor was placed for retraction of wound margins. Diagnostic image quality of intraoperative liver scans were analyzed with a grading scale, 1–4 (1 = no diagnostic quality to 4 = no artifacts) and the number of liver lesions in pre- and intraoperative scans were assessed by two experienced radiologists.

Results: In all patients intraoperative CT scans were of diagnostic value with no diagnosis hindering artifacts. Pre-operatively 32 liver lesions and intra-operatively 26 lesions were detected. All missed lesions were cysts smaller than 8 mm in size.

Conclusion: Intraoperative liver CT is feasible with diagnostic quality and depicts all relevant liver lesions. Intra-operative CT might help the surgeon to adjust the preoperative virtual three-dimensional model of the liver on the intra-operative setting. In future liver-segmentation might take place intra-operatively.

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Utility of computed tomography (CT) for the detection of voluntary ingested packets of illegal drugs

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Purpose: Our goal was to evaluate the diagnostic value of unenhanced multidetector CT (MDCT) without bowel preparation as an imaging modality for the detection of suspected incorporated packets of illegal

drugs in so-called body stuffers. These are individuals who ingest drug packets in an attempt to escape detection by authorities. To do this we analysed the imaging characteristics and the positive predictive value of this radiological method.

Methods and materials: We analysed retrospectively 114 CT-scans of suspected body stuffers brought to our department by law enforcement authorities over a period of eight years. Our results were compared with the ones obtained by the analysis of the stools of the suspected body stuffers.

Results: 48% of the 114 exams we studied were rated as positive that is the imaging findings showed internal concealed drugs. Of these 35 were true positive cases which means that drug was actually found in the stool of the individuals and 17 were false negative. The positive predictive value of this method was 67%.

Conclusion: Unenhanced MDCT without bowel preparation is a useful and reliable imaging modality with a high diagnostic value for the immediate detection of voluntary ingested packets of illegal drugs, thus facilitating the forensic and legal management.

BRAIN, HEAD AND NECK

MRI findings in patients imaged for sensorineural hearing loss

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Purpose: This educational poster reviews the characteristic MRI findings of a variety of pathologic conditions affecting the inner ear and cerebello-pontine angle seen in patients imaged for acute or slowly progressing sensorineural hearing loss.

Methods and materials: Retrospective analysis of the MR and clinical/surgical data of 360 consecutive patients imaged for sensorineural hearing loss at our institution during the past 3 years. Patients were imaged on a 1.5 T or 3 T unit according to a standard protocol consisting of T2 w, FLAIR and diffusion-weighted images of the brain, 3DCISS images through the cerebello-pontine angle, T1 w pre- and post-contrast images of the temporal bone and brain and 3D TOF images through the polygone of Willis.

Results: 12% of the 360 cases were abnormal. Among these, 94% were benign and 6% were malignant. The benign conditions included: extra-axial lesions (schwannoma, lipoma, meningioma, aneurysms, epidermoid cysts and arachnoid cysts) and intra-axial lesions (multiple sclerosis, cavernoma and cerebral ischemia). Inner ear lesions included dilatation of the endolymphatic sac, cholesterol granuloma and labyrinthitis, semi-circular canal dehiscence. Cerebello-pontine angle metastases, carcinomatous meningitis and perineural tumor spread from extracranial head and neck tumours were the most common malignant lesions. We herewith review these conditions in a systematic fashion with emphasis on imaging characteristics and differential diagnosis.

Conclusion: A variety of benign and malignant lesions may result in sensorineural hearing loss. Knowledge of the pertinent imaging findings and differential diagnosis is essential when imaging these patients.

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Skull base chordoma and chondrosarcoma - MRI characterization in a patient collective referred for proton radiation therapy

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Purpose: To characterize the MRI features of chordoma and chondrosarcoma of the skull base in a patient collective referred for proton radiation therapy and to determine their differentiability based on these features.

Methods and materials: Between January 2007 and June 2009, 71 patients with skull base tumours (n = 49 chordomas, n = 22 chondrosarcomas) predominantly after prior surgical tumour resection underwent MRI in preparation of Proton Radiation Therapy at the Paul Scherrer Institute. All MRI studies at our institute were performed on the 1.5 T Siemens Avanto scanner using a standardized protocol (STIR, T2w, T1w, contrast enhanced T1w, 3–4 mm). Initial MRI scans of all

patients acquired at the time of diagnosis were re-evaluated by a senior neuroradiologist. MRIs were investigated for initial and post surgical tumour extent, involved anatomy and signal intensities. MRI features were compared to histopathology.

Results: At the time of initial diagnosis, skull base chordomas were as expected predominately located at the midline, chondrosarcomas mostly in the vicinity of the petro-occipital synchondrosis; overlap did occur. No significant difference in signal intensities (e.g. T2w hyperintense to brain parenchyma), tumour volume or invasion was observed. Surgical alterations were sometimes difficult to distinguish from residual or recurrent tumour.

Conclusion: Best imaging criteria for differentiation of both tumour entities is still their site of origin despite topographic classification limitation due to the extent of tumour invasion. Our findings support the prevailing opinion that skull base chordomas are predominantly located at the midline whereas chondrosarcomas mostly in the vicinity of the petro-occipital synchondrosis.

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Temporal bone fractures and related complications: CT findings in patients imaged in the acute emergency setting

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Purpose: To analyse the prevalence and complications of temporal bone fractures in patients investigated for head/face trauma in the acute emergency setting.

Methods and materials: Retrospective analysis of a consecutive series of 186 patients with suspected head/face trauma investigated by CT in the emergency situation. In all patients CT of the brain and 0.75–1 mm slices through the skull and face were available for analysis; in 45.7% additional contrast enhanced images were obtained. Temporal bone fractures and associated injuries of the ossicular chain, facial nerve, cochlea, venous sinuses, carotid artery, and brain were analysed and correlated to trauma mechanisms and clinical symptoms.

Results: Temporal bone fractures were suspected clinically only in 27.8% of patients, those with otorrhagia. However, CT revealed 152 temporal bone fractures in 186 patients (81.7%). 80.2% of fractures were longitudinal. The tympanic cavity was involved in 53.5% of cases, the external auditory canal-temporomandibular joint complex in 46.5%, the ossicular chain in 4.5%, and the facial nerve canal in 10.9%, respectively. 4.5% of fractures had an otic component. Carotid canal injuries (31.2%) were more frequent than fractures involving the transverse sinus but sinus thrombosis (4.5%) was more common than carotid dissection (1.0%). The majority of patients had associated traumatic brain injuries (77.7%) and other fractures of the face and cranial vault (86.6%).

Conclusion: Temporal bone fractures and related complications are common in the head/face trauma setting and their recognition is essential for the early diagnosis and proper clinical management.

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Fusion of low-dose CT coronary angiography and cardiac magnetic resonance: Feasibility and added diagnostic information

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Purpose: To evaluate the feasibility, accuracy, and added diagnostic value of fusion of low-dose computed tomography coronary angiography (CTCA) and cardiac magnetic resonance (CMR) for assessing hemodynamically relevant coronary artery disease (CAD).
Methods and materials: Twenty-seven patients with significant coronary stenoses on prospectively ECG-gated dual-source CTCA, confirmed by catheter angiography, and perfusion defects on CMR at 1.5T were included. Surface-representations and volume-rendered images from fused CTCA/CMR data were generated using a newly developed software prototype. Fusion accuracy was evaluated by calculating surface-distances of blood pools and Dice-similarity coefficients. Two independent, blinded readers assigned myocardial defects to culprit coronary arteries with side-by-side analysis of CTCA and CMR and using fused CTCA/CMR. Added value of fused CTCA/CMR was defined as change in assignment of culprit coronary artery to myocardial defect compared to side-by-side analysis.
Results: Fusion of CTCA/CMR was feasible and accurate (surface-distance 4.1 ± 1.3 mm, range 2.4–7.1 mm, Dice-coefficient 0.78 ± 0.08 , range 0.51–0.86) in all patients. Side-by-side analysis of CTCA and CMR allowed no assignment of a single culprit artery to a myocardial defect in 6/27 (22%) patients. Fused CTCA/CMR allowed further confinement of culprit coronary arteries in 3 of these 6 patients (11%). Myocardial defects were reassigned in 2/27 (7%) patients using fused CTCA/CMR, whereas the results remained unchanged in 22/27 (81%) patients. Inter-observer agreement for assignment of culprit arteries to myocardial defects increased with fused CTCA/CMR ($k = 0.66$ – 0.89).
Conclusion: Fusion of low-dose CTCA and CMR is feasible and accurate, and adds, at a low radiation dose, diagnostic value for the assessment of hemodynamically relevant CAD as compared to side-by-side analysis alone.

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

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Purpose: To prospectively compare the diagnostic performance of low-dose computed tomography coronary angiography (CTCA) and cardiac magnetic resonance imaging (CMR) and combinations thereof for the diagnosis of significant coronary stenoses.
Methods and materials: Forty-three consecutive patients with known or suspected coronary artery disease underwent catheter coronary angiography (CA), dual-source CTCA with prospective electrocardiography gating, and k-space and time broad use linear acquisition speed-up technique accelerated cardiac CMR (1.5 Tesla). The following tests were analyzed: 1) low-dose CTCA, 2) adenosine stress-rest perfusion-CMR, 3) late gadolinium enhancement (LGE), 4) perfusion-CMR and LGE, 5) low-dose CTCA combined with perfusion-CMR, 6) low-dose CTCA combined with late gadolinium-enhancement, 7) low-dose CTCA combined with perfusion-CMR and LGE. CA served as the standard of reference.
Results: CA revealed >50% diameter stenoses in 68/129 (52.7%) coronary arteries in 29/43 (70%) patients. In the patient-based analysis, sensitivity, specificity, NPV and PPV of low-dose CTCA for the detection of significant stenoses were 100%, 92.9%, 100% and 96.7%, respectively. For perfusion-CMR and LGE, sensitivity, specificity, NPV, PPV, and accuracy were 89.7%, 100%, 82.4%, and 100%, respectively. In the artery-based analysis, sensitivity and NPV of low-dose CTCA was significantly ($p < 0.05$) higher than that of perfusion-CMR and LGE. None of the combinations of low-dose CTCA and perfusion-CMR and/or LGE did improve diagnostic performance when compared to low-dose CTCA alone.
Conclusion: Taking CA as standard of reference, low-dose CTCA outperforms CMR with regard to sensitivity and NPV, whereas CMR is more specific and has a higher PPV than low-dose CTCA.

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Diagnostic accuracy of high pitch dual-source CT for the assessment of coronary stenoses: First experience

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Purpose: To prospectively investigate the diagnostic accuracy of high pitch (HP) dual-source computed tomography coronary angiography (CTCA) compared with catheter coronary angiography (CCA) for the diagnosis of significant coronary stenoses.
Methods and materials: Thirty-five patients (7 women; mean age 62 ± 8 years) underwent both CTCA and CCA. CTCA was performed with a second generation dual-source CT system permitting data acquisition at a HP of 3.4. Patients with heart rates >60 bpm were excluded from study enrolment. All coronary segments were evaluated by two blinded and independent observers with regard to image quality on a 4-point scale (1: excellent, to 4: non-diagnostic) and for the presence of significant coronary stenoses (defined as diameter narrowing exceeding 50%). CCA served as the standard of reference. Radiation dose values were calculated using the dose-length-product.
Results: Diagnostic image quality was found in 99% of all segments (455/459). Non-diagnostic image quality occurred in a single patient with a sudden increase in heart rate immediately before and during CTCA. Taking segments with non-evaluative image quality as positive for disease, the sensitivity, specificity and positive and negative predictive values were 94%, 96%, 80% and 99% per segment and 100%, 91%, 88% and 100% per patient. The effective radiation dose was on average 0.9 ± 0.1 mSv.
Conclusion: In patients with heart rates ≤ 60 bpm, CTCA using the HP mode of the dual-source CT system is associated with high diagnostic accuracy for the assessment of coronary artery stenoses at sub-millisievert doses.

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High-pitch dual-source CT angiography of the thoracic and abdominal aorta: Is simultaneous coronary artery assessment possible?

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

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Quantification of coronary artery stenosis using Dual-Source CT in comparison with histopathology

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Purpose: To investigate the ex-vivo performance of high-resolution computed tomography (CT) for quantitative assessment of percentage stenosis in coronary arteries compared to histopathology.

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Methods and materials: Dual-source CT (spatial resolution 0.4x0.4x0.4 mm³, temporal resolution 83 ms) was performed in 26 human heart specimens. After injection of iodinated contrast media in coronary arteries, 274 plaques were visually identified on CT images and the grade of stenosis for each plaque was measured with electronic calipers. All coronary plaques were characterized by histopathology according to the Stary classification, and stenosis percentage was measured.

Results: CT depicted 84% (274/326) of all coronary plaques identified by histology. Missed plaques by CT were of Stary type I (n = 31), II (n = 16), III (n = 5). The stenosis degree significantly correlated between CT and histology (r = 0.81, p < 0.001). CT systematically overestimated the stenosis degree of calcified plaques (mean difference - 11.0 ± 9.5%, p < 0.01) and systematically underestimated the stenosis degree of non-calcified plaques (mean difference -6.8 ± 10.4%, p < 0.05) while there was an excellent correlation for mixed-type plaques (mean difference -0.4 ± 11.7%, p < 0.85). There was a significant underestimation of stenosis degree as measured by CT for Stary II plaques (mean difference -14 ± 9%, p < 0.01) and a significant overestimation for Stary VII plaques (mean difference 9 ± 10%, p < 0.05), but there was no significant difference in stenosis degree between both modalities for other plaque types.

Conclusion: High-resolution CT is able to depict advanced stage coronary plaques and stenosis. CT systematically overestimates the degree of stenosis in calcified and underestimates in non-calcified plaques, while CT is accurate in stenosis quantification in mixed plaques.

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CT-angiographic assessment of left ventricular outflow tract for interventional aortic valve replacement

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Purpose: To test validity and reproducibility of CT-angiographic morphometry of the left ventricular outflow tract (LVOT) for planning interventional aortic valve replacement.

Methods and materials: Thirty-four patients assigned for interventional aortic valve replacement were subjected to CT-angiography of the aorta and trans-esophageal echocardiography (TEE). Repeated CT-measurements of eight relevant anatomic parameters of the LVOT were tested for accuracy and reproducibility by Lin's "Concordance Correlation Coefficient" (CCC) and Bland-Altman's "Limits of Agreement". Accuracy and precision were tested for measurements of the aortic valve annulus comparing CT- and TEE-measurements.

Results: With an overall concordance of 0.9, CT-angiographic measurements of LVOT imply high precision and an accuracy of 98%. Increased valvular calcification does not compromise reliability. Albeit a high CT-angiographic validity of 0.9, the concordance coefficient of 0.5 for CT-angiographic and TEE-measurements indicates a lack of inter-method reliability.

Conclusion: CT-angiography provides morphometry of LVOT and Aorta with high validity and reliability and thus is a strong tool for preinterventional assessment. TEE-morphometry of the aortic root, however, is hampered by poor inter-method reliability and thus may not be useful as a sole modality for preinterventional imaging.

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Selective cardiac evaluation by cardiac computed tomography in patients undergoing repair of abdominal aortic aneurysms

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Purpose: To determine in patients prior to abdominal aortic aneurysm (AAA) repair coronary calcium burden and prevalence of coronary artery disease (CAD) in relation to cardiovascular risk factors, and to assess left ventricular (LV) function using cardiac computed tomography (CT).

Methods and materials: Sixty consecutive patients (6 females; 72.2 ± 9.0 years) with AAA underwent calcium scoring and coronary angiography using dual-source CT prior to repair (n = 17). Patient charts were reviewed for cardiovascular risk factors according to the Framingham risk score (FRS). Coronary calcium burden was determined using the Agatston score (AS), CT coronary angiography data was assessed for significant coronary stenoses, and LV function was determined using semi-automated software.

Results: FRS ranged from 5–43%. Twenty patients (33%) had a low, 16 (27%) had an intermediate, 24 (40%) had a high risk for cardiovascular disease. The median AS was 393 (range, 0–3538). No significant correlation was found between the AS and the FRS (P = .76). 846/851 coronary segments (99%) in 57/60 patients (95%) were depicted with a diagnostic image quality. Significant stenoses were found in 132/846 segments (16%) in 33/60 patients (55%). Sixteen patients (27%) suffered from one-vessel, 10 patients (17%) from two-vessel, and 7 patients (11%) from three-vessel CAD. 5 patients (8%) with significant coronary artery stenosis showed a reduced global LV systolic function (EF < 50%). Extent of CAD was significantly correlated with AS (r = .43, P < .01), whereas no correlation was found for FRS (P = .55).

Conclusion: Cardiac CT is feasible in patients with AAA and allows for evaluating coronary calcium, CAD, and LV function. The calcium burden and coronary stenoses assessment with cardiac CT provides incremental information beyond traditional cardiovascular risk factors alone.

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Mapping of spinal arterial supply in patients pre thoracoabdominal aortic aneurysm repair using MRA with gadofosveset trisodium at 3T-MRI

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Purpose: Surgical thoracoabdominal aortic aneurysm repair is associated with an up to 5% risk of postoperative spinal cord ischemia causing paraplegia. Preoperative mapping of the arterial spinal cord supply including the Adamkiewicz artery is proposed to reduce postoperative ischemic complications.

Methods and materials: Twenty consecutive patients underwent a preoperative spinal MRA in a 3-Tesla MRI-scanner (MAGNETOM Verio, Siemens). The sequence applied was a steady-state coronal 3D-FLASH MRA with 0.7-mm isotropic voxels after injecting gadofosveset trisodium at 3 ml/sec. Postprocessing techniques included multiplanar reconstructions and maximum-intensity-projection for the Adamkiewicz artery and its segmental artery mapped from aortic origin to the spinal canal entry. Assessment of the images was performed by three independent observers.

Results: Identification and localization of the Adamkiewicz artery and its segmental artery as major arterial spinal supply was successful in all patients including the level of aortic origin and spinal canal entry. The interobserver variance for the overall image quality and anatomy depiction was 0.874 and 0.738 respectively. All patients underwent surgery for thoracoabdominal aortic aneurysm repair and no clinical postoperative ischemic sequelae occurred.

Conclusion: 3-Tesla-MRA with gadofosveset provides an efficient, non-invasive tool for identification of the Adamkiewicz artery and its segmental artery with regard to the level of aortic origin and spinal canal entry.

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Prediction rules for the detection of coronary artery plaques: Evidence from cardiac CT

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Purpose: To evaluate spatial plaque distribution patterns in coronary arteries based on CT coronary angiography and to express the learned patterns in prediction rules.

Methods and materials: 252 consecutive patients with CAD underwent CT coronary angiography. Coronary plaques were manually labelled and their position and composition (calcified, mixed or noncalcified) were noted. The frequent itemset mining algorithm was used to statistically search for plaque distribution patterns.

Results: In 200/252 (79.4%) patients, at least one coronary plaque (range, 1–22 plaques) was found. In total 1229 plaques (990 calcified, 80.6%; 227 mixed, 18.5%; 12 noncalcified, 1%) in 916 segments and 507 vessels were manually labelled. Four main distribution patterns were identified: 20.6% of patients had no plaques at all; 31.7% had plaques in the left coronaries; 46.4% had plaques both in left and right coronaries, whereas 1.2% had plaques solely in the RCA. Rules were found predicting plaques in the LAD, given plaques in segments of the RCA or in the LM. Further rules predicted plaques in the LAD, given plaques in the LCX. The segment selection based on the prediction rules from frequent itemset mining performed significantly better (P < .001) for revealing 48 initially missed plaques.

Conclusion: This study demonstrates spatial plaque distribution patterns in coronary arteries as determined by CT. Use of the frequent itemset mining algorithm yielded rules that predicted plaques at certain sites given plaques at other sites of the coronary artery tree. Use of these prediction rules improved manual labeling of plaques.

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Evaluation of aortic root for preoperative planning using high pitch acquisition: ECG- versus non-ECG-gating

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Purpose: To investigate the need of ECG-gating to assess the aortic aorta for preoperative planning and follow-up using CT angiography with high pitch acquisition.

Methods and materials: 35 patients underwent prospectively contrast-enhanced CT-scan with and without ECG-gating on a Somatom Definition Flash during the same examination using a pitch of 3.2. The maximal diameter of the valve plane, sinus valsalva, sinotubular junction and ascending aorta were measured by one reader with dedicated software for both examinations and compared (wilcoxon signed-rank test). The image quality of the proximal coronary arteries, sinotubular junction and ascending aorta were qualitatively assessed by two readers using a 4 point score (4 = excellent, 1 = not assessable). The image quality was compared (wilcoxon signed-rank test) and agreement was assessed (Kappa).

Results: Comparing the diameter no significant difference was found for valve plane and sinus valsalva. But the maximal diameter was significantly higher on non-ECG-gated scans for the sinotubular junction (0.8 mm, $p = 0.0069$) and ascending aorta (1.1 mm, $p = 0.0001$). The image quality was significantly better for ECG-gated for coronary arteries ($p > 0.001$; 3.3 v. 2.6) and sinotubular junction ($p = 0.023$; 3.7 v. 3.4) but not for the ascending aorta ($p = 0.0657$; 3.9 v. 3.7). There was an excellent and good interobserver agreement for ascending aorta and sinotubular junction respectively for coronary arteries.

Conclusion: Although the image quality is slightly better on ECG-gated scans all relevant structures of the aortic root for preoperative planning and follow-up can be adequately assessed without ECG-gating using high pitch acquisition.

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Effect of beam hardening on arterial enhancement in thoracoabdominal multi-detector row CT angiography with increasing patient size: An in vitro and in vivo study

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Purpose: To assess the effect of beam hardening on arterial enhancement in thoracoabdominal CT angiography for various body sizes in a phantom and a clinical study.

Methods and materials: An abdominal aortic phantom was placed into three cylindrical water containers simulating a small, an intermediate and a large patient (diameters; 22, 30, and 40 cm, respectively). CT scanning was done at 80, 100 and 120 kVp and aortic attenuation was assessed. In an HIPAA-compliant retrospective study, thoracoabdominal aortic attenuation was assessed in 100 consecutive patients (75 men, 25 women, mean body weight (BW) 79 kg) undergoing thoracoabdominal 64-slice CT angiography (Somatom Sensation Cardiac 64, Siemens, Germany) at 80 kVp. Overall aortic attenuation between patients grouped by BW [small patients ($n = 26$): <70 kg; intermediate patients ($n = 41$): 70–85 kg; large patients ($n = 33$): >85 kg] was compared. Overall aortic attenuation was correlated with BW, height, body mass index (BMI), body surface area (BSA) and lateral diameter using linear regression.

Results: Comparing the intermediate and large phantom with the small phantom, mean aortic attenuation decreased by 9.7% and 13.4% at 80 kVp, 9.8% and 15.1% at 100 kVp, and 13.8% and 23.8% at 120 kVp, respectively ($P < 0.0001$). In the clinical study, the overall aortic attenuation decreased by 11.3% and 20.0% in the intermediate and large groups relative to the small patient group, respectively ($P < 0.05$). Overall aortic attenuation correlated well with BSA ($R = -0.454$), height ($R = -0.440$) and body weight ($R = -0.432$), followed by lateral diameter ($R = -0.292$) and BMI ($R = -0.219$).

Conclusion: Beam hardening substantially contributes to reduced arterial enhancement in larger patients undergoing thoracoabdominal CT angiography. The beam hardening effect on arterial enhancement is more pronounced at higher tube voltages.

High low-density lipoprotein concentration correlates with plaque location: A computational case study in human right coronary arteries

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Purpose: Subendothelial accumulation of low-density lipoprotein (LDL) in arterial walls is believed to be an initiator of atherosclerotic plaque formation. Our aim was to calculate LDL concentrations in patients' artery walls prior to the onset of atherosclerosis and investigate possible correlations between healthy state LDL concentration distribution and sites of subsequent plaque formation.

Methods and materials: We performed patient-specific blood flow and shear-dependent LDL transport simulations under normal and hypertensive conditions on 30 patients' right coronary arteries obtained through dual-source computed tomography.

Results: Under hypertensive conditions, we found the maximum subendothelial LDL concentration at plaque locations to be, on the average, 50% higher than the average subendothelial concentration. The maximum subendothelial concentration reached at normal blood pressure was, on the average, 67% of the maximum subendothelial LDL concentration at plaque locations under hypertensive conditions. In 44% of the plaques, maximum subendothelial LDL concentration is found in the proximal part of the plaque location, compared to 9% in the distal part.

Conclusion: These results quantify the relationship between high LDL concentration and plaque formation, demonstrate one of the ways in which hypertension promotes atherosclerosis and confirm the hypothesis that plaques have a tendency to grow in the proximal to distal direction.

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Effect of reader experience on variability, evaluation time and accuracy of coronary plaque detection with computed tomography coronary angiography

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Purpose: To assess the effect of reader experience on variability, evaluation time, and accuracy in the detection of coronary artery plaques with computed tomography coronary angiography (CTCA).

Methods and materials: Three independent, blinded readers with three different experience levels labelled twice 50 retrospectively ECG-gated contrast-enhanced dual-source CTCA data sets (15 female, age 67.3 ± 10.4 years, range 46–86 years) indicating the presence or absence of coronary plaques. The evaluation times for the readings were recorded. Intra- and inter-observer variability expressed as k statistics and sensitivity, specificity, and negative and positive predictive values were calculated for plaque detection, with a consensus reading of the three readers taken as the standard of reference. A bootstrap method was applied in the statistical analysis to account for clustering.

Results: Significant correlations were found between reader experience, and evaluation times ($r = -0.59$, $p < 0.05$) and intra-observer variability ($r = 0.73$, $p < 0.05$). The evaluation time significantly differed among the readers ($p < 0.05$). The observer variability for plaque detection, compared with the consensus, varied between $k = 0.582$ and $k = 0.802$. Variability of plaque detection was significantly smaller ($p < 0.05$) and more accurate ($p < 0.05$) for the most experienced reader.

Conclusion: Reader experience significantly correlated with observer variability, evaluation time, and accuracy of coronary plaque detection at CTCA.

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MRI (T2*) for non-invasive diagnosis of myocardial and hepatic iron overload

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Purpose: MRI enables highly reproducible quantitative measurements of myocardial and hepatic iron load using T2* sequences. It is proposed to be a reliable, non-invasive tool to allow for early diagnosis and treatment prior to development of cardiac failure. Purpose of this study was to evaluate our initial results as a validated reference centre for this method in Switzerland.

Methods and materials: Fifteen patients (6 women and 9 men, mean age 48 ± 18) with suspected cardiac and/or hepatic iron overload

(thalassemia n = 5, hemochromatosis n = 6, other n = 4) underwent liver and myocardial T2* assessment using a Siemens Sonata 1.5-T scanner with gradient echo sequences. Iron analysis was performed using CMR-Tools (Cardiovascular Imaging Solutions, London, UK). Guidelines for iron assessment were as follows:

Myocardial loading	Myocardial T2*	Hepatic loading	Hepatic T2* (ms)	Dry weight
None	>20 ms	None	>6.3 ms	<2 mg/g
Mild	>14–20 ms	Mild	>2.7–6.3 ms	2–>5 mg/g
Moderate	10–14 ms	Moderate	1.4–2.7 ms	5–10 mg/g
Severe*	<10 ms	Severe	<1.4 ms	>10 mg/g

Of patients with heart failure, 89% have heart T2<10 ms

Results: Cardiac iron load was none in 13 patients. Two patients with thalassemia demonstrated an increase in cardiac iron load, which was either severe (4.9 ms) or moderate (12.3 ms). Hepatic iron load was normal in 10 patients, mild in two patients (thalassemia n = 1, hemochromatosis n = 1), and moderate in three patients (thalassemia n = 1, hemochromatosis n = 2).

Conclusion: Myocardial and hepatic iron load could be successfully quantified using T2*. This technique could be used for early intensification of iron chelation therapy in order to reduce mortality from this reversible cardiomyopathy

High-pitch dual-source CT for the assessment of coronary stents in a phantom study

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Purpose: To evaluate the quality of stent lumen delineation using DSCT in the standard pitch mode (SP) as compared to the high pitch mode (HP) in a phantom study.

Methods and materials: 40 different coronary stents placed in plastic tubes filled with contrast agent were imaged with a second generation DSCT system in a SP (pitch 0.23) and HP (pitch 3.0) mode in orientations of 0°, 45° and 90° relative to the z-axis. Two observers independently measured the visible lumen diameter and the attenuation values in the centre of the stent. The residual lumen diameter (RLD) was calculated using the measured visible lumen diameter and the nominal diameter of the plastic tube.

Results: Interobserver correlation was excellent for diameter of visible stent lumen (0.86) and attenuation measurements (0.91). There was no significant difference neither for RLD (SP: 37.2–45.3%; HP: 36.0–44.2%) nor attenuation (SP: 356–395 HU; HP: 352–384HU) between SP and HP mode. For both modes, the orientation of the stent relative to the z-axis significantly affects RLD and attenuation (each p <0.001).

Conclusion: The HP mode in DSCT provides visualization of the coronary in-stent lumen and measurement of in-stent diameters comparable to those measured in the SP mode.

CHEST AND BREAST

Ventricular short-axis measurements in patients with pulmonary embolism: Effect of ECG-gating on variability, accuracy and risk prediction

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Purpose: To assess prospectively, in patients with suspicion of pulmonary embolism (PE), the intra- and inter-observer variability and accuracy of right ventricular (RVd) and left ventricular (LVd) short-axis measurements for risk stratification using ECG-gated compared to non-ECG-gated chest CT, and to test whether ECG-gating improves the prognostic value of RVd/LVd ratio for predicting early outcome.

Methods and materials: Sixty consecutive patients were examined with non-ECG-gated and ECG-gated CT. Two blinded and independent observers measured RVd and LVd on four-chamber views. Intra- and interobserver variability of RVd and LVd were calculated using both protocols. RVd/LVd ratios were calculated using both protocols and were related to 30-days adverse clinical events using receiver-operating-characteristic (ROC) with area-under-the-curve (AUC) analyses.

Results: Twenty-one of the 60 patients (35%) had PE. Inter-observer agreement revealed significant differences between the two readers for RVd (p <.05) and LVd (p <.01) when comparing ECG-gated with non-ECG-gated CT for all patients and for patients with PE [(p <.05) and LVd (p <.01)]. Using a RVd/LVd ratio cut-off of 0.9, significantly more patients were classified as being at high risk when using ECG-gated CT as compared to non-ECG-gated CT (19 versus 8, p <.01). ROC analysis revealed a significantly larger AUC of the RVd/LVd ratio from ECG-gated CT than that from non-ECG-gated CT (p <.05).

Conclusion: Measurements of RVd and LVd using ECG-gated CT is less subject to intra- and inter-observer variability and more accurately reflect ventricular function, particularly in patients with PE, when compared to non-ECG-gated CT. Use of RVd/LVd ratio from ECG-gated CT better predicts short-term outcome.

3D reconstruction and sphericity of silicone implants in a serial study in rat using dual contrast 3D radial UTE-MRI

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Purpose: The fibrotic reaction around implantable medical devices limits function and causes pain in patients. 10–15% of silicone breast implants are replaced due to capsular contraction. A 3D radial MRI technique with ultrashort TE and multiple contrasts is proposed for early quantification of fibrotic tissue formation.

Methods and materials: Rats were transplanted with multiple 1 ml volume implants (n = 9) and imaged using 3D radial UTE on a Siemens 3T clinical scanner (isotropic resolution 0.35 mm, 120 mm FOV, 35000 projections, TE(1)/TE(2)/echo-spacing/FA = 0.07 ms/7.4 ms/9.6 ms/10°). Respiratory triggering used a pressure pad and input (SA Instruments Inc., USA) with trigger delay 150 ms to ensure constant position for acquisitions over the 6 min scan. The second echo is in-phase for fat/water. Fat suppression was applied to identify tissue layers. Analysis included segmentation and calculation of sphericity (a function of volume and surface area) to quantify distortion.

Results: UTE gives an artifact free image with good contrast from implant, coating and surrounding tissue layers to facilitate segmentation for shape assessment. A non-distorted implant has a sphericity value of 0.75. Deformation (0.7–0.8), rupture and leakage (<0.7) have characteristic values that are stable over time (slope vs day <0.0007, mean 0.770, sd 0.016) if no further distortion occurs.

Conclusion: With the reduction of chemical shift and motion artifacts, high isotropic resolution and segmentation, change of shape, rupture and tissue build-up can be quantified, predicting a standardized method for early detection of excessive capsular deformation, decreasing complication rates in patients.

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Imaging for suspected pulmonary embolism in pregnancy – what about the fetal dose? A comprehensive review of the literature

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Basel

Purpose: the purpose of this work is to give a comprehensive overview about fetal doses reported in literature when imaging the pregnant woman with suspected pulmonary embolism (PE).

Methods and materials: A comprehensive literature research in pubmed, medline and embase databases yielded a total of 1687 papers that have been analysed with regard to fetal dose in suspected PE radiological imaging strategies.

Results: Fetal dose in chest CT (dependent on the scanning protocols) is substantially lower than even dose reduced scintigraphy pathways (0.003–0.24 mGy in early and 0.051–0.1 mGy in late pregnancy for CT; 0.1–0.6 mGy in early and 0.6–0.8 mGy in late pregnancy for 99mTc-MAA perfusion scintigraphy - dependent on activity; 0.1–0.3 mGy for 99mTc-Aerosols ventilation scintigraphy – dependent on activity). The approximate fetal dose from a single plane chest radiograph is reported to be <0.01 mGy. But there is concern about female breast irradiation in CT that is higher than in scintigraphy. CT radiation risks for breast tissue remain unclear.

Conclusion: Knowledge about dosimetry and radiation risks is crucial in radiological work up of suspected PE in pregnancy. Apart from clinical risk stratification and laboratory tests lower limb compression ultrasound should be performed in all pregnant patients prior to further radiologic tests. It is reasonable to reserve scintigraphy only for pregnant patients with normal chest radiographic findings and no history of asthma or chronic lung disease. Else performing CT applying dose reduction measurements instead of scintigraphy will minimize fetal and maternal radiation dose and maximize the diagnostic value.

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Characterizing diffuse FDG accumulation in the lung upon combined PET/CT scanner

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Sion

Purpose: The aim of this educational poster is to shed light over characterizing diffuse FDG accumulation in the lung parenchyma using the concomitant morphological CT data upon PET/CT examination.

Methods and materials: Interpreting the identity of diffuse FDG accumulation in the lung parenchyma could be challenging since many benign and malignant lesions may share the same aspect upon PET examination. For, instance pneumonic lesions, active lung fibrosis, and pulmonary atelectasis are not easily differentiated upon PET scan from lymphangitis carcinomatosa or diffuse form of bronchioloalveolar carcinoma. Correlating the FDG PET findings to CT is highly recommended to avoid many interpretative pitfalls that may lead to unnecessary invasive procedures like needle biopsy or bronchoscopy.

Results: Pneumonic FDG avid lesions of infectious or post radiation origin are characterized by parenchymal condensation with or without air-bronchogram, whereas atelectasis that accumulate FDG is usually of post-stenotic origin by virtue of proximal occluding tumour. Lung fibrosis has a typical irregular thickened septal lines and focal subpleural honeycombing appearance upon CT that facilitates its identification. On the other hand, lymphangitis carcinomatosa is presenting with peribronchovascular thickening and abnormal thickened nodular septal lines, whereas, diffuse bronchioloalveolar carcinoma is characterized by a low attenuating consolidation that may extend to the contralateral lung.

Conclusion: Morphological correlation of diffuse pulmonary FDG accumulation is a keystone in narrowing the differential diagnosis of this frequent PET finding.

INTERVENTIONAL

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Patient factors influencing success rate of patients undergoing lumbar spine infiltrations: Retrospective analysis of 836 patients

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Solothurn

Purpose: Infiltration of peridural space, periforaminal region and facet joints of the lumbar spine with a combination of local anaesthetics and corticosteroids is a well established treatment for back pain. Patient factors influencing success of this treatment are less known.

Methods and materials: All consecutive patients undergoing lumbar spine infiltrations (L1 –S1) between 2005 and 2009 were retrospectively evaluated (n = 836; 451 female, 385 male; 59.1 ± 16.1, range 19–97 years). They underwent infiltration under CT control of peridural space (n = 445), periforaminal region (n = 301) and facet joints (n = 90). Pain score was assessed using a scale from 0 to 10 before, immediately after, one day after and 4 weeks after intervention. Wilcoxon signed rank and Mann Whitney tests served for statistical analysis between responders and non-responders, men and women and three age groups (19–49, 50–69, and >70).

Results: Pain before treatment is significantly reduced immediately after infiltration, one day after and 4 weeks after intervention (each p <0.0001). A high pain score before treatment results in more immediate responders. There were no sex differences and no difference in response between the techniques. Evaluation of three age groups reveals a better effect in elderly vs younger patients (p = 0.002). Effect is significantly high in elderly men (p = 0.009). 79% of elderly and 71% of young women showed good response (tendency, p = n.s.).

Conclusion: In patients undergoing lumbar infiltration for back pain, a better response can be expected when pre-interventional pain score is high. Elderly respond better than younger patients and elderly men better than women.

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How time flies in a waiting room

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Purpose: This prospective study was to evaluate if the subjective waiting period decreases when patients look TV in the waiting room.

Methods and materials: 157 patients (99 f, 58 m; mean age 55.8 ± 16.4, range 17–84) waiting for a radiologic examination (US, CT, MR, Mammography, conventional X-rays) were interviewed. Time between registration at the front desk and the beginning of the examination was measured. Patients had to specify how many minutes they had to wait. Patients were interviewed at different days and watched 3 different randomized TV programs: no TV, information TV in German (ntv or sf info), or portuguese TV. Mann Whitney and Wilcoxon signed rank tests served for statistics (significance level after Bonferroni correction 0.05/6; p = 0.0083).

Results: Measured waiting time was 22.6 ± 13.2 minutes, Subjective waiting time was 24.7 ± 17.3 minutes. There were no sex differences for measured (p = 0.44) and subjective waiting time (p = 0.63). Patients watching German TV (n = 31) had a significantly shorter subjective waiting period than patients without TV (n = 30) and those watching Portuguese TV (n = 57; p <0.0001). Patients watching German or Portuguese TV had a significantly shorter waiting period than those without TV (p = 0.0078). There was no significant difference between patients watching Portuguese or German TV.

Conclusion: Patients watching TV in the waiting room perceive the waiting time shorter than patients without TV. This seems to be less influenced by the program, since subjective waiting time is also reduced in patients who look TV in a foreign language.

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Below the knee revascularisation: Geneva experience

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Purpose: Most vascular lesions Below The Knee (BTK) occur in diabetic patients. Among this population, 20% develop a Critical Limb Ischemia (CLI). Without treatment, 33% will undergo amputation. The treatment of CLI related to BTK disease requires a multidisciplinary approach, with endovascular percutaneous angioplasty as first therapeutic option. The aim of our study was to evaluate the safety and effectiveness of BTK procedure.

Methods and materials: 33 BTK revascularisations were attempted over a 12 month period. Patients mean age was 76 years. Fontaine stage distribution: stage IIb-III 21.2% (n = 7); stage IV 78.8% (n = 26). We used 0.014" wires and dedicated long PTA balloons with low compliance and high conformability and applied long inflation time

(2 minutes). At the end of the procedure we administered a dual anti-aggregative therapy. The goal was to restore direct blood flow in at least one vessel to the foot.

Results: Technical success rate was 85% (n = 28). Failure rate was 15% (n = 5), mostly because of uncrossable lesion and in one case because of a surgical ligation of the artery. No major complication occurred. Minor complication rate was 9% and included pseudoaneurysm (n = 1), puncture-site hematoma (n = 1) and a small perforation during a subintimal procedure (n = 1). All were successfully treated during the same intervention.

Conclusion: BTK revascularisation is a safe and effective procedure. As part of a multidisciplinary approach, like in a "Diabetic Foot Unit", extensive indication for BTK endovascular intervention should be considered.

MUSCULOSKELETAL RADIOLOGY**Radiostereometric analysis of cervical spine arthroplasties and anterior cervical spine fusion**

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Purpose: Artificial disc replacement by disc prosthesis seems to be a promising treatment of symptomatic degenerative disc disease. To relieve overstraining of adjacent discs segmental motion should be preserved which is very difficult to evaluate and has not yet been proven. The aim of the current study was first to analyze segmental motion following artificial disc replacement using disc prosthesis. A second aim was, to compare both segmental motion as well as clinical result to the current surgical gold standard (ACDF).

Methods and materials: This is a prospective controlled study. 49 patients with cervical disc herniation were enrolled and assigned to either study groups (receiving a disc prosthesis) or control group (receiving ACDF, using a cage with bone graft and an anterior plate.). 8 patients were excluded from the study. Radio Stereometric Analysis (RSA) was used to quantify intervertebral motion immediately as well as 6, 12 weeks, 6 months as well as 1 and 2 years postoperatively. Also, clinical results were judged using visual analog scale and neuro-exam at each RSA follow-up.

Results: Cervical spine segmental motion decreased over time in the presence of both disc prosthesis or fusion device. However, the loss segmental motion is significantly higher in the fusion group. We observed significant pain reduction in neck and arm postoperatively, without significant difference between both groups.

Conclusion: Cervical spine disc prosthesis remains segmental motion within 2 years after surgery. The clinical results are the same when compared to the early results following ACDF.

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In the articular cartilage, T1rho was 7–8% higher using 3D technique (p = 0.005). The expected zonal variation of T1rho values from deep to superficial regions of cartilage was present in both the 2D and 3D sequences (mean T1rho radial/transverse zone 53.5/71.5ms). T1rho values acquired at variable angular orientation with respect to the main magnetic field did not show significant differences in either sequence.

Conclusion: Both sequences show a zonal variation in T1rho from deep to superficial layers of articular cartilage. Gel phantom T1rho measurements show significant differences in values acquired with the 2D versus 3D sequences in 2% and 3% agarose gel phantoms raising the possibility that variability between the techniques may be introduced at low proteoglycan concentrations.

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Extensor carpi ulnaris (ECU) subsheath: Normal MRI appearance and findings in athletic injuries

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Purpose: First, to report ECU subsheath's normal MRI appearance and the findings in athletic injuries. Second, to determine the best MRI sequence for diagnosis.

Methods and materials: Sixteen patients (13 males, 3 females, mean age 30.3 years) with ECU subsheath's athletic injuries sustained between January 2003 and June 2009 were retrospectively reviewed. Wrist MRI studies were performed on 1.5-T units and consisted of at least transverse T1 and STIR sequences in pronation, and FS Gd T1 in pronation and supination. Two radiologists assessed the following items, in consensus: injury type (A to C according to Inoue), ECU tendon stability, and associated lesions (ulnar head oedema, extensor retinaculum injury, ECU tendinosis and tenosynovitis). Then, each reader independently rated the sequences' diagnostic value:

0 = questionable, 1 = suggestive, 2 = certain. Follow-up studies were present in 8 patients. ECU subsheath's normal visibility (medial, central and lateral parts) was retrospectively evaluated in 30 consecutive control MRI studies.

Results: FS Gd T1 sequences in supination (1.63) and pronation (1.59) were the most valuable for diagnosis, compared to STIR (1.22) and T1 (1). The study group included 9 type A, 1 type B and 6 type C injuries. There were trends towards diminution in pouches' size, signal intensity and enhancement in follow-up studies, along with tendon stabilization within the ulnar groove. In control studies, ECU subsheath's visibility in medial, central and lateral parts were noted in 66.7–80%, 63.3–80% and 30–50% respectively.

Conclusion: ECU subsheath's athletic injuries are visible on 1.5-T MRI studies. FS Gd T1 sequences in supination and pronation are the most valuable.

Comparison of T1-measurements in agarose phantoms and human patellar cartilage using 2D multi-slice spiral and 3D MAPS techniques in cadaveric patella specimens at 3T

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Purpose: To compare in vitro T1rho measurements in agarose phantoms and articular cartilage using a 2D multi-slice spiral and 3D MAPS technique.

Methods and materials: Three agarose phantoms and five cadaveric patella slices were scanned in a 3T MRI-system. T1rho sequences were acquired using a 2D multi-slice spiral technique and 3D MAPS technique. Measurements were performed in the phantoms and in the radial and transitional zones of the cadaveric patellar cartilage in the medial and lateral facet.

Results: Average T1rho values were measured in 2%, 3% and 4% concentration agarose gel phantoms and were 43.0/37.4/26.0ms using 2D technique, and 49.9/34.6/26.2ms using 3D technique respectively. In the patella specimens, average T1rho was 59.5ms (range, 29.0–106.1) using 2D, and 64.5ms (range, 29.2–109.9) using 3D technique.

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Muscular MRI in occulo-pharyngeal muscular dystrophyA. Fischmann, S. Fasler, M. Gloor, D. Fischer
Basel

Purpose: Occulopharyngeal muscular dystrophy (OPMD) is a genetic disorder with progressive muscular weakness. With potential treatments under development, extent and progression of muscular involvement in OPMD is of increasing importance.

Methods and materials: We performed MRI (1.5 Tesla Magnetom Avanto) of the lower extremities in 8 Patients with OPMD, using axial T1w imaging as well as quantitative measurements of muscle fat content (MFC) with 2-point Dixon, T2-measurements and steady state free precession (SSFP) sequences. Patterns were evaluated on a 4 point visual scale (0 to 3).

Results: All Patients but one (asymptomatic) revealed a distinct pattern of muscular fatty replacement without atrophy. We detected symmetric involvement of the adductor magnus and soleus muscles 7 patients. Depending on disease extent we found progressive involvement of the semimembraneous and semitendineous, the femoral biceps, as well as the medial head of the gastrocnemius muscles. In contrast vastus medialis and gracilis muscle, as well as the anterior tibial and peroneal group muscles were spared in all but one patient. Quantitative MFC measurements revealed a very high linear correlation between fatty replacement measured with the 2-point Dixon and the quantitative T2-values ($R^2 = 0.95$), while histogram analysis with the SSFP-sequence had a lower correlation ($R^2 = 0.88$).

Conclusion: OPMD displayed a distinct pattern of muscular involvement. MRI can depict muscular involvement and is helpful for quantitative assessment of MFC in involved muscles. Quantitative MFC assessment could be an useful tool for the evaluation of disease progress.

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MR-histologic correlation in rotator cuff tendonsF. M. Buck, H. Grehn, M. Hilbe, C. W. A. Pfirrmann,
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Purpose: To relate histologic changes in rotator cuff tendons to the appearance in T1-weighted, T2-weighted fat-saturated, and proton density-weighted fat-saturated MR sequences.

Methods and materials: T1-weighted, T2-weighted fat-saturated, and proton density-weighted fat-saturated sequences of eighteen cadaveric shoulders were acquired. The supraspinatus, infraspinatus, and subscapularis tendons were evaluated histologically. Twenty-six abnormalities were found. In addition, histologically normal tendon parts ($n = 32$), including three segments with normal histology but abnormal MR signal, considered to represent magic angle effects, were defined. All ROIs were evaluated by two musculoskeletal radiologists independently and blinded to histology.

Results: In the 26 areas with abnormal histological findings mucoid degeneration ($n = 13$), chondroid metaplasia ($n = 11$), fatty infiltration ($n = 1$), and foreign-body granuloma ($n = 1$) after tendon suture were found. Compared to normal tendon, mucoid degeneration was hyperintense on T2-weighted fat-saturated ($p = 0.007$) and on proton density-weighted fat-saturated images ($p = 0.006$). Chondroid metaplasia was hyperintense compared to normal tendon in all sequences ($p < 0.05$). Mucoid degeneration was hypointense compared to chondroid metaplasia on T2-weighted fat-saturated images ($p = 0.038$) and hypointense compared to magic angle artifacts on T1-weighted images ($p = 0.046$).

Conclusion: Chondroid metaplasia of rotator cuff tendons appears to be more common than expected. Both mucoid degeneration and chondroid metaplasia may explain increased tendon signal on MR images of the rotator cuff.

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Morphology of the distal radioulnar joint with emphasis on the articular facets, cartilage distribution, bare areas, and patterns of degenerationF. M. Buck¹, M. A. C. Nico², R. Gheno³, P. Haghighi⁴, D. Trudell⁴,
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Purpose: To demonstrate the physiological extent and thickness of the cartilage and the bare areas of the distal radioulnar joint (DRUJ) based on gross anatomy, MR imaging, and MR arthrography with the forearm in neutral position, maximal pronation, and maximal supination.

Methods and materials: Ten cadaveric specimens (age range, 56–97 years at death; mean age, 82.9 years) were obtained and used according to institutional guidelines. MR imaging and MR arthrography were performed in neutral position, maximal pronation and maximal supination of the forearm. Cartilage surface and thickness were assessed, and degenerative changes and bare areas were evaluated by two musculoskeletal radiologists in consensus. Gross anatomy and histology served as the reference standard.

Results: MR imaging in maximal pronation and supination was helpful in the evaluation of the ulnar cartilage. In the axial plane, any change in cartilage thickness in the ulnar head was related to chondral degeneration. In the coronal plane, cartilage thickness proved to be an unreliable sign in the assessment of chondral degeneration. The presence of osteophytes in the proximal aspect of the joint was easily detected and proved to be a reliable criterion for joint degeneration. Bare areas were found at the proximal and volar attachments of the joint capsule.

Conclusion: Detailed knowledge about the anatomy of the DRUJ should allow more accurate assessment of degenerative changes and the localization of erosions in inflammatory joint disease. Imaging in maximal pronation and supination of the forearm can be used to improve the visualization of the ulnar head cartilage.

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MR/CT image fusion of the spine after spondylodesis:**A feasibility study**C. A. Karlo¹, I. Steurer-Dober², M. Leonardi¹, C. W. A. Pfirrmann¹,
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Purpose: To evaluate feasibility, accuracy and time requirements of MR/CT image fusion of the lumbar spine after spondylodesis.

Methods and materials: Sagittal MR and CT images derived from standard imaging protocols (sagittal T2-weighted MR / sagittal reformatted multi-planar-reformation of the CT) of the lumbar spine with correct ($n = 5$) and incorrect ($n = 5$) implant position were fused by two readers (R1, R2) using OsiriX in two sessions placing one (session 1) or two (session 2) reference point(s) on the dorsal tip(s) of the cranial and caudal endplates from the second lumbar to the first sacral vertebra. R1 was an experienced musculoskeletal radiologist; R2 a spine surgeon, both had received a short training on the software tool. Fusion times and fusion accuracy, defined as the largest deviation between MR and CT in the median sagittal plane on the ventral tip of the cranial end plate of the most cranial vertebra visible on the CT, were measured in both sessions. Correct or incorrect implant position was evaluated upon the fused images for all patients by an experienced senior staff musculoskeletal radiologist.

Results: Mean fusion time (session 1 / session 2; in sec) was 100.4/95 (R1) and 104.2/119.8 (R2). Mean fusion deviation (session 1 / session 2; in mm) was 1.24 / 2.20 (R1) and 0.79 / 1.62 (R2). The correct / incorrect implant position was identified correctly in all cases.

Conclusion: MR/CT image fusion of the spine with metallic implants is feasible, fast, accurate and easy to implement in daily routine work.

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CT-guided sternoclavicular joint injections: Description of the procedure, reliability of imaging diagnosis and short-term patient responsesC. K. Peterson, N. Saupe, F. M. Buck, C. W. A. Pfirrmann,
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Zürich

Purpose: Sternoclavicular (SC) joint injections are mentioned in review papers focusing on diagnostic and therapeutic joint injections but not in original papers. This study reports the changes between pre-injection and 15 minute post-injection visual analogue scale (VAS) scores in patients receiving these injections.

Methods and materials: Fifty patients who had CT-guided injections of corticosteroid and local anesthetic into their SC joints were included in the study. Pre-injection and 15 minute post injection VAS data were recorded and compared to the imaging findings agreed by consensus. Clinically significant pain response was determined to be >50% reduction in pain. Kappa statistics were calculated for the reliability data. Proportions of patients improving after joint injection were calculated and the risk ratio comparing the response of patients with OA to those without OA was done. The correlation between the severity of OA and pain response was also calculated using Spearman's correlation coefficient.

Results: Sixty six percent of the patients reported clinically significant pain reduction at 15 minutes. For patients with OA the proportion of patients with a clinically significant response was 67% compared to 64% of patients without OA. This difference was not statistically or clinically significant. There was no correlation between the severity of OA and the amount of pain reduction ($r = .03$).

Conclusion: The majority of patients having SC joint injections of corticosteroids and local anesthetics report clinically significant improvement irrespective of the abnormalities detected on their CT images.

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Osteoid osteoma-like lesions: MDCT features and treatment by radiofrequency ablation

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Purpose: To assess the MDCT features of bone lesions that mimic osteoid osteoma (OO-like lesions) and evaluate their treatment by radiofrequency (RF) ablation.

Methods and materials: All percutaneous RF ablations performed between May 2002 and June 2009 for a presumed (clinical and MDCT features) diagnosis of OO were retrospectively reviewed. Per-procedural biopsies were always performed and histopathological diagnoses were noted. The following MDCT features of all bone lesions were assessed by two musculoskeletal radiologists in consensus: skeletal distribution and location within the bone, size, central calcification, surrounding osteosclerosis and periosteal reaction. Clinical success was also evaluated.

Results: Eighty patients (54 males, 26 females, mean age 24.1 years, range 5–48) underwent RF ablation. The histopathological diagnoses were: 54 non-contributory biopsies, 16 OO, 10 OO-like lesions (5 chronic osteomyelitis, 3 chondroblastoma, 1 eosinophilic granuloma, 1 fibrous dysplasia). The OO-like lesions were significantly greater in size ($p = 0.001$) and exhibited trends toward medullary location within the bone, moderate surrounding osteosclerosis and less periosteal reaction, compared to OO. Primary clinical success for OO-like lesions was 100% at 1 month, 85.7% at 6 and 12 months, and 66.7% at 24 months. Secondary success was 100%.

Conclusion: Greater size, medullary location within the bone, lesser surrounding osteosclerosis and periosteal reaction on MDCT may help differentiate OO-like lesions from OO. OO-like lesions are safely and successfully treated by RF ablation.

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Cervical radiculopathy: Efficiency of CT-guided cervical facet joint corticosteroid injection

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Purpose: Cervical foraminal injection performed with a direct approach of the foramen may induce serious neurologic complications. Cervical facet joint (CFJ) injections are easier to perform and safe, and may diffuse in the epidural and foraminal spaces. We analyzed the efficiency and tolerance of CT-guided CFJ slow-acting corticosteroid injection in patients with radiculopathy related to disc herniation.

Methods and materials: Pilot study included 17 patients presenting typical cervical radiculopathy related to disc herniation without relief of pain after medical treatment (one month duration). CFJ puncture was performed under CT guidance with a lateral approach. CT control of the CFJ opacification was performed after injections of contrast agent (1 ml), followed by slow-acting corticosteroid (25 mg). Main criteria for judgment was pain relief one month later (delta visual analogical scale VAS for 0 to 100 mm). Diffusion of iodinated contrast agent in the foramen was assessed by two radiologists in consensus.

Results: Pain relief was significant at one month (delta VAS 22 ± 23 mm, $p = 0.001$) and 41% (7/17) of patients had pain relief more than 50%. In cases with foraminal diffusion, pain relief more than 50% occurred in 5 patients (50%) and only in 2 patients (29%) in cases without foraminal diffusion. No complication occurred.

Conclusion: CT-guided CFJ slow-acting corticosteroid injection is safe and provided good results at one month follow-up. It may be considered as an interesting percutaneous treatment in patients suffering from cervical radicular pain related to disc herniation.

Elbow stiffness: Effectiveness of conventional radiographs and CT to explain osseous causes

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Purpose: To evaluate the effectiveness of conventional radiographs and CT explaining the osseous causes of elbow stiffness.

Methods and materials: Two independent readers analyzed loose bodies and osteophytes on conventional radiographs and CT (or CT arthrography) of the elbow in 94 consecutive patients (71 men, 23 women, mean age 41 years, range: 18–68 years). Arthroscopic or surgical correlation was available in 58 (62%) patients. In all 94 patients, the expected restriction of motion was measured on images and correlated (Pearson correlation) with the clinical restriction of motion. Kappa statistics were performed for interobserver agreement.

Results: Accuracy for detecting loose bodies was 67% with conventional radiographs and 79% with CT. Differences in accuracy were most pronounced for detecting loose bodies in the posterior joint space (64% for conventional radiographs vs. 79% for CT). Accuracy for detecting osteophytes was 69% with conventional radiographs, and 76% with CT. Expected restriction of motion on conventional radiographs correlated significantly with clinical restriction only for one reader for flexion ($R = 0.21$, $P = 0.04$). Expected restriction of extension on CT correlated significantly with clinical restriction of motion by both readers ($R = 0.34/0.33$, $P = 0.001/0.001$). Expected restriction of flexion on CT correlated significantly by one reader ($R = 0.24$, $P = 0.02$). Interobserver agreement with regard to detection of both loose bodies and osteophytes was higher for CT (Kappa values: 0.83, 0.76) than for conventional radiographs (0.64, 0.60).

Conclusion: CT is more effective than conventional radiographs in explaining the osseous causes of elbow stiffness.

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Extensor carpi ulnaris accessory tendinous slips (ECUATS): MRI features at 3.0T and correlation with tendinosis

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Purpose: To assess the visibility and the features of ECUATS on 3.0-T MRI studies, and evaluate their correlation with tendinosis.

Methods and materials: Our retrospective study was approved by IRB, with waiver of informed consent. Fifty wrist MRI and 48 MR arthrographs from 98 patients (55 males, 43 females, mean age 42.3 years) performed between January and November 2009 on 3.0-T units were reviewed. Images (transverse T1, T2, FS Gd T1 and VIBE) were independently analyzed by two radiologists, and a consensus reached with a third reader in case of disagreement. The visibility of ECUATS was assessed on each available transverse sequence. When present, ECUATS' origins, diameters and insertions were noted. ECU tendinosis was also evaluated. Inter-rater agreement was assessed using Cohen's Kappa coefficient.

Results: ECUATS observed prevalence was 23.5% (23/98). ECUATS were more frequently noted on the VIBE sequence, with a good inter-rater agreement (Kappa = 0.72). Origins were noted in 95.7% of cases: 3 were at the level of, and 20 distal to ECU subsheath. Insertions were seen in 43.5%: 2 were on 5th metacarpal bone, 8 on extensor apparatus of 5th finger. ECUATS mean shortest and longest diameters were 0.54 and 0.85 mm respectively. ECU tendinosis was statistically more frequently noted in patients with ECUATS ($p < 0.05$).

Conclusion: ECUATS are readily visible on 3.0-T MRI studies, especially on transverse GRE VIBE images. ECU tendinosis is more frequently noted in patients bearing ECUATS.

Normal position of the extensor carpi ulnaris tendon (ECU) in neutral position, supination and pronation in asymptomatic wrists

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Purpose: To prospectively evaluate variability of position, signal intensity and form of the extensor carpi ulnaris tendon (ECU) in 40 asymptomatic wrists in three different forearm positions.

Methods and materials: Institutional review board approval and informed consent were obtained. Both wrists in 20 volunteers (10 women, 10 men; mean age 37.2 years) with asymptomatic wrists and no history of wrist problems were scanned in a 1.5 T MRI scanner in neutral position, supination and pronation. Two readers assessed tendon position and tendon form in relation to distal ulnar groove. Additionally measurements of depth of distal ulnar groove and signal intensity of tendon in T1- and PD fatsat-sequence in neutral position were obtained.

Results: Tendon signal in neutral position is mostly homogenous or slightly inhomogeneous in T1- and slightly inhomogeneous in the PD fatsat sequences. Tendon form in neutral position or supination is mostly flat or comma-shaped. In pronation tendon form is mostly flat. Tendon position in neutral position and supination is mostly off-centre in groove or over ulnar wall. In pronation position is mostly centered or off-centre in groove. Distal ulnar groove is significantly deeper in males than in females ($p = 0.005$). Groove depth mean significantly influences tendon position in neutral position and supination.

Conclusion: In asymptomatic wrists the position of the ECU tendon in neutral forearm position is mostly off-centre in relation to ulnar groove. Groove depth mean significantly influences tendon position in neutral position and supination of the wrist. Signal of the ECU tendon is mostly inhomogeneous in T1 and PD fat sat sequences.

Semi-automatic segmentation of acetabular fractures

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Purpose: The purpose of this study was the development and evaluation of a method for the segmentation of bones and bone fragments using clinical computed tomography (CT) datasets of acetabular fractures. These segmentations are the basis for extracting patient-specific anatomical models to be used in computer-based surgical planning.

Methods and materials: CT was performed in 14 patients with complex acetabular fractures. In seven patients a manual segmentation of the bones and bone fragments was performed by a radiologist. A semi-automatic multi-step segmentation algorithm was developed using bone enhancement filtering and a graph-cut based bone fragment separation. Parameters of this algorithm were optimized using the expert ground truth segmentation available in seven CT datasets. In the second set of seven patients without ground truth data the segmentation was performed by a radiologist with the new algorithm. Processing times were measured and segmentations were scored as either 1 (segmentation can be used as is), 2 (minor refinements necessary) or 3 (major refinements necessary).

Results: Initial evaluation with seven clinical CT datasets of acetabular fractures showed that the proposed segmentation method was able to segment the bone fragments within four to six minutes in all cases, with only minimal user interaction. The segmentation was scored as 1 in six patients (6/7; 86%), while one case was scored as 2 (1/7; 14%) due to an anterior column bone fragment focally impacted onto the femoral head.

Conclusion: The presented method is able to perform fast and accurate segmentations of the bone fragments in complex acetabular fractures.

Evaluation of temperature changes in cartilage by MR thermometry using the proton resonance frequency (PRF) technique: Preliminary application for the knee joint and potential medical applications

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Purpose: MR thermometry is mostly used to measure the temperature of soft tissues, and especially to monitor the treatment of tumors by different techniques that heat up tissues. Very little is known about the application of this technique to bones or joints and his potential applications. The purpose is to evaluate the applicability of MR thermometry using the PRFS technique to a joint (for instance in the knee), and to discuss the potential medical applications.

Methods and materials: MR Thermometry using the PRF technique was performed using an RF spoiled segmented GRE-EPI (voxel size 1x1x5 mm, TR/TE/FA = 300 ms/13 ms/20°, 3 parallel slices acquired in 6 seconds, 250 dynamic scan). A healthy volunteer was scanned, at rest and after exercise (one hour of jogging). Temperature maps were calculated in both knees and the precision of the measurements were analysed.

Results: The results were presented on a map and we showed a high accuracy in the temperature measurement, especially for the cartilage (0.17 °C). When applying MR thermometry just after a physical exercise we could measure a significative decrease of the intraarticular temperature of the knee (about 2.5 °C in 20 minutes).

Conclusion: It is possible to apply the PRFS MR thermometry to a joint like the knee. Potential medical applications include evaluation of intraarticular temperature in arthritic or other inflammatory conditions; the high precision of temperature measurements in the cartilage opens a new field of research about chondropathy. Other applications like monitoring treatments are also of interest.

CT-guided sacroiliac joint injection: Easy or difficult?

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Purpose: Fluoroscopy-guided sacroiliac joint (SIJ) injections are technically difficult to perform because of the complex anatomy with helicoidal conformation of the joint. Our study describes the procedure of CT-guided SIJ injection, its feasibility and its rate of success.

Methods and materials: Retrospective study included 46 consecutive patients. The procedure was performed by 3 MSK radiologists and consisted in a puncture with a posterior approach in the inferior articular part of SIJ, then in an injection of iodinated contrast agent (1ml) with CT control of SIJ space opacification and finally in an injection of slow-acting corticosteroid. The SIJ approach was noticed as correct if there was an inferior articular puncture and if the needle was in the articular space, and as impossible if there was ankylosis or osteophytosis. The study was divided in two successive periods: period 1 (4 first months) and period 2 (12 last months).

Results: SIJ opacification was successful in 57% (26/46). We observed a learning curve: opacification was succeeded in 66% (23/35) and there was incorrect approach in 9% (3/35) during period 2 versus respectively 27% (3/11) and 45% (5/11) during period 1. Causes of failure were incorrect approach in 40% (6/20 too low, 2/20 too high), impossible approach in 30% (6/20) and unexplained in 30% (6/20). Mean duration of procedure was about 28 minutes. No complication occurred.

Conclusion: CT guided SIJ injection is safe and successful in 66% after a training period. The success depends on SIJ correct approach and also on anatomical lesions.

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Survey on CT dose reduction strategies used among swiss radiology institutes and on interest in CT dose reduction

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Purpose: A survey was conducted to assess the current status of CT dose reduction strategies and the interest in an optimization process for lowering the CT-associated radiation exposure.

Methods and materials: The survey was carried out in 8 radiology institutes (7 hospitals and 1 outpatient imaging centre) throughout Switzerland with a total number of 52400 CT examinations per year (range of annual number of CT examinations; 1400–19000).

A questionnaire asked about the importance and use of CT dose reduction strategies and the desire to further optimize their CT protocols.

Results: All institutes use automatic tube current modulation, limited scan range and a reduction of total number of imaging phases for lowering CT dose. 50% of the institutes reduce the tube voltage (kV) in the appropriate situation. Testicle shielding is applied in 63% of the institutes. No institution uses breast or eye shielding. Specific low dose protocols are used in 88% of the institutes, most often to rule out kidney stones (75%). The institutes ranked their knowledge on CT dose reduction strategies on average as good. Among practice priority, applying low dose CT protocols holds an intermediate importance. However, the interest of the institutes to be educated in the future on CT dose optimization is high.

Conclusion: The survey demonstrates that CT dose reduction strategies are frequently used in Switzerland; however, room for refinement exists. Furthermore, radiologists are willing to reduce CT-associated radiation exposure and are interested in acquiring further knowledge on CT dose reduction strategies.

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Screening for renal insufficiency following ESUR (European Society of Urogenital Radiology) guidelines with on site creatinine measurements in an outpatient setting

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Purpose: To report the results and implications for workflow introducing ESUR guidelines to screen for potential renal insufficiency in a outpatient setting with on- site creatinine measurements.

Methods and materials: 1766 consecutive outpatients scheduled for contrast- enhanced CT completed the ESUR questionnaire enquiring about kidney disease, renal surgery, proteinuria, diabetes mellitus, hypertension, gout or use of nephrotoxic drugs. Patients with positive risk factors underwent on- site creatinine measurement and calculation of estimated glomerular filtration rate. Attending radiologists adapted further imaging depending on renal function and presence of risk factors.

Results: 796 (45.1%) patients had one or more ESUR risk factors: hypertension (37.7%), nephrotoxic medication (21.3%), diabetes mellitus (8.0%), proteinuria (3.9%), renal disease (4.1%), gout (3.1%) and renal surgery (2.6%). Pre-procedural creatinine measurements revealed: Severe RI (eGFR <30 ml/min/1.73 m²) in 10 (1.3%), moderate RI (eGFR 30–59 ml/min/1.73 m²) in 106 (13.8 %). Imaging work-up was adapted in 132 (16.6%): reduction of contrast material dose (n = 85), CT without contrast (n = 40), changeover to MRI (n = 3) or scintigraphy (n = 4).

Conclusion: Screening for RI following ESUR guidelines requires creatinine measurements in nearly half of outpatients scheduled for CECT and reveals moderate to severe renal impairment in 6.6%.

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Capabilities of a new braided Nitinol Stent in treatment of neurovascular pathologies

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Purpose: We studied the deliverability and safety of a braided, self-expanding, closed-cell nickel-titanium stent especially designed for the endovascular treatment of carotid artery bifurcation stenosis with special regard to in-stent stenosis and thrombosis compared with a laser-cut reference nitinol stent in a porcine model of percutaneous vascular interventions.

Methods and materials: Eight minipigs received a total of 42 stents: 14 reference stents and 28 E-volution stents. Eleven of the E-volution stents were additionally coated with heparin. Control angiography was

obtained immediately before and after vascular intervention as well as 4 weeks after the procedure. Primary endpoints were 28 days of angiographic analyses as well as histomorphometric analysis and determination of injury score and inflammation scores.

Results: All stents could be delivered successfully without procedural complications, morbidity, or mortality during our observation time. Compared with common carotid arteries, subclavian arteries are significantly more vulnerable to developing in-stent stenosis caused by neointima proliferation (p <0.05). The E-volution stent, especially when heparin coated, is in line with the comparison to the laser-cut reference stent displaying similar results of angiographic, histologic, and histomorphometric analyses (p >0.05).

Conclusion: Compared with the reference laser-cut stent, the self-expanding nitinol stent (E-volution) with its advanced braiding technology is feasible and safe. The high radial resistive force and the advanced braided design may be beneficial in terms of plaque stabilization. Moreover, the special design with tight stent strut interstices seems to be a promising treatment of intracranial aneurysms.

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Exposure of the Swiss population by medical radiology: The 2008 national survey

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Purpose: Average dose to the population from medical exposure in developed countries represents the highest contribution of man-made irradiation. Nationwide surveys on the exposure of the population by medical radiology are conducted with a periodicity of 5 to 10 years. Switzerland has a long tradition in dose surveys. The average annual effective dose per caput was found to be 1 mSv in 1998 and 1.2 mSv in 2003. This difference was due to the increase of CT examinations. Our objective is to estimate annual effective dose per caput for the year 2008.

Methods and materials: For this reason, an online database was developed (www.raddose.ch). More than 8,000 hospitals, clinics and medical practices who use radiography units were asked to participate to the survey by i) online registration, ii) filling in paper forms or iii) sending their annual data.

Results: By the beginning of December 2009, 1300 of the participants entered and validated their data in the database. In addition, more than 200 participants sent their data in paper form. Among those who validated their data, 40% were medical practitioners, 10% dentists, 4% chiropractors and the rest hospitals and clinics.

Conclusion: The collection of data continues until the end of the year 2009. Results will be announced and discussed during the conference.

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Does announcing an analysis reduce the approval time of radiological reports?

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Purpose: A brief time period of approved written radiographic reports is essential for successful patient treatment. In this study, the approval time of reports was analyzed during three time intervals of equal length.

Methods and materials: Between 01/2008 to 09/2009 the number of all written radiological reports at our institution was obtained from the hospital radiological information system (Centricity, GE Healthcare Barrington, IL, USA). For each month the overall amount of approved reports, the time interval between drafting and approval of the report, the percentage of reports approved within 24 hours and after 10 days was calculated. In period A (01-07/2008) the evaluation was made retrospectively. In period B (08/2008 to 02/2009), the analysis was announced to the staff. During period C (03-09/2009) the goal to approve 85% of all reports within 24 hours was announced. The mean time interval for each period and the percentage of approved reports within 24 hours were compared using the Student's t-test.

Results: A total of 175,334 reports were analyzed. In period A, B and C the mean approval time was 49.9 ± 47.3h, 39.1 ± 47.1h and 28.5 ± 38.0h respectively. The percentage of approved reports within 24h was 36.5%, 52.1% and 62.6% respectively and after 10 days was 95.4%, 95.5% and 97.0% respectively. The differences of approval time and percentage of approved reports within 24h were significant (p <0.0001).

Conclusion: Announcing the analysis has already led to a significant reduction of approval time. A further significant reduction was achieved by defining a clear goal communicated by the management.

Superselective ophthalmic artery chemotherapy with Melphalan for intraocular retinoblastoma

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Purpose: To evaluate the efficacy of superselective ophthalmic artery chemoperfusion with Melphalan as a cytostatic agent in children with advanced retinoblastoma, in order to avoid enucleation.

Methods and materials: From november 2008 to december 2009 6 children (mean age: 32 months, range: 11–50 months) affected by group D retinoblastoma underwent superselective chemotherapy directly in the ophthalmic artery of the affected eye. This treatment was performed under general anesthesia by a femoral artery approach using dedicated microcatheters. Every treatment consisted of an intra-arterial infusion of chemotherapy (melphalan) over a 30-minute period. For each patient 3 sessions separated by an interval of 3–4 weeks were performed. Ophthalmic examinations, digital photography of the retina and fluorescein angiography performed every 3 weeks were used to document local results and toxicity.

Results: Technical success was achieved in all cases (15 procedures) with dramatic regression of tumors, vitreous seeds and subretinal seeds in 5 cases. No severe systemic complications (fever, neutropenia, anemia) were observed. Locally, one patient developed a retinal detachment (corrected surgically) and 3 patients showed conjunctival and lid edema which resolved spontaneously. After a mean follow-up of 6 months one patient developed resistance to intraarterial and systemic chemotherapy and the eye was enucleated; the other 5 treated children are alive without recurrence and enucleation could be avoided. Vision stabilized or improved in all but 1 child after treatment.

Conclusion: Superselective intra-arterial chemotherapy in the ophthalmic artery with melphalan is well tolerated, achieves dramatic response rates and can avoid enucleation in children with group D retinoblastoma.

PEDIRAD “Skelettröntgen”, an online pediatric skeletal radiology teaching file

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Purpose: To introduce PediRad “Skelettröntgen” (pediatric skeletal radiology), a web based learning tool for students and residents. **Methods and materials:** The AUM (Abteilung für Unterricht und Medien) of the University of Bern provides a variety of medical e-learning contents for different medical subspecialties. PediRad “Skelettröntgen” is based on the first e-learning module for pediatric radiology PediRad “Thorax”. Interesting and instructive cases from the teaching files of the pediatric radiology department were brought together for e-learning. A radiology resident worked within the scope of her medical thesis on this project. Two pediatric radiologist proofread all images and text for its quality and content. The content can be improved and expanded permanently.

Results: PediRad consists of a systematically structured database with approximately 300 shortly commented cases and more than 1000 high quality images (mostly radiographs). These are divided into 3 main subgroups:

1. Normal images of different skeletal regions and patient ages.
 2. Pathological images (according to: region, etiology, age).
 3. A student module includes 20 typical cases of important diseases. More detailed explanations give a first introduction into pediatric skeletal radiology. Students, pediatricians and radiology residents are able to view common pediatric skeletal radiology cases and train their knowledge for clinical indications in pediatric musculoskeletal imaging.
- Conclusion:** PediRad Skeleton is a freely accessible web based teaching tool for students and medical professionals in training. It offers a web-based access to more than 300 commented, normal and pathologic cases in pediatric skeletal radiology.

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