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ONLINE ABSTRACT BOOK
of the Swiss Congress of Radiology

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Dear Delegates and Visitors of the Swiss Congress of Radiology 2017,
Dear Colleagues!

The Swiss Society of Radiology (SGR-SSR), the Swiss Society of Nuclear Medicine (SGNM-SSMN) and the Swiss Association of Radiographers (SVMTRA-ASTRM) are delighted about the high quality and the great amount of abstracts which were submitted for presentation at the annual Swiss Congress of Radiology.

The continuous excellent work of all authors is highly appreciated as it makes the congress a very prestigious scientific meeting.

This "Online Abstract Book of the Swiss Congress of Radiology" is the 7th issue which is solely published online. It represents a cost efficient, durable and platform independent documentation of scientific abstracts, integration of the abstract data into both the Society's and Congress' web page as well as permanent accessibility all over the world.

The "Online Abstract Book of the Swiss Congress of Radiology" will permanently be accessible on both the Society's and Congress' web page at www.radiologiekongress.ch. It includes all the abstracts of the scientific talks and posters presented at the annual Swiss Congress of Radiology in Bern.

Proper citation of scientific abstracts is however important, especially in case of online-only web publications. The Swiss Society of Radiology thereof recommends the use of the following structure to cite abstracts from the new "Online Abstract Book of the Swiss Congress of Radiology":

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We look forward to welcoming you to the Swiss Congress of Radiology 2017 in Bern.

Prof Dr. G. Andreisek,
President Scientific Committee SGR-SSR

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Ultrasound measurements of the corpus callosum in premature babies at birth: a mirror of the intra utero growth during the third trimester of pregnancy

M. Deléaval, L. Barrelet, M. Laurent, S. Hanquinet, L. Merlini; Geneva/CH

Purpose: The growth of corpus callosum (CC) during the fetal period is poorly understood. We performed measurement of the CC, in order to understand the anatomical evolution during the third trimester of pregnancy.
Methods and Materials: On routine transfontannellar ultrasound (sagittal section), measurement of genu, body, isthmus, splenium, anteroposterior distance of the CC in 213 newborns (24 to 41 weeks gestational age GA). These measurements were afterword repeated with a dedicated software (Osirix), adding the surface measurement. These measurement were correlated to gemellarity, birth weight, cranial perimeter, in-utero delay of growth, Apgar score, gender. The observation gaps were analyzed between the two measurement techniques, using the Bland and Altman Plot method. With a system of linear regression we determined Pearson correlation coefficients for each part of the CC. With a second-degree polynomial function, we established length and surface's curves per GA.
Results: We confirmed good reproducibility between 2 measurement techniques only for the length measurement. Growth rate of the genu, length and surface showed significant correlation coefficients with GA, birth weight and cranial perimeter. Length and surface follow a non-linear curve, increasing up to the 39th and 36th weeks, respectively, and decreasing thereafter. Between 39th and 41st weeks, the growth rate is negative.
Conclusion: Our data are a mirroring of the intra utero growth of the CC. We speculate that the decreasing growth during the last two weeks is the result of axonal pruning.

In utero diffusion tensor imaging of the developing brain: reproducibility, sources of errors and possible solutions for clinical practice

A. Jakab, R. Tuura-O'Gorman, C.J. Kellenberger, I. Scheer; Zurich/CH

Purpose: Our purpose was to evaluate the reproducibility of in utero diffusion tensor imaging (DTI) and the visibility of major white matter structures.
Methods and Materials: In utero MRI for 20 fetuses (20-31. postmenstrual weeks) were acquired on 1.5T or 3.0T scanners. Repeated DTI were acquired with 15 diffusion-weighting directions, TR/TE: 2200/63 ms, voxel size: 1*1 mm, slice thickness: 3-5 mm, b-factor: 700 s/mm2. Reproducibility was evaluated from structure detectability, variability of DTI measures using the coefficient of variation (CV), and image structural similarity across three repeated scans in each case. The effect of age, scanner type and pathology was determined using Wilcoxon rank-sum test (p<0.05). We utilized diffusion tractography to demonstrate the development of fibers during gestation and in corpus callosum agenesis.
Results: White matter structures were detectable in the following percentage of fetuses in at least two of the repeated scans: corpus callosum genu 88%, splenium 71%, internal capsule, posterior limb 60%, brainstem fibers 50% and temporal association pathways 60%. CV of DTI metrics ranged between 5% and 15%. Head motion was negatively correlated with reproducibility, this effect was partially ameliorated by a novel fetal motion-correction algorithm.
Conclusion: Fetal DTI is reproducible for projection and commissural bundles, however, in 15-25% of the cases, data were corrupted by artifacts, resulting in impaired detection of white matter structures. To achieve robust results for the quantitative analysis of diffusivity and anisotropy values, fetal-specific image processing is recommended and repeated DTI is needed to ensure the proper visualization of fibers and reproducible measurements during development.

Temporomandibular joint MRI findings in adolescents with primary disk displacement in comparison to those in juvenile idiopathic arthritis

J. Bucheli, D. Ettlin, C.J. Kellenberger; Zurich/CH

Purpose: To investigate potential differences of morphology and inflammation in temporomandibular joints (TMJs) affected by primary anterior disk displacement (ADD) and juvenile idiopathic arthritis (JIA).
Methods and Materials: Ethics-board-approved retrospective comparison of contrast-enhanced magnetic resonance images of TMJs with ADD in 18 adolescents (15female,age15±2y) to those of age- and gender-matched JIA controls. Morphology of disk and bony structures were described. Osseous deformity and inflammation were qualitatively scored with 4-grade scales and compared between groups. Mandibular ramus length was compared between groups and to normal values.
Results: In the ADD-group, 31/36 showed anterior dislocation and thickening of posterior band (27/31). TMJ disks of JIA patients were mainly flattened (n=23) and/or centrally perforated (n=12) but rarely dislocated (n=1). TMJs with ADD and JIA showed similar overall grades of inflammation (p=0.39) and deformation (p=0.53). While erosions were frequent in both groups (ADD:25/31;JIA:32/36,p=0.55), the mandibular condyle and glenoid fossa were less flattened in ADD (p<0.001). In ADD bone marrow edema was less frequent (p=0.001) and grades of joint enhancement slightly lower (p=0.03), but presence of synovial thickening (p=0.43) and degree of effusion (p=0.87) were not significantly different between groups. Mandibular ramus length was not significantly different (p=0.72), but clearly decreased compared to normal values (p<0.0001).
Conclusion: Disks in TMJs affected by JIA are rarely dislocated. Surprisingly, TMJs with primary ADD show considerable inflammatory change including condylar erosions. Still, systemic inflammation in JIA joints results in considerable higher deformity of the mandibular condyle and the temporal joint surface.

Evaluation of hepatocellular nodules with a hepatocyte-specific contrast agent MRI in a pediatric population

M. Laurent, S. Toso, L. Merlini, S. Hanquinet; Geneva/CH

Purpose: To demonstrate the utility of Gd-EOB-DTPA (Primovist®), hepatospecific MR contrast agent used « off label » in children to characterize hepatic nodules discovered by ultrasound in various clinical contexts.
Methods and Materials: Primovist® hepatic MRIs were performed in 8 children (5 to 19 years) after the sonographic discovery of hepatic nodules : 2 oncologic cases (neuroblastoma, acute lymphoid leukemia), 2 portacaval shunts, a tyrosinemia, 2 autoimmune disorders, one incidental finding on ultrasound.
MRI protocol included: T2-weighted FSE, diffusion, T1-weighted gradient echo images without contrast media. After Primovist® (0.1 ml/Kg) injection, 3 phases were obtained: arterial, venous and hepatocyte (20 min) phases. All the sequences were analyzed and compared to biopsies (2 cases) or clinical/ultrasound follow-up.
Results: Diffusion was the best sequence to detect all nodular lesions. In the tyrosinemia case, Primovist MRI showed multiple hypointense nodules on the hepatospecific phase suggesting malignant lesions confirmed by histology (hepatocellular carcinoma). In the other 7 cases, MRI analysis diagnosed benign lesions: one dyplastic nodule with an increased signal on the hepatospecific phase (histologically confirmed) and 6 focal nodular hyperplasias-like lesions (FNH) with stability on follow-up. Three different patterns were distinguished for the FNH on the hepatocyte phase : hyperintense lesions with a hypointense central scar, isointense lesions with a hypointense central scar, isointense lesions without a scar.
Conclusion: Hepatic nodules are increasingly detected on ultrasounds. As in adults, hepatospecific MRI is a useful and non-invasive technique to differentiate FNH-like lesions from malignant lesions in children in various clinical settings.

Femoral torsion assessment with MRI in children: should we use the bony or cartilaginous contours?

A.B. Rosskopf, C.A. Agten, L. Ramseier, C.W. Pfirrmann, F.M. Buck; Zurich/CH

Purpose: To assess whether the use of cartilaginous contours at the femoral condyles instead of bony contours significantly changes femoral torsion measurements in children.

Methods and Materials: Femoral torsion was measured in 32 girls (mean age 10.1 years ±2.3 standard deviation) and 42 boys (10.9 years ±2.5) on axial magnetic resonance (MR) images by two independent readers (R1,R2). The femoral condyle angle was measured using each the cartilaginous and bony contours of the distal femur. Cartilage thickness at femoral condyles was assessed. Intraclass-correlation-coefficient (ICC) and Pearson`s correlation were used for statistical analysis.

Results: Mean difference between cartilaginous and bony femoral torsion in girls was -1.1°±1.75 (range, -5.4° to 3.1°) for R1 and -1.64°±1.67 (-6.3° to 2.1°) for R2, in boys -1.5°±1.87(-8.4° to 1.1°) for R1 and -2.28°±1.48 (-4.3° to 9.7°) for R2. Weak-to-moderate correlations between difference of cartilaginous-versus-bony measurements and cartilage thickness (r=-0.15 to -0.55,P<0.001-0.46) or age (r=-0.33 to 0.46,P<0.001-0.006) were found for both genders. Intermethod-ICC for cartilaginous versus bony femoral torsion measurements was 0.99/0.99 for R1/R2 in girls, and 0.99/0.98 in boys.

Conclusion: The measurement of femoral torsion in children can be reliably done with MRI using either the bony or cartilaginous borders of the femoral condyles.

Diagnostic accuracy of ultrasound, computed tomography and wedge portography in the pre-operative work-up for mesenterico-rex bypass in children with extrahepatic portal hypertension: a cohort study

S. Toso, R. Breguet, _M. Anooshiravani-Dumont_, S. Terraz; Geneva/CH

Purpose: To identify the diagnostic accuracy of ultrasound (US), computed tomography (CT) scan and portography (wedge hepatic vein portography or direct portography) in the pre-operative work-up of mesenterico-rex bypass performed for extrahepatic portal hypertension in children.

Methods and Materials: We conducted a retrospective analysis of pre-operative imaging for mesenterico-rex bypass in our tertiary hospital over the last 12 years. We analyzed all patients between the ages of 0-16 years, with extrahepatic portal hypertension necessitating surgical treatment that underwent US, CT and portography.

Three reviewers independently analysed the permeability of the left portal vein, mesenteric vein, splenic vein and the presence of communication between the left and right portal vein on preoperative imaging with correlation to surgical findings. Statistical analysis of diagnostic accuracy was performed.

Results: Twelve patients underwent mesenterico-rex bypass for portal hypertension secondary to portal vein thrombosis. Two patients had partial liver transplant. CT with ultrasound correlation was sufficient in responding to the preoperative criteria in 75% (9 /12) cases. Portography was useful in the 25% (3/12) cases where CT could not respond to preoperative criteria, in particular the presence of left-right communication. There was good inter-rater correlation for each modality and good correlation of findings between modalities.

Conclusion: In the majority of cases the use of ultrasound and CT is sufficient for preoperative planning for mesentrico-rex bypass. Portography is mandatory in cases with large intra-hepatic cavernoma, where the left-right communication could not be confirmed on CT.

Peripherally inserted central catheters in pediatric patients – to repair or not repair

R. Gnannt[1], P. Patel[2], M. Temple[1], J. Amaral[1], D. Stephens[1], D. Parra[1], B. Connolly[1]; [1]Toronto/CA, [2]London/UK

Purpose: Preservation of venous access in children is a major concern in pediatric interventional radiology. If a peripherally inserted central catheter (PICC) breaks, there are two options: repair the line with a repair kit or exchange the line over a wire in the interventional suite. The purpose of this study is to assess the outcome of PICC repairs in children and to compare these with the outcomes of PICC exchange.

Methods and Materials: Single center, retrospective study of central line-associated bloodstream infection (CLABSI) following management of externally broken PICCs (2010–2014). The occurrence of CLABSI within 30 days after repair (Group A) or exchange (Group B) of a line were analyzed as well as PICCs exchanged following an initial and failed repair.

Results: 235 PICC breaks were included in the study, of which 161 were repaired, and 116 of whom were successful (68%, Group A). No repair was performed in 74 PICCs - 55/74 of these were exchanged over a wire (74%, Group B), and 19/54 lines were removed. The 30 days post-repair CLABSI rate (Group A) was 2.0 infections per 1000 catheter days and the calculated risk was 4.3%. In comparison the 30 days post-exchange CLABSI rate (Group B) was 4.0 per 1000 catheter days and the calculated risk 10.9%.

Conclusion: The results showed a higher rate of infection associated with a PICC exchange compared to a PICC repair. The results of this study support repairing a broken PICC instead of removing or replacing the line.

The impact of pneumoperitoneum during fluoroscopic guided percutaneous gastrostomy tube insertion in children

R. Gnannt[1], N. Vignesh[2], A. Amirabadi[2], J. Amaral[2]; [1]Zurich/CH, [2]Toronto/CA

Purpose: Fluoroscopic Guided Percutaneous Gastrostomy / Gastrojejunal Tubes (FGPGT) are inserted for establishing enteral access in children unable to take oral feedings. A pneumoperitoneum is a known finding after a FGPGT insertion. The purpose of this study was to describe the incidence of pneumoperitoneum after a FGPGT insertion and its clinical significance.

Methods and Materials: Single center retrospective study of retrograde FGPGT insertion between January 1st 2010 and December 31st 2012. Patients were divided into four groups (consensus reading): no, mild, moderate, and severe pneumoperitoneum. Tube size inserted, patient demographics and post-procedural clinical data was collected: bowel sounds and abdominal tenderness, fever, use of antibiotics, and days until reaching full feeds.

Results: 444 patients (mean age 4 years, mean weight 13.4kg) were included in the study, 406 had a gastrostomy tube and 38 a gastrojejunal tube inserted. 173 out of 444 (39%) had a pneumoperitoneum at the end of the procedure (mild: 105, 60.7%; moderate: 65, 37.6%; severe: 3, 1.7%). Patients with a post-procedural pneumoperitoneum had significantly more often a tender abdomen (P<0.001) and duration until full feeds was reached was significantly longer (mean 4.46 vs 3.65 vs days; P<0.001). No significant difference was seen in days of post procedural fever (P=0.832).

Conclusion: A pneumoperitoneum is frequently seen in patients after FGPGT insertion. Patients with a post-procedural pneumoperitoneum after FGPGT have more pain and duration until full feeds was reached was longer.

Midterm MRI follow-up of TMJ inflammation, deformation and mandibular growth in JIA patients under systemic or without treatment

A. Bollhalder, R. Patcas, M. Eichenberger, L. Müller, S. Schroeder, R.K. Saurenmann, C.J. Kellenberger; Zurich/CH

Purpose: To investigate course of temporomandibular joint (TMJ) inflammation, deformation and mandibular ramus growth in patients with juvenile idiopathic arthritis (JIA) without previous articular corticosteroid injection (CSI).

Methods and Materials: Retrospective ethics-board-approved MRI study of 49 consecutive JIA patients (35 female, median age 14y) who underwent TMJ MRI examinations ≥2y apart and received no CSI. TMJ inflammation and osseous deformity were assessed with progressive 4-grade scales. Change of respective grades was assessed with Wilcoxon test. Mandibular growth was determined by ramus length change and compared to normal values.

Results: Over a median period of 3.4y(IQR 2.4–4.6y), TMJ inflammation improved (p<0.001) with decrease in frequency of grade 3(4.1%to0%) and grade 2(19.4%to4.1%). Inflammatory grades improved both in patients with (n=39,p=0.007) and without (n=10,p=0.02) systemic medication. Osseous deformation slightly improved (p=0.04), with decrease in frequency of grade 3(5.1%to3.1%) and grade 2(9.2%to6.1%), and increase of grade 0(48%to54.1%). Mandibular ramus growth rates (median,1.34mm/y) were not significantly different from normal (p=0.27) and did not significantly differ between patients without (median,1.25mm/y) and patients treated with systemic disease modifying drugs (median, 1.35mm/y,p=0.9)

Conclusion: In patients with systemic treatment of JIA, both the degree of TMJ inflammation and osseous deformity as seen on MRI improved at midterm follow-up. Normal growth of the mandibular ramus was maintained. These results are in contrast to those from an earlier cohort treated with CSI, in which on average deformities deteriorated and growth was impaired.

Do ADC-values reflect renal function or obstruction in children with uretero-pelvic-junction obstruction?

P. Grehten, A.C. Eichenberger, C.J. Kellenberger; Zurich/CH

Purpose: The use of diffusion weighted imaging (DWI) in renal MRI is increasing. In adults as well as in infants a positive linear correlation between ADC-values and glomerular filtration rate has been demonstrated. The aim of our study was to assess whether renal DWI can provide information on the grade of urinary tract obstruction or renal function in children with uretero-pelvic-junction(UPJ)-obstruction.

Methods and Materials: Retrospective analysis of 19 children (age 3.1±4.5y) with unilateral UPJ-obstruction who underwent pre- and postoperative MRI at 1.5T and 6 normal controls (age 6.6±4.0y). Functional MR-Urography and multiple b-value DWI were part of the MR-protocol. Renal ADC-values were correlated to measures of obstruction and function, and compared between obstructed and non-obstructed kidneys and between pre- and postoperative studies.

Results: No correlation was found between mean parenchymal, cortical or medullary ADC-values and calyceal transit time(CTT), renal transit time(RTT) and measures of differential renal function(%parenchymal volume,vDRF,p-DRF). There was moderate correlation with absolute parenchymal volume and total kidney volume, and low correlation with pelvic volume. ADC-values showed high correlation with age and patient's weight. ADC-values normalized for age or weight showed low correlation with RTT and CTT, but no correlation with functional measures. ADC-values were not significantly different between obstructed and contralateral normal kidneys (p=0.2-0.9) or between pre- and postoperative studies (p=0.3-1).

Conclusion: Renal ADC is dependent on age and weight in young children and does not correlate with differential renal function. For assessing urinary tract obstruction with ADC normative values need to be established.

Value of tibial tilt measurement for detection of hyperextension toddler fracture

A. Hambardzumyan Schmid, C. Aufdenblatten, C.J. Kellenberger; Zurich/CH

Purpose: To investigate the utility of the „positive anterior tilt angle" in diagnosing hyperextension fractures of the proximal tibial metaphysis.

Methods and Materials: Ethics-board-approved retrospective tibial tilt measurement on lateral lower leg radiographs from 791 toddlers (median age 2.1y, range 1–5y) for constructing age-related reference intervals (from 516 children without fracture) and comparison of tibial tilt angle between different fracture types and normal values. Detection of proximal metaphyseal fractures in the original report, at a first consensus reading by two radiologists and a second reading of cases with a tibial tilt angle exceeding the 95th percentile (>3° from age 2 to 5 y) were compared.

Results: Proximal metaphyseal fractures showed a mean anterior tibial tilt (2.0±6.7°) while all other fracture types had a mean posterior tilt not significantly different from normal (-4.3±4.8°). As only 32/47 proximal metaphyseal fractures, 46/228 other fractures and 85/516 children without fracture had an anterior tibial tilt, its sensitivity (62%) and specificity (82%) for diagnosing a proximal metaphyseal fracture were low. All of the 4/47 hyperextension fractures missed in the original report had an anterior tilt and were diagnosed by detecting direct fracture signs at the consensus reading (n=3) or second reading (n=1).

Conclusion: Although neither an anterior tibial tilt nor a tilt angle exceeding the 95th percentile alone are diagnostic for a proximal metaphyseal fracture, it should prompt a search for this fracture. Besides tibial tilt measurements, familiarity with the subtle radiographic signs are required for increasing the detection rate of proximal metaphyseal tibial fractures.

Overscanning in chest CT: comparison of incidence among five swiss hospitals and its impact on radiation dose

F.R. Schwartz[1], B. Stieltjes[1], Z. Szucs-Farkas[2], A. Euler[1]; [1]Basel/CH, [2]Biel/CH

Purpose: To compare the incidence of overscanning in chest CT among five Swiss hospitals and its impact on radiation dose.

Methods and Materials: The scout images of 250 chest CT scans from a total of five hospitals (A-E), which participate in a regional dose registry, were retrospectively reviewed using a radiation dose tracking software (RTS) (Radimetrics, Bayer Healthcare). The RTS offers the possibility to virtually alter the cranial and caudal scan limits on each scout image and to estimate the changes in radiation dose, based on Monte Carlo simulations. Incidence of cranial and caudal overscanning was assessed by comparing the actual scan limits of each scan to optimized scan limits determined by a third-year radiology resident. In the optimized scan limits, 2 cm of safety margin were added to the cranial and caudal anatomic borders to account for patient's respiration and operator dependency. Changes in effective dose were calculated by the RTS. Descriptive statistics and Wilcoxon matched pairs test were applied.

Results: Cranial overscanning was observed in 24%, 28%, 30%, 0% 14% of scans; caudal overscanning in 66%, 32%, 6%, 10%, 6%; both cranial and caudal overscanning in 20%, 10%, 2%, 0%, 0% for hospital A, B, C, D and E, respectively. Simultaneous caudal and cranial overscanning increased the effective dose on average by 0.36 mSv, 0.37 mSv, 0.02 mSv, 0 mSv, 0 mSv for A, B, C, D, E, respectively.

Conclusion: Substantial differences in the incidence of overscanning in chest CT exist among different hospitals resulting in excessive effective dose to the patient by up to 20%.

Vertical off-centering affects organ dose in chest CT

N.N. Saltybaeva, H. Alkadhi; Zurich/CH

Purpose: The objective of our study was to assess the effect of patient vertical off-centering on organ dose in chest CT with tube current modulation (TCM).

Methods and Materials: For this purpose male and female anthropomorphic phantoms were scanned at eleven different vertical positions (maximal off-centering ± 5 cm). Dose distributions were obtained by Monte Carlo simulations performed for each of the investigated setup, using individual TCM curves. Organ doses for lungs, heart and breast were calculated as a function of vertical off-centering and compared with the reference values at the gantry isocenter. Image noise was also calculated as a function of phantoms vertical position. Pearson statistical analysis was used to determine the correlation coefficient between image noise and organ dose values with vertical off-centering.

Results: Results of our study showed that vertical off-centering below 20 mm in both directions resulted in organ dose differences lower than 4%, while the off-centering above 40 mm was associated with organ dose changes of about 13%. The highest dose difference of 26% was observed for the female lungs at the lowest table positions. A significant correlation between organ doses and vertical off-centering was found ($p<0.005$). Image noise behaved opposite to the radiation dose and increased at higher table positions.

Conclusion: Strong vertical off-centering in chest CT with tube current modulation results in misoperation of the TCM function, therefore special attention must be paid to a correct patient positioning in order to optimize organ doses and image quality.

Objective and subjective image quality in chest MDCT: impact of the ASiR-V algorithm

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Purpose: To investigate the effects of implementing ASiR-V on subjective and objective image quality (IQ) using appropriate physical metrics, in routine oncologic chest MDCT. Secondly, to determine the optimal ASiR-V level for the analysis of lung parenchyma at regular dose level.

Methods and Materials: Twenty patients underwent oncologic thoraco-abdominal MDCT performed on a 64-MDCT scanner at regular dose level (CTDIvol=12mGy) with images reconstructed using FBP. The same patients subsequently underwent (mean time interval=10months) follow-up imaging on a 256-MDCT scanner with 20% dose reduction (CTDIvol=9.6mGy) with images reconstructed using six ASiR-V levels (0%-100%, 20% increments). Subjective IQ was assessed by two independent and blinded radiologists. Objective IQ was evaluated on patient MDCT images by measuring standard deviation (SD), SNR and CNR, and on phantom images by computing detectability indices (d') with the Non-prewhitening with eye filter model observer.

Results: Regarding subjective IQ comparison between both CT systems, ratings from the two observers diverged. However, in subjectively determining the optimal ASiR-V level, both observers preferred 80% due to perceived lack of subtle details at 100%, with substantial interrater agreement (weighted kappa=0.69). Concerning objective assessment, ASiR-V significantly impacted IQ. Increasing ASiR-V level up to 100% significantly decreased SD, while concomitantly increasing SNR and CNR ($p<0.001$) on clinical images. On phantom images, d' indices gradually increased to peak at ASiR-V 100% ($p<0.001$).

Conclusion: ASiR-V at a level of 80% in oncologic chest MDCT enhances objective IQ for the analysis of lung parenchyma, while concomitantly enabling a dose reduction of 20% as compared with FBP.

Pulmonary signal enhancement ratio mapping at 1.5T using 3D ultra-fast balanced steady-state free precession MRI

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Purpose: To analyze the signal enhancement in the lung parenchyma in 3D ultra-fast steady-state free precession (ufSSFP) MRI after administration of gadolinium-based contrast agents in healthy subjects and investigate the feasibility of the method in patients with common pulmonary diseases.

Methods and Materials: Ten healthy subjects were examined at 1.5T before and three minutes after i.v. injection of Gadobenate-Dimeglumine. Signal enhancement ratio (SER) maps were computed from pre- and post-contrast images using ufSSFP in comparison to volume-interpolated breath-hold examinations (VIBE). For demonstration of clinical feasibility, the method was tested in three patients with common pulmonary diseases (1 COPD GOLD II and emphysema, 1 lung cancer and COPD GOLD III, and 1 pulmonary fibrosis (NSIP)), including also a visual comparison with 99mTc-MAA-SPECT.

Results: In the healthy subjects, the SER maps of the lung parenchyma were more homogeneous for ufSSFP than for VIBE. The mean SER observed in healthy lung parenchyma with ufSSFP was 100%±11% (mean±intersubject SD). This was significantly higher ($P<10-6$) than for VIBE (50%±16%) and also significantly higher ($P<0.01$) than in the blood pool (84%±11%) and in other tissues (liver 35%±9%, muscle 29%±10%, fat 2%±1%). In the patients, the ufSSFP SER functional maps reflected the underlying pulmonary disease well and showed a good visual agreement with SPECT/CT.

Conclusion: Volumetric 3D ufSSFP SER mapping allows for depicting the functional integrity of the lung parenchyma in a highly selective manner. It is feasible in clinical routine and may be used as a simple, fast and radiation-free alternative to lung perfusion SPECT/CT for patients with pulmonary diseases.

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Increased expiratory CT-density in preserved lung parenchyma of idiopathic pulmonary fibrosis patients might indicate increased alveolar collapsibility

V.D. Petroulia, M. Funke, P. Zumstein, L. Ebner, J.T. Heverhagen, A. Pöllinger; Bern/CH

Purpose: Idiopathic pulmonary fibrosis represents a progressive and lethal chronic lung disease with unclear pathogenesis. Radiological hallmark finding is the usual interstitial pneumonia (UIP) pattern accentuated in the basal lung periphery with otherwise preserved lung structure. One hypothesis is that alveolar collapse and consequent induration leads to fibrotic transformation of lung tissue. The aim of this study was to investigate variation of CT lung density of healthy-appearing lung tissue during expiration in IPF patients, COPD and healthy controls.

Methods and Materials: The study was approved by the local ethics committee. We retrospectively assessed a total of 45 patients (15 patients with IPF, 15 patients with COPD and 15 controls) with non-enhanced chest CT in inspiration and expiration with a standard-dose protocol at 120 kV and 100 kV acquired on two different CT-scanners (Siemens SOMATOM Definition Flash; Philips Brilliance 64). Densitometry of unaffected lung tissue was performed in all lung lobes with a ROI of 15 mm diameter (slice thickness 1mm) during inspiration and expiration. A multi-parameter comparison was performed with one-factor ANOVA.

Results: One-factor ANOVA analysis yielded significant difference in attenuation changes between in- and expiration of unaffected lung parenchyma between all subject groups in all lung lobes (p<0.001). For IPF-patients, highest differences in densities were observed in the lower lobes, which is the predominant affected side of UIP. In COPD and healthy controls the density remained rather equal in the entire lung.

Conclusion: High CT-attenuation changes between inspiration and expiration in IPF patients might indicate alveolar collapse of unaffected lung tissue possibly preceding pulmonary fibrosis.

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Emphysema quantification und lung volumetry in chest X-ray equivalent ultralow dose CT - intra-individual comparison with standard dose CT

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Purpose: To determine the value of ultralow dose chest CT for emphysema quantification and lung volumetry and to test for the influence of advanced modelled iterative reconstruction (ADMIRE) on quantitative analyses.

Methods and Materials: 84 consecutive patients from a prospective study were included and underwent clinically indicated standard dose chest CT (1.7±0.6mSv) and additional single-energy ultralow dose CT (0.14±0.01mSv) at 100 kV and fixed tube current at 70 mAs with tin filtration in the same session. One radiologist performed fully automated software-based pulmonary emphysema quantification and lung volumetry of standard and ultralow dose CT with different levels of ADMIRE. Friedman test and Wilcoxon rank sum test were used for multiple comparison of emphysema volume using standard dose filtered back projection (FBP) as reference.

Results: The low-attenuation areas (LAA) using FBP standard dose was 4.4% and decreased to 2.6% and 1.8% with a median difference of -1.0% and -1.6% for ADMIRE 3 and 5 in standard dose, respectively (p<0.001 compared to FBP). The median values of LAA in ultralow dose CT was 5.7%, 4.1% and 2.4% for ADMIRE 3, 4, and 5, respectively, representing median differences of +1.3%, +0.1%, and -0.9% in comparison with standard dose FBP (ADMIRE 3 and 5 p<0.001; ADMIRE 4 p=0.355).

Conclusion: Ultralow dose CT at chest X-ray equivalent dose levels allows for lung volumetry as well as detection and quantification of emphysema. However, longitudinal CT analyses require fixed dose levels and reconstruction algorithms for reproducibility.

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Segmentation of solid lung nodule volume in obese persons – a phantom study

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Purpose: To investigate influence of different phantom-sizes and iterative reconstruction with ADMIRE on volume segmentation of solid lung nodules acquired with same dose parameters.

Methods and Materials: CT-scans were obtained with standard dose,1/2 and 1/4 of standard-dose using a chest phantom containing solid microspheres (2-10mm). Using two extension rings different patient-sizes (M,L,XL) were simulated. Image reconstruction was performed with FBP, ADMIRE3, ADMIRE5. Nodule-volumes were segmented semi-automatically by two observers. To evaluate measurements' accuracy relative percentage error (RPE) was computed. According to literature clinically significant nodules are ≥5mm.Thus, univariate ANOVA with post-hoc Bonferroni-test was applied to assess influence of various parameters on RPE for nodules ≥5mm. P<0.05 was considered statistically significant.

Results: Intra-class correlation coefficient for RPE of nodules <5mm and ≥5mm was 0.940 and 0.989. Univariate ANOVA (R2=0.681,p<0.001) showed significant contribution of phantom-size, nodule diameter, CT dose protocol, nodule-density and reconstruction-algorithm to RPE (all p<0.001). Underestimation of mean nodule volume among all dose protocols was -3.5±2.8%, -5.4±3.2% and 8.7±5.1% for phantom-size M, L and XL, respectively (all p<0.001). For all phantom-sizes and dose protocols, image reconstruction with ADMIRE3 (-6.1±4.4%) and ADMIRE5 (-6.5±3.7%) showed significant higher negative RPE, compared to FBP (-5.0±4.9%) with p<0.001 for both. For all phantom-sizes and reconstruction algorithms, scanning with 1/4 of standard-dose (-6.7±4.6) showed significant higher nodule-volume understimation, compared to standard-dose (-5.0±3.7%,p<0.001) and 1/2 of standard-dose (-5.8±4.6%,p=0.033).

Conclusion: Our phantom study suggests significant volume underestimation of solid lung nodule-volumes ≥5mm in obese persons by using same dose parameters, compared to persons with normal weight.

Does supine examination of lumbar spine underestimate stenosis of neural foramina? Results of 3D-tomographies of lumbar spine in supine and upright weight-bearing position using a twin robotic X-ray unit

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Purpose: Clinical Relevance
Tomographic examinations of lumbar spine are generally performed in supine non-weight-bearing position. This position is unphysiologic and might underestimate pathologies due to lack of body-weight.

Purpose
Evaluation of changes of lumbar neural foramina in supine non-weight-bearing and upright weight-bearing position using 3D-X-ray-tomography.

Methods and Materials: Lumbar spines of 48 patients (14 male; 34 female) with a mean age of 67.8±13.0 years were examined in upright weight-bearing position using a twin robotic X-ray unit (Multitom Rax, Siemens Healthineers). Supine non-weight-bearing scan was either performed using the X-ray unit or conventional CT. All patients were prospectively enrolled after IRB approval. Images were reformatted according to the intervertebral disc and axis of the spine at each lumbar level. Sizes of neural foramina (area and cranio-caudal diameter) were measured by two readers independently on sagittal reformats. Wilcoxon signed rank test (P<0.05) was used and interreader reliability was defined by intraclass correlation coefficient (ICC).

Results: Area of neural foramina significantly decreased at nearly all levels for both readers from supine (reader 1; L5: 1.20±0.36cm2) to upright (1.15±0.41cm2; P=.005) position, except for L4. Cranio-caudal diameter of neural foramina decreased in all levels L1-3 and at left L5 level for both readers. Interreader reliability for area was fair to excellent (0.504-0.894) and showed a wide range of variability for cranio-caudal distance (0.322-0.744).

Conclusion: Upright weight-bearing position decreases size of neural foramina causing potential risk factors for neural nerve compression that might be not evident on routine supine examinations. Thus, more specific diagnoses in unclear cases might be made using 3D-tomography.

Can listhesis on upright radiographs predict the Schizas grade of lumbar spinal canal stenosis assessed on MRI?

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Purpose: To assess the correlation between the grade of degenerative listhesis on upright radiographs with the grade of central spinal stenosis on supine magnetic resonance imaging (MRI) in patients with lumbar spinal stenosis (LSS).

Methods and Materials: MR images and conventional radiographs of 141 consecutive patients (77 female, mean age 73) were retrospectively evaluated in this IRB–approved study. The grade of listhesis (in millimeter [mm]) was assessed on upright radiographs and on supine MRI of the lumbar vertebral segment 4/5. In addition, the grade of central spinal stenosis of the same segment was evaluated according to the classification of Schizas and correlated to the listhesis severity in radiographs. Kappa and ICC statistics were performed.

Results: Listhesis was detected in significantly more patients in radiographs (n = 53; 38 %) compared to MRI (n = 27; 19 %), p < 0.001. Pairwise comparison demonstrated a significant larger extension of listhesis in radiographs (mean 8.6 ± 2.8 mm) compared to MRI (mean 5.6 ± 1.9 mm), p < 0.001, each. A significant positive correlation was found regarding the grade of listhesis measured in radiographs and the grade of stenosis in MRI (Pearson correlation 0.48, p < 0.001). The interreader agreement was excellent for the presence of listhesis (Kappa = 0.938) and for the grading of listhesis (ICC = 0.913).

Conclusion: The grade of listhesis on radiographs is highly correlated with the grade of central LSS on MRI.

Feasibility of synthetic MRI of the spine – fast and quantitative imaging

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Purpose: Synthetic MR is a method that produces multiple contrasts as well as quantitative T1, T2 and PD images and that has already been validated in cerebral applications. The goal of this study was to implement synthetic MR in the spine and to evaluate its diagnostic confidence compared to conventional sequences.

Methods and Materials: Thirty-one patients underwent MRI for spine examination. Conventional T1/T2/STIR TSE sequences were performed as well as the syntac sequence. Synthetic T1, T2 and STIR contrasts were generated with SyMRI v8 software (SyntheticMR AB, Linköping, Sweden). Random analysis of the sets was performed by a blinded neuroradiologist who graded the image quality (non-diagnostic, medium, good), the presence of artifacts and identified the different pathologies in conventional and synthetic images.

Results: All synthetic images were graded as medium (6.5%) to good quality (93.5%), none was rated as non-diagnostic quality. Conventional images were all graded as good quality. The diagnosis was concordant in 87.1% of cases. The diagnosis was discordant in 3.2% and uncertain in 9.7% of cases. A majority (84%) of synthetic STIR presented flow artifacts and/or noise compared to conventional images.

Conclusion: Our study shows that Synthetic MRI is feasible for spinal imaging and produces, in general, good image quality and diagnostic confidence even if efforts will still have to be made to increase image quality in the dorso-lumbar spine. The non-negligible time saving and the ability to obtain quantitative measurements as well as to generate several contrasts with a single acquisition should secure an interesting future for synthetic MRI in clinical routine.

Particulate vs. non-particulate corticosteroids for transforaminal nerve root blocks: comparison of outcomes in 494 patients with lumbar radiculopathy

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Purpose: Based on U.S. FDA warnings, this hospital switched from using particulate to non-particulate corticosteroids for lumbar nerve root injections. We set out to compare outcomes in lumbar nerve root block patients receiving particulate or non-particulate corticosteroids.

Methods and Materials: This is a comparative effectiveness outcomes study on 2 cohorts of lumbar radiculopathy patients. 321 received particulate and 173 non-particulate corticosteroids at CT-guided transforaminal lumbar nerve root injections. Pain levels were collected at baseline using an 11 point numerical rating scale (NRS) at 1 day, 1 week and 1 month. Overall 'improvement' was assessed using the Patients Global Impression of Change (PGIC) at same time points (primary outcome). The proportions of patients 'improved' were compared between the two groups using the Chi2 test. The NRS change scores were compared using the unpaired t-test.

Results: A significantly higher proportion of patients treated with particulate steroids improved at 1 week (43.2% vs 27.7%, p=0.001) and 1 month (44.3% vs. 33.1%, p=0.019). Patients receiving particulate steroids had significantly higher NRS change scores at 1 week (p=0.02) and 1 month (p=0.007).

Conclusion: The particulate corticosteroids have significantly better outcomes compared to non-particulate corticosteroids. This hospital has since started again using particulate corticosteroids.

Spin echo T2w-Dixon imaging: a one-stop shop for the detection of vertebral metastases?

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Purpose: To compare the diagnostic performance of a sagittal spin echo T2-Dixon sequence (including fat and water reconstructions) to the currently standard protocol (sagittal T1- and fat suppressed T2-weighted sequences) for the detection of vertebral metastases.

Methods and Materials: 121 consecutive exams from 101 patients undergoing a whole-spine MRI for suspected vertebral metastasis from September 2014 to May 2016 were retrospectively included. Two musculoskeletal radiologists independently reviewed two protocols during two sessions at one month apart: (Protocol1) T1 and T2-Dixon water reconstruction; (Protocol2) T2-Dixon fat and water reconstructions. Cervical, thoracic, lumbar and sacral levels were independently assessed for the presence of metastatic lesions. The final radiological report was used as a reference. Sensitivities, specificities, accuracies, positive and negative predictive values, inter-observer agreements were computed.

Results: Diagnostic performance was not statistically different between protocols for both readers (Protocol1 vs. 2: Se 92-97% vs. 96-97%; Sp 96% vs. 85-96%; Acc 93-97% vs. 93-97%; PPV 99% vs. 96-99%; NPV 75-89% vs. 85-89%, all p-values>0.06 (McNemar test)). Interprotocol agreement was substantial for both readers at all levels (cervical, thoracic, lumbar and sacral) (Reader1: 0.73, 0.71, 0.77, 0.67; Reader2: 0.71, 0.64, 0.65, 0.68, respectively). Inter-observer agreement of the two protocols was substantial for the same levels (Protocol1: 0.72, 0.65, 0.72, 0.72; Protocol2: 0.69, 0.75, 0.76, 0.70, respectively).

Conclusion: A single sagittal T2-Dixon sequence with fat and water reconstructions may replace the currently accepted standard protocol for the detection of vertebral metastases.

Normative values for computed tomography based texture analysis of vertebral bodies in dual-X-ray absorptiometry confirmed normally mineralized subjects

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Purpose: To develop age-, sex- and location-specific normative values for texture analysis (TA) of spinal computed tomography (CT) in subjects with normal mineral bone density.

Methods and Materials: In this retrospective IRB-approved study, TA was performed using a freely available software on sagittal CT images of the thoracic and lumbar spine in 122 patients with normal dual-X-ray absorptiometry (DEXA) findings. Equal numbers of female and male subjects were included per age decade. Three-hundred-sixteen TA features were analysed in various thoracic and lumbar vertebrae using free-hand regions-of-interest. Intraclass correlation (ICC) coefficients were calculated for determining variability of each feature. Further dimension reduction was performed by averaging TA features within each level. Sex- and location-related differences were analysed using the Wilcoxon signed rank test. Age-specific texture variations were tested using the Spearman's rank correlation coefficient.

Results: Fifty-one of the 316 TA parameters (16%) with an ICC<0.9 were excluded because of reduced reproducibility. From the remaining features, a significant negative correlation was found between the histogram-feature mean and age (females, r=-.403, males, r=-.589, both, p<0.001). Significant differences were found between genders for various TA features with increasing age (p<0.05). Regional differences between the thoracic and lumbar spine were found for the histogram-feature variance (p = .005) and for the higher-level features Mean_RLNNonUniform (p =.004) and Mean_GreyLevelNonUnion (p = .002).

Conclusion: Our study establishes age-, sex- and location-specific normative values of TA features in CT imaging, which is a prerequisite before TA can be implemented into clinical routine.

High prevalence of vitamin D insufficiency among radiologists: a profession at risk?

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Purpose: To assess prevalence of vitamin D insufficiency among radiologists. Our hypothesis was that radiologists have a higher prevalence of vitamin D insufficiency because of the generally dark working environment, compared to non-radiologists.

Methods and Materials: This study was approved by the local ethics committee. Informed consent was obtained from all participants. The study was conducted at the Swiss Congress of Radiology in May 2016. Attendees (radiologists and non-radiologists) were asked to give a venous blood sample to measure vitamin D(25-hydroxyvitamin) blood serum level. Vitamin D insufficiency was defined <50nmol/l. We collected information on age, gender, profession, vitamin D supplements, sunny vacation in the last two months, eating fish. We compared vitamin D between radiologists and non-radiologists.

Results: In total 301 blood samples, 137 radiologists (mean-age 38-years; 38.7% female) and 164 non-radiologists (mean-age 40-years; 65.9% female) were analyzed. Mean vitamin D in radiologists was 49.7nmol/l, in non-radiologists 47.5nmol/l (p=0.374). Vitamin D insufficiency was more frequent in radiologists (58.4% (80/137) vs. 53.7% (88/164)), however this was not statistically significant (p=0.479). 26 radiologists and 17 non-radiologists were under vitamin D supplementation with higher vitamin D than those without supplementation (70.4nmol/l vs. 44.7nmol/l; p<0.0005). There was no difference in vitamin D between radiologists and non-radiologists without vitamin D supplementation (44.9nmol/l vs. 44.6nmol/l; p=0.884). Subjects with a recent sunny vacation had higher vitamin D (55.0 vs. 45.9nmol/l; p<0.0005). Eating fish had no relevant impact on vitamin D.

Conclusion: Vitamin D insufficiency is very common among radiologists (58.4%), but not significantly higher than in non-radiologists.

Evaluation of low contrast detectability and patient exposure using abdominal CT protocols: a multicentre study

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Purpose: To highlight the spread of patient exposure and image quality performances for comparable clinical questions.

Methods and Materials: An abdominal phantom containing spheres of 5 and 8mm at 10 and 20 HU was scanned on 58 CT machines of 50 different institutions using locally clinical settings of the native phase for the detection of focal liver lesions (FLL). Objective image quality was assessed with a Channelized Hotelling Observer (CHO) with ten dense differences of Gaussian channels. The area under the ROC curve (AUC) was used the figure of merit (FOM). Because of various reconstructed slice thicknesses, the product of the CTDIvol and slice thickness, dose-slice thickness product (DSP) was used as radiation dose metric.

Results: No significant differences in AUC were noted between FBP and iterative reconstructions, but the DSP varied from 2.6 to 61mGy.mm and the reconstructed slice thickness varied from 2 to 5mm. For the 5mm-20HU target, 49% of the CTs gathered around an AUC range of 0.86-0.98 for a DSP range of 5-20mGy.mm. Nevertheless, 10% of the CTs were outliers because of relatively high dose levels and limited AUC scores.

Conclusion: The use of a CHO model showed that the majority of institutions performed reasonably well when searching FLL. However, the limited spread in objective image quality was associated with a large spread in the chosen dose indicator. In the future, an expected level of low-contrast detectability should be used as FOM to ensure that the optimization process does not impair the diagnostic goal.

Impact of various iterative reconstruction algorithms on low-contrast detectability in patients with varying abdominal diameters: a CT phantom study

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Purpose: To objectively compare the effects of FBP and various iterative reconstruction (IR) algorithms on low-contrast detectability (LCD) in patients with varying abdominal diameters.

Methods and Materials: An anthropomorphic abdominal phantom with an optional ring (equivalent diameters, 24cm and 35cm) and containing 5mm targets of 20HU contrast was scanned on four CTs using routine abdominal protocols (CTDIvol, 5.9-19.6mGy): Revolution, Discovery CT750 HD (GE), Somatom Definition Flash, Somatom Definition Edge (Siemens). Images were reconstructed using both FBP and various IR algorithms: statistical IR (ASIR50% on Discovery), statistical model-based IR (MBIR, ASIR-V50% on Revolution, SAFIRE3 on Flash, ADMIRE3 on Edge), or the full MBIR (VEO on Discovery). Slice thickness/interval were 2/1mm (Siemens) or 2.5/1.25mm (GE), except 0.625/0.625mm for VEO. A channelized Hotelling observer with 10 dense differences of Gaussian channels was used to assess LCD, with the area under the curve as a figure of merit.

Results: With the smaller phantom, we found no significant difference between FBP and various iterative algorithms for all CT (p≥0.07). For the larger phantom, a slight but statistically significant improvement in LCD was observed with statistical IR (2.3%, p=0.0003) and statistical MBIR algorithms (1.7%-2.3% p<0.0004), as compared with FBP. VEO enabled a greater significant improvement in LCD (8.5%, p<0.0001) together with a four times better longitudinal spatial resolution.

Conclusion: For smaller-sized patients, the various IR algorithms have no effect on LCD. For larger-sized patients, the full MBIR algorithm substantially improves LCD at higher longitudinal spatial resolution, whereas other IR algorithms have a smaller effect on LCD.

The value of CT signs in patients with internal hernia/Petersen's hernia after gastric bypass surgery

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Purpose: To evaluate various CT findings in patients with internal hernia/Petersen's hernia after gastric bypass in correlation with intraoperative findings.

Methods and Materials: 24 patients (age range 22-67, mean age 37, 3 male, 21 female) with a history of gastric bypass surgery and CT imaging (between May 2012 and June 2016) for clinical suspicion for internal hernia/Petersen's hernia and subsequent laparoscopy/laparotomy were enrolled in this retrospective study. CT images were evaluated regarding 12 different findings: small intestine distension in the upper abdomen; herniated intestinal loop segment in the left upper abdomen; whirlpool sign; mesenteric fat haziness; ligament of Treitz displaced anteriorly and to the right; middle-distal ileum courses downwards in the left hypochondrium; free intraabdominal fluid; free intraabdominal air; ileus; mushroom shape of hernia; small bowel wall thickening; clustered small bowel loops. CT findings were correlated with intraoperative findings.

Results: 8 patients had Petersen's hernia, 11 had an internal hernia other than Petersen's and 5 had no herniation at surgery. "Whirlpool sign" showed to be a sensitive (89%) and specific (80%) sign for internal hernia. "Mesenteric fat haziness" was sensitive (84%) but not very specific (40%). The other signs showed high specificities (60-100%) but insufficient sensitivities (5-63%).

Conclusion: Regarding the diagnosis of internal hernia/Petersen's hernia in patients with abdominal pain after gastric bypass surgery, "whirlpool sign" and "mesenteric fat haziness" are the most helpful CT signs. There are several other rather specific but insensitive CT signs.

Evaluation of complex renal cystic lesions with contrast enhanced ultrasound (CEUS) and functional magnetic resonance imaging (MRI) versus the gold standard: computer tomography (CT)

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Purpose: To assess and compare the diagnostic performance of contrast enhanced ultrasound (CEUS) and functional magnetic resonance imaging (MRI) with computer tomography (CT) for classification of cystic renal lesions according to the Bosniak system.

Methods and Materials: This prospective observational study, starting from July 2014, has been approved by the ethic committee. After signing informed consent, 28 patients (9 women and 19 men; age range 36-88 years; median age 57years) with complex cystic lesions of the kidney were scanned on an Acuson S3000 ultrasound scanner (Siemens) after injection of SonoVue and in a 3Tesla MRI machine, Skyra (Siemens). The CT scan was performed during routine clinical workup.

Results: On CT scans, the lesions were classified as Bosniak I (n=1), Bosniak II (n=9), Bosniak IIf (n=4), Bosniak III (n=3) and Bosniak IV (n=11). Similar evaluation on MRI resulted in Bosniak I (n=1), Bosniak II (n=12), Bosniak IIf (n=1), Bosniak III (n=4) and Bosniak IV (n=10) and on CEUS as Bosniak I (n=0), Bosniak II (n=2), Bosniak IIf (n=9), Bosniak III (n=5) and Bosniak IV (n=12).

MRI showed a better correlation with CT (24/28) than CEUS. CEUS overestimated the Bosnaik grade in 11/28 patients. One Bosniak IV lesion on CT was classified as Bosniak III on both MRI and CEUS due to better visualization of the multiple septae which appeared more solid on CT.

Conclusion: MRI classification of Bosniak cysts correlated better with the CT classification. CEUS tended to upgrade the classification due to better spatial resolution and better visualization of contrast enhancement.

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The cortico-medullary ADC difference reduces inter-system variability in renal diffusion-weighted magnetic resonance imaging

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Purpose: Renal Diffusion-Weighted Imaging (DWI) suffers from variability across studies that limits the comparison of apparent diffusion coefficient (ADC) from different studies, despite attempts for a standardized protocol for DWI inter-comparison. The cortico-medullary difference, ΔADC, that is strongly correlated to renal interstitial fibrosis, reduced physiological inter-subject variability by comparison to cortical or medullary ADC. Our goal was to determine if ΔADC could be compared across multiple MR scanners and, to reduce potential variability observed in renal ADC, using ΔADC.
Methods and Materials: Eight volunteers were scanned over different Siemens (SKYRA 3T, PRISMA 3T, AERA 1.5T) and Philips (PET-MR 3T, INGENIA 1.5T) MR systems with: TR=2000ms, TE varying between 50 and 71ms, 2×2×5mm resolution, 3 b-values (0, 500, 700s/mm2) and 18 to 26 second breathhold. Comparison of ADC values (cortex, medulla and ΔADC) between the different MR systems was carried out using paired t-test (p < 0.05 (*)).
Results: The paired t-test showed no significant difference between the three 3T MR scanners for the cortical, medullary and ΔADC. Significant differences were measured between Siemens MR scanners at 1.5 and 3T (p=0.02 for cortex and p=0.002 for medullae of PRISMA 3T and AERA 1.5T) and between scanners at 1.5T (p=0.04 for cortex of AERA and INGENIA). However, no significant difference was measured using the ΔADC parameter across all MR systems with all p>0.05.
Conclusion: Inter-scanners variability of ADC between different MR systems observed in the cortex and medulla were corrected by the use of the cortico-medullary difference ΔADC.

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MRI T2 mapping of the pancreas

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Purpose: The aim of this study was to assess the feasibility of MRI to quantify pancreatic T2 values.
Methods and Materials: In 7 healthy volunteers, T2 mapping of the pancreatic parenchyma was performed with free-breathing using respiratory triggering . MR images were reconstructed employing a combination of Generalized Auto-calibrating Partially Parallel Acquisition (GRAPPA) and Model-based Accelerated Relaxometry by Iterative Non-linear Inversion (MARTINI), termed GRAPPATINI.
A radiologist drawn several regions of interest (ROIs) in the head, body and tail of each pancreas in order to measure the mean T2 values including their standard deviation (SD). The T2 values of all volunteers were compared with each other (inter- and intra-subject comparison) to estimate a range of normal pancreatic T2 values. To compare the obtained T2 values with prior literature reports, ROIs were also drawn in each liver lobe to measure the mean T2 values.
Results: The respiratory triggered GRAPPATINI T2-mapping sequence was successfully performed in all subjects. T2 values in inter-subject comparison were stable in the different portions of the pancreas (mean T2 value: head: 56.8ms, body: 57ms, tail: 57.3ms) with low variability (SD: head: 2.8, body: 3.4, tail: 3.4). Intra-subject comparison showed a low variability between the different acquisitions (SD<2.7ms).
The measured hepatic T2-values (right lobe: 50.6ms, SD4.1; left lobe 50.4ms, SD4.1) showed good agreement with previous values (51ms, SD5.4) reported in the literature.
Conclusion: Free-breathing quantitative T2 measurements using triggered GRAPPATINI at 3T in moving abdominal organs, such as the pancreas, are feasible. The obtained quantitative T2-values of healthy pancreas are stable and reproducible.

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New era of neuroendocrine tumor imaging using 68Ga-DOTA-NOC PET: experience from a large neuroendocrine tumor center

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Purpose: Our aim was to assess the role of Ga-DOTA-NOC-PET/CT as a tool for the management of neuroendocrine tumors (NETs), evaluating the clinical impact on patients from a large NET center.
Methods and Materials: This is a retrospective study of patients with NETs who underwent Ga-DOTA-NOC-PET/CT at Mount Lebanon Hospital (Lebanon). Indications for imaging and findings of the PET/CT along with demographic and clinical outcome data were recorded and evaluated.
Results: One hundred and twenty-nine patients fulfilled the inclusion criteria, with a median age at the time of diagnosis of 68 (range: 3-88) years; 54 (42%) patients were male. Ga-DOTA-NOC-PET/CT was indicated for staging in 56 (43.4%) patients, for diagnosis in 36 (27.9%) patients, for follow-up in 28 (21.7%) patients.
Thirty-six (27.9%) patients underwent Ga-DOTA-NOC PET/CT for the primary diagnosis of NET, of whom 19 (52.7%) patients presented with a clinical suspicion of NET and 14 (38.8%) patients presented with a suspicious NET lesion discovered on another imaging modality. The most common clinical presentation was typical carcinoid syndrome.
Results on the basis of histology were used as the gold standard (57%) and on the basis of follow-up. Sensitivity, specificity, negative-predictive value, and positive-predictive value of PET/CT were 87.1, 97.7, 79.6, and 98.7%, respectively, for the entire sample.
Conclusion: Ga-DOTA-NOC-PET/CT is a highly sensitive and specific study for the diagnosis and follow-up of patients with neuroendocrine tumors. These results support the use of Ga-DOTA-NOC PET/CT contributing significantly toward the clinical management of NET patients. Further studies correlating RECIST/PERCIST criteria to patient outcomes are recommended.

SS133

PET CT and MRI: evaluation of retrospective fusion for liver lesions characterisation

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Purpose: To compare retrospective fusion of FDG PET/CT and MRI (PET/MRI) to FDG PET/CT and MRI for the detection and characterisation of focal liver lesions.
Methods and Materials: A retrospective review of 150 hepatic lesions in 70 patients (30 female, 40 male; mean age 56 years +/-14), who had FDG PET/CT and MRI (mean scan time interval 41 +/- 11 days) with intravenous contrast (gadoterate meglumine). HERMES® software was used to fuse PET/CT and MRI scans which were reviewed by 2 readers using the Likert score (scale 1-5) to characterise lesions as benign (1-3) or malignant (4-5). Final diagnosis was determined by histopathology or follow-up imaging (mean time 12 +/- 6 months). Results of PET/MRI were compared to PET/CT and MRI alone.
Results: For detection, PET/MRI and MRI demonstrated 100% of lesions whereas PET/CT detected 89.4%. For characterisation sensitivity, specificity, accuracy, PPV and NPV were 55.6%, 83.3%, 66.7%, 83.3%, 55.6% using FDG PET/CT and 67.6%, 92.1%, 80%, 89.3%, 74.5% for MRI, respectively. The sensitivity, specificity, accuracy, PPV and NPV increased to 91.9%, 97.4%, 94.7%, 97.1%, 92.5% with PET/MRI fusion. The sensitivity, specificity, accuracy, PPV and NPV of PET/MRI remained superior to FDG PET/CT and was higher or equal to MRI regardless of lesion size or lesion SUVmax.
Conclusion: Retrospective fusion of PET with MRI has increased the detection rate and improved characterisation of focal liver lesions compared to MRI or FDG PET/CT alone, regardless of size or SUVmax.

SS134

Texture features in liver MRI predict metastases in mice

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Purpose: To investigate whether any texture features show a correlation with tumor growth before the metastases are visible to the eye.

Methods and Materials: Eight male C57BL6 mice (8–12 weeks) were injected intraportally with MC-38 colon cancer cells and 2 mice with phosphate-buffered saline (sham control). Dedicated small animal MRI at 4.7T was performed at baseline and days 4, 8, 12, 16, 20 after injection. Images were evaluated qualitatively by two independent readers for visible metastases. Region-of-interest-based texture analysis was performed on the MR images yielding 32 texture features derived from histogram, grey-level co-occurrence matrix, grey-level run-length matrix and grey-level size-zone matrix. The features over time were examined with a linear regression model/Pearson correlation test. A p-value <0.05 was considered significant. Hierarchical cluster analysis was performed to assess the features for co-dependence (redundancy). From each cluster, the feature with the lowest variance over all days was selected.

Results: Tumors were visible on MRI after 20 days. 18 features exhibited significant correlations before day 20 in the experiment group, but not in the sham control animals. Cluster analysis revealed three distinct clusters of independent features; the features with the lowest variance were Energy, Short Run Emphasis and Grey Level Non-Uniformity.

Conclusion: Texture analysis may have the potential to detect liver metastases before they become visible to the human eye.

The impact of education, as a metric of cerebral functional reserve, on the diagnosis of Alzheimer's disease: an FDG PET single-subject design analysis

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Purpose: In Alzheimer's disease, the onset of symptoms is modulated by a "reserve-capacity". Various elements such as education contribute to this reserve. We used the years of education as metric of functional-reserve and FDG-PET as biomarker for the severity of synaptic-dysfunction. The aim of this study is to measure the impact of education on the threshold of hypometabolism on FDG-PET and its diagnostic-accuracy
Methods and Materials: 90 healthy controls and 181 AD-patients from the ADNI-database were included. We used the mean glucose-metabolism within a set-of-regions typically affected (metaROI), normalized to the activity in the cerebellar-vermis and corrected for age. A Receiver-Operating-Characteristic (ROC) curve approach was used to test the diagnostic performance of the metaROI in the whole population, the 1st and 4th quartile of educational level. The area-under-the-curve (AUC) of the ROC-curves was compared with a t-test.
Results: The AUC of the metaROI to discriminate AD-patients from controls was 0.832. The cut-off value providing a minimum of 80% sensitivity was 1.3765. The AUC of the metaROI was 0.826 in patients with lower-reserve and 0.861 in patients with higher-reserve. The difference between the two AUC was not significant. The cut-off value providing a minimum of 80% sensitivity was 1.3765 in subjects with lower-reserve and 1.19 in subjects with higher-reserve, indicating that a lower cut-off should be used in patients with higher-reserve.
Conclusion: FDG-PET as a diagnostic test is valid in both high and low-reserve subjects, wth a difference in the threshold, highlighting the need to adapt the threshold on the basis of the years of education.

Spatial and temporal dissemination of gadolinium deposits within deep brain nuclei

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Purpose: Gadolinium can deposit within the brain, after repeated injections of linear GBCAs. Nevertheless, this phenomenon has been underestimated by past studies, referring only to accumulation within dentate nucleus (DN) and globus pallidus (GP). McDonald et al (Radiology 2015) reported deposition also in posterior thalamus and Zhang et al (Radiology 2016) reported deposition within other deep brain nuclei in a cohort of 13 patients who received more than 39 injections, including substantia nigra (SN), red nucleus (RN), posterior thalamus).
Methods and Materials: We analysed retrospectively MRIs from a cohort of 300 patients at CHUV, who received 5 to 32 injections of non-ionic linear gadodiamide (Omniscan, GE healthcare, Piscataway, New Jersey). We calculated the difference of native T1 mean SI ratios of DN, GP, pulvinar, SN, RN, subthalamic nuclei, superior colliculus and posterior putamen, to adjacent structures not known to accumulate significantly gadolinium (pons, middle cerebellar peduncle, anterior thalamus).
Results: We observed a significant increase of SI ratios in ROIs after successive injections, suggestiing a gradual deposition in space and time. After 4 injections (p < 0.001), T1 hypersignals start to appear in DN and later on could be observed in SN and GP (mean = 6 injections; p < 0.001) and pulvinar (mean = 8 injections; p < 0.001).
Conclusion: Gadolinium deposition within deep brain structures may occur gradually in space and time. Gadolinium deposition leading to T1 hypersignals may be linked respective iron content of brain structures, and subsequent increased probability of transmetallation reactions with the GBCA ligand and of gadolinium unchelation.

Investigation of cerebral spinal fluid pulsatility using cardiac-gated intravoxel incoherent motion MRI

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Purpose: To assess the feasibility of the Intra-voxel Incoherent Motion (IVIM) model for quantification of the fast diffusion component of the turbulent cerebrospinal fluid (CSF) during different phases of the cardiac cycle.
Methods and Materials: Five healthy volunteers underwent prospective phase-contrast flow imaging and diffusion-weighted (DW) imaging at 3T. Cardiac-gated sagittal-oriented DW-images were acquired with 15 b-values (0-1300 s/mm2) along three orthogonal directions in systole and diastole. For each of the three diffusion-encoding directions, IVIM parameters were computed pixel-wise using bi-exponential fitting with an iterative non-parametric algorithm. IVIM parameters and fluid velocity were computed in regions-of-interest manually drawn over the Foramen magendii and the median aperture. For each diffusion-encoding direction, the differences between diastole and systole were assessed for possible correlation (Pearson's R, p<0.05) of the phase velocity with the pseudodiffusion coefficient (D*) and the perfusion fraction (Fp).
Results: Mean velocity at systole was 7.8±13.6 cm/s and at diastole 3.8±12.0 cm/s. Fp in craniocaudal orientation at systole was 0.51±0.09 and at diastole 0.62±0.06. D* was 0.37±0.13×10-3 mm2/s at systole and 0.32±0.10×10-3 mm2/s at diastole. The differences in fluid velocity correlated significantly with the differences in Fp (R=0.68, p=0.03), while no correlation with D* was found (R=0.29, p=0.41). For diffusion-encoding transverse to the spinal canal, no significant correlation between the IVIM parameters and fluid velocity was found.
Conclusion: Fast diffusion quantified using the IVIM model follows the CSF dynamic during the cardiac cycle. Bi-exponential analysis of the DW-signal of the CSF may allow quantitative monitoring of pathological changes in CSF movements.

Anisotropy of the IVIM signal in the healthy cerebral gray matter: a tensor model

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Purpose: The Intra-voxel Incoherent Motion (IVIM) model ascribes the signal attenuation in diffusion-weighted images to water self-diffusion and to the flow of the water molecules in segments of the capillary network. The aim of this study was to investigate the dependence of the IVIM estimates from the diffusion-encoding direction in the human cerebral gray matter.
Methods and Materials: DW-images from three volunteers were acquired using an EPI sequence with bipolar spin-echo diffusion preparation (TR/TE=4100ms/90ms; bandwidth=1685Hz/px; voxel size=2x2x2 mm3; b-values:0/5/10/20/35/55/80/110/150/200/300/500/750/1000/1300 s/mm2, 20 diffusion-encoding directions) at 3 Tesla. For each diffusion-encoding direction, a step-wise analysis of the signal was performed for estimation of the IVIM parameters, fraction of perfusion, pseudo-diffusion, and diffusion. IVIM parameters were formalized as symmetric rank 2 tensors. After computation of the eigenvalues ($\lambda_{max},\lambda_{med},\lambda_{min}$), Westin measures (cs=$\lambda_{min}/\lambda_{max}$, cL=($\lambda_{max}$-$\lambda_{med}$)/$\lambda_{max}$) and trace ($\lambda_{max}$+$\lambda_{med}$+$\lambda_{min}$)/3) were computed for quantification of the geometrical properties of the derived tensors. For each subject, mean values were computed over the segmented gray matter.
Results: While the diffusion tensor mainly predicts a spherical geometry for the gray matter, both, fraction of perfusion and pseudo-diffusion, presents a substantial (in the order of 30%) contribution of planar and linear components to the tensor metrics.
Conclusion: Preliminary results showed that the IVIM perfusion estimates in the cerebral gray matter present a weak but detectable deviation from the spherical model. These non-spherical components may reflect the direction-dependent morphometry of the microcirculation, which might allow non-invasive monitoring of cerebral capillary micro-architecture during development/aging and in pathologies.

Assessment of microvascular cerebral pulsatility using ferumoxytol enhanced T2* MRI

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Purpose: Ferumoxytol is a true blood-pool contrast agent. In this work, the feasibility of ferumoxytol-enhanced T2* MRI to capture cerebral parenchymal microvascular blood volume pulsatility is assessed.

Methods and Materials: This IRB approved study prospectively enrolled 10 healthy subjects (age range 20-51y, mean=30y, 7F). MRI: images were acquired using 2D EPI and 3D spiral trajectory T2*-weighted sequences on a 3.0T scanner with a 32ch head coil. 2D EPI images were acquired before and after administration of 5mg/kg ferumoxytol (AMAG Pharmaceuticals, Inc., Cambridge, MA). 3D spiral images were acquired only after ferumoxytol injection. For every acquisition, peripheral gating data were acquired simultaneously for retrospective cardiac gating. Brain parenchyma was manually segmented into gray matter (GM) and white matter (WM). Microvascular pulsation was assessed via the pulsatility index, PI = (max - min / mean) based on T2*-differences during the cardiac cycle. Statistical analysis was performed using paired student's t-test (significance at P<0.05).

Results: PI increased significantly with ferumoxytol concentration in GM but not in WM in the 2D EPI images (GM precontrast: 0.009, postcontrast: 0.016, p=0.002, WM precontrast: 0.008, postcontrast: 0.01; p=0.061). Also, there was a significant increase in PI in GM when compared to WM PI after contrast injection in both 2D EPI and 3D spiral acquisitions (2D EPI: GM-PI: 0.016,WM-PI: 0.01; p=0.006, 3D-Spiral: GM-PI: 0.015, WM-PI: 0.012, p=0.015).

Conclusion: The described, non-invasive method to assess microvascular blood volume pulsatility over the cardiac cycle might serve as a potential marker to study capillary pulsatility and narrow the gap of knowledge between arterial and venous measurements.

MR-based carotid pulsation imaging

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Purpose: Atheromatosis of the carotid arteries is characterized functionally as an increase in vessel wall rigidity, which thus decreases arterial distensibility. Magnetic resonance imaging (MRI) does not currently provide us with this information. The purpose of this study was therefore to investigate a novel MRI approach, to determine its feasibility for the quantitative assessment of common carotid artery (CCA) distensibility, and to compare the results to those from the current gold standard ultrasound (US).

Methods and Materials: Five healthy subjects without any cardiovascular risk factors, were recruited. CCAs were studied one centimeter proximal to the right carotid bifurcation. Ultrasound-based surface area measurements were obtained on a Philips IU22 using a linear 12Mhz transducer in the transverse plane and MRI-based surface area measurements were obtained with a self-gated steady-state free precession imaging sequence in the axial plane on a Siemens Prisma 3T using Compressed Sensing and sampling covering the entire cardiac cycle. Additionally, blood pressure was recorded.

Results: Ten averaged measurements of surface area covering the entire cardiac cycle were recorded using both MRI and US. MRI-based measurements over the entire cardiac cycle strongly correlated with those obtained on US(R=0.9).

Five pairs of mean CCA distensibility were calculated separately from surface area measurements generated by MRI and US. Distensibility was similar between both modalities(R=0.56) with a positive systematic bias of US measurements.

Conclusion: Carotid pulsation waveforms and distensibility measurements generated by self-gated MRI significantly resembled those generated by US. MRI may provide an alternative to dynamically study the CCA, while operator dependency may be reduced.

Carotid Plaque Neovascularization Detected By Contrast-Enhanced ultrasound compared with dynamic contrast enhanced magnetic resonance imaging: a blinded head to head comparison

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Purpose: The relationship between CEUS and DCE-MRI in the evaluation of plaque neovascularization (vasa vasorum, VV) to detect high-risk plaque in carotid atherosclerosis. is not understood. Aim of the study was to investigate the correlation of VV as assessed by CEUS grading and by DCE-MRI. Secondary objective was to correlate CEUS-detected VV with plaque features by multicontrast MRI.

Methods and Materials: We recruited subjects with asymptomatic carotid stenosis (≥50%). VV was visually graded by CEUS according to three different methods named: CEUS_A (1 = absent; 2 = present); CEUS_B a three-point scale; CEUS_C a four-point scale. We used a 3.0 T MRI scanner for multicontrast analyses and VV quantification by DCE-MRI using gadolinium contrast kinetic modelling: fractional plasma volume (vp) and transfer constant (Ktrans), measured in adventitia only and in the entire plaque.

Results: Thirty patients were analized. Significant correlation between CEUS and DCE-MRI was observed for CEUS_C grading and DCE-MRI Ktrans in adventice (r 0.460, p 0.010) and plaque (r 0.374, p 0.042). CEUS_B (r 0.416, p 0.022) and CEUS_C (r 0.443, p 0.014) grading showed significant correlation with maximal Ktrans. There were no significant correlations of CEUS-detected VV with multicontrast MRI features, except CEUS_B with percent calcification volume and surface ulceration.

Conclusion: A moderate correlation appears to exist between CEUS and DCE. These data support both techniques for carotid plaque neovascularization imaging and possibly for appropriate risk stratification. Small sample size, intrinsic technical limitations and the multifaceted pathophysiology of atherosclerosis may have limited the correlation. Financial support. Swiss heart foundation.

Correlation between carotid haemorrhagic plaques on MRI and metabolic activity on PET-CT

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Purpose: To determine whether carotid haemorrhagic plaques on MRI are more likely to be metabolically active on FDG PET-CT.

Methods and Materials: A total of 23 patients (15 males, 6 females; mean age, 73 years; range, 54-90 years) undergoing carotid artery MRI and FDG PET-CT (exam interval median, 7 days) from 2009 to date were included in this retrospective study. The presence of carotid plaque haemorrhage on MRI was independently evaluated by two neuroradiologists as high signal intensity in the plaque on a 3D fat-saturated black-blood T1-weighted imaging (BB-T1WI) sequence. In case of disagreement, the final decision was made by a third experienced neuroradiologist. Metabolic activity was evaluated on FDG PET-CT by measuring the SUVmax of the plaque, which was subsequently normalized by the averaged mean SUV of both jugular veins. Statistical analysis was performed by independent samples t-test, and a 0.05 significance level (two-tailed) was used.

Results: All 23 patients had at least one carotid plaque, of which 19 bilaterally and four unilaterally. A total of 42 carotid plaques were found, of which 16 were haemorrhagic. Haemorrhagic plaques showed a significantly higher (p<0.05) normalized SUVmax (2.21 ± 0.58) than non-haemorrhagic plaques (1.84 ± 0.45). Additionally, the mean normalized SUVmax of haemorrhagic plaques was higher than the generally accepted threshold for metabolically versus non-metabolically active plaques (1.9), whilst that of non-haemorrhagic plaques was lower.

Conclusion: Carotid artery plaques are more likely to be metabolically active if they are haemorrhagic.

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Correlation between quantitative diffusion weighted imaging parameters and histology in primary and recurrent squamous cell carcinoma of the oropharynx and oral cavity

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Purpose: To compare quantitative diffusion-weighted imaging (DWI) parameters of primary and recurrent head and neck squamous cell (HN-SCC) carcinoma of the oral cavity and oropharynx and correlate these findings with histology.

Methods and Materials: We performed a retrospective study based on 146 consecutive patients (mean age = 61±2 years, 43 females, 103 males) with HNSCC of the oral cavity and oropharynx seen at the interdisciplinary HN tumour board. All patients underwent MRI for pre-treatment evaluation with morphologic and DWI sequences. Monoexponential apparent diffusion coefficient (ADC) maps were calculated. ADC measurements and voxel by voxel histogram analysis were obtained by contouring the largest tumor areas on two consecutive slices by two experienced readers blinded to histologic results and clinical data.

Results: There were 122 primary and 24 recurrent HNSSCs. Histology revealed a significantly higher number of well to moderately differentiated tumours in the recurrence group in comparison to the primary group (23/24 versus 85/122 $p=0.01$), however, no significant difference regarding the presence or absence of keratinization ($p=0.25$). At DWI analysis recurrent HNSCCs had higher mean ADC than primary HNSCCs ($1265±271 \times 10^{-6} mm^2/s$ versus $1157±181 \times 10^{-6} mm^2/s$, $p<0.005$), higher median ADC ($1244±276 \times 10^{-6} mm^2/s$ versus $1129±190 \times 10^{-6} mm^2/s$, $p<0.05$), lower skewness (0.26 versus 0.48, $p<0.02$) and lower kurtosis (0.26 versus 0.81, $p<0.02$), respectively.

Conclusion: Recurrent HNSCCs of the oral cavity and oropharynx have different quantitative DWI parameters in comparison to primary HNSCCs of the same anatomic regions due to underlying differences in the degree of histologic differentiation.

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4D Flow MRI: influence of Contrast application, different field strength and velocity encoding on qualitative and quantitative assessment of liver blood flow

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Purpose: To evaluate the impact of Gadolinium contrast media application, velocity encoding (venc) and different field strength on 4D flow MRI imaging of liver hemodynamics in liver cirrhosis patients and normal controls.

Methods and Materials: Our study cohort consisted of 10 liver cirrhosis patients and 5 normal controls. K-t GRAPPA accelerated 4D flow MRI (temp.resol.=2.5x2.1x1.3mm3, TR=40.8ms, TE=2.7ms) was applied before and after application of contrast media, with two different velocity encodings (venc=50cm/s or venc=100m/s), and on either 1.5T or 3T MR system. Qualitative assessment was based on time-resolved particle traces in arterial and portal venous (PV) system of the liver. Quantitative analyses consisted of peak velocities and net flow of liver hemodynamics.

Results: Overall n=78 datasets were available. Visualization of all arterial and PV was successfully performed with good image quality. Contrast media application offered higher flow volumes in the PV system (p<0.05). Quantitative analysis of 4D flow MRI acquisition was feasible with 1.5T and 3T with similar results. Changes in velocity encoding showed significantly improved visualization (p<0.01) and increased flow volume (15%, p<0.05) for the PV system. Significant differences for hemodynamic parameters between patients and controls were found for flow volume in the PV system and the hepatic artery (p<0.05).

Conclusion: Selection of different velocity encoding gradients showed the greatest impact on vascular visualization and quantification using k-t GRAPPA accelerated 4D flow MRI acquisition. Further studies are necessary to assess the effect of velocity encoding on 4D flow MRI in larger patients cohorts with altered liver hemodynamic parameters.

Assessment of pulmonary artery mean pressure with 4D flow MRI

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Purpose: A robust non-invasive method to estimate increased pulmonary artery mean pressure (mPAP) is needed. Recently, a 2D velocity encoding MRI study has shown that vortex duration in the pulmonary artery (PA) was related to mPAP (Reiter, Radiology,2015;275(1):71). This present study investigated the potential of 4D flow MRI to assess mPAP.

Methods and Materials: Thirteen patients with suspected Chronic Thromboembolic Pulmonary Hypertension (CTEPH) were assessed by right heart catheterization (RHC) and cardiac MRI, including a 4D phase contrast flow sequence. Streamlines were reconstructed in the pulmonary artery from the 4D MRI and the duration of the vortical blood flow, defined as closed concentric ring-shaped curves parallel to the pulmonary artery, was measured as a % of the cardiac cycle. The vortex duration was compared to the RHC mPAP, right ventricular volume (RVV), PA diameter and PA distensibility.

Results: CTEPH was confirmed in 10 / 13 patients. The mPAP was 30.3 ± 14.7 mmHg (11-66 mmHg). On the 4D flow data, vortex was difficult to assess on the first trial but after a learning curve, reproducibility was excellent with an ICC between vortex duration measurements of 0.93. Vortex duration correlated excellently with mPAP with R2 = 0.75, p<0.005 and outperformed all the other parameters (RVV: R2 = 0.0026, p=0.87; PA diameter: R2 = 0.29, p=0.087; PA distensibility: R2 = 0.09, p=0.32).

Conclusion: Vortex duration derived from 4D flow MRI was the most promising MRI parameter to assess pulmonary artery pressure. Further work should include the development of an automated method to facilitate the vortex duration measurement.

Risk stratification in acute pulmonary embolism: effects of arterial obstruction index, cardiopulmonary comorbidities and age

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Purpose: Recent reports emphasize the critical role of risk stratification in acute pulmonary embolism (PE) to improve patient survival. Among several tools, those derived from CT pulmonary angiography (CTPA) are particularly attractive given their readily availability, such as the CT obstruction index (CTOI). The objective of the present study was to provide risk stratification based on CTOI, the presence or absence of any cardiopulmonary comorbidities and age.

Methods and Materials: Consecutive symptomatic and hemodynamically stable patients with radiologically proven acute PE by CTPA were included (n=690; 53% females; mean age 63 years). CTOI was calculated according to the Qanadli Index. Two discrete CTOI severity thresholds were established in order classify patients either as low (CTOI<20%), medium (CTOI 20-37.5%) or high severity (CTOI≥40%). Patients were further subjected into two subgroups, based on the presence (R+) or absence (R-) of preexisting cardiopulmonary disease. Three-month mortality rates were assessed for the study population overall, and for the cardiopulmonary disease groups (R+ and R-).

Results: A CTOI <20% predicted 3-month survival for the study population overall (p=0.029) and group R- (p=0.049), but failed to do so for group R+. A CTOI of ≥40% was predictive of mortality for the study population overall (p=0.019), as well as for group R- (p<0.001), but was not for group R-. Age was found to be predictive of mortality in all subgroups (p<0.03).

Conclusion: _PE patients can be accurately risk-stratified based on CTOI (Qanadli Index) and age, given they do not have any preexisting cardiopulmonary disease._

Prospective Randomized Comparison of high-pitch CT at 80 kVp under free breathing with standard-pitch CT at 100 kVp under breath-hold for detection of pulmonary embolism

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Purpose: Prospective Randomized Comparison of High-pitch CT at 80 kVp under Free Breathing with Standard-pitch CT at 100 kVp under Breath-Hold for Detection of Pulmonary Embolism.

Methods and Materials: One hundred consecutive patients (47 females; mean age 58.7±16.6) randomly underwent HPCT-FB (n=50) or SPCT-BH (n=50). Radiation doses were documented. One reader measured pulmonary artery attenuation and noise; mean signal-to-noise ratio (SNR) was calculated. Two readers assessed image quality, diagnostic confidence for detection of PE, motion artifacts, assessability of anatomical structures, and presence of transient interruption of contrast as sign of Valsalva maneuver. Inter-reader agreement was calculated.

Results: Radiation dose was significantly lower in HPCT compared to SPCT (2.68±0.60 mGy vs 6.01±2.26 mGy; P<.001). Mean pulmonary artery attenuation and image noise were significantly higher in HPCT (attenuation: 479 Hounsfield unit (HU) vs 343HU; P<.001; noise: 16 HU vs 10 HU; P<.001) whereas SNR was similar between groups (34 HU vs 38 HU; P=.258). HPCT had significantly higher diagnostic confidence for PE detection (P=.048), less cardiac and breathing artifacts (P<.001), better assessability of anatomical structures, and fewer cases of transient interruption of contrast (P<.001) compared to the SPCT.

Conclusion: HPCT-FB allows for a significant reduction of breathing and motion artifacts compared to SPCT-BH. Diagnostic confidence, assessability of vascular and bronchial structures, as well as SNR are maintained.

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Impact of advanced modeled iterative reconstruction on coronary artery calcium quantification

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Purpose: To evaluate the influence of advanced modeled iterative reconstruction (ADMIRE) on the coronary artery calcium (CAC) scores by computed tomography (CT).

Methods and Materials: Sixty patients underwent CAC imaging with dual-source 192-slice CT. Agatston, volume and mass score were calculated from filtered back projection (FBP) and iterative reconstructions with different levels of ADMIRE. Friedman test and Wilcoxon rank sum test were used for multiple comparisons of CAC values and the difference ratio among different ADMIRE groups using FBP as reference.

Results: The median Agatston score (range) using FBP was 115 (0.1–3047) and significantly decreased with incremental ADMIRE levels 1–5: 96 (0.1–2813), 91 (0–2764), 87 (0–2699), 80 (0–2590), 70 (0–2440); all P < 0.001. In comparison with FBP Agatston, volume and mass scores significantly decreased with increasing ADMIRE levels 1–5 (P < 0.001): from –12% to –39%, from –14% to –41%, and from –13% to –40%, respectively. In four patients with low calcium burden, the use of ADMIRE 2 or higher resulted in the disappearance of calcium that was detectable using FBP or ADMIRE 1. The decrease of CAC in highlevel ADMIRE resulted in a reassignment to a lower Agatston risk group in 27%.

Conclusion: ADMIRE causes a substantial reduction of the CAC scores measured by cardiac CT, which leads to an underestimation of cardiovascular risk scores in some patients.

SS149

Quantification of aortic valve calcification on contrast-enhanced CT of patients prior to transcatheter aortic valve implantation

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Purpose: To develop a formula enabling the quantification of aortic valve calcification (AVC) on contrast-enhanced CT of patients prior to transcatheter aortic valve implantation (TAVI).

Methods and Materials: 217 consecutive patients (105 females, median age 82 years) with severe aortic valve stenosis undergoing non-enhanced and contrast-enhanced electrocardiography-gated CT angiography prior to TAVI were subdivided into a training (n=145) and validation cohort (n=72). AVC was semi-automatically segmented on contrast-enhanced CT using a threshold defined as average attenuation plus three standard deviations of attenuation in the aortic root (AVC_{CE}). Linear regression model was applied to derive a formula for quantification of the Agatston Score (AS) on contrast-enhanced CT in the training cohort. The formula was subsequently tested in the validation cohort. The AS quantified on non-enhanced CT served as reference-standard.

Results: On non-enhanced CT, patients in the training cohort had a median AS of 2454 (interquartile range [IQR]: 1511-3636). The formula for computing the AS on contrast-enhanced CT in the training cohort was: $(2.27+1.04*(AVC_{CE})^{1/3})^3$. Testing the formula in contrast-enhanced CT of the validation cohort yielded a predicted median AS of 2339 (IQR: 1609-3643), being not significantly different to the reference standard AS based on non-enhanced CT (median 2455, IQR: 1503-3611, p=0.452). The intra-class correlation coefficient between predicted and reference-standard AS in the validation cohort was 0.897; Bland-Altman analysis showed a small mean difference of -0.75.

Conclusion: We introduced a formula enabling the accurate quantification of AVC on contrast-enhanced CT with similar results as compared to the standard Agatston method using non-enhanced CT.

SS150

Systolic versus diastolic aortic annulus differences assessed by high-pitch low-contrast CT before trans-catheter aortic valve replacement

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Purpose: To evaluate systolic versus diastolic aortic annulus differences assessed by high-pitch low-contrast CT before trans-catheter aortic valve replacement (TAVR) and its consequences on device selection.

Methods and Materials: Fifty-three patients underwent high-pitch ECG-gated CT: a first systolic cardiac acquisition (20% R-R) was immediately followed by a second diastolic thoracic-abdominal acquisition (60% R-R) during a unique low dose iodine contrast injection (60cc, Iohexol 350).

Mean attenuations of the aortic valve, ascending, descending and abdominal aorta, and iliac arteries were measured. Calcium scoring of the aortic annulus was calculated and subjective image quality was rated on a 3-point scale.

Aortic annulus perimeter and area were measured in systole and diastole. Predicted device sizes based on systolic and diastolic CT were compared and correlated to the implanted device size.

Results: No difference was noted between systolic and diastolic mean attenuations of the ascending and descending aorta (438±124HU vs. 413±156HU;p=0.13; 393±108HU vs. 423±164HU;p=0.27). Mean attenuations were 447±149HU and 423±145HU on the abdominal aorta and iliac arteries.

Image quality of the aortic annulus was excellent in 42/53 patients and moderate in 11/53, allowing measurement of a mean systolic-diastolic perimeter difference of 2±1.4 mm (p=0.26) and an area difference of 0±1.8 cm2 (p=0.23). The variability in perimeter difference was greater among patients with lower calcium scoring.

No difference was found between predicted systolic vs. diastolic device size. 32 patients underwent TAVR and all had similar implanted device size to the predicted systolic-diastolic CT size.

Conclusion: Systolic versus diastolic aortic annulus assessment had no significant differences and no implications for device sizing.

SS151

3D-printed heart model to guide LAA closure: preliminary results

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Purpose: Percutaneous left atrial appendage (LAA) occlusion is as an alternative therapeutic approach to medical therapy for stroke prevention in patients with atrial fibrillation The correct sizing of the occluding device remains challenging due to the complex and variable shape of the LAA. We investigated the use of personalized 3Dprinted model of the LAA to guide the selection of the device size.

Methods and Materials: Seven patients scheduled for an occlusion of the LAA underwent a cardiac CT with contrast media injection (Siemens Somaton Flash). The left atrium was segmented by semiautomatic algorithms using Vitrea® software (Vital Images, Inc., Minnesota USA) and a 12 mm thick shell of the left atrium was exported in STL format and printed on an object260 connex3 printer (Stratasys Ltd. Rheinmünster, Germany) using the tangoblackplus flexible material. Then, a new CT scan of the 3D printed model with and without Amplazer® Amulet cardiac plugs (St. Jude Medical (Schweiz) AG) was acquired.

Results: The segmentation process was fast (less than 15 min for all the cases). On the CT, the proximal disc sealing the ostium of the LAA and the close contact of the distal lobe with the LAA wall could be seen very well. In case of incorrect sizing, absence of contact with the LAA wall or device deformation was easily identified. The correct size of the device was correctly predicted in all the 7 patients.

Conclusion: We introduced a fast and robust protocol using personalized 3D printed LAA model to select the correct size of the occluding device.

SS152

Towards quantitative cardiac CT imaging: texture analysis of myocardial infarction

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Purpose: To investigate the ability of texture analysis (TA) for CT imaging to distinguish through quantitative image information between healthy subjects and patients with acute myocardial infarction (MI).

Methods and Materials: Twenty patients (8 females; mean age 42±15.2 years) with no cardiac abnormalities (hereafter termed controls) and twenty patients (5 females; mean age 56±10.3 years) with proven acute MI underwent cardiac CT. Short axis reformations of the left ventricle (LV) were reconstructed at slice thicknesses of 1mm, 2mm, and 5mm. Two independent, blinded readers segmented the LV myocardium in controls and patients. TA was performed yielding first-level features (based on the histogram), second-level features based on the gray-level co-occurrence matrix (GLCM), and third-level features based on the gray-level run-length matrix (GLRLM).

Results: Inter-and intrareader agreement was good to excellent for all first and second-level features (ICC:0.661-0.988), and was variable for the third-level features (ICC:-0.115-0.991). Multivariate logistic regression analysis showed the single best feature from each level to be an independent predictor of acute MI (kurtosis, OR 0.86, P=0.019; correlation, OR 0.97, P=0.22; short run high grey-level emphasis, OR 1856, P=0.79). The AUC showed best results when combining the features kurtosis and short run high grey-level emphasis (AUC:0.985) and when using the 5mm short axis reformations.

Conclusion: TA can be used in cardiac CT for distinguishing healthy from acutely infarcted myocardium with most reproducible and accurate results at a short axis slice thickness of 5mm.

SS201

Follow-up ultrasound imaging in young patients with diagnosis of probably benign breast lesions (BI-RADS category 3)

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Purpose: To evaluate the clinical usefulness of repeated short-term follow-up with ultrasound in patients younger than 35 years with a BI-RADS3 lesion at first ultrasound examination and proven lesion stability at the 6-month follow-up.
Methods and Materials: In this IRB-approved study 492 women, aged 18-34 years (mean±standard deviation, 28±4.5 years) who underwent their first breast ultrasound examination in 2012-2014 were retrospectively evaluated. Inclusion criteria: presence of at least one BI-RADS3 lesion and (a)biopsy/surgical excision or (b)follow-up of at least 18 months(including a 6-month follow-up). For each lesion, BI-RADS category assigned during the follow-up as well as pathologic findings in cases undergoing biopsy/surgical excision were collected. We calculated recommended biopsy rates(RBR) at the 6- and 18-month follow-up and the positive predictive value(PPV) for biopsy after recommendation due to interval changes(PPVbio).
Results: In 97 patients, 151 lesions initially classified as BI-RADS3 were identified. Biopsy/surgical excision was performed after initial assessment in 25/151(16.5%) lesions. At 6-month, assessment category was changed to BI-RADS1/2 in 23/126(15.3%) and to BI-RADS4 in 9/126 lesions(7.1%) due to interval growth. Pathological diagnosis of these lesions was fibroadenoma in 5 and benign phyllodes tumor in 4 cases (RBR 7%, PPVbio 44.4%). At 18-month one lesion was classified BI-RADS4 due to interval growth and pathological diagnosis was fibroadenoma(RBR 1.1%, PPVbio 0%).
Conclusion: Follow-up imaging performed after 18 months from a first BI-RADS3 diagnosis does not affect clinical treatment and the 6-month follow-up may be sufficient to assess the stability of probably benign lesions and to discern those which entail further investigation.

SS202

Withdrawn

SS203

Assessment of breast lesion malignancy using phase contrast imaging

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Purpose: Investigate the sensitivity and specificity of phase contrast imaging (PCI) in assessing breast lesion malignancy.
Methods and Materials: Fresh microcalcification-containing samples from 40 female patients referred for stereotactic VAB were measured directly after extraction on a vertical X-ray Talbot-Lau grating interferometer setup operated at 40 kVp. Three images were retrieved from the measurements: Absorption, differential phase contrast (DPC) and dark field (DF). The ratio between the DF and absorption signals (the so-called R-value) was computed in the microcalcifications area and used to classify the lesion either as benign or malignant utilizing different thresholds, and a corresponding Receiver Operating Characteristic (ROC) curve was generated. After measurements, samples were fixed in formalin and taken to pathology to confirm the findings.
Results: The pathological workup classified 10 of the lesions as malignant and 30 as benign. Using an R-value threshold equal to 3, PCI was able to yield a sensitivity of 0.7 and a specificity of 0.57. For cases having more than 4 microcalcifications (22), a sensitivity of 1 and a specificity of 0.53 were obtained.
Conclusion: PCI demonstrated capabilities to non-invasively diagnose malignant breast lesions based on the microcalcification R-value. However, both the sensitivity and specificity can still be improved and more statistics are required to strengthen the preliminary conclusions drawn from this study.

SS204

Deep learning in mammography: diagnostic accuracy of a multi-purpose artificial neural network in the detection of breast cancer

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Purpose: To evaluate the diagnostic accuracy of a multi-purpose image analysis software based on deep learning with artificial neural networks (dANN) for the detection of breast cancer in mammography in an independent, dual-center dataset.
Methods and Materials: In this retrospective, HIPAA compliant study 3271 mammography patients were included. Histology or clinical long term follow-up served as reference standard. The dANN was trained with (i) all 143 cancer cases and 143 matched controls and (ii) 125 cancer cases and the remainaing eligible controls (n=770) from ¾ of the study timespan (screening-like cohort). Performance was assessed (i) with an external dataset (n=70) (ii) with the remaining ¼ of cases (n=18+233). Three radiologists evaluated both test cohorts. The area under the ROC-curves (AUC) beween readers and the dANN were compared including breast densitiy classification. P-value of <0.05 with Bonferroni correction was considered signficant
Results: In (i) the dANN performed with AUC=0.81 (95%CI:0.78-0.84) similar to one of the human readers (AUC 0.83, p>0.016) but outperformed by the other two (AUC 0.91/0.94, p<0.016) with sensitivity/specificity of 59.8/84.4% at the optimal cut-off. In (ii) performance of dANN (AUC 0.82, sensitivity/specificity 70.4/76.2%) was not different from humans (AUC 0.77-0.87, p>0.016). Radiologists were consistently less sensitive and more specific than the dANN. For both dANN and humans the sensitivity decreased with increasing breast density
Conclusion: Artificial neural networks detect cancer in mammographies with similar accuracy to radiologists, even in a screening-like cohort with low breast cancer prevalence

SS205

Texture analysis of histologically proven invasive cervical cancer in MRI – identification of potential predictive features

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Purpose: To identify texture analysis features allowing the differentiation of tumor type or grade of cervical cancer on MR Imaging for local staging.
Methods and Materials: In this prospective study 23 patients with histologically proven cervical cancer, which were graded by an experienced gynecological pathologist, were included and underwent diffusion weighted MRI of the pelvis. Apparent diffusion coefficient (ADC) maps were calculated. Texture analysis with polygonal regions of interest (ROI) of gluteal muscle, subcutaneous fat and the cervical tumor was performed on ADC maps. Texture-features yielded 32 texture features derived from histogram and spatial-grey-level-matrices.1) Features influenced by ROI size were identified in muscle and fat with analysis of variance and consecutively excluded. 2) Remaining features were tested for correlation with the different tumor types and grades using Spearman's rank correlation. A p-value <0.05 was considered statistically significant.
Results: Tumor subtypes were 1) squamous cell carcinoma (n=10), adenosquamous (n=4) and adenocarcinoma (n=9). Two tumors were well differentiated, eight moderately, two moderately to poorly and five poorly differentiated. Six tumors could not be accurately graded. 1) Eight texture-features were biased by ROI size and were consequently excluded from further analysis. 2) None of the texture analysis features differed between the tumor types.Four features correlated significantly with the tumor grade, namely Zone-Percentage ($\rho=-0.49$, p=0.04); Long-Run-High-Grey-Level-Emphasis (GLE) ($\rho=0.53$, p=0.04), Small-Zone-Emphasis ($\rho=-0.51$, p=0.04) and Large-Zone-Low-GLE ($\rho=0.55$, p=0.04).
Conclusion: Texture analysis in DW-MRI of cervical carcinoma may allow to predict tumor differentiation and thus potentially help in optimization of treatment planning.

SS206

Diffusion tensor imaging for evaluation of sacral plexus abnormalities in patients with deep pelvic endometriosis with pelvic pain: a pilot study

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Purpose: To investigate if fractional anisotropy(FA) or apparent diffusion coefficient(ADC) of the sacral plexus roots, correlate with the intensity of pelvic pain in patients with deep pelvic endometriosis(DPE). A secondary aim of this study was to identify if there is a difference between FA or ADC values in patients with DPE documented on MRI compared to those for whom morphologic MRI is negative.
Methods and Materials: In this prospective study, a DTI sequence was performed in 51 consecutive patients(mean age 33.5±8.9y) referred for pelvic MRI with the indication of clinical suspicion of DPE. The patients filled in a questionnaire with self-evaluation of pelvic pain in a scale from 0-10. FA and ADC for the first 3 sacral roots were calculated. Correlation coefficient r between pain scale and FA and ADC was calculated. FA and ADC values between patients with MRI documented DPE and those without DPE lesions on MRI were compared.
Results: No correlation between FA or ADC and pelvic pain score was found. The average of maximal ADC of the 3 first sacral roots in patients with DPE on MRI was significantly lower compared to women without DPE lesions (p=0.02192).
Conclusion: Neither FA nor ADC correlates with deep pelvic pain intensity. Thus, DTI cannot be used to predict response of pain to surgical treatment. However, the difference between maximum ADC in patients with and without DPE lesions suggests that ADC calculation could be proposed in the future as a quantitative parameter that would help the radiologist improving diagnostic confidence for reporting DPE lesions

SS207

Value of MR defecography parameters used in diagnosis of obstructed defecation

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Purpose: To assess the value of MR-defecography (MRD) parameters used in diagnosis of obstructed defecation.
Methods and Materials: Twenty-two consecutive patients (16 women, 6 men; mean age 51±19.4) with obstructed defecation and 20 healthy volunteers (11 women, 9 men; mean age 33.4±11.5) underwent MRD in a closed-configuration 3.0T MRI-system in supine position. MRD included midsagittal T2-weighted images at rest and during defecation after filling the rectum with 250ml water-based gel. Two independent and blinded radiologists measured pelvic floor descent in reference to the pubococcygeal line (PCL) and HMO-lines during defecation, anorectal angle (ARA), and qualitatively assessed grade of evacuation (GE), paradoxical contraction (PC), and missing sphincter relaxation(MSR).
Results: Interreader agreement for PCL-, HMO-, and ARA-measurements was good to excellent (Intraclass-correlation-coefficient [ICC], 0.60-0.99), for GE excellent (k-value, 0.76-0.80), and for PC and MSR fair to moderate (k-value, 0.24-0.47). Posterior compartment descent, H-, M-line and ARA were significantly greater in patients compared to volunteers (p<0.05). 30-50% of volunteers had mild anterior and middle compartment descent and hiatal enlargement. 50% of volunteers had moderate rectal descent. Impaired evacuation (0-<2/3 of rectal filling evacuated) was seen in 9/20 (45%) volunteers and 9/22 (41%) patients. Also PC and MSR were equally found in volunteers (40%, 40%) and patients (41%, 32%).
Conclusion: Quantitative, but not qualitative MRD-parameters show both excellent interreader agreement and ability to differentiate patients with obstructed defecation from healthy volunteers. However, pelvic floor descent values considered abnormal according to PCL and HMO-system are found in a substantial number of healthy volunteers and therefore need to be redefined.

SS208

Comparison of image quality and signal to noise ratio between four different diffusion-weighted sequences for magnetic resonance imaging of the prostate

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Purpose: To compare image quality and signal-to-noise-ratio (SNR) of four different magnetic resonance (MR) diffusion weighted imaging (DWI) sequences in the prostate.
Methods and Materials: Axial T2-weighted turbo-spin echo images (TSE-T2w) and axial DWI echo planar imaging (EPI) sequences, including single-shot spin-echo (ss-EPI), readout-segmented multi-shot (rss-EPI), selective-excitation reduced field of view (sTX-EPI) and prototype single-shot sequence applying slice slice-by-slice shimming (prot-EPI) sequences were acquired at 3T in ten healthy volunteers (mean age 25.9 ± 3.8; BMI 23.2 ± 3.0). Two radiologists, blinded to the type of DWI, independently rated DWI-sequences on a 5-point Likert scale regarding subjective image quality features (resolution, demarcation of prostate capsule, zonal anatomy). Interreader agreement was assessed using the intra-class correlation coefficient (ICC). Quantitative image analysis was performed, evaluating the SNR in the transitional and peripheral zone. Significant differences were calculated using the Wilcoxon rank sum test with Benjamin-Hochberg-correction for qualitative parameters and analysis of variances (ANOVA) for quantitative-parameters.
Results: Interreader agreement was good to excellent (ICC 0.712 – 0.792) for all qualitative features. Subjective IQ regarding "resolution" was significantly better for ss-EPI than rss-EPI (p=0.031) and sTX-EPI (p=0.046) and for prot-EPI as compared to rss-EPI (p=0.031) and sTX-EPI (p=0.047). There was no significant difference regarding capsule demarcation and zonal anatomy. SNR was significantly higher in prot-EPI than sTX-EPI (p=0.015).
Conclusion: ss-EPI and prot-EPI showed tendency towards superior image quality and SNR compared with rs-EPI and sTX-EPI.

SS209

Multiparametric MRI(mpMRI) of the prostate based on PI-RADS version 2: detection rate and negative predictive value

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Purpose: To assess the detection rate of significant prostate cancer (PCa) and the negative predictive value (NPV) of prostate mpMRI based on PI-RADSv2.

Methods and Materials: Between January 2014 and April 2016, 276 consecutive men (mean age 65 years, range 43 -79) underwent pre-biopsy mpMRI due to rising PSA, suspicious DRE or positive family history. These men underwent MR-TRUS-fusion-guided targeted biopsy of the suspicious lesion (PI-RADSv2 3 to 5) and standard template biopsy of the entire prostate. Suspicious lesions (PI-RADSv2 3 to 5) were delineated on a sector map and discussed with the urologist. Histopathology served as gold standard.

Results: *Significant PCa* was detected in 106 of 276 (39%) patients based on histology. MRI detected significant PCa in 105/106 men (PI-RADS 4/5: n=92 men/144 suspicious MRI, PI-RADSv2 3: n=13/101 suspicious MRI). In only 1 of 31 patients with no suspicious findings on MRI, histology revealed significant PCa (Gleason 3+4=7, 4 mm transitional zone). *The estimated NPVs* of mpMRI for significant PCa is 97%. Insignificant prostate cancer was found on histology in 53 out of 276 (19%) men (PI-RADSv2 4/5: n=26, PI-RADSv2 3: n=22). Five of these were not detected on MRI. In 117 (42%) lesions histology revealed no cancer

Conclusion: MpMRI based on PI-RADSv2 allows to detect significant prostate cancer. The high NPV might reduce the number of biopsies in case of a negative MRI.

SS210

Diagnostic performance of a short dual-pulse sequence prostate MR protocol versus standard multiparametric MRI for detection of clinically significant prostate cancer: a multi-reader study

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Purpose: To compare the diagnostic performance of a short dual-pulse sequence magnetic resonance imaging protocol versus standard six-pulse sequence multiparametric MRI for detection of clinically significant prostate cancer.

Methods and Materials: Between 2013 and 2015, 63 patients who underwent mpMRI of the prostate on a 3T including axial T1-weighted, axial, triplanar T2-weighted), DWI and dynamic contrast-enhanced (DCE)-MRI were included in this retrospective study. Image set one ($mpMRI_{short}$) consisted of axial T2w and DWI images only. Image set two ($mpMRI_{standard}$) contained all 6 aquired pulse sequences. Three expert readers (R1-R3) from different institutions assessed the likelihood for presence of prostate cancer on a 5-point scale. Diagnostic performance on a quadrant basis was assessed using areas under the ROC-curves. Transperineal template saturation biopsy served as reference standard.

Results: At histopathology, 84/252 (33.3%) quadrants were cancer positive in n=38/63 (60.3%) men. There was no statistically significant difference in detection of tumors ≥0.5ml for any of the readers (AUC_{short} [range R1-R3] 0.74-0.81 [83.8%CI: 0.64, 0.89] and $AUC_{standard}$ [range R1-R3] 0.71-0.77 [83.8%CI: 0.62, 0.86]). Sensitivity (Range R1-R3, 0.76-95 [95%CI 0.53, 0.99] and 0.76-0.86 [95%CI 0.53, 0.97]) and specificity (Range R1-R3, 0.84-0.90 [95%CI 0.79, 0.94] and 0.82-0.90 [95%CI 0.77, 0.94]).

Conclusion: For the detection of clinically significant prostate cancer, the diagnostic performance of a short mpMRI protocol consisting of an axial T2w and DWI pulse sequence only was similar to a standard mpMRI protocol.

SS211

PET/MRI imaging of tumor hypoxia in high grade prostate cancer before and after neoadjuvant androgen deprivation therapy

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Purpose: Hypoxia is associated with radio-resistance and poor prognosis after radiation-therapy (RT). The aim of this study was to evaluate the occurrence of hypoxia and the correlation between tissue and imaging hypoxia-biomarkers before and after androgen-deprivation-therapy (ADT) in high-grade prostate cancer before curative-RT.

Methods and Materials: 11 patients underwent F-MISO-PET/MRI before and after 3 months of ADT. Patients also underwent 18F-Choline (FCHO) PET/CT at initial staging. Immunohistochemistry for tissue hypoxia-related biomarkers (EGFR, CAIX, VEGF-A, HIF-1alpha, GLUT1 and Ki67) was performed in all highest GS zones. These results were correlated with F-MISO, FCHO uptake, MRI Prostate-Imaging-Reporting-and-Data-System (PIRADS) scores and GS before ADT initiation.

Pre- and post-treatment F-MISO Tumor-Background-ratio (TBR) was compared in all biopsy-positives areas by repeated ANOVA. The correlation between imaging and histological parameters was measured by Spearman non-parametric test.

Results: F-MISO uptake was significant in 7 patients and in 5 cases corresponded to the highest GS lesion.

Mean F-MISO TBR before ADT (1.26±0.4) was significantly higher than after ADT (1.06±0.4) (p=0.005).

A statistically significant relation was found between GS and F-MISO TBR (.351, p=0.018), between GS and FCHO SUVmax (.570, p<0.001), between GS and PIRADS (.494, p=0.001) and between FCHO SUVmax and PIRADS (.346, p=0.02).

No statistically significant correlation was found between F-MISO imaging and tissue-hypoxia biomarkers.

Conclusion: F-MISO-PET imaging showed variable uptake in the prostate, associated with GS, lowering significantly after 3 months of ADT. This suggests the existence of hypoxic-microenvironment in prostate cancer and further supports the re-oxygenation role of a neoadjuvant ADT in combined hormono-RT treatment.

Imaging skeletal muscle regeneration after muscle crush injury and satellite stem cell treatment

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Purpose: Urinary incontinence compromises a patient's quality of life. Recent advances using cell therapy such as satellite stem cells (SSCs) are promising but evaluating the success in vivo is difficult. We show that MRI properties enable the monitoring of adult stem cell myogenic differentiation in a mouse model.

Methods and Materials: We have isolated, characterized and expanded human SSCs followed by injection into a tibialis anterior muscle crush mouse model simulating acute muscle injury. We followed up the *in situ* differentiation via MRI (4.7 T scanner) for 21 days focusing on Magnetization Transfer Ratio (MTR) and Diffusion-Tensor Imaging (DTI) properties of the *de novo* tissue and confirmed the results by histology, immunohistochemistry, protein expression and real time PCR. Regeneration after cell transplantation was compared to the regeneration after injection of a collagen type 1 carrier or PBS.

Results: MT measurements showed an initial MTR decrease before increasing steadily and approximating the MTR values of reference skeletal muscle tissue. DTI revealed that *de novo* generated muscle fibers are orientated in the same direction as the surrounding fibers which were not affected by the initial muscle crush injury. Cell differentiation and myofibers formation could be confirmed by increased muscle specific markers.

Conclusion: Human SSCs form muscle tissue *in situ* and MT-MRI allows to directly assess muscle fiber formation as a measure of myogenic differentiation. DTI there while highlights the direction of the newly formed fibers. These results will be transferable to the clinical setting as a non-invasive biomarker for the assessment of muscle tissue regeneration in patients.

Would metal artefact reduction benefit from an optimal combination of specific and general iterative reconstruction algorithms in hip prostheses CT imaging?

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Purpose: To evaluate iterative metal artefact reduction (iMAR) technique in hip prosthesis on CT and the added value of advanced modeled iterative reconstruction (ADMIRE) compared to standard filtered back projection (FBP).

Methods and Materials: 22 hip prostheses (16 patients) CT examinations were reconstructed with iMAR algorithm in addition to FBP and ADMIRE techniques. Objective image quality was assessed by measuring image noise and attenuation values with standardized region of interest (ROI) in 4 predefined anatomical structures (gluteus medius, rectus femoris, inferior and anterior abdominal fat and femoral vessels when contrast media was present). Subjective image quality was graded on a 4-point scale, taking into account the size of artefacts, the conspicuity of pelvic organs and the diagnostic confidence.

Results: iMAR showed a significant decrease in image noise in all ROIs as compared with FBP and ADMIRE. Improvement in overall image quality was statistically significant using iMAR (p<0.001). Patients with bilateral hip prosthesis showed similar results. ADMIRE did not show any impact in image noise and attenuation value nor in global quality image. In some cases, new artefacts were seen in bone to metal interface.

Conclusion: iMAR algorithm allows a significant reduction of metal artefacts on CT images with unilateral or bilateral prostheses without additional value of ADMIRE.

Can initial radiographs prevent futile dual-energy CT for urate crystal detection in the work-up of gouty arthritis?

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Purpose: Due to inherent methodological reasons, urate crystal deposits can be detected with dual-energy CT (DECT) only in the presence of hyperdense soft tissue deposits when a certain attenuation threshold is exceeded. Thus, we examined whether initial radiographs are capable to rule in or out soft tissue deposits in the work-up of gouty acroarthritis.

Methods and Materials: This retrospective study included 64 patients (48_male,mean-age_62±15) with suspected gouty arthritis who underwent 90 DECT scans. Two readers blinded to clinical data independently evaluated DECT images for the presence/location of hyperdense soft tissue and subsequently urate crystal deposits. Additionally, both readers evaluated corresponding radiographs for the presence/location of these deposits 4 weeks later. Finally, DECT/radiographs datasets were evaluated to examine whether the particular location or density of the deposits may influence the detection likelihood on radiographs.

Results: Inter-reader agreement for detection of soft tissue and urate crystal deposits with DECT was excellent (k=0.84/0.95) as was the detection of deposits on radiographs (k=0.82). DECT showed deposits in fifty-seven of the 90 scans (63%). Thirty of these 57 examinations (53%) only had detectable deposits on radiographs (p<0.05). In twenty-three (85%) of the remaining 27 examinations with deposits proven by DECT the low deposit density and in 4 patients (15%) the particular deposit location was regarded as the main reason for missed detection on radiographs.

Conclusion: Radiographs are not sufficiently capable to rule in or out soft tissue deposits and thus cannot aid a priori if a dual-energy CT is reasonable in the work-up of gouty acroarthritis.

Quantitative dual-energy computed tomography-based imaging of hemosiderin in pigmented villonodular synovitis

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Purpose: (1)To assess the feasibility of dual-energy computed tomography(DECT) in the detection and quantification of hemosiderin deposits in patients with known intra-articular knee masses detected previously on MRI. (2)To quantify the iron content of the two types of pigmented villonodular synovitis (PVNS).

Methods and Materials: Seventeen consecutive patient(mean age of 38 years) with known intra-articular knee masses underwent single-source DECT scans. Semi-automated volumetric tumor segmentation was performed. Two-basis material decomposition was applied(Iron versus water). Tumor volume and iron content were quantified. Histopathological analysis was used as the reference standard.

Results: All 17 masses showed hemosiderin deposits at histopathology. Ten lesions were giant cell tumors of tendon sheath (localized-type PVNS), three were diffuse-type giant cell tumors and four were classified as non-PVNS masses: two arteriovenous malformations and two post-traumatic lesions. Among both PVNS masses, mean mass volume was 14.3 +/- 17.9 cm^3 for the localized types, and 62.7 +/- 60.6 cm^3 for the diffuse types(p = 0.09). Mean iron volume was 3.5 +/- 3.9 cm^3 for the localized types, and 17.0 +/- 16.0 cm^3 for the diffuse types(p = 0.07). Mean iron/tumor volume ratio was 0.25 for the localized types, and 0.27 for the diffuse types(p = 0.62).

Conclusion: (1)Dual-energy computed tomography is a feasible technique that allows the detection and quantification of hemosiderin deposits in patients with intra-articular knee masses. (2)Hemosiderin volume is greater in diffuse-type PVNS compared with localized-type PVNS. Comparative studies are required to test the reliability of hemosiderin volume measures.

MRI grading of cartilaginous bone tumors: comparison of texture analysis with visual assessment

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Purpose: To assess the inter-reader agreement and diagnostic accuracy of MRI texture analysis (TA) for grading of cartilaginous bone tumors in comparison to visual MR-analysis.

Methods and Materials: MRI of 101 cartilaginous neoplasms (grade 0-4) were retrospectively included. T1w- and contrast enhanced T1-weighted fat-saturated-images were analyzed independently by four musculoskeletal radiologists: Qualitative visual MR-features (N=14) consisted of tumor characteristics as well as cortical bone, bone marrow and soft tissue abnormalities, whereas quantitative TA-parameters (N=19) consisted of grey-level histogram, co-occurrence and run-length-matrix features. Inter-reader reliability, univariate, multivariate and ROC-analysis were performed for MR- and TA-parameters separately and for combined models to determine independent predictors and diagnostic accuracy for grading of cartilaginous lesions.

Results: Mean inter-reader agreement of MR- and TA-features were 0.49 (range: 0.08-0.82) and 0.79 (range: 0.43-0.99) respectively. Diagnostic accuracies for differentiation of benign from malignant as well as for benign from low-grade cartilaginous lesions were 93.2% and 93.9% using a combined model of MR- and TA-predictors, 87.1% and 78.7% using MR-predictors or 90.5% and 91.9% using TA-predictors exclusively. For differentiation of low-grade from high-grade chondrosarcoma no statistically significant independent TA-predictors existed, whereas a model containing MR-predictors exclusively had a diagnostic accuracy of 87.4%.

Conclusion: TA shows substantial higher inter-reader reliability compared to visual MR-analysis. A model combining visual MR- and TA-features showed a higher diagnostic accuracy for differentiation of benign from malignant as well as for differentiation of benign from low-grade cartilaginous lesions compared to models using exclusively visual MR- or TA-predictors.

How to diagnose ulnar neuropathy at the elbow (UNE)? Comparison of electrodiagnostical testing, neurosonography, MR-neurography including DTI in ulnar neuropathy at the elbow

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Purpose: To compare diagnostic signs in electrodiagnostical testing, neurosonography, MR neurography and diffusion tensor imaging (DTI) in patients with clinical symptoms of ulnar neuropathy at the elbow (UNE).

Methods and Materials: In this prospective study electrodiagnostical testing, neurosonography and MR neurography were performed on both sides of 14 symptomatic patients and of 10 controls at standardized sites at the elbow. Nerve caliber in neurosongraphy and MR neurography, T2-weighted contrast-to-noise ratios of MR neurography and fractional anisotropy (FA) and mean diffusivity (MD) of DTI were assessed as diagnostic signs.

Results: Diagnostic performance, as measured with area under the receiver operating characteristic curve (AUC), was excellent for nerve conduction latency in electrodiagnostical testing (AUC = 0.91; 95%), nerve caliber in neurosonography (AUC = 0.84; 95%), nerve caliber in MR neurography (AUC = 0.87; 95%), nerve T2-weighted signal (AUC = 0.74; 95%, [CI]: 0.81, 1.00) and moderate for FA (AUC = 0.63; 95%) and MD (AUC = 0.60; 95%) in DTI to discriminate symptomatic from a asymptomatic findings in patients with UNE.

Conclusion: Electrodiagnostical testing ist still the most sensitive and specific diagnostic test for detection of UNE. Nerve calibre measurements in neurosonography and MR neurography as well as the T2-weighted signal in MR neurography might add information in unclear cases, when electrodiagnostic testing is inconsistent or not tolerated by the patient. DTI supports diagnostic findings of other tests, but is less sensitive and less specific.

Feasibility of synthetic MRI in knee imaging in routine practice: image quality and diagnostic accuracy

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Purpose: Synthetic MR is a method allowing reduction of examination time and access to quantitative imaging. In the musculoskeletal field, this technique is promising in standard protocols like knee. The aim of this study is to assess the quality of image examination and the diagnostic accuracy compared to conventional MRI in patients with post traumatic or degenerative knees.

Methods and Materials: Twenty patients underwent knee MRI where Syntac sequence was added to the standard protocol (coronal T1 and STIR, sagittal PD). Synthetic T1/PD/STIR images were generated with SyMRI v8 software (SyntheticMR AB, Linköping, Sweden) in addition to quantitative T1, T2 and DP images. An MSK radiologist analysed the anonymized images and evaluated the overall image quality (poor, fair, good), the visualisation of anatomic structures and the presence of artefacts. In addition final diagnosis was compared to conventional MRI.

Results: The syntac sequence was acquired in 39% less time than the conventional MR imaging. Sagittal Synthetic PD-/T1-/STIR-weighted images were rated as fair (5%, 20%, 5% respectively) or good quality (95%, 80%, 95%) despite the presence of popliteal artery pulsations artifacts in all cases, severe in 50% of cases. Cartilage, meniscus and tendons were well visualised in all cases in Synthetic images. Diagnostic accuracy was identical than in conventional MR in all cases.

Conclusion: Our pilot study confirmed the feasibility of Synthetic MR in knee examinations, allowing generation of T1/PD/STIR images in faster time with appropriate quality and good diagnosis confidence. This is an important step toward clinical integration of synthetic MRI in standard protocols.

Buy one, get two for free: simultaneous knee T2 mapping and morphological analysis on synthetic images using grappatini

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Purpose: To evaluate a fast quantitative T2 mapping technique that additionally provides the generation of synthetic MR images of the knee with different TEs, allowing a significant decrease in acquisition time while preserving image quality.

Methods and Materials: This prospective study was approved by our institutional review board. The requirement for informed consent was waived. Phantom experiments were performed to validate the T2 estimation with the GRAPPATINI sequence. This sequence was then used to estimate T2 and M0 maps of the knee at 3T using a 15-channel knee coil in 5 healthy volunteers (3 males, age 30.2±3.3 years). Additional synthetic contrasts with TE=34ms and TE=80ms were generated. Standard IW (TE=34ms) and T2w (TE=80ms) morphological TSE images were also acquired. The synthetic morphological images were compared quantitatively (SNR, CNR) and qualitatively (image quality, contrast, noise, artifacts, and global diagnostic value) with the conventional TSE images.

Results: The T2 values of the phantom experiments were accurate. The quantitative analysis showed similar SNR between the synthetic and conventional sequences (average SNR=9.9 for both sequences, p=0.99). CNR values were not statistically different (cartilage/fluid: 6.2 vs. 6.6, p=0.62; meniscus/fluid: 11.3 vs. 11.6, p=0.81). The qualitative analysis showed no difference in image quality (average score: 0, 95%CI=[0;0.4]). Artefact scores were slightly higher for the synthetic sequences (average score: -0.1, 95%CI=[-0.002;-0.6]), while visual noise and contrast were slightly better for the synthetic sequences (average score: 0.1, 95%CI=[0.002;0.6]).

Conclusion: The GRAPPATINI sequence provides accurate T2 values and synthetic sequences that are quantitatively and qualitatively similar to conventional TSE sequences, with reduced acquisition times.

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T1 mapping for detection of early tendon degeneration: a phantom MRI study

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Purpose: To quantitatively assess early tendon degeneration using T1 mapping in normal and chemically degenerated bovine Achilles tendons

Methods and Materials: Twelve cadaveric bovine Achilles tendons underwent MRI at 1.5T before and after chemical tendon degeneration. Fiber cross-linking or protein denaturation resembling the first or the second step of tendon degeneration was chemically induced in six tendons respectively. A variable-flip angle sequence was used for T1 mapping. Each scan (untreated and treated tendons) was repeated twice at different time points and T1 times were correlated with different grades of early tendon degeneration. Standard T1- and T2 weighted spin-echo (SE) sequences were acquired for visual assessment of tendon texture.

Results: The degree of tendon cross-linking and denaturation ranged from mild to strong. T1 times were reproducible, showing no difference between scan 1 and 2 for untreated and treated tendons (both, P<0.01). The mean T1 times were significantly different between normal and degenerated tendons (p<0.01) and correlated well with the degree of tendon degeneration (R=0.86, P<0,05). Standard T1 and T2 SE sequences showed no signal in both treated and untreated tendons, resulting in identical visual scores.

Conclusion: T1 mapping has the potential to detect and quantify early tendon degeneration before changes in tendon structure become visible on standard MRI.

SS221

Combined quantitative MR imaging assessment of the rotator cuff integrity at 3.0T by multi-echo Dixon-based fat quantification and diffusion tensor imaging

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Purpose: To establish quantitatively normative values of fractional fat content (FF%) and diffusion tensor imaging (DTI) parameters (fractional anisotropy [FA] and apparent diffusion coefficient [ADC]) of normal rotator cuff (RC)-muscles.

Methods and Materials: 40 patients underwent standard direct MR arthrography of the shoulder including 3D-multi-echo-Dixon and 3D echo-planar DTI sequences (15 gradient encoding directions, b-value 600 s/mm2) at equal spatial resolution. RC-muscles and tendons were qualitatively assessed. Goutallier gradings >1 and tendon tears were excluded from further analysis. FF%, FA and ADC were evaluated quantitatively by region-of-interest (ROI) measurements at Y-position of the scapula by two independent radiologists. Intraclass correlation coefficients (ICC) were calculated. Pearson correlation, Student's t-test, Chi-Square test and one-way ANOVA testing were performed to correlate measurements with age and gender and to compare different RC muscles and two Goutallier groups (0 and 1).

Results: Interreader agreements for quantitative measurements were perfect (ICC 0.90-0.99). Goutallier 0 muscles showed significant positive correlations of FF% and FA with age (R=0.269, p<0.01 and 0.206, p<0.05) as well as FF% with FA (R=0.351, p<0.001). Significant differences were seen among different RC muscles in Goutallier group 0 for FF% and ADC (p=0.011 and p=0.001) but not in Goutallier group 1 (p>0.05). ADC is significantly different between Goutallier groups for all RC-muscles (p<0.05).

Conclusion: Quantitative MR assessment of RC-muscle integrity delivers high interreader agreement. In normal RC-muscles FF% and FA increase significantly with age. ADC allows best to differentiate between Goutallier group 0 and 1 in all RC-muscles.

SS222

Predictive value of MR-arthrography findings for pain relief after glenohumeral corticosteroid injection

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Purpose: To determine the predictive value of MR-arthrography findings for pain relief after glenohumeral corticosteroid injection.

Methods and Materials: This study enrolled prospectively 212 patients undergoing fluoroscopy guided glenohumeral corticosteroid injection. All patients had an MR-arthrography of the shoulder less than 3 month prior to the injection and returned questionnaires assessing patients' shoulder pain using the 11-point numeric rating scale (NRS), covering a 1 month follow-up period. MR-arthrograms were retrospectively assessed for abnormalities of the rotator cuff, long biceps tendon, glenohumeral bone and cartilage and labrum as well as for synovitis, bursitis and signs of adhesive capsulitis. MR-arthrography findings were compared to patients' NRS-change using univariate and multivariate analysis.

Results: Pain reduction of 2 points or more was considered to represent clinical relevant improvement, which was seen in 70.8% of patients 1 week and in 74.0% of patients 1 month after the injection. Univariate analysis of MRI-findings showed that an intact labrum and signs of adhesive capsulitis were associated with significantly higher NRS-reductions after 1 month in comparison to patients without these findings (3.7 vs. 2.6, p=0.003 and 4.0 vs. 3.0, p=0.007, respectively). Multivariate analysis proved both factors to be independent predictors of improved outcome after 1 month (beta=0.212, p=0.001 and beta=0.176, p=0.039 respectively).

Conclusion: Glenohumeral corticosteroid injections for pain relief have a high success rate with 74.0% of patients reporting clinical relevant improvement after 1 month. An intact labrum and signs of adhesive capsulitis are independent predictors of improved outcome.

Long-term optional vena cava filter: evaluation of a structured retrieval follow-up program

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Purpose: Optional vena cava filters (VCF) are disposals which can be used either as permanent or retrievable filters. The retrievable option is recommended in case of temporary contraindication to anticoagulation. However, a very low rate of filters removal has been reported. The main reason was a lack in following patients after VCF placement.
The objective of the study was to determine the value of a structured program designed to follow the patient after the VCF placement, at least during 5 months, by the interventional radiology team.
Methods and Materials: We enrolled 156 consecutive patients (mean age 64.5 years; 91 men and 65 women) who had benefit from VCF placement (Denali filter) for various indications, between January 2014 and November 2016. The program of follow-up consists on informing patients and clinicians to remove the filter as soon as possible and planning a systematic appointment in 5 months, the day of the VCF placement, with an interventional radiologist.
Results: During the observation time, 88 VCF filters have been retrieved. The procedure was technical successful in 98.3% of the cases. The 30 days' mortality was 20.5%. At 5 months, 5 patients (3.2%) were lost to follow-up. The overall retrieval rate was 56.4%; in eligible patients the retrieval rate was 95.8%, with 12.3% more after the 5 months visit and a reassessment rate of 4.7%.
Conclusion: The structured program improves the retrieval rate. However, a significant number of patients remain not eligible for retrieval, independently from the follow-up.

Endovascular treatement for long steno-occlusive disease of femoro-popliteal arteries : a retrospective study

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Purpose: The aim of this study was to evaluate efficacy, safety, and mid-term patency of long femoro-popliteal steno-occlusive disease (≥ 15cm) treated by endovascular treatment in patients with intermittent claudication or chronic critical limb ischemia.
Methods and Materials: From February 2012 to March 2014, twenty patients (22 legs) were treated for TASC C (57%) and D (43%) femoro-popliteal lesions by angioplasty with provisional stenting (bare-metal self-expandable stent). The patients were followed for up to 12 months by Doppler ultrasound examinations, ankle-brachial index and assessments of Leriche and Fontaine class.
Results: Technical success was achieved in 100% of procedures. The one-year primary patency rate was 54%. Ten out of 22 legs underwent successful drug eluting balloon angioplasty because of endofibrotic in-stent restenosis. At twelve months, the primary assisted patency rate was 100%.
Conclusion: Percutaneous endovascular treatment of TASC C and D atherosclerotic disease of the femoro-popliteal arteries is a safe and clinically effective procedure. It offers a durable patency provided that patients obtain a close angiologic follow-up.

Endovascular management of acute upper extremities ischemia

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Purpose: Investigate the outcome of endovascular management of acute upper extremities ischemia from various etiology.
Methods and Materials: Hospital records of patients with upper extremities acute ischemia who underwent angiography between January 2005 and December 2016 were retrospectively reviewed, evaluating clinical presentation and etiology, endovascular and surgical management and clinical outcome.
Results: Of 36 patients who underwent arteriography, 23 were treated by an endovascular procedure. Mean age was 58 years, there were 17 males and 6 females. Etiology was trauma in 6 patients, arterial drug injection in 5, aortic or cardiac thrombus in 3, atherosclerosis in 2, arterial catheterization in 2, drug-associated arteriopathy in 1, vibration injury in 1, paradoxical embolism secondary to patent foramen ovale in 1 and of unknown etiology in 2. Level of proximal occlusion was sub-clavian/axillary artery in 7 patients, brachial artery in 6, radial and or ulnar in 8 and hand in 2. Twelve patients underwent thrombolysis, 6 as unique treatment and 6 in association or followed by another procedure. Seven patients underwent thromboaspiration, 1 angioplasty, 8 stenting and 1 the three procedures. Immediate result were complete revascularization in 7 patients, partial in 13, no revascularization in 3. Partial revascularization was secondary to digital arteries embolism or spasm in the majority of cases and treated successfully by anticoagulation in 10 patients. Two patients underwent surgical revascularization and 1 amputation. Two of the three patients with unsuccessful revascularization underwent amputation.
Conclusion: Endovascular management of acute upper extremities ischemia permits complete revascularization with an excellent clinical outcome in the majority of cases.

Prospective randomized controlled trial comparing efficacy of percutaneous microwave ablation and percutaneous radiofrequency ablation for the treatment of hepatocellular carcinoma in patients with a chronic liver disease

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Purpose: We performed the first prospective randomized multi-centric study comparing the efficacy of radiofrequency ablation (RFA) and microwave ablation (MWA) in terms of local tumor progression and survival in patients with hepatocellular carcinoma (HCC) <4cm with chronic liver disease.
Methods and Materials: From 2011 through 2015, we prospectively randomized patients with HCC with≤3 lesions of≤4cm non-surgical candidates. Our final groups consisted in group RFA (n=73,15% female,73% Child-Pugh A, 104lesions treated) and group MWA (n=71,17% female,80%Child-Pugh A,98 lesions treated). The primary outcome was rate of local tumor progression (LTP) at one year, in intention-to-treat analysis. Secondary outcomes included time to progression (TTP), incomplete treatment rate, safety and survival time.
Results: We found no difference in LTP at 1year of follow-up (RFA: LTP 2.8%; MWA: 5%, p=0.65) and at more than 20 months of follow-up (RFA: LTP 8.6%; MWA:7.1%, p=0.98). Mean TTP was not different (RFA 15 months (SD:7) and MWA 12 months (SD:8); p=0.48). This was confirmed by competing risk and inverse probability of censoring weighting analyses accounting for transplantation or death. Rate of incomplete treatment after one session of thermo-ablation was similar (4% and 5% respectively; p=0.93). No major complication occurred. Two grade 4(SIR classification) complications occurred, both in MWA group. Rate of survival at 20 months, was 88.5% and 88.8% respectively (p=0.88).
Conclusion: In a prospective randomized study with patients with HCC eligible for thermo-ablative treatment, we found no difference in local tumor progression and survival at more than 20 months of follow-up for lesions treated by RFA or MWA.

SS227

Prototype metal artifact reduction algorithm in flat panel CT – performance in patients with intraarterial angiography during hepatic selective internal radiotherapy

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Purpose: To retrospectively compare the effect of a prototype metal artifact reduction (MAR) algorithm in flat panel (FP)-CT on quantitative and qualitative image parameters in patients undergoing intraarterial (ia)-angiography during selective internal radiotherapy (SIRT) of hepatic masses.

Methods and Materials: After ia-catheter placement in celiac trunk application of 36ml contrast-agent (Ultravist®300 18ml + 18ml NaCl 0.9%) a FP-CT was acquired (Artis zeego, Siemens Healthineers) using a 8s rotation protocol (200 degrees rotation, 397 projections) in 29 patients (11 female), including 16 patients with arterial metallic coils. Image reconstructions with and without MAR were evaluated quantitatively by region-of-interest (ROI) measurements of attenuation in most pronounced streak-artifacts and qualitatively assessing visibility of hepatic parenchyma and vessels in near (2cm) and far field (5cm) of artifact sources (catheter curvature and coils). Paired Wilcoxon sign rank and Student t-test were used to compare qualitative scores and quantitative measurements of corrected and uncorrected images.

Results: Quantitative evaluation showed significant reduction of near field streak-artifacts with MAR (p<0.001), while remaining stable in far field and unaffected organs (all p>0.05). Qualitative image scores in near field were significantly improved after MAR (all p<0.005). Standard deviation of attenuation values in the near field decreased significantly after MAR (p<0.05). There was no significant difference in the amount of artifact reduction between catheter tips and metallic coils (p<0.01).

Conclusion: MAR quantitatively and qualitatively improves image quality for visibility of hepatic parenchyma and vessels in near field of artifact sources in patients undergoing FP-CT ia-angiography for SIRT.

SS228

Evaluation of a novel, patient-mounted system for CT-guided needle navigation

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Purpose: To compare the accuracy and efficiency of a novel patient-mounted system for CT-guided needle navigation to free-handed punctures ex vivo.

Methods and Materials: The system consists of an injection-molded plastic cube and an accompanying software. The cube is attached to the patient in advance and included in the planning scan. The software recognises and localises the cube using a computer vision algorithm in the scanned image data. To plan the intervention the interventionalist places a virtual needle according the intended needle trajectory using the software and image data. The closest pair of holes in the cube's upper and lower plate is calculated and displayed. Seventy-two punctures were performed by 6 interventionalists using a phantom to compare accuracy and timely effort of the conventional free-handed procedure to the new method.

Results: Compared to a conventional free-hand procedure, the use of the navigation system resulted in an improved accuracy (3.4 mm± 2.3 mm (free-hand 4.9 mm ± 3.2 mm)) and overall lower intervention time (168 s ± 28.5 s (freehand 200 s ± 44.8 s). An asymptotic Wilcoxon-test showed the results to be significant (z = -2.201, p = .028, n = 6 resp. z = -2.201, p = .028, n = 6) and the effect after Cohen (1992) to be strong (r=.89 resp. r=.9). The system allows double oblique punctures to be performed.

Conclusion: The new navigation system is a promising technique to improve accuracy and reduce intervention time in CT guided needle navigations.

SS229

Radiation dose to the interventional radiologist during CT-guided interventions

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Purpose: Potential dose and its variation at different positions in the CT suite during CT-guided interventions were measured in order to introduce changes in behaviour and techniques aiming at optimised radiation protection for the interventional radiologist and supportive personnel.

Methods and Materials: The active dosimetry system i2 (Unfors RaySafe AB, Sweden) was used to assess dose rates and cumulative doses at different positions in the CT suite during several spinal interventional pain procedures with different patients. Active dosimeters were positioned next to the patient's head, next to the gantry, at the patient's feet and at the opposing room's wall. The average user dose outside the lead apron per DLP was calculated for all dosimeter positions.

Results: The measured cumulative doses from the CT fluoroscopy ranged from 4.1μSv to 21.0μSv for the position at the patient's head, from 0.24μSv to 1.7μSv for the position at the patient's feet and from 0.0μSv to 0.4μSv for the wall position, respectively. A cumulative dose below 0.05μSv was measured for all patients at the position next to the gantry. The average dose per 10mGycm DLP was 1.6μSv, 0.18μSv, 0.05μSv and 0.0μSv for the position at the patient's head, patient's feet, at the wall and next to the gantry, respectively.

Conclusion: User dose during CT-guided interventions is strongly influenced by user position, duration of the procedure and patient volume. If presence of the interventionalist inside the CT suite is required during interventions the safest place in terms of radiation protection would be next to the gantry, protected by the gantry's structures.

SS230

Operator exposure and patient skin dose after interventional radiology procedures: an in-vivo dose collection with subsequent phantom study on 12 radiology suites

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Purpose: To compare patient skin dose rates delivered by locally implemented image acquisition protocols, as well as operator exposure, in order to homogenize radiation protection behavior.

Methods and Materials: 12 interventional radioscopy suites were included. Operators were equipped with electronic dosimeters above their lead apron and informed to perform their interventions as usual. Operator doses were normalized with patient kerma-area product, thus expressing personal radiation protection behavior while taking into account the examination duration, patient body habitus and case complexity. Patient skin exposure was evaluated using a 6-cc ionization chamber, and PMMA slabs were used to simulate patients of various body sizes. Dose rates were expressed as incident with back-scattered air kerma, thus representative of the patient's skin exposure.

Results: Operator scatter factors ranged between 0.1 and 7.0 uSv / (Gy cm2), thus showing a 70-fold difference in relative staff exposure. This was due to the various uses of leaded screens (ceiling-suspended, mobile or on-table, and additional patient sterile heavy metal draping). Patient dose rates (at 15 fps, 20 cm of PMMA) ranged between 5 and 50 mGy / min for fluoroscopy, 0.5 to 5 mGy / frame for digital subtraction angiography (DSA), and even 80 and 160 mGy / min for 'special' acquisition modes. These values can be used to adapt and optimize acquisition parameters based on actual clinical practice.

Conclusion: These measurements allowed estimating local radiation protection behavior for the operator as well as the patient. Further improvements in the methodology should focus on reducing these exposures while maintaining sufficient image quality.

SS231

Withdrawn

SS232

Deriving diagnostic groups from outpatient billing data – data and text mining at work

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Purpose: Costs in ambulatory care are a growing issue in Switzerland. The current fee-for-service system, TARMED (TM), does not meet the requirements of a disease-outcome-oriented reimbursement system. There is a lack of diagnostic information in billing data, which would allow for outcome performance measurements.

The purpose of this paper is to find patterns of diagnostic groups from radiology and billing data. This would allow to derive diagnostic groups, which then can be compared in various efficiency and efficacy dimensions. It would contribute to compare performance of health care institutions from both a public health and an economic perspective.

Methods and Materials: We use the methodological and novel approach of data- and text mining techniques to infer these diagnostic groups from the Radiology Information System (RIS) and TM-positions (billing data). We applied standard regression analysis and other parametric models to derive associations between the TM-positions and diagnostic groups.

Results: We could infer these diagnostic groups from the RIS and TM data and align them to the ICD-10 sub-chapters' catalogue.

Conclusion: These findings can support policymakers to evaluate performance in health care delivery in ambulatory settings, and create a potential basis for new reimbursement models. It also allows medical department, i.e. radiologists to compare performance between each other. Further investigation needs to be done to include more diagnostic groups.

SS233

Internal audit in interventional radiology: what should be included?

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Purpose: The European Society of Radiology (ESR) has recently published the "ESR Clinical Standards and Audit Template" to guide audits in computed tomography as part of the quality assurance in Radiology. The aim of the present study was to build a template for internal audits in interventional radiology (IR) and apply them in clinical practice.

Methods and Materials: Based on the ESR audit template, standards and associated indicators for IR were identified. Source of information were local and international regulations as well as peer-reviewed journals. Data collected was both quantitative and observational.

Results: An internal audit in IR could be based on the following 3 standards: "radiation dose records" (1), "standardization" (2), and "optimization" (3), consisting of a total of 11 indicators (n=4, n=3, and n=4, respectively for each standard). Among these indicators are "dose variation" (dose difference within the same procedure conducted in different angiography suites; target: <25%) and "dose tracking" (automatic dose summation of different procedures within the same patient to avoid the occurrence of deterministic effects; target: 100%), which both can be facilitated by automatic collection of dose data with a dose management software. Moreover, "presence of internal diagnostic reference levels (DRLs) for various IR procedures and complexity levels" (e.g. differentiated in "simple, standard, and difficult") or "presence of a skin dose policy" are important indicators and, if not met, should be implemented accordingly.

Conclusion: The "ESR Clinical Standards and Audit Template" can be successfully translated from CT to IR to guide internal audits in IR.

Measurements performed during abdominal sonography: how much are we accurate?

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Purpose: Organs are regularly measured during abdominal sonography. Sizes are compared to references, in order to identify pathological enlargement or shrinkage, or evaluate changes during follow-up. Sonography is an operator dependant technique and errors in measurements may have deleterious clinical impact.
The aim of our study was to determine the accuracy and reproducibility of the measurements of abdominal organs with ultrasound.
Methods and Materials: Ten observers performed ten times an abdominal sonography on a dedicated phantom. They followed a pre-established protocol and measured sequentially the different abdominal organs. Measurements and time needed to perform them was retrieved. All the measurement were performed on the same Epiq 7 machine with a C5-1 probe. Official sizes of the organs embedded in the phantom, as specified by the supplier were used as gold standard. Accuracy of measurements, variance amongst observer and time spent to measure were analyzed
Results: Measurements were accurate only for the CBD and Wirsung. For the other organs, a large majority of observers found a larger size as the gold standard, except for the aorta and the spleen, where they found a smaller size. The time spent for performing the measurements decreased significantly between the first and last sessions.
Conclusion: A systematic bias appeared in the measures of large abdominal organs performed with ultrasound. Even the measurements did not fit the gold standard, the errors remained stable during the different measurements for the different observers. The learning curves of the performance of measurements applied to the time spend to perform the measurements, not to their accuracy.

Dynamic MRI of the pelvic floor in different body positions: success rate of MR defecography in supine vs. left lateral body position

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Purpose: To assess the success rate of MR-defecography (MRD) performed in supine versus lateral body position and assess differences in pelvic floor measurements.
Methods and Materials: 22 consecutive patients (16 women, 6 men; mean age 51±19.4) with obstructed defecation underwent MRD in a closed-configuration 3.0T MRI-system in supine and lateral position. MRD included midsagittal T2-weighted images at rest and during defecation after filling the rectum with 250ml water-based gel. Two independent radiologists measured pelvic floor descent in reference to the pubococcygeal line (PCL) and assessed grade of evacuation (GE) in both body positions. Image quality (IQ) was rated on a 5-point-scale (5=excellent, 1=poor).
Results: Grades of middle and posterior compartment descent were similar in supine and lateral position (p>0.05). Anterior compartment descent was significantly higher in lateral position, but still normal to small in the majority of patients (4.6±23.1 cm vs. 8.9±25.2 cm, p<0.042). When attempting to defecate in supine position 6/22 (27%) patients showed no evacuation, while in lateral position only 3/22 (14%) were not able to evacuate. Image quality was equal at rest (4.4±0.5 and 4.7±0.6, p>0.05) and slightly better in supine compared to the lateral position during defecation (4.5±0.4 vs. 3.9±0.9, p<0.017).
Conclusion: In lateral position more patients were able to evacuate with similar grades of pelvic floor descent compared to supine position. Image quality was slightly degraded during defecation in lateral position. MRD in lateral position is a valuable alternative for patients unable to defecate in supine position.

CT in severe pancreatitis - is there any relationship between the accumulated radiation dose and clinical parameters or radiological signs?

F. Ramos Porões, F.R. Verdun, R.A. Meuli, P. Eckert, S. Schmidt; Lausanne/CH

Purpose: To evaluate the overall dose exposure due to follow-up CT examinations in patients with acute pancreatitis (AP) and to compare it with clinical, radiological parameters and patients' outcome.
Methods and Materials: We retrospectively included 27 patients (22 men, mean age 65y) with acute pancreatitis requiring ICU care for ≥24h and being followed-up by CT. Reading the CT images in consensus, two readers registered the CT severity index (CTSI) in each patient and collected patients' dose exposure parameters, i.e. dose-length product (DLP), effective dose (ED) and size specific dose estimates (SSDE) resulting from follow-up by CT. Clinical and laboratory parameters indicating disease's severity, the length of hospital and ICU stay, acute complications, the need for intervention and/or surgery were registered and correlated with the accumulated radiation dose exposure parameters (t-test, ANOVA).
Results: Altogether, 258 CT examinations were performed in all patients (mean 9.56, range 1-25) during their hospital stay. Six patients (22%) died from acute complications. The mean accumulated DLP due to CT was 7781 mGy*cm (range 6239-29194).
The individual CTSI score, subdivided in 3 categories, significantly correlated with patients' laboratory parameters (lipasis, amylasis, CRP), length of hospital stay, number of complications, interventions, CT examinations, and DLP (p<0.05).
The accumulated DLP significantly correlated with patient's CRP, length of hospital stay, number of CT examinations, acute complications and consecutive radiological interventions (p<0.05).
Conclusion: The overall dose exposure resulting from follow-up CT examinations in patients with acute pancreatitis depends on the disease's severity (CTSI score). However, it is considerable and should not be neglected.

Accelerated DWI lymph node assessment in the pelvis applying simultaneous multislice acquisition: a healthy volunteer study

A. Ciritsis, C. Rossi, A. Boss; Zurich/CH

Purpose: The purpose of this study was to evaluate the feasibility of accelerated simultaneous multislice diffusion weighted sequences (SMS-DWI) for lymph node detection in the pelvis.
Methods and Materials: This prospective study was approved by the local ethics committee. After written informed consent was obtained, 8 healthy volunteers were included in this investigation. MRI examinations were performed on a clinical 3.0 T scanner using a flexible 18-channel body matrix-coil. Conventional DWI sequence and a SMS DWI sequence with different acceleration factors (AF: 2-3) was acquired. Two radiologist reviewed each DWI sequence and assessed the number of lymph nodes and overall image quality. Signal to noise (SNR) was calculated via subtraction method. Additionally, SNR efficiency with regard to the acquisition time (TA) of each DWI sequence was calculated.
Results: Compared to conventional DWI scan time decreased 46.9 % and a detection rate of 95.6 % was achieved with SMS-DWI and AF 2; with AF 3 a 57.2 % scan time reduction and a detection rate of 82.2 % was possible. All DWI sequences exhibited similar image quality, however SMS-DWI with AF3 showed slight artefacts. In accelerated DWI sequences SNR was up to 33% lower for AF3. By applying higher acceleration factors the SNR efficiency increased up to 67 % for AF 2 and 76 % for AF 3.
Conclusion: The present study showed that lymph node detection in the abdominopelvic region with accelerated SMS-DWI sequences is feasible whereby an AF of 2 poses the best compromise between image quality, SNR and TA.

Diuretic (F+30) whole body 18F-Choline PET/CT in recurrent prostate cancer: do we still need the early dynamic acquisition?

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Purpose: To compare lesion detectability and conspicuity of late diuretic and early dynamic ^{18}F-Choline PET/CT in patients with recurrent prostate cancer.

Methods and Materials: Forty one patients with clinical and/or chemical suspicion of recurrent prostate cancer underwent dual-phase ^{18}F-Choline PET/CT that consisted of an early dynamic pelvic acquisition and late diuretic whole body scan. Oral and parenteral hydrations were started directly after the end of dynamic acquisition. Thirty minutes after tracer injection, each patient received 20 mg of i.v. furosemide then whole body PET/CT started within 30min. To manage any potential urinary output during late data acquisition, an external urine collection device was applied for each patient before the diuretic scan. Analysis of pathological tracer uptake on either phase was done and compared.

Results: A high image quality in the pelvic region was achieved on the late diuretic ^{18}F-Choline PET/CT in all patients. Thirty (73%) patients had active tumor manifestations in the form of locally recurrent foci (n=14), regional lymph node metastases (n=20), and distant metastases (n=15). The mean SUVmax of these lesions were: 5.2 ±2.1, 7 ±3.8, and 10 ±4, respectively. All pelvic lesions were equally detected by both acquisitions, however, lesion conspicuity was better on late diuretic scan in 8 (20%) patients with locally recurrent foci (n=5), regional lymph node metastases (n=2) and bone metastases (n=1).

Conclusion: Diuretic ^{18}F-Choline PET/CT seems very efficient in detecting recurrent tumour foci in prostate cancer patients. This new practical approach has the potential to safely eliminate the early dynamic acquisition without any loss in the diagnostic yield.

Differentiation of physiologic and pathologic 68Ga-DOTA-TOC uptake in histological confirmed pancreatic neuroendocrine tumors

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Purpose: We wanted to establish the range of ^{68}Ga DOTA TOC uptake in pancreatic neuroendocrine tumours (NET). This would allow differentiation between physiological uptake and tumour related somatostatin receptor (SST) expression in the pancreas (including the uncinate process).

Methods and Materials: 115 ^{68}Ga DOTA TOC PET/CT studies were performed in order to detect or exclude SST-expressing malignancy. Histopathology confirmed NET of the pancreas in 14 patients who underwent surgery after positive ^{68}Ga DOTA TOC PET/CT scan.

Results: SUV_{max} (mean +/- standard deviation) values of ^{68}Ga-DOTA-TOC were 33.2 +/- 15.1 in three NET of the uncinate process, 57.9 +/- 67.6 in three NET of pancreas body and 47.2 +/- 39.7 in nine NET of the pancreas cauda. Significant differences in SUV_{max} between nonmalignant and malignant tissue was found for the pancreas cauda (p<0.03). At a cut off value of 17.1 the specificity and sensitivity for differentiating tumors in the uncinate process were 92.0% and 100% (p<0.0001) and 92.5% and 88.9% (p<0.0001) for the cauda at a cut off value of 12.0, respectively. A cut off value of 14.4 was evaluated for the pancreas body, resulting in a specificity and sensitivity of 100% (p<0.0001), respectively.

Conclusion: ^{68}Ga DOTA TOC is an excellent tracer for the imaging of pancreatic NET expressing SST on the tumour cell surface. The noninvasive PET/CT approach by measurement of regional SUV_{max} offers important clinical information to distinguish between physiological and pathological somatostatin receptor expression, especially in the case of unclear anatomical correlation of the pancreas.

Is additional contrast-enhanced CT of any benefit to end-of-therapy PET/CT evaluation in follicular lymphoma?

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Purpose: The aim of the study was to investigate if there is any advantage in the use of contrast-enhanced CT (ceCT) vs. unenhanced low-dose CT (ldCT) in end-of-therapy PET/CT evaluation of patients with FL.

Methods and Materials: Thirty FL patients who underwent end-of-therapy PET/CT protocol with ldCT and ceCT were analyzed retrospectively. Number and sites of nodal or extra-nodal disease were compared, using PET/ceCT as gold standard in order to evaluate if the type of CT could result in changes of the DS and therapeutic strategy.

Results: In 26 of 30 patients (87%; 95% confidence interval, 73%-98%), PET/ldCT showed the same number and sites of lesions highlighted by PET/ceCT. The inter-observer concordance and overall concordance between imaging procedures were excellent with a very high Cohen's kappa (respectively 0.82 and 0.83). 97% of lesions (103/107) were found by PET/ldCT and in 4 of 30 patients (13%) PET/ceCT provided additional nodal lesions in the mesenteric and iliac regions (3 mesenteric nodes and 1 iliac node; <1%). In these 4 patients, DS and the therapeutic strategy were not changed after additional ceCT findings. PET/ldCT accuracy, sensibility, specificity, positive predictive value and negative predictive value were respectively 87%, 83%, 100%,100% and 60%.

Conclusion: Our results indicate that the clinical impact of PET/ceCT in assessing end-therapy evaluation in FL is limited. The PET/ldCT could be suggested as primary imaging modality of choice, thus limiting the acquisition of PET/ceCT images only for doubtful cases of residual disease in mesenteric area (represented solely by 13 % in our series).

New demands of radiology in adult dominant polycystic kidney disease (ADPKD) evaluation

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Learning Objectives: The aim of this educational exhibit is to show and explain what is now required for kidney volume evaluation for treatment stratification and reimbursement of a novel drug for ADPKD.

After viewing this educational exhibit, the reader should be able to correctly plan imaging studies and calculate height adjusted total kidney volume (Ha TKV).

Background: ADPKD is a common genetic disorder causing multiple cyst formations in the kidneys with progression to end stage renal disease. Usual requirements for imaging studies are gross quantification of cystic burden, oncologic surveillance, evaluation for stones or inflammation and gross kidney volume evaluation for possible transplant recipients. The advent of a novel drug that slows disease progression, with related costs and adverse events, created a need for simple ADPKD classification of renal dysfunction for treatment stratification and reimbursement. Ha TKV has been validated as a biomarker that correlates well with ADPKD classification and can be obtained with CT or MRI.

Imaging Findings or Procedure Details: MRI and CT play an important role in the evaluation of ADPKD. Clear understanding of a precise kidney volume calculation can help plan the correct imaging protocol and choose the correct diameters and calculation algorithms. We highlight milestones from current literature and explain how to use an online calculator from the Mayo Clinic (USA) for the Ha TKV measurement.

Conclusion: Knowledge of the correct diameter selection and volume calculation algorithm helps answer a new question posed in ADPKD imaging.

LI-RADS classification system in liver imaging

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Learning Objectives: To describe and explain the value of the LI-RADS classification system for evaluation of focal liver lesions in routine cross-sectional liver imaging.

Background: Hepatocellular carcinoma (HCC) is a global health problem for which patients at increased risk are screened regularly. As findings at liver imaging are inconsistently interpreted and reported, the American College of Radiology launched the Liver Imaging Reporting and Data System (LI-RADS) to reduce variability in lesion interpretation by standardizing report structure and content. The LI-RADS systems aims to improve communication with referring physicians and to facilitate decision making for treatment options.

Imaging Findings or Procedure Details: LI-RADS categorizes focal liver lesions in high-risk patients into five categories (LR-1 to LR-5). It differentiates between definitively benign (LR-1) and probably benign (LR-2) findings as well as findings with an intermediate risk for HCC (LR-3), findings that are probably (LR-4) and findings that definitely are an HCC (LR-5). To differentiate between LR-3-LR5 findings the presence or absence of major imaging features like arterial hyperenhancement, venous washout, capsule and threshold growth are used. Furthermore, the size of a lesion (<10 mm, 10-19 mm or >20 mm) is taken into account. Lesions that have previously been treated are classified as LR-T(treated). If a lesion is suspicious for malignancy but is not specific for HCC it is categorized as LR-M. LR-5V is used if tumor is seen invading a vein.

Conclusion: Cross-sectional imaging plays an increasing role for non-invasive diagnosis of HCC. LI-RADS allows to objectively categorize imaging observations according to the risk of HCC and guide therapeutic decisions adequately.

Illegal intracorporeal smuggling: the Geneva experience over a 10 years period of time

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Geneva/CH

Learning Objectives:
- To present the value and limitations of various imaging techniques in diagnosing intracorporeal packets (body-packets).
- To describe the various aspects of body-packets, their complications and mimics.

Background: Body packing refers to concealing illegal substances in body cavities for the purpose of international transportation. The smuggled-packets are generally swallowed to be obscured in the intestines either in great quantity by conveyors or for the personal use by stuffers.

Imaging Findings or Procedure Details: Abdominal radiography is traditionally used for the screening of body-packets. Although it is highly specific, its clinical application is limited by a relatively low sensitivity, which is affected by the number, the density and the concealing of the packets. CT is considered the standard method for detection of body-packets, but raises ethical concerns with regard to the dose of radiation. In our institution, abdominal radiography has been replaced by low-dose CT, delivering a similar dose of radiation. Low-dose CT demonstrates the packets number, their location and potential complications, as well as incidental findings. Body-packets are usually identified as oval structures distributed from the stomach to the rectum and sometimes in vagina. Their density varies depending on their content and covering material. Body-packets may be complicated by intestinal obstruction and packet rupture.

Conclusion: This presentation aims to make the radiologist familiar with the imaging of illegal intracorporeal smuggling, based on a 10 years experience of a large university emergency center.

Blunt bowel and mesenteric injury: how to avoid pitfalls?

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[2]Lausanne/CH

Learning Objectives: To describe CT-features of blunt intestinal and mesenteric trauma. To compare radiological findings with surgical data.

Background: Early diagnosis of blunt bowel and mesenteric trauma requiring surgery remains a challenge and delayed diagnosis can lead to significant morbidity and mortality. Thus, identification of early signs on CT-images is essential, although they can be subtle. Moreover, it may be difficult to identify mesenteric lesions in case of concomitant hemoperitoneum caused by splenic or hepatic laceration which obscure mesenteric fat oedema and/or lack of bowel wall enhancement.

Imaging Findings or Procedure Details: We retrospectively reviewed 830 abdominopelvic trauma CT-examinations looking for free pneumoperitoneum, hemoperitoneum, mesenteric contusion or hematoma, bowel wall thickening or lack of enhancement, vascular extravasation, bowel wall discontinuity and associated abdominal lesions, such as splenic or hepatic laceration, bladder, adrenal or kidneys lesion, abdominal wall contusion or pelvic bones fractures. To understand and reduce pitfalls, we compared our radiological findings with surgical data.

We will demonstrate typical and subtle CT-signs, some of the latter missed in the acute situation, especially in case of nearby hemoperitoneum caused by splenic or hepatic laceration. Furthermore, we will point out indirect lesions, such as mesenteric fat haziness, however requiring surgery since rapidly evolving.

Conclusion: Radiologists should be familiar with the CT-features of intestinal and mesenteric trauma and keep a watchful eye in case of subtle mesenteric fat edema which could always be an indirect sign of mesenteric trauma. Particular attention must be paid in case of concomitant hemoperitoneum caused by splenic or hepatic laceration.

PO12

How rapid is RAPID?

Y. Thali, A.E.T. von Hessling; Lucerne/CH

Purpose: CT based assessment of perfusion maps in acute stroke patients is an important decision tool whether a patient will profit from intravascular lysis therapy and/or thrombectomy. RAPID is an automated software which calculates perfusion maps and estimates parameters of ischemia (infarct volume, penumbra, mismatch ratio). In a retrospective study we analysed how much time is saved by the automated evaluation compared to the manual evaluation with Siemens' perfusion software (SYNGO).

Methods and Materials: 51 cases received a CCT perfusion protocol with RAPID and SYNGO from October to September 2016. A control group (before introduction of RAPID in our institute) is formed by 46 cases from September 2015 to February 2016, only assessed with SYNGO. We used times, noted in the DICOM-Header of each examination (acquisition time and series time) to calculate the delay from data aquisition to the generation of perfusion maps.

Results: Average time for manual evaluation with SYNGO was 15 minutes. Average time for the automated evaluation with RAPID was 4 minutes. There was a significant time reduction from SYNGO to RAPID of 11 min ($p=2.5 \times 10^{-10}$). There was no significant time difference between SYNGO assessment time before and after the introduction of RAPID (Mean 15min, $p=0.92$).

Conclusion: RAPID significantly reduces the time for the interdisciplinary stroke team to get perfusion-maps information. This potentially decreases the door to needle/decision time in the setting of acute ischemic stroke.

PO13

Morphometry brain analysis of anorexic patients with MP2RAGE MR sequence

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Purpose: To estimate regional brain atrophy in anorexic patients by cerebral segmentation with magnetization-prepared 2 rapid acquisition gradient echo (MP2RAGE) MR sequence.

Methods and Materials: We performed a retrospective study of 16 patients with clinical suspicion of anorexia nervosa (15 females, 1 male; mean age, 26.2 years; range, 16.1-48.7 years). Three subgroups were formed based on the WHO BMI cutoffs: 1 (all patients, n=16), 2 (BMI<18.5 kg/m2, n=13), and 3 (BMI<16 kg/m2, n=10). Controls were 306 healthy subjects with normal BMI (51% males; mean age, 66.4 years; range, 19-90 years). Patients were scanned on a Siemens 3T MR. Automated segmentation was performed with the MorphoBox prototype software which takes the second inversion contrast and the uniform MP2RAGE contrast as input.

Results: Group 1, corresponding to all patients, had significantly lower volumes of whole brain (p<0.001), total gray matter (p<0.001), cortical gray matter (p<0.001) and insula (p<0.01). This group also showed significantly higher volumes of CSF (p<0.001) and the ventricles (p<0.05). In group 2 (BMI<18.5 kg/m2), results were comparable but volumes of the corpus callosum (p<0.05) and cerebellum (p<0.01) were also significantly lower. Group 3 (BMI<16 kg/m2) was the only subgroup to show significantly lower volume of white matter (p<0.05). Significant positive correlations were found between BMI and the volumes of the insula (p<0.05), caudate (p<0.001) and putamen (p<0.001), and a negative correlation between BMI and volume of intracranial CSF (p<0.01).

Conclusion: Cerebral segmentation based on the MP2RAGE-MR sequence was able to demonstrate whole brain volume loss and volume loss of specific brain structures in anorexic patients.

PO14

Would treated aneurysm follow-up benefit from new techniques of reconstruction to reduce metallic artefact?

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Purpose: To assess the increase of diagnosis confidence with the use of new techniques specifically designed to reduce metal artefact due to neurosurgical clips or endovascular coils by comparing different types and generations of reconstruction algorithms.

Methods and Materials: With the approval of our local ethics committee, 13 unenhanced cerebral CT examinations performed on our SOMATOM Definition Flash unit (Siemens, Forchheim, Germany) were reconstructed with filtered back projection (FBP) and with advanced modeled iterative reconstruction (ADMIRE), both techniques with and without iterative metal artefact reduction (iMAR) algorithm, resulting in 4 series by acquisition. Subjective assessment of image quality was performed as a double-blinded evaluation with a 5-point-likert scale (1: worst diagnosis confidence; 5: best diagnosis confidence) and the detection of unusual artefacts. Those results are given as medians. The inter-reader agreement was measured by Cohen's kappa coefficient.

Results: The inter-reader agreement was excellent (k=0.806). FBP and ADMIRE without iMAR were scored 4. FBP and ADMIRE with iMAR were scored 5. Unusual artefacts were noticed in most series reconstructed with iMAR; this artefact is particularly obvious when combined with ADMIRE.

Conclusion: The algorithm iMAR reduced the non-diagnostic area centred on a metallic intracranial device. However, it created a new artefact in the form of a halo of photon-starvation, especially when combined with ADMIRE.

PO15

The retroneural approach in CT-guided lumbar transforaminal epidural steroid injections: assessment of efficacy and safety

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Purpose: Lumbar transforaminal epidural steroid injection (LTFESI) is an important tool in the non-surgical management of low back pain. There have been selected reports of major complications such as spinal cord infarction, most likely due to direct trauma or embolization of a radiculomedullary artery. These events might be associated with the use of particulate steroid and the specific technical approach, i.e. subpedicular, retrodiscal or retroneural. The aim of this study was to assess the short-term efficacy and safety of a CT-guided retroneural approach in LTFESI.

Methods and Materials: This retrospective study included 393 patients (495 procedures in total) receiving CT-guided spinal injections with steroids and local anaesthetics. 180 patients (228 procedures in total) met our inclusion criteria. Short-term outcomes in terms of pain relief were assessed by the visual analogue scale (VAS) at baseline and 30 minutes post-intervention. Additionally, the distance from the needle tip to the neural foramen was measured.

Results: Mean pain reduction of 3.04 points (SD=2.13) on the VAS was achieved. The median distance from the needle tip to the neural foramen was 3 mm. There was no correlation (p=0.17) between improvement in VAS and needle tip position relative to the neural foramen using the retroneural approach. 17 cases of local anaesthetic-related transient muscle weakness and 3 cases of vasovagal response have been reported. No major complications were observed.

Conclusion: The retroneural approach in LTFESI is a safe and effective technique in interventional treatment for low back pain.

Withdrawn

Contrast enhanced FLAIR MRI of inflammatory leptomeningeal disease

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Learning Objectives: To illustrate the usefulness of contrast enhanced (ce) fluid attenuated inversion recovery (FLAIR) sequences for the imaging of inflammatory leptomeningeal disease.
Background: The ability of ce FLAIR sequences to visualize very low concentrations of contrast medium has been shown in vitro. Several studies have shown the value of this technique for various applications in neuroradiology.
Imaging Findings or Procedure Details: Examples are provided where ce FLAIR identified inflammatory leptomeningeal pathologies, and comparison of lesion conspicuity was made to noncontrast FLAIR and to ce T1-weighted imaging. Ce FLAIR demonstrated superior and distinct enhancement of inflammatory leptomeningeal pathologies including lymphoid follicles in multiple sclerosis, vasculopathy in Susac's syndrome, and meningitis.
Conclusion: Ce FLAIR is a widely available technique that is more sensitive than ce T1 in detecting certain leptomeningeal pathologies, and thus may facilitate diagnosis and clinical follow up in certain diseases.

Reconstruction algorithm related central dot artifact mimicking basilar artery thrombosis

M. Cieciera, K. Strobel, J.E. Roos, T.C. Treumann; Lucerne/CH

Learning Objectives: To recognize and correctly proceed when confronted with a dot artifact in the basilar artery in cranial CT images on a SIEMENS CT scanner.
Background: Several CT artifacts are known, e.g. noise, metal artifacts, beam hardening, scatter and ring artifacts. Depending on the reconstruction algorithm, other artifacts can occur, such as cone beam artifacts. A central dot artifact was observed which seems to be related to reconstruction algorithm.
Imaging Findings or Procedure Details: A dot artifact mimicking basilar artery thrombus was observed in the basilar artery sporadically in cranial CT angiography. In most incidents, the finding was interpreted as artifact. In one case, a catheter angiography was performed to exclude basilar artery thrombosis. Angiography turned out negative. No technical malfunction was detected on the scanner. The images and raw data were analyzed by the manufacturer. The artifact was identified as a reconstruction algorithm artifact and attributed to the specific condition of a dense tubular object following the z-axis in the isocenter of the gantry.
Conclusion: Radiologists should be aware of a possible reconstruction algorithm artifact in the basilar artery in cranial CT angiography to avoid unnecessary catheter angiography for suspected basilar artery thrombosis. The artifact can occur when the basilar artery is in the isocenter and follows the z-direction of the gantry.

How to write a meaningful radiologic report for thyroid nodules incidentally detected at ultrasonography

M. Luscher, V. Lenoir, S. Stefanelli, M. Pusztaszeri, M. Becker; Geneva/CH

Learning Objectives: The purpose of this educational poster is to provide a practical approach for the recognition of ultrasound (US) features of incidentally detected thyroid nodules that require fine needle aspiration (FNA) cytology.
Background: Ultrasonography (US) plays an important role in the diagnostic management of thyroid nodules but its widespread use in clinical practice generates variable descriptions and recommendations regarding further work-up in radiologic reports. The aims of this educational exhibit are to provide a practical US-based classification system for thyroid nodules in order to promote standardized and facilitated description, as well as uniform management based on the TI-RADS (Thyroid Imaging and Reporting Data System) Score System.
Imaging Findings or Procedure Details: Based on the TI-RADS Score System, the following radiologic features are reviewed: nodule position, capsular-extracapsular relationship, number of lesions, shape (width and depth), internal content, echogenicity, presence of calcifications, margins, vascularity, and size. Combining these US features, a thyroid nodule can be classified as: highly suspicious (TI-RADS score 4B-5) and weakly suspicious (TI-RADS score 4A) for malignancy, probably benign (TI-RADS score 3), and almost certainly benign (TI-RADS score 2). The implications of this classification on the necessity to obtain FNA cytopathologic analysis are described and illustrative cases are provided.
Conclusion: After reading this educational exhibit, the reader should be able to: accurately describe the US features of a thyroid nodule, provide a standardized and reproducible report including the TI-RADS classification, identify nodules that require additional diagnostic FNA cytopathologic analysis.

Fusion of CT coronary angiography and whole-heart 3D CMR myocardial perfusion – building a framework for comprehensive 3D imaging

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Purpose: To develop a first-of-its-kind, high-quality framework for hybrid imaging of CT coronary angiography (CTCA) and dynamic whole-heart 3D cardiovascular magnetic resonance stress perfusion (CMR-3D-Perf) image data to correlate coronary artery stenoses to stress induced myocardial perfusion deficits without the disadvantages of nuclear imaging or invasive procedures.

Methods and Materials: 23 patients underwent CTCA and CMR-3D-Perf. For CT, image quality and stenoses > 50% were documented. For CMR-3D-Perf data, image quality and stress induced perfusion deficits were noted. A new software framework was developed to allow for fused imaging of patient data revealing relevant stenoses and corresponding perfusion deficits. Computation steps included: 1) fully automated segmentation of CT coronary arteries and heart contours; 2) manual segmentation of the left ventricle in CMR-3D-Perf images; 3) automatic co-registration of CT and MR datasets; 4) projection of the CMR-3D-Perf values on the CT left ventricle. Results of the hybrid 3D analysis were compared to the separate read-outs from CT and CMR data.

Results: CT and CMR image quality was rated as good to excellent (scores 3.5 ± 0.5 and 3.7 ± 0.4, respectively, scale 1–4, 0=poor, 4=excellent). Multi-modal image fusion including fully automated segmentation of the coronaries, manual segmentation of the left ventricle, and automatic co-registration of datasets was feasible in all patients. Perfusion deficits could be correlated to culprit coronary lesions.

Conclusion: Fusion of high resolution CTCA and functional CMR-3D-Perf is feasible using the imaging framework presented in this work. Hybrid imaging can ease the anatomic correlation of stress induced myocardial perfusion deficits and their culprit lesions.

Texture analysis for the prediction of ischemic myocardial scar on non-contrast cine MR images – first patient experience

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Purpose: To test whether texture analysis (TA) allows for the diagnosis of myocardial infarction (MI) on non-contrast enhanced cine cardiac magnetic resonance (MR) images, thus obviating late gadolinium enhancement (LGE) imaging.

Methods and Materials: In this retrospective, IRB-approved study 120 patients (15 females, mean age 64±10 years) with large transmural (n=60) and small transmural and subendocardial (n=60) MI based on LGE undergoing cardiac MR imaging were included. Sixty patients (27 women, mean age 48±17 years) with normal cardiac MR served as controls. Regions-of-interest for TA encompassing the left ventricular myocardium were drawn on cine images in endsystole using a freely available software package for TA (MaZda, V4.6). A step-wise dimension reduction and texture feature selection based on reproducibility, machine learning, and correlation analyses was performed for selecting features allowing the identification of ischemic scars on non-contrast cine MR images.

Results: Five independent texture features allowed for distinguishing between ischemic scar and normal myocardium on cine MR images in both patient subgroups: Teta1, Perc.01, Variance, WavEnHH.s-3, and S(5,5)SumEntrp (all, p<.001). The first-order feature Perc.01 and higher-order feature Teta1 showed significant differences between MI patients with transmural scar and controls (p<.001 for both) and between MI patients with smaller transmural and subendocardial scar (p<.001 for both). The two parameters allowed for predicting myocardial scar with an area-under-the-curve of receiver operating characteristic analyses of 0.96 and 0.87, respectively

Conclusion: TA of non-contrast cardiac cine MR images allows for the identification of transmural and non-transmural ischemic scar with high accuracy.

Reduction of metal artifacts after transcatheter aortic valve implantation in cardiac CT: value of iterative metal artifact reduction

K. Higashigaito, M. Mannil, R. Manka, H. Alkadhi; Zurich/CH

Purpose: To assess metal artifact reduction (MAR) capabilities of iterative metal artifact reduction (iMAR) in patients after transcatheter aortic valve implantation (TAVI) in cardiac CT.

Methods and Materials: First, MAR capabilities of three different prototype iMAR settings were evaluated in a phantom study by placing four different TAVI devices in a commercially available human chest phantom. Second, the best iMAR setting was then selected and tested in patients after TAVI which were scanned on a third generation dual source CT. Images were reconstructed with and without iMAR. Two blinded readers independently assessed qualitative image quality in three locations (center, anterior and lateral of TAVI device) by using a 5-point Likert scale (5=excellent, no artifacts, 1=non diagnostic, severe artifacts). Quantitative image quality was assessed on the same regions by measuring image noise. Intraclass correlation coefficients (ICCs) and Cohen's k were calculated to evaluate interreader agreements. Wilcoxon signed-rank test and the student's T-test were used to compare qualitative and quantitative image quality.

Results: Agreements between both readers were good to perfect (all, k ≥ 0.683) for qualitative and high (ICC ≥ 0.98) for quantitative image quality. As compared to images reconstructed without iMAR, images reconstructed with iMAR achieved significant higher qualitative (average image score: 4.1 vs. 3.2) and quantitative (average image noise: 37±9 HU vs. 52±17 HU) image quality in all three locations and all TAVI systems (all p>0.05).

Conclusion: iMAR significantly improves qualitative and quantitative image quality by reducing metal artifacts produced by TAVI devices.

CT imaging of the tricuspid valve in patients with tricuspid regurgitation: tailored contrast media protocol and dynamic analysis of the annulus

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Purpose: To introduce a tailored contrast media (CM) protocol for visualization of the tricuspid valve (TV) with cardiac CT and to analyze the dynamic dimensions of the tricuspid annulus (TA) in healthy subjects and patients with functional tricuspid regurgitation (FTR).

Methods and Materials: Fifteen patients with no cardiac abnormalities (=controls), 15 patients with FTR<3+ and 13 with FTR≥3+ (determined by echocardiography) underwent a three-phasic CM protocol for optimized visualization of the right heart. Using a segmentation and image analysis software, the annular area, the entire annular circumference, its anterior, posterior and septal annular parts, and the antero-posterior and septo-lateral diameters were measured by two independent, blinded readers in end-systole and mid-diastole in 3D and 2D. Attenuation and standard deviation of attenuation (indicating homogeneity) were determined.

Results: The homogeneity of attenuation in the right heart showed a negative correlation with the degree of FTR (r=-0.61,P<.001). Interreader agreement was excellent for all measurements (ICC=0.995-0.999). Annular area, annulus and diameters were larger in patients with FTR as compared to controls (P<.05). There were significant differences between systole and diastole in controls, patients with FTR<3+ and those with FTR≥3+ for the area and annulus (all,P<.05). Anterior, posterior, septal and entire annulus were significantly smaller (all,P<.05) in 2D compared to 3D measurements (systematic underestimation 1.0-1.3mm), the difference decreasing with increasing FTR grades.

Conclusion: Using a tailored CM protocol allows for the dynamic analysis of the TA with cardiac CT, showing differences within and between patients with FTR and demonstrates systematic errors for 2D assessments.

CT stress perfusion in heart transplant recipients: comparison with 3D stress CMR imaging and coronary angiography

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Purpose: In heart transplant recipients, cardiac allograft vasculopathy (CAV) is a significant limiting factor with regards to long-term survival. We therefore aimed to assess the diagnostic performance of CT stress perfusion imaging (CTP) in comparison to 3D stress CMR imaging with coronary angiography as the reference standard for the detection of CAV.

Methods and Materials: Between 04/2015 and 04/2016, 13 patients (93% male, mean age 57±12 years, mean time since transplantation 10±9years) were included. 3D stress perfusion imaging was performed at 1.5 Tesla (Philips Achieva) at rest and under adenosine stress. Additionally, patients underwent 192- slice dual source (Siemens Somatom) CTP imaging under adenosine.

Results: All patients underwent 3D stress CMR perfusion imaging with good image quality. The mean LV ejection fraction was preserved (56±5%). Under adenosine, a perfusion deficit could be observed in 4 patients. A significant stenosis in the corresponding coronary vessel could be documented in 3 patients. Positive late gadolinium enhancement with a post- ischemic pattern was present in 2 patients.

CTP imaging was performed in all patients with 1 dataset being unuseable for analysis due to breathing artefacts. An effective mean radiation dose of 6.7mSv could be documented. Under adenosine stress, 4 patients displayed myocardial ischemia corresponding to CMR 3D perfusion imaging. Quantitative analysis of myocardial blood flow revealed generally low mean values in comparison with known reference values (mean MBF under stress 125.6±36ml/100g/min).

Conclusion: CTP imaging represents a feasible alternative imaging modality with moderate radiation dose and excellent concordance to CMR imaging on a per- patient base.

Chest pain CT in emergency department patients: value of coronary artery calcium scoring for ruling-out acute coronary syndrome

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Purpose: To determine the value of coronary artery calcium scoring (CS) for ruling-out Acute Coronary Syndrome (ACS) in patients presenting to the ED undergoing chest pain CT for simultaneous evaluation of ACS, Pulmonary Embolism (PE), and Acute Aortic Syndrome (AAS).

Methods and Materials: 204 consecutive patients (mean age: 58 years; 141 male) were referred to the ED with acute chest pain undergoing ECG-gated chest pain (or: triple rule-out) CT for two or three of the diagnoses ACS, PE, and AAS. Calcium scoring (CS) was performed prior to contrast-enhanced CT. Clinical endpoint was ACS during 30 days after index hospitalization.

Results: 89/204 patients (44%) underwent chest pain CT including an evaluation of the coronary arteries; 115/204 patients (56%) underwent chest pain CT without evaluating coronary arteries (ruling-out PE and AAS). The Agatston score was 0 in 93/204 (46%) and >0 in 111/204 patients (54%). 28/204 patients (14%) were diagnosed with ACS, of which 3/28 (11%) had an Agatston score of 0 and 25/28 (89%) an Agatston score >0. The diagnostic performance of CS (dichotomized to an Agatston score of 0 and >0) for detecting ACS was as follows: accuracy 56%, sensitivity 89%, specificity 51%, PPV 23% and NPV 97%. Area-under-the-curve (AUC) of CS for predicting ACS was 0.75. Multivariate model showed that the dichotomized Agatston score was independently associated with ACS (p=0.02) and provided additional diagnostic value over traditional risk factors.

Conclusion: CS is an excellent tool for ruling-out ACS in patients presenting to the ED with acute chest pain who undergo chest pain CT.

Prevalence of visceral artery stenosis in patients with severe aortic valve stenosis

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Purpose: Vascular complications are known complication after aortic valve replacement. Patients at risk of peripheral vascular complications have been evaluated, particularly in patients candidates for trans-femoral aortic valve implantation (TAVI). However, no data exists in evaluating visceral arteries.

The objective of this study was to evaluate the prevalence of visceral artery stenosis in patients candidates for TAVI.

Methods and Materials: 264 consecutive patients candidates for a TAVI procedure were considered for the study. 224 patients, who underwent CT angiography before the TAVI, were included (mean age 81,5 years). 40 were excluded when there was no CT or insufficient quality of the CT. Caelio-mesenteric and internal iliac arteries were evaluated and stenosis graded as significant (SAS), when >50%, or not for each artery. Depending on the presence of SAS, patients were classified as no stenosis, 1-vessel, 2- or 3-vessel-disease.

Results: 30% of patients had a celiac trunk SAS, 24% a superior mesenteric SAS, 27% inferior mesenteric SAS, 40% left internal iliac SAS, 38% right internal iliac SAS. Among patients with SAS, 20% of patients were classified as a single vessel-disease, 27% a two vessel-disease while 48% a 3-vessel-disease arterial.

Conclusion: A high prevalence of SAS was observed in patients with severe aortic valve stenosis and candidates for TAVI. Near half of patients with SAS should be considered at high risk of intestinal ischemia as 48% had 3-vessel-disease. Further evaluations are needed to determine the clinical impact of such observation and to better define the decision making process to prevent perioperative related complication.

Endovascular management of central venous obstruction due to cardiac implanted electronic devices

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Purpose: One of the late complications of cardiac implanted electronic devices (CIEDs) is central venous obstruction (CVO). The aim of this study is to investigate the efficacy and safety of endovascular treatment of CVO due to CIED leads.

Methods and Materials: From February 2005 to April 2016, 17 patients (12 men, 5 women) have been considered for endovascular management of their device-related CVO. 14 patients had pacemaker and 3 had defibrillator. Twelve patients were asymptomatic and were referred for vein recanalization due to the need of pacemaker replacement or implantation of additional wires. Five patients had a superior vena cava (SVC) syndrome. Obstruction was focally located at the entry of the leads in 10 patients. In 7 patients obstruction concerned a long part of central veins with or without extension to the SVC. All patients were evaluated with conventional phlebography and in patients suffering from SVC syndrome CT phlebography had also been performed.

Results: Twelve patients were treated with angioplasty only and 5 with angioplasty and stenting. Technical success was achieved to 11 of 12 asymptomatic patients. In one patient recanalization was not possible. Technical and clinical success were achieved in all symptomatic patients. No complications were reported. Restenosis of the lumen was found in two patients and was treated by angioplasty. In one patient treated by stenting, early replacement of the pacemaker battery was needed.

Conclusion: Endovascular management of CVO due to CIED is a safe and efficient method. Plain balloon angioplasty is sufficient for lead replacement purposes while stenting is needed for symptomatic CVO.

Collateral pathways in superior thoracic inlet venous obstruction – a systematic analysis

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Learning Objectives: List different collateral pathways occuring in SVCS. Describe physiological and reversed bloodflow depending on location of occlusion in patients with SVCS. Recognize imaging pitfalls associated with these pathways.

Background: Superior vena cava syndrome (SVCS) describes a partial or complete occlusion of the superior vena cava with variable clinical symptoms such as edema, cyanosis and enlarged venous vessels. Other symptoms are cough, stridor and dyspnea, or in severe cases coma. Reduced or stopped blood flow via the physiological main route decreases cardiac output and forces blood to develop detours to compensate for the diminished minutevolume.

Imaging Findings or Procedure Details: Contrast-enhanced CT is the modality of choice for clarification. It is widely available and offers confirmation and morphologic depiction of the extent of obstruction as well as the underlying pathology. Main causes are tumors, radiotherapy and iatrogenic interventions. Hematoma, infection and long-term hemodialysis are less common causes. We reviewed CT angiography studies with known thoracic venous inlet obstruction. Based on the analysis of these CTA examinations, we identified a total of seven collateral pathways. Often, these detours of blood from the systemic circulation to the right heart develop simultaneously in more than one pathway. We describe each pathway individually from an anatomical perspective and point out its clinical relevance and potential pitfalls.

Conclusion: Thoracic collateral venous pathways may play a critical role in radiologic imaging because pseudopathologic enhancement of bony structures and parenchymal organs may occur. Recognizing these imaging findings in the presence of collateral pathways may help in the correct interpretation and to avoid unnecessary follow-up examinations.

Heart and liver: crossing the diaphragm wall

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Learning Objectives: To describe imaging features of liver involvement in heart diseases, and of heart involvement in liver diseases
To describe imaging features of diseases affecting both organs
To describe both paediatric and adult populations

Background: The liver and the heart are close organs, connected by large vessels. As a consequence, the liver can be involved in heart diseases, leading to chronic hepatitis and congestion, fibrosis deposition and cirrhosis. On the other hand, the heart can be affected by liver diseases, leading to high-flow heart failure, and pulmonary hypertension and overload. Finally both organs can be affected by common diseases, mainly metabolic, and vascular.

Imaging Findings or Procedure Details: Heart diseases mainly affect the liver by passive congestion due to right heart overload, eventually leading to chronic congestive liver disease. On imaging, the liver mosaic enhancement pattern is predominant. The major causes are heart failure, pulmonary hypertension and valvular heart disease, or congenital heart disease. Heart volume overload and pressure overload should be clearly differentiated.

Liver diseases primarily affect the heart through high blood flow and vasoactive imbalance, eventually leading to cirrhotic cardiomyopathy. On imaging, shunts and cardiac dilatation are predominant. The major causes are cirrhosis, and congenital portosystemic shunts. Hepatopulmonary syndrome, and portopulmonary hypertension should be differentiated.

Diseases affecting both organs include both acute and chronic conditions. Acute diseases, especially infectious, cause hepatitis and myo-pericarditis. Chronic diseases, especially metabolic, autoimmune, or congenital, cause cirrhosis and cardiomyopathy.

Conclusion: The liver and the heart can be involved in many diseases, including heart diseases, liver diseases and diseases affecting both organs.

Pearls and pitfalls in staging the Adamkiewicz artery using high-resolution MR angiography

J.K. Richter, J.T. Heverhagen, M. Ith, B. Jung, A. Muhaxheri, L. Scheuner, H. von Tengg-Kobligk; Bern/CH

Learning Objectives: This poster will focus on 4 major areas, making use of routine clinical exams to convey the benefits of high-resolution MR imaging at 3T in visualizing the Adamkiewicz artery (AKA, A. radicularis magna).
(1) Standard anatomy of AKA and its variation including diagnostic pitfalls.
(2) Workflow illustration to meet expatiations from referring clinical partner.
(3) Technical basis and requirements needed for MRA implementation and successful image acquisition.
(4) How to perform image processing in order to achieve maximum identification rates of both AKA and its supplying arteries including visualization pearls of the imaging result for the referring clinician.

Background: The neurological deficits potentially caused by spinal ischemia may include paraplegia and neurogenic bladder dysfunction resulting in a dramatic change of the affected patient's life. We focus on supporting vascular surgery to avoid loss of blood supply via the AKA after open aortic repair. Aim is to describe the exact localization of the origin of the relevant posterior intercostal artery.

Imaging Findings or Procedure Details: Normal spinal artery anatomy (see figures) is demonstrated as well as its variants. The poster provides the clinical radiologist with relevant clinical case examples provided by high-resolution 3T MRA. Essential technical preparatory details including sequence design and contrast media details should allow a smooth transition of this setup at his or her institution.

Conclusion: High-resolution MRA of the spinal arteries can be achieved with excellent image quality using standard clinical equipment. Advantages of MRA over micro-invasive intra-arterial catheter-based angiography become evident with proper image acquisition, processing as well as focused reporting.

Quantification of DNA-double strand breaks (DSB) by using γ-H2AX-epitope 3D visualization

N.O. Ruprecht, J.T. Heverhagen, I. Böhm; Bern/CH

Purpose: Currently, irradiation-induced and other genotoxic influences are analyzed within eukaryotic cell nuclei by using the γ-H2AX immunofluorescence method to visualize both the onset of DSB, and DNA repair. Disadvantage of the method is the fact that the 3D nature of the nucleus is not taken into account. Confocal microscopy enables an improved view insight, and an exact basis for the quantification of fluorescence signals, as described below.

Methods and Materials: Cells of the MRC-5 cell line (lung fibroblasts) were irradiated with a 44Cs radiation source. The cells were exposed in vitro to the following radiation doses: 200 mGy, 500 mGy and 1000 mGy, fixed, incubated with anti-γ-H2AX mAb (mouse), and stained by using anti-mouse Alexa™ 488. Visualisation and counting of the foci was done by using conventional fluorescence microscopy (Zeiss Axiovert) or confocal microscopy (Zeiss LSM 880, Airyscan).

Results: By using fluorescence microscopy the entirety of fluorescence signals are visualized as integral without correct delineation of single foci. In contrast confocal microscopy is able to display existing γ-H2AX foci in real number, size, and spatial arrangement within the cell nucleus.

Conclusion: Confocal microscopy imaging enables the correct detection of present γ-H2AX foci. In contrast, on the basis of the established fluorescence microscopy procedures, only a rough estimation is possible. The herein presented method provides an innovative tool for the quantification of DSB.

Application of a handheld backscatter X-ray imaging device to image ancient human specimens – with an outlook on possible future clinical applications

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Purpose: While standard clinical X-ray based imaging modalities rely on the transmission of X-rays through the imaged body part, backscatter X-ray imaging detects reflected radiation to generate an image. The aim of our study was to demonstrate the feasibility to image ancient human specimens with a commercially available handheld backscatter X-ray Imaging device – originally developed for a use at border and security checkpoints – with an outlook on possible future clinical applications.

Methods and Materials: Using such a device, we imaged three different human specimens from ancient Egypt: an entire mummy contained in cartonnage, a mummified head, as well as a mummified left hand. These images were then compared to standard X-ray images acquired with mobile clinical digital X-ray equipment.

Results: Image quality was acceptable within the expected limitations of the handheld device regarding resolution, penetration depth, signal to noise ratio and geometric distortion. Various anatomical structures of the imaged human specimens could be well identified in accordance to the reference X-ray images. Furthermore backscatter-images revealed additional structures, which were not distinguishable on conventional X-ray images.

Conclusion: Backscatter X-ray imaging bears great potential for scientific and diagnostic clinical applications. A highly desirable feature offered by this imaging method, is the placement of the radiation source and the detector on the same side of the imaged specimen (or patient). A further development of this technology towards scientific and medical applications is thus part of our ongoing research.

Withdrawn

In vitro analysis of the composition of urinary calculi by dark-field X-ray radiography

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Purpose: Pain caused by urinary calculi is a common medical condition. Since treatment and prevention measures depend on the type of stone found reliable diagnostic tools are required: In vivo, dual energy CT allows for a classification of the stones found. After extraction, the stone composition can be investigated in the laboratory.

We investigate to which degree X-ray differential phase contrast imaging (DPCI), which measures simultaneously the attenuation, refraction and scattering of X-rays, allows determining the composition of urinary calculi by caclulating the material specific ratio R of the attenuation and scattering powers.

Methods and Materials: We investigated 75 renal stones which were extracted during routine clinical practice. Pathology revealed that about 50 % of the calculi were pure (Ca-Monohydrate or Ca-Dihydrate). The rest of the stones were composed of several minerals, mostly Oxalates and Phosphates, and just a few containing Uric acid.

Measurements were executed on a DPC prototype at PSI. The attenuation, refraction and scattering of X-rays were measured and the R value measured.

Results: Dense but compact calculi exhibit a higher R value than light and structured calculi (e.g. Uricite). R value images of mixed stones allow localizing the individual minerals. Uric acid stones could be identified with a sensitivity of 1 at a specifity of 0.87.

Conclusion: In vitro, dark-field imaging allows investigating the composition of urinary calculi. It is expected that the R value contrast between different minerals will be reduced when measured in patients. Further studies are needed to assess the performance of this new method.

Smart(phone) mobile ultrasound with novel wireless ultrasound probes: a feasibility study

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Purpose: Ultrasound (US) is the most frequently used diagnostic imaging modality. As point-of-care ultrasound (POCUS) it is a tool for initial patient evaluation to answer simple queries in more or less emergency and/or interventional settings. We report on novel wireless US probes which can easily be carried and can be used in combination with a smartphone or a tablet.

Methods and Materials: We performed POCUS with wireless probes using a convex and a linear probe with a fixed frequency of 3.5 MHz and 7.5 MHz, respectively. Both probes are equipped a with 128 element transducer array. Probe dimensions are 156x60x24mm with a weight of about 300g. Different apps are available for different mobile devices like iPhone®, iPad® or Android® devices. The apps come with the usual tools like freeze button, gain, save image/clips and calliper.

Results: With the convex probe we examined e.g. pleural effusion, dilated bile ducts, steatotic liver and free pelvic fluid. With the linear probe we examined e.g. carotid artery plaque, thyroid gland nodules and biceps brachii tendinitis. All examinations showed the present pathologies although the image quality lacked somewhat and was in the range of older mid-end machines.

Conclusion: The novel wireless ultrasound probes are a technical milestone for POCUS applications, even if the image quality should be improved. The utilization especially with an iPad mini® or an Android® tablet is intuitive. We are convinced that technical progress will overcome the issue of image quality and other, more technical issues, as the demand for POCUS increases.

Indication based CT: the right dose for the right diagnosis. Prospective multicenter study

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Purpose: To compare diagnostic reference levels (DRLs) for CT examinations when using clinical indication versus anatomical region protocols.

Methods and Materials: CT dose data from a network of 7 scanners were collected after parameters uniformization and protocol Radlex mapping, using a dose management software (DoseWatch, GE). The institutional DRLs (median CTDIvol) of chest and abdomen CT examinations were estimated based on anatomical region and clinical indication protocols and compared to each other as well as to national DRLs. Statistical assessement : one-sample Wilcoxon signed rank and Mann-Whitney tests.

Results: The institutional DRLs based on anatomical region (175 chest and 499 abdomen CT examinations) were: chest 5.7mGy, abdomen 8mGy and were significantly lower than national DRLs (10mGy chest, 15mGy abdomen, p<0.0001).

Per clinical indication, the dose was significantly lower than national DRLs in all cases: Chest DRLs: emphysema 4.8mGy, pulmonary embolism 7mGy, pneumonia 5.6mGy (p<0.0001 for all). Abdomen DRLs: colonography 4.6mGy, liver 7.5mGy, pancreas 7.6mGy, renal infection 6.5mGy, renal tumor 6.7mGy, diverticulitis 9mGy (p<0.0001 for all).

When comparing institutional DRLs per clinical indication to anatomical region protocols: For Chest, there was no statistical significant difference (p-value range 0.2-0.8). For abdomen, there was a statistical significant difference for CT colonography (p<0.05), diverticulitis (p<0.05), renal infection (p<0.005) and renal tumor (p<0.002).

Conclusion: National DRLs are not reflecting clinical practice, were protocols are adapted to clinical indication rather than to anatomical region.

Clinical relevance : DRL values should be linked to clinical indication, which may require different image quality and therefore a different dose.

Characterizing and validating DECT rho/z algorithm for proton therapy application: an experimental study

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Purpose: Dual Energy Computed Tomography (DECT) allows tissue specific estimation of electron densities ρ and effective atomic numbers Z. Aside from material classification, it has been previously demonstrated that ρ and Z can be used for proton therapy planning. Purpose of this feasibility study is to evaluate SIEMENS ρ/Z algorithm as a function of scanning parameters, dose and reconstruction technique.

Methods and Materials: A phantom with two 99.95% pure Zinc and Carbon is constructed. Both combinations of 140Sn/100 kV and 140Sn/80 kV, with high and low currents (232/300 and 58/75 mAs for 140Sn/100 kV; 116/300 and 29/75 mAs for 140Sn/80 kV) and rotation time 0.5s and 1s are tested on SIEMENS Definition Flash. For 140Sn/100 kV and 232/300mAs, filtered back projection and iterative (SAFIRE) reconstruction are evaluated. Values obtained with SIEMENS ρ/Z algorithm were compared between scans and with theoretical values.

Results: CTDI value was reduced by factor 4 between high and low mAs combinations. The ratio ρ/Z for Zinc was different from the expected value as the HU number was saturated. For carbon, the ratio ρ/Z was within 20% from nominal value, with variations within 0.4% and 1.5% for different scans. No influence of reconstruction algorithm was found.

Conclusion: The dose to the patient can therefore be minimized, without influencing the ρ/Z calculation or compromising therapy plan calculation accuracy. When harder materials (e.g. metals) are considered, HU value is saturated. This problem would be overcome with extended CT range, which is currently not available for DECT on SIEMENS Definition Flash.

Ultrasound needle visibility in contrast imaging mode: an in-vitro study

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Purpose: To evaluate needle visibility in ultrasound under contrast mode conditions.

Methods and Materials: Needle visibility was evaluated for the bevel, EchoTip® and shaft areas of a 18G Chiba biopsy needle with a 9MHz linear probe (GE Logiq E9). Insertion angles were varied with a positioning system between 30° (steep) and 90° (parallel to the probe surface). Acoustic output (transmit signal level) was varied from 5% to 28%. Two different contrast mode presets, with either 'Amplitude Modulation' (Penetration) or 'Phase Inversion Harmonics' (High Resolution), were assessed; all other imaging parameters were kept constant. The visibility of bevel, EchoTip® and shaft was assessed for grey-scale and color-coded images with a three point Likert-like scale (not visible, poorly visible, well visible) by two independent readers. In addition echogenicity of the needle bevel, EchoTip® and shaft was assessed in logarithmic scale (dB) on the color-coded images.

Results: With parallel insertion angle all needle areas were successfully identified. At steep insertion the EchoTip® was the only visible area, and High Resolution was superior to the Penetration preset. Visibility and echogenicity of needle bevel, EchoTip® and shaft increased with increasing acoustic output. Grey-scale images were superior to color-coded images for needle visualization.

Conclusion: Parallel needle insertion, use of echogenic tip, adequate choice of presets, increased acoustic output and dual view of grey-scale and color-coded images improve needle visibility in ultrasound under contrast mode conditions.

Effect of lipid accumulation on the magnetization transfer ratio measured in the regenerating mouse liver

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Purpose: Magnetization transfer (MT) in tissues largely relies on the water proton magnetization transfer rate from the free-water pool to the macromolecular pool. Increased lipid content hampers water-protein interactions, but little is known about the extent of this interference. Here, we aimed to quantify the reduction of magnetization transfer ratio (MTR) with increasing parenchymal liver lipid content studying the regenerating liver upon conventional hepatectomy (cPH) and extended hepatectomy (ePH) in a mouse model.

Methods and Materials: Anesthetized mice were measured after conventional hepatectomy (n=8) respectively extended hepatectomy (n=7) in a 4.7T small animal MR imager with an in-phase/opposed phase-FLASH sequence for fat quantification before and after surgery. MT was determined with a 3D gradient-echo sequence with /without MT prepulse. Region-of-interest based post-processing was done with home-made computer scripts calculating fat fraction and MT ratio (MTR).

Results: Day one post–surgery, average lipid content in the regenerating liver increased to up to 12% relative signal intensity for cPH and to up to 17% relative signal intensity for ePH, whereas the average MTR decreased to 89,3% for cPH and 85,3% for ePH. The retrieved data of the hepatectomized mice displayed a negative correlation of the increasing lipid content on the retrieved MTR (Pearson r = -0.92, P < 0.0001).

Conclusion: A decrease in magnetization transfer is found after liver resection, which presumably is mostly due to fat accumulation in the liver, potentially to a lesser degree to altered parenchymal protein concentrations. Thus, MT measurements may provide a biomarker reflecting both, tissue lipid infiltration and reduced protein content.

The physics of clinical MR taught through images – simultaneous multi-slice imaging focusing on 2D EPI (DWI) and FSE (T1, T2 and Proton Density)

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Learning Objectives: This poster discusses both the principles involved and clinical relevance of simultaneous multi-slice imaging (SMS), focusing on 2D EPI and FSE.
(1) The basic principles behind SMS are discussed, including optimization of sequence parameters, applicable exams, and hardware requirements.
(2) Current clinical applications with 2D DWI are presented, together with the potential utility of readout segmented EPI and FSE SMS.

Background: SMS is one of the major innovations for MR in the current decade, with widespread clinical utility. Areas of applicability include the brain, neck, breast, liver, prostate, MSK, neurography, and whole body (screening). SMS offers a substantial decrease in image acquisition time (with little to no loss in SNR) - which can be used to obtain the required anatomic coverage in a reasonable scan time, or alternatively improved spatial/diffusion resolution.

Imaging Findings or Procedure Details: The technical basis of simultaneous multi-slice imaging, as relevant to the clinical radiologist, is explained. The application of SMS pulse sequences (DWI and FSE) is shown in several important anatomical areas (including the brain, head and neck, breast, liver and musculoskeletal imaging), for example permitting the whole brain to be scanned using DWI with a 1 mm slice thickness in 4:39 min:sec.

Conclusion: SMS is a powerful tool providing a substantial increase in both diagnostic quality and cost efficiency. The poster concludes with a discussion of additional current advances, specifically implementation in readout segmented DWI and FSE, and further innovations in the future.

So-called „breakthrough" reactions (BTR) after premedication in patients with contrast medium allergy: contraindications for further applications of contrast agents in the future?

I. Böhm, K. Nairz, O. Endrich, P. Silva Hasembank Keller, J.T. Heverhagen; Bern/CH

Purpose: Allergy reactions despite of a premedication are termed breakthrough reactions (BTRs). BTRs are thought to be contraindications for contrast media (CM). The purpose was the critical analysis of the cause of BTRs and the presentation of a strategy to prevent such adverse reactions and to safely allow CM-enhanced radiology exams despite of previous BTRs.

Methods and Materials: RIS-/KIS data of patients who have been examined between 2000 and 2016, and who received anti-allergy-premedication were analyzed retrospectively. Since the term BTR is not established in routine practice, we searched appropriate paraphrases and keywords.

Results: We identified 40 BTR-patients. The reactions were induced by iodinated CM (n=32) or GBCA (n=8). Most patients had non-recurring BTRs (87.5%). We revealed the following reasons for the BTR: severe reaction and premedication in too low doses (50%), non-adequate/suboptimal premedication (22.5%), and unknown causes (27.5%). 27 patients had post-BTR follow-ups: native scans, symptom-related premedication, or CM-enhanced examinations with an alternate compound (same chemical-group). These prophylactic actions were effective in preventing subsequent CM-reactions. Due to our experiences we recommend the following: 1) omission of the culprit CM, and use of an alternate CM; 2) symptom-related premedication (adequate drug, dose and time-point of application) when the injection of an alternate CM should not be possible.

Conclusion: Since BTRs are avoidable, this kind of reactivity is no contraindication for the application of CMs. Knowledge of the pathological background and an exact documentation (applied CM, and clinical features) are the basis for an effectively managed reduction of BTR, and thereby for CM safety.

What needs to be considered in an internal audit in mammography?

C. Heilmaier[1], F. Zanca[2], D. Weishaupt[1]; [1]Zurich/CH, [2]Buc/FR

Purpose: Recently, the "ESR Clinical Standards and Audit Template" was introduced to guide audits in computed tomography. The aim of the present study was to determine standards and indicators for an internal dose audit in mammography and assess the role of a dose tracking system for such purposes.

Methods and Materials: By leveraging national and international regulations and/or recommendations as well as peer-reviewed journals, standards and indicators relevant for mammography were defined and applied in clinical practice. A dose tracking system (DoseWatch®, GE Healthcare) was installed and used during the study for data collection and analyses.

Results: A template in mammography audits could include the following standards: (1) radiation dose records, (2) protocol standardization, and (3) optimization. Within standard (1), the radiation dose information gained with the dose monitoring system can be used to verify that patient dose levels are within European dose limits and to perform analyses that enable corrective actions. Protocol standardization and dose variation were considered as part of section (2), with a target of 80% and less than 25% variation respectively on all collected data. Diagnostic reference levels (DRLs) were reviewed as part of (3), with a target of 75% of the procedures below DRLs. Corrective actions were also defined when standards were not achieved.

Conclusion: The ESR-template can be successfully adapted to mammography for quality improvement. The use of automatic registry systems for patient dose in digital mammography facilitates internal audits and patient dose analysis while fulfilling the requirements of the European Directives.

Patient-centred radiology

S.Y. Kim, J.T. Heverhagen, M.H. Maurer; Bern/CH

Learning Objectives: To demonstrate the use of patient-centered health care in radiology.

Background: Patient-centred health care aims to organize health care facilities around the needs of patients and their families. Also in radiology, the traditional business model of radiologists being "doctors to other doctors" is changing towards a patient-centred imaging care where the patient is placed at the centre of the health care environment and the imaging service is organized around the patients' needs and preferences.

Imaging Findings or Procedure Details: The different dimensions of patient-centred imaging care (e.g., effective communication, education of the patient, emotional support) will be demonstrated to empower patients to participate in their medical care and decision-making. Several key indicators to build a patient-centred environment like appropriateness of imaging procedures, scheduling and registration, physical comfort during imaging procedures, management of radiation exposure, and development of reporting programs will be presented as well as methods to redesign radiology processes towards a patient-centred imaging care.

Conclusion: Patient-centered care can also be applied in radiology to improve imaging service processes by focusing on patients' needs and preferences.

Implementing RADPEER for screening the quality of radiology reports in a university hospital

K. Nairz, I. Böhm, T.P. Meyl, J.T. Heverhagen, M.H. Maurer; Bern/CH

Learning Objectives: To present the RADPEER system as a method for an ongoing quality screening of radiology reports in a university hospital and to give an estimate about the application costs.

Background: The diagnostic radiology examination is probably the most streamlined and efficient medical process in hospitals. Due to its high throughput and good documentation it is easy to derive key process quality parameters such as efficiencies, waiting and reporting times. However, assessing the quality of the content of radiology reports has proven elusive, because it is dependent on expert knowledge, cannot be automatized, and is interfering with clinical routine. Acknowledging these obstacles, ACR has developed RADPEER as a simple tool based on the peer-review principle that can be integrated into routine interpretation. In brief, while interpreting new images, a senior physician will typically form an opinion about previous findings in the patient record. The RADPEER program ideally would be used to score previous records on a tripartite scale ranging from complete agreement to disagreement whenever they have been assessed.

Imaging Findings or Procedure Details: We will present how RADPEER can be used and implemented in the clinical routine. We will also present calculations about the projected costs and critically discuss the difficulty of integration in the light of a recent and very badly communicated change of the scoring system.

Conclusion: RADPEER is a suitable method to provide a quality screening for radiology reports. However, its use is associated with high costs as it is dependent on the expert knowledge of radiologists.

Risk stratification of intravenous roentgen contrast media in patients under beta blocker treatment

I. Böhm[1], J. Morelli[2], K. Nairz[1], P. Silva Hasembank Keller[1], J.T. Heverhagen[1]; [1]Bern/CH, [2]Tulsa/US

Learning Objectives: The radiologist is able to improve the quality of care and the patients safety in cases who are under beta blocker therapy. Background: Beta blockers and iodinated radio-contrast media (ICM) are frequently used, so that a relevant proportion of patients undergoing ICM-enhanced CT or other X-ray-related imaging procedures can be estimated to be under treatment with beta blockers. Several papers including the ESUR guide-lines state that the intake of beta blockers is a risk in concert with the application of ICM. Unfortunately, further explanations and recommendations are missing. On the basis of available literature we summarize the current knowledge, and provide recommendations for patients under beta blocker therapy.

Imaging Findings or Procedure Details: Evidence in the medical literature suggests that beta blockers do not increase the frequency of anaphylaxis, but do increase the risk for severe anaphylaxis and for treatment-refractory conditions. Interestingly, the older the paper the more harmful the CM-application in patients who receive beta blockers. This fact possibly might reflect the use of less tolerated ionic CM of high-osmolality in former times, and currently the more better tolerated non-ionic CM of low-/iso-osmolality.

Conclusion: Beta blocker-receiving patients who will undergo ICM-enhanced radiological examinations should be asked as to whether they tolerate ICM. If the answer is yes, no further prophylactic actions are necessary. If the answer is no, in cases of elective examinations, a diagnosis is recommended to find out individual tolerable ICM; in emergency cases, radiologists should be prepared for an adverse reaction (e.g. by an anesthesia-stand-by).

Techniques and applications of three-dimensional (3D) printing in medicine

J. Klaus, A. Bähler, J.T. Heverhagen, A. Poellinger; Bern/CH

Learning Objectives: To learn about the most common techniques and possible applications of 3D printing in medicine.

Background: 3D printing is a relatively new technology that was first created for rapid industrial prototyping 35 years ago. 3D-printed models derived from CT, MRI, or echocardiography data are highly customizable and provide the advantage of 3D visualization, haptic feedback with direct manipulation, and thus enhanced understanding of anatomy and underlying pathologies. Recent advances of techniques in 3D printing have led to rapid expansion of related medical research and possible clinical applications. Radiology is poised to be a key player in this process because of its role in the acquisition of patient based imaging data and related postprocessing.

Imaging Findings or Procedure Details: Description of the most common techniques in 3D printing such as stereolithography, selective laser sintering, fused deposition printing and multijet modeling.

Selection of possible applications for 3D printing in clinical practice such as individual patient based models for complex surgical procedures and teaching purposes or the printing of tissue grafts and artificial organs.

Discussion of remaining limitations concerning the integration of 3D printing in daily practice like lacking regulation concerning the production and use of personalized 3D models, material limitation and limited access to the required equipment.

Conclusion: 3D printing offers great promise for medicine. Radiology is poised to be a key player in the development of clinical applications. Individual 3D models of anatomical structures of the human body can be a powerful tool in various medical disciplines, but there remain some challenges before implementation in daily routine.

Minimally invasive aspergillosis pneumonia in pediatric patients with hematologic malignancies: multidetector computed tomography imaging

A. Shcherbakov, E. Ternovaya, T. Komarova, G. Tereshenko; Moscow/RU

Purpose: Children with hematological malignancies can`t resist infections because of hematopoiesis aplasia or induced netropenia due to chemotherapy or bone marrow transplantation. Development of secondary pathlogicall processes associated with threatment of leukemias and lymphomas uncontrollable fungal pneumonia are common and life-threatining complications in these patients.
Presentation of results of CT study

Methods and Materials: Study group consisted 450 patients (average age 3,5 ± 0,5 yr) diagnosed with ALL and AML. Chest CT was preformed to all patients in induced hematopoesis aplasia with persistent fever for more then 48 hours without signs of primary infection locus. Imaging was performed with scan increments of 0.62mm and it was followed by contrast enhanced protocol (contrast 1/1.5mL/kg). Bronchoscopy with bronchoalveolar lavage was performed in patients with lung parenchyma phatology.

Results: In 90% of patients CT signs of invasive fungal infection were detected at an early stage of the disease. Classic halo sign (97.5%), segmental or subsegmental consolidation (75%), single or multiple nodules (70%), nodular infiltrates (15%) were considered as early indicators of IFI. Nearly half of patients had positive galoctomannan (≥0,5) and mannan (≥1) in bronchoalveolar lavage.

Conclusion: Our study shows that early stages of invasive fungal pneumonia can be detected by CT. CT imaging has been used to direct BAL galactomannan antigen detection and has shown good sensitivity prior to instigation of empirical therapy. An interdisciplinary approach to the problem of invasive pulmonary aspergillosis can lead to maximum results in the treatment of fungal infections in pediatric patients with hematological malignancies.

Computer-aided detection (CAD) of solid pulmonary nodules in chest x-ray equivalent ultralow dose chest CT – first in-vivo results at dose levels of 0.13 mSv

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Purpose: To determine the value of computer-aided detection (CAD) for solid pulmonary nodules in ultralow radiation dose single-energy computed tomography (CT) of the chest using third-generationdual-source CT at 100kV and fixed tube current at 70mAs with tin filtration.

Methods and Materials: 202 consecutive patients undergoing clinically indicated standard dose chest CT (1.8±0.7 mSv) were prospectively included and scanned with an additional ultralow dose CT (0.13±0.01 mSv) in thesame session. Standard of reference (SOR) was established by consensus reading of standard dose CT bytwo radiologists. CAD was performed in standard dose and ultralow dose CT with two different recon-struction kernels. CAD detection rate of nodules was evaluated including subgroups of different nodulesizes (<5,5–7,>7mm). Sensitivity was further analysed in multivariable mixed effects logistic regression.

Results: The SOR included 279 solid nodules (4.3±3.4 mm, 1–24mm). There was no significant difference in per–nodule sensitivity of CAD in standard dose with 70% compared to 68% inultralow dose CT both overall and in different size subgroups (all p>0.05). CAD led to a significant increaseof sensitivity for both radiologists reading the ultralow dose CT scans (all p<0.001). In multivariableanalysis, the use of CAD (p<0.001), and nodule size (p<0.0001) were independent predictors for noduledetection, but not BMI (p=0.933) and the use of contrast agents (p=0.176).

Conclusion: Computer-aided detection of solid pulmonary nodules using ultralow dose CT with chestX-ray equivalent radiation dose has similar sensitivities to those from standard dose CT. Adding CAD inultralow dose CT significantly improves the sensitivity of radiologists.

18F-FDG-PET/CT for evaluation and monitoring of therapeutic effectiveness of TKI treatment in iodine-resistent thyroid cancer

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Purpose: Tyrosin Kinase Inhibitors (TKI) for thyroid cancer treatment lead to changes in tumour metabolism. The therapeutic effectiveness cannot be measured with morphologic imaging only. 18F-FDG-PET/CT was evaluated in monitoring tumour metabolism through changes in SUV.

Methods and Materials: From 2005 until now 15 patients between 36 and 75 years of age with iodine-resistent thyroid cancer have been treated with different TKIs.
18F-FDG-PET/CT (Siemens Biograph 16) was performed for treatment monitoring in all patients. Target lesions were identified. Standard uptake values (SUVs) and the longest diameter of every lesion were measured in the scan.

Results: Most of the patients showed a mixed response in glucose metabolism. Mainly pulmonary and hepatic metastases showed a decline of SUV whereas bone metastases showed rather stable or even progressive behaviour with rising SUVs. Lymph node metastases showed a mixed response.
18F-FDG-PET/CT led to a change of TKI medication in at least 2 patients due to progression in pulmonary and/or soft tissue metastases, while a mixed response with isolated progression of bone metastases led to additional therapeutic approaches like external beam radiation therapy or operative stabilization.
Additionally, 18F-FDG-PET/CT detected massive tumour lysis in 2 patients which rapidly led to the appropriate treatment.

Conclusion: In expensive therapies with known side effects, choosing and monitoring a suitable treatment is essential.
18F-FDG-PET/CT is a feasible tool for monitoring TKI therapy and showing its effectiveness. Furthermore, 18F-FDG-PET/CT is able to lead to a rapid and appropriate adaption of different therapeutic approaches.

Withdrawn

PO51

Imaging for the assessment of pulmonary hypertension (PH) – is it useful?

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Learning Objectives: To assess imaging methods that are used to determine PH in comparison to the current invasive gold standard - right heart catheterization (RHC).

Background: PH is defined as an increase in mean pulmonary arterial pressure ≥ 25 mmHg at rest assessed by RHC. As PH is associated with increased mortality it is of utmost importance to detect PH early and classify it correctly. Suspected diagnosis is based on echocardiography, but gold standard for PH diagnosis remains RHC. Computed tomography (CT) is part of investigational algorithms in order to determine the etiology and thus direct treatment choice.

Imaging Findings or Procedure Details: This educational poster reviews both established signs of PH in CT and MR imaging such as increased diameter of the main pulmonary artery (mPA), of segmental arteries and of the ratio of main pulmonary artery to aorta ascendens as well as new studies trying to characterize PH: Some MR-studies focus on cardiac anatomy and function such as right ventricular dilation and contractility. Also T1 mapping of the right ventricle was shown to be correlated with PH. Other studies focused on mPA and investigated its stiffness and flow parameters with methods like 4D flow MRI.

Conclusion: Our review and summary of the current literature research shows, that CT and MR imaging can be useful for detection and classification of pulmonary hypertension as well as the evaluation of treatment response. It is of utmost importance to further develop these diagnostic tools to offer non-invasive diagnostic alternatives to invasive right heart catheterization.

Evaluation of achilles tendon stiffness using strain sonoelastography: preliminary results

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Purpose: The aim was to evaluate Achilles tendon stiffness using strain sonoelastography with an external reference material during isometric contractions.

Methods and Materials: Thirteen healthy participants were analyzed. Strain sonoelastography, using an external reference material with known elasticity properties, was performed in the longitudinal plane at the level of the medial malleolus. The experimental protocol was tested and validated in a previous published work.

The external reference material was used to provide a comparison between the examined tissue and a material with a known elasticity. Stiffness was computed according to the sonoelastography color scale as the strain ratios between the tendon and reference material.

Sonoelastography images were captured during rest and during isometric contraction of the gastrocnemius muscle at different force levels (0.5kg, 1kg, 2kg, 5kg, 10kg.)

The mean and standard deviation of the strain ratios for all the subjects in the different conditions were calculated and the Friedman test was used to compare tendon stiffness between the difference force levels.

Results: The strain ratio (mean±SD) of all the tendons was 0.82 ±0.29 during rest, and 1.02±0.38, 1.31±0.75, 1.88±0.92, 3.52±2.09 and 13.70±17.03 for 0.5Kg, 1Kg, 2Kg, 5Kg and 10Kg respectively. The strain ratio is increasing with increasing force, and its increase between different contraction levels is statistically significant for each pair of conditions (p<0.05) except for adjacent levels (p>0.05).

Conclusion: Strain sonoelastography can accurately intercept Achilles tendon stiffness changes during isometric contractions of the gastrocnemius muscle.

Intergenerational changes of lumbar bony spinal canal dimensions: an MRI study

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Purpose: Previous CT studies have shown that there was a generational trend towards narrowing of the lumbar and cervical bony spinal canals, particularly in polytrauma patients. We aimed to verify whether this also held true with MRI, which provides additional data on the intracanalar neural content.

Methods and Materials: We retrospectively included 175 patients with abdominal (n=131) or whole-body (n=44) MRI, divided in two groups of "younger" (born during the 70s, n=86) and "older" (born during the 40s, n=89) patients, matched for gender (p=0.588). Two independent observers measured the cross-sectional area (CSA) at L1-L5 pedicle levels on axial-oblique fluid-sensitive MRI sequences, and assessed the morphology of the neural content of the dural sac at both pedicle and disc levels using Lausanne grading system

Results: Mean CSAs were significantly larger in the "younger" group at all pedicle levels (p≤0.032). There was, however, no significant difference in morphological grades at any pedicle or disc levels (p≥0.10). Males had numerically larger bony spinal canals at all pedicle levels, albeit reaching statistical significance only at L4 (p=0.007) and L5 (p=0.013). Inter- and intra-observer reproducibility for measurements were excellent (p≥0.829), while agreement for subjective morphological grading was moderate to excellent (weighted kappa=0.54-1.00).

Conclusion: Contrary to previous CT studies, there appears to be a significant increase in dimensions of the lumbar bony spinal canal bone from one generation to another. Additional larger studies are needed to verify if this trend applies to patients born during other decades and in other countries.

Early bone-SPECT-CT for prediction of prognosis in patients with castration resistant prostate cancer treated with 223-Ra: skeletal tumor burden based assessment vs visual analysis

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Purpose: The purpose of this study was to assess the prognostic value of early Bone-SPECT/CT (BS), using treatment-related changes in skeletal tumor burden compared with visual assessment, in patients with metastatic castration resistant prostate cancer (mCRPC) treated with 223-Ra dichloride (223-Ra).

Methods and Materials: Eleven patients with a mCRPC underwent bone SPECT/CT (BS) before and after 3 cycles of 223-Ra therapy for evaluation of skeletal metastatic disease. In order to determine skeletal tumor burden semi-automated isocontour VOIs were performed on pre-treatment and post 3-cycle BS. Active tumor volume (ATV) and maximum metastatic bone uptake (MBup) on base-line BS and their changes post 3-cycle BS were recorded and compared with visual analysis for predicting event-free survival (EFS). A correlation with treatment-related changes in prostate-specific antigen (PSA) and alkaline phosphatase (ALP) was assessed.

Results: An optimal cutoff value of 47% ATV reduction from baseline to mid-therapy obtained from ROC analysis (p< 0.0001; 95% CI 0,715 to 1,000) yielded an accuracy of 91%. EFS was 17% in patients with ATV reduction ≤ 47% (Mean 7,1 months; 95% CI 4,496 to 9,837) compared with 80% (Mean 11,8 months; 95%CI 9,696 to 13,904) in those with reduction > 47% (p 0,0485). Corresponding ALP levels reduction was more evident (66,7%) in the group with ATV reduction > 47% .

Conclusion: Quantitative assessment on 3-cycles BS during 223-Ra therapy could be a predictive biomarker improving the prognostic value in terms of no treatment discontinuation and absence of skeletal related events (SRE)

MRI-guided biopsies of suspected soft tissue sarcomas – first results of a pilot project

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Purpose: To investigate the accuracy and safety of MRI-guided biopsy of suspected soft tissue sarcomas (STS).

Methods and Materials: 29 patients that underwent 30 MRI-guided biopsies for suspected STS between January 2014 and October 2015 were evaluated. MRI-guided biopsy was performed in a 1.5T wide-bore MRI-Scanner (Siemens, Germany) using a custom made surface biopsy-coil (RapidBiomedical, Germany) for image acquisition. Needle placement was performed under real-time imaging by using a dynamic T2 TrueFISP sequence and MR-compatible coaxial needles as well as MR-compatible full automatic biopsy guns (Invivio, USA). Technical success was determined by the correct needle placement on imaging. The mean number of passes, mean procedure time, type of anesthesia and biopsy related complications were assessed. 22 patients underwent subsequent surgical resection of the lesions and comparison with the surgical specimen was performed.

Results: Technical success of all 30 MRI-guided biopsies was 100% and total diagnostic success rate was 97%. On average 4.7 tissue samples were taken from each lesion. Biopsy-needle size ranges from 14-18G, in majority of cases (n=17) a 18G needle was used. 11 lesions (n=11) were classified as malignant and 18 (n=18) as benign. In the biopsy-diagnosed malignancy group 10 patients underwent surgical resection of the tumor. In all cases the specific diagnosis made on the biopsy-sample was confirmed. Mean procedure time was 36.3 minutes. No complications were noted.

Conclusion: MRI-guided biopsy of suspected STS offers high success rate with low procedure time and number of needle passes and should be considered as the first option for lesions that cannot be targeted under ultrasound.

Interreader agreement and accuracy of brown adipose tissue grading in (18)FDG-PET/CT: an in-depth analysis

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Purpose: To evaluate the interreader agreement of a three-tier craniocaudal grading system for brown fat activation and investigate the accuracy of the distinction between the three grades.

Methods and Materials: After IRB approval, 340 cases were retrospectively selected from patients undergoing (18)FDG-PET/CT between 2007-2015 at our institution, with 85 cases in each grade and 85 controls with no active brown fat. Three readers evaluated all cases independently. Agreement between the readers was assessed with Cohen's Kappa (k), the concordance correlation coefficient (CCC) and the intraclass correlation coefficient (ICC). Accuracy was assessed with Bland-Altman and receiver operating characteristics (ROC) analysis. A Bonferroni-corrected two-tailed $p<0.016$ was considered statistically significant.

Results: Agreement was excellent by all three metrics with $k = 0.83-0.89$, $CCC = 0.83-0.89$ and $ICC = 0.91-0.94$. Bland-Altman analysis revealed only slight average over- or underestimation (-0.01-0.14) with the majority of disagreements within one grade. ROC analysis yielded slightly less accurate classification between higher vs. lower grades (Area under the ROC curves 0.78-0.84 vs. 0.88-0.92) but no significant differences between readers.

Conclusion: Grading the activation of brown fat by assessment of the most caudally activated depots results in excellent interreader agreement, comparable to previously reported agreement using SUV measurements.

MR reporting of the ankle made easy: a checklist

M. Kaniewska, R.A. Kubik-Huch, M. Peterhans, U. Neurauter, K. Eid, S. Anderson; Baden/CH

Learning Objectives: To familiarise radiology residents with a simple standardized reporting form, which is based on similar from international radiological societies such as RSNA, ESSR and ESR, in magnetic resonance imaging of the Ankle and to increase diagnostic detection of pathological changes.

Background: Ankle injuries are amongst one of the most common reasons for referrals to musculoskeletal radiology departments. According to the recent publications while athletic activities account for higher rates of ankle sprain, women are also generally at a higher risk of longstanding ankle injury.

The reports are an integral part of a daily routine for each radiologist and constitute an important communication tool with referring physicians. Hence they should be consistent and simply constructed. Proposed reporting form in MRI of the Ankle delivers information on anatomically and clinically relevant structures and simultaneously provides a comprehensive tool for clinicians.

Imaging Findings or Procedure Details: We offer a checklist for MR examination of the Ankle with following components:
1. Bones
2. Joints and cartilage (ankle, subtalar, chopart, lisfranc)
3. Medial and lateral ligaments
4. Tendons (flexor, extensor and peroneal, Achilles tendon)
5. Soft tissue and general findings
MR images of the described structures are provided.

Conclusion: Report templates can be used in musculoskeletal radiology and help in detection of pathological changes in MRI of the Ankle.
Moreover, they are consistent and therefore enable better communication with clinicians and referring physicians.

Desmoid tumors, from diagnosis to treatment

L.C. Farracho, I. Bagetakos, C.D. Becker, S. Boudabbous; Geneva/CH

Learning Objectives: With this study we aim to understand the role of imaging in the diagnosis and the follow up of desmoid tumors (DT).

Background: DT is a soft tissue and abdominal fibromatosis affecting fascia, septa and aponeuroses between muscles. It is a rare pathology, mostly seen in young adults. DT is a benign fibroproliferative process, as it doesn't metastasize. However it is locally aggressive and has the capacity to recur following resection. The etiology remains uncertain, although they are frequently associated with previous trauma or surgery. It has a typical appearance on MRI but the final diagnosis is done by biopsy. Many issues regarding the optimal treatment remain controversial because of the heterogeneity of the biological behavior of this tumors. Watchful waiting is now considered a reasonable option in selected asymptomatic patients.

Imaging Findings or Procedure Details: A retrospective study from 65 patients, old from 16 to 89 years, with 'desmoid tumor" reference in a radiological report of our institution during the past 10 years were listed. From that, 35 patients (54%) had a
desmoid tumor, confirmed histologically (83% from surgical tissue, 7% from percutaneous biopsy). Each tumor was categorized by localization, underlying etiology, first imaging study, complications, treatment, follow-up and recurrence.

Conclusion: Imaging has a fundamental role of diagnosis (typical features), follow-up, detection of recurrence and aggressive behaviour of DTs. In the past 10 years they were often diagnosed from surgical tissue, and that might change with the possibility of percutaneous biopsy and immuno-modulator treatment.

MR imaging classification of soft-tissue vascular malformations: from morphological to functional assessment

C. Santarosa, A. Neroladaki, I. Bagetakos, J-P. Vallee, M. Becker, H. Yilmaz, C.D. Becker, S. Boudabbous; Geneva/CH

Learning Objectives: To raise awareness about the classification of vascular malformations by the International Society for the Study of Vascular Anomalies (ISVVA) and to review the MRI appearances of soft tissue vascular malformations with a special focus on the added diagnostic value of functional dynamic MR angiography.

Background: VM are often a diagnostic challenge. Moreover persistence of inaccurate nomenclature acts as a confounding factor in their multidisciplinary evaluation. According to the ISVVA classification, vascular malformations are categorized as either low-flow or high-flow lesions. Since treatment strategy depends on their hemodynamic flow characteristics, differentiation of high-flow and low-flow vascular malformations is of paramount importance.

Imaging Findings or Procedure Details: We retrospectively analyzed MRI exams of 33 patients with soft tissue vascular malformations performed in our institution between February 2006 and December 2016. Morphological sequences helped in the assessment of extension and anatomical relationships of vascular malformations. Nevertheless, they showed just indirect signs of the hemodynamic behavior of these lesions such as the presence of signal voids or the enlargement of feeding arteries and draining veins. On the contrary dynamic time-resolved contrast-enhancement MR angiography allowed for a blood flow tracking providing information about the flow direction and the presence of an early lesion enhancement or an early venous shunting.

Conclusion: Radiologists should be aware of the standardized ISVVA classification of vascular malformations. With this educational poster we illustrate the MRI patterns of these lesions and the role of MRI in their classification besides Doppler ultrasound and DSA angiography.

PO60

Pearls and pitfalls of ankle tendon pathologies

M. Lunkiewicz, A. Ritz, R.A. Kubik-Huch, M. Peterhans, U. Neurauter, K. Eid, S. Anderson; Baden/CH

Learning Objectives: To be aware of the common and rare ankle tendon pathologies and to learn about the imaging appearances including some artifacts.

Background: Ankle sprains are a common injury frequently requiring imaging. They comprise of 3-5% of all Emergency Department attendances in the US (1) with increasing numbers seen in developed countries as participation in sports rises (2). Awareness of common and rare tendon pathologies, including the acute and chronic injuries, can help with reporting (3,4). Some tendon pathologies coexist und may overlap (5), which can make diagnosis difficult.

Imaging Findings or Procedure Details: From our daily activity we have chosen some typical and relatively unusual tendon pathologies, which will be demonstrated to assist in high quality reporting. These will include tendon and tendon sheath pathologies such as partial and complete tear, inflammatory and reactive tendinopathy and some unusual cases including those associated with acute trauma. Pitfalls will be shown related to e.g. magic angle and metal artifact.

Conclusion: Being aware of common and rare tendon pathologies as well as understanding the imaging appearances can improve diagnostic and reporting quality.

Ultrasound characteristics of breast cancer recurrence

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Purpose: Ultrasound diagnosis of recurrent breast cancer is a challenge for radiologists. Specific appearances of these lesions, developed after local and systemic treatment, may differ from those of primary cancer. The purpose of our study was to describe ultrasound characteristics of recurrent breast cancer.

Methods and Materials: We retrieved the data of 82 consecutive patients with biopsy-proven recurrent breast cancer treated in our institution between 2013 and 2016. Patients with distant recurrences and patients for whom ultrasound images were not available were excluded. Two independent readers retrospectively analyzed ultrasound images showing recurrent breast tumor and registered the descriptors and localization of each breast lesion and metastatic axillary lymph-node according to BI-RADS lexicon. Cohen's kappa coefficient was calculated to assess interobserver agreement. A consensus was reached between the two first and a third reviewer in case of disagreement.

Results: Sixty patients with 51 breast tumors and 15 metastatic axillary lymph nodes were analyzed. Cohen's kappa coefficient was 0.66, showing substantial agreement between observers. The most frequently reported descriptors were irregularly-shaped lesions(n=43,(84%)), hypoechoic(n=23,(45%)), with indistinct borders(n=23,(45%)) and acoustic shadow(n=14,(27%)). However, 37(72%) tumors had no inner vascularity, 6(12%) tumors were hyper- or iso-echoic and 1(2%) was localized in the skin, while 5(10%) were in the pectoral muscle. Axillary lymph nodes demonstrated uniform(n=4,(27%)) or focal(n=4,(27%)) cortical thickening, non-circumscribed margins(n=9, 60%), with no visible hilum(n=7, (7%)) and with cortex vascularity(n=11,(73%)).

Conclusion: Ultrasound findings of recurrent breast tumors essentially follow the pattern of primary breast tumors, with some important exceptions.

MRI-guided breast vacuum biopsy: localization of the lesion without contrast agent application using diffusion-weighted imaging

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Purpose: Dynamic contrast-enhanced (DCE) MRI in MR-guided breast vacuum biopsies is cumbersome and the contrast may be applied only once. This study is evaluating the feasibility of Diffusion-Weighted Imaging (DWI) for lesions targeting for vacuum assisted MRI biopsies.

Methods and Materials: Retrospective study, which was approved by the local ethics committee. All patients having had a vacuum assisted MRI-guided breast biopsy (for an additional lesion or for evaluating the total extension of the cancer) including a DWI-sequence were included. Apparent diffusion coefficient (ADC) values from the lesions and the adjacent normal breast tissue, biopsy results and final histological workup (including the size of the lesion) after total excision were noted. Thirty-two patients were included. In six patients no final histological proof was available due to an alternative therapy (due to neo-adjuvant chemotherapy or surgery performed at another hospital).

Results: Tumor size ranged between 1.8 cm and 8 cm. ADC values of the tumors were between 0.76-1.01x10-3 mm2/s and showed a restriction, compared to normal breast tissue, where values between 1.89-2.00 x10-3 mm2/s were measured. The tumors were best visible in the DWI datasets displaying a high hyperintense signal.

Conclusion: DWI may be used as an alternative to dynamic contrast-enhanced MRI with the advantage of reproducibility. However, the targeted lesion requires the characteristics of a mass-like lesion and a substantial diffusion restriction.

Imaging of ductal carcinoma in situ

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Learning Objectives:
- How to deal with suspicious microcalcifications
- Sensibility and specificity of different imaging modalities

Background:
- DCIS represents 20-25% of newly diagnoses cases of Breast cancer in USA
- Risk factors are the same as those for invasive breast cancers
- Suspicious microcalcifications have a likelihood of malignity of 70% if they are fine linear or branching; of 29% if they are fine pleomorphic; of 21% if they are amorphous and of 13% if they are coarse heterogeneous

Imaging Findings or Procedure Details:
- 80-85% of DCIS detected by mammography (microcalcifications, asymmetry of density) exceptionally by MRI
- 25% of malignant microcalcifications demonstrated stability over 8-63 months; stability is unreliable for exclusion of malignity
- US: has a low sensivity for tumor detection and has a low sensivity for microcalcifications detection and has a very low specificity
- MRI: has a high sensivity (85% for DCIS and 100% for micro invasive DCIS). Non mass like enhancement is representative and is linear, segmental or ductal. Dynamic behavior is not relevant. MRI in mammographic BIRADS 3 has a VPN of 100% in non calcified lesions. MRI is useful in case of asymmetry or architectural distorsion. VPN is 76-97% for suspicious microcalcifications

Conclusion:
- 10-15% of DCIS is not diagnosed with MRI
- MRI is not a problem solving modality
- Suspicious microcalcifications should never be classified as BIRADS 3
- Stereotactic vacuum-assisted core biopsy gives the definite diagnosis
- Natural history of DCIS is still unknown and aggressive treatments are started
- No data available demonstrating that detection of DCIS averts breast cancer deaths.

Novel magnetic resonance technique for functional imaging of cystic fibrosis lung disease

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Purpose: Cystic fibrosis (CF) is characterized by chronic respiratory infections and functional impairment of the lung. Lung function tests such as nitrogen multiple breath washout (N2-MBW), are sensitive in detecting ventilation inhomogeneity, but cannot determine its exact origin. Novel magnetic resonance imaging (MRI) methods such as matrix pencil decomposition MRI can visualize functional changes in the lung without the administration of contrast agents and the need for breathing maneuvers. Objectives: To examine the correlation between novel functional MRI and lung function tests in patients with CF.

Methods and Materials: Methods: Forty patients with CF (mean age 11.7 years, range 6–18) underwent MRI and lung function tests on the same day. Functional MRI provided semi-quantitative measures of the perfusion (RQ) and ventilation (RFV) impairment as percentages of the affected lung volume. Morphological MRI was evaluated using a CF-specific score. N2-MBW provided information about global (lung clearance index, LCI) ventilation inhomogeneity.

Results: Results: MRI detected functional impairment in all patients with CF: RFV ranged from 19% to 38% and RQ ranged from 16% to 35%. RFV and RQ were strongly correlated with LCI (r=0.76, p<0.001; r=0.85, p<0.001, respectively), as well as total morphology scores and sub-scores.

Conclusion: Conclusions: Non-invasive functional MRI is a promising method to detect and visualize perfusion and ventilation impairment in CF without the need of contrast agents or breath holding maneuvers.

Dr. Heinz Tschäppeler X-ray-archive, an online teaching file of musculoskeletal paediatric radiology

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Purpose: The aim of this work was to transfer the musculoskeletal Dr. Tschäppeler-X-ray-archive into the online web page „PediRad" and to structure the archive for the pediatric radiology teaching curriculum.

Methods and Materials: The classification of the images of the extremities in the learning-modules is based on the paediatric radiology teaching-program of the department of diagnostic, interventional and paediatric radiology, university hospital of Bern. Every case has a specified number of image-identification; they were all revised, made anonymous and digitized. The image comments were edited and amendments such as modalities, anatomical region and age of the children were added. The images were prepared for automatic data import. The musculoskeletal images of the Tschäppeler-archive are structured in the learning modules D, E and G on the PediRad-platform. The categories "classification of anatomical region" and "classification of age" were constructed and the images were additionally divided in these categories. For each learning module questions, appropriate for their educational objectives, were constructed.

Results: Around 1200 musculoskeletal radiological cases with a wide range of x-ray images are now easily accessible for a broad audience and will soon be published among the established PediRad modules. Among the radiographs there are many very rare paediatric diseases. The cases of the "Dr. Tschäppeler-archive" will be used for education and advanced training of students, paediatricians and radiologists.

Conclusion: Within the web page PediRad the images of this exquisite collection are now for everyone freely online available and may be an excellent image database for rare paediatric musculoskeletal diseases.

The abernethy malformation: pre-treatment catheter angiography

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Purpose: The Abernethy malformation is a congenital extrahepatic portosystemic shunt which joins directly the portal trunk or 1 of its branches to the inferior vena cava or 1 of its branches. Traditionally there are 2 types of Abernethy malformation: Type I (end-to-side shunt), Type II (side-to-side shunt). The purpose of this case review was, to describe the angiographic techniques and findings in children with congenital extrahepatic porto-systemic shunts i.e. the Abernethy malformation, prior to curative closure.

Methods and Materials: 4-year retrospective review (ending 2015) on 8 consecutive patients undergoing direct shunt / mesenteric venography & pressure measurements (SV, n=8), wedge hepatic venography (WHV, n=4) and superior mesenteric arterio-portography (SMAP, n=2).

Results: SV demonstrates variant branching of usually small IHPVs in the Abernethy malformation. WHV was done in 4/8 patients. Using this previously undescribed technique for such patients, the IHPVs were demonstrated in 3/4 pts, 2/3 having a Type II and 1/3 a Type I Abernethy malformation. On SMAP in 1/2pts. SMAP was done in 2 cases with Type II Abernethy malformation and IHPVs were demonstrated in 1/2 cases, despite being present and demonstrable with other angiographic techniques.

Conclusion: The interventional radiologist has an important role in evaluating these patients before shunt closure (radiologic/surgical/combined) and direct SV and preasure measurement is required in all. Direct SV can demonstrate variant branching of usually small intrahepatic portal veins in the Abernethy malformation type I and II. SMAP & WHV techniques are useful angiographic adjuncts employed on an individual case basis.

Imaging of cancer therapy related toxicities in children: a pictorial essay

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Learning Objectives: To illustrate the imaging findings of complications of cancer treatments in children.

Background: Current therapies against cancer in children have significantly improved overall prognosis. However treatments, especially chemotherapeutics, are more aggressive often lead to different complications compared to those in adults. The radiologist must be familiar with the appropriate techniques and imaging findings related to a specific toxicity. Imaging plays a pivotal role in discriminating between progression of the disease which needs continued treatment and post-treatments complication which require stopping the administration of the responsible agent.

Imaging Findings or Procedure Details: We illustrate the typical imaging characteristics of therapeutic complications related to chemotherapy, radiation and bone marrow transplantation (BMT) in children with cancer based on the organ involved: heart (cardiomyopathy), lung (infections, bronchiolitis obiterans, idiopathic pneumonia), gastrointestinal system (pneumatosis, enteropathy, neutropenic colitis, GVHD), hepatobiliary system (steatosis, veno-occlusive disease and focal nodular hyperplasia), pancreas (pancreatisis), kidney/urinary tract (nephromegaly, nephrolithiasis, hemorrhagic cystitis), musculoskeletal system (osteonecrosis, bone marrow changes, myositis), central nervous system (brain and spine leukoencephalopathy, thrombophlebitis).

When appropriate, we indicate the responsible therapy, for example: asparaginase as cause of thrombophlebitis, actinomycin for venous occlusive hepatic disease or methotrexate for encephalopathies.

For each entity, the time of the clinical appearance and the choice of the imaging modalities (standard RX, ultrasound, CT and MRI) are reported.

Conclusion: Children's exposure to anti-cancerous treatments is often a source of complication. Knowledge of the typical imaging characteristics is necessary to differentiate between disease progression and treatment complication and helps improving patient management and outcomes.

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Atypical findings in a series of lung sequestration

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Learning Objectives: The aim of this educational poster is
- to briefly review the classification of pulmonary sequestration
- to describe the atypical findings observed in a series of pulmonary sequestration.

Background: Pulmonary sequestration is an infrequent congenital lung malformation, consisting in anomalous, non-functioning lung tissue that presents with systemic arterial supply and shows no continuity with the tracheobronchial tree. Lung sequestrations have been traditionally classified into intra- or extralobar, depending on their venous drainage and the presence of independent pleura. Most published cases are extralobar, located at the left lung basis. Patients are usually asymptomatic at birth.

Imaging Findings or Procedure Details: We identified all cases of lung sequestrations diagnosed in our Hospital in the last five years (n=13) and reviewed all the pre-and postnatal imaging studies performed in these patients, including the pathological findings after surgical resection of the lesions. We collected this atypical cases because of the location (diaphragmatic, abdominal); their vascular supply (multiple arterial supply, mixed venous drainage), and/or the presence of associated on histologic findings (bronchogenic cysts, CPAM).

Conclusion: In this series, lung sequestration differed from the classical description we are used to, in a significant number of cases. Our data show that these lesions are more complex and present with a more varied spectrum that what is reflected in the actual classification.

L'analyse du travail au service de la professionnalisation : un dispositif innovant

L. Seferdjeli, A. Goudeaux; Geneva/CH

Purpose: La présentation est consacrée à un dispositif de formation innovant conçu à partir des résultats d'une recherche en cours financée par le FNS. Inscrite dans le courant de l'analyse du travail, elle vise la conception d'une plate-forme numérique d'apprentissage (site web) au service de la formation initiale et continue des TRM.

Methods and Materials: Le caractère innovant de ce dispositif réside dans son orientation sur les activités réelles des TRM. Au travers de séquences vidéo, il permet l'entraînement à la description, à l'explicitation, à l'analyse et à l'évaluation des activités professionnelles. Les séquences vidéo sont commentées et analysées selon trois points de vue : celui des TRM filmés, celui de collègues et celui des chercheurs.

Results:
- Un apprentissage se réalise parce qu'il est sous-tendu par des processus d'immersion et d'engagement mimétique permettant à l'étudiant de mettre en relation sa propre activité avec l'activité visionnée ;
- Le visionnement permet une prise de conscience que les problèmes rencontrés ne sont pas personnels mais typiques du métier ;
- L'engagement mimétique produit une insatisfaction soit de sa propre activité soit de l'activité visionnée ce qui engage à une explicitation des normes sous-tendant l'activité cible puis à une possible renormalisation de sa propre activité.

Conclusion: La plate-forme vient compléter la formation par la simulation ou par les travaux pratiques mais sa plus-value réside dans le fait que les vidéos, en donnant à voir des situations de travail réel, permettent de prendre en compte les éléments de l'environnement contraignant ainsi que le flux temporel dans lequel l'activité s'insère.

Conception technique du dispositif pédagogique « Devenir TRM »

L. Seferdjeli, K.M. Schmidt, O. Cagdas; Geneva/CH

Purpose: Trois présentations s'inscrivent dans ce projet : celles de L. Seferdjeli, d'O. Cagdas et le présent abstract.
La présentation est consacrée à un dispositif de formation innovant conçu à partir des résultats d'une recherche en cours financée par le FNS. Inscrite dans le courant de l'analyse du travail, elle vise la conception d'une plate-forme digitale d'apprentissage au service de la formation initiale et continue des TRM.

Methods and Materials: Le caractère innovant de ce dispositif réside dans son orientation sur les activités réelles des TRM. L'utilisation des outils pédagogiques digitaux, telle qu'une plateforme numérique accessible tant par les apprenants, les pédagogues ou encore les professionnels du terrain devrait permettre à ses utilisateurs de pouvoir avoir accès, quelle que soit leur localisation (en école ou en institut de soins), à des contenus de formations relatifs à l'activité réelle du TRM.

Results: La solution retenue a été le développement d'un CMS (Content Management System) doublé d'un LMS (Learning Management System) permettant, respectivement, d'une part d'afficher les contenus pédagogiques d'une manière distincte et d'autre part d'offrir la possibilité d'un apprentissage coopératif et interactif. Le choix d'une dualité de navigation a été adoptée afin de permettre d'une part un enseignement tutoré (en salle de classe ou avec un tuteur) et d'autre part autonome (auto-formation). Le système est accessible en E-Learning.

Conclusion: La plateforme se doit de respecter une typologie spécifique de navigation pour les utilisateurs et obtenir un statut pérenne. Ainsi, le développement d'un LCMS (Learning Content Management System) remplaçant la solution initialement retenue pourrait être envisagé.

En quoi consiste la dimension relationnelle de l'activité du technicien en radiologie médicale lors d'une prise en charge ?

L. Seferdjeli, K.M. Schmidt, O. Cagdas, C. Malleret, F. Wyss; Geneva/CH

Purpose: La présentation est consacrée à la prise en charge d'un patient lors de son examen d'IRM aux Hôpitaux Universitaire de Genève. La séquence vidéo de cette activité et son analyse viennent documenter un dispositif de formation innovant (site web) qui permet de solliciter la réflexivité des étudiants.

Methods and Materials: Les méthodes utilisées sont celles de l'analyse du cours d'action :
- Enregistrement vidéo de la séquence d'activité
- Entretien d'auto-confrontation avec le TRM qui a réalisé l'activité
- Entretien avec le patient
- Analyse de la vidéo dans une perspective interactionnelle
- Analyse de l'auto-confrontation selon la méthode du cours d'action
- Analyse thématique de l'entretien avec le patient
Ces matériaux constituent les points de vue externe et interne à la situation filmée.

Results: L'analyse des entretiens et du film permet de mettre en évidence :
- les ressources utilisées par les professionnels lors de l'échange, comme l'observation, l'humour et le travail sur les émotions ;
- les compétences invisibles déployées par le professionnel :
  Observer et interpréter les réactions du patient
  Typifier l'attitude du patient
  Anticiper les réactions du patient
  S'ajuster en permanence à tous les éléments de la situation

Conclusion: Si les protocoles et autres guides de la communication sont utiles, ce ne sont pas eux qui font le travail mais bien le professionnel. Ce dernier doit sans cesse s'ajuster à son interlocuteur, interpréter ses réactions, les anticiper et moduler son propre comportement de sorte à faire émerger un « monde commun » pour le temps de l'examen.
(S'inscrit dans le même projet que celles de L. Seferdjeli & K. Schmidt)

MR-safety guidance document

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Purpose: To raise awareness of the open availability of a Swiss MR-safety guidance document.

Methods and Materials: So far no document has been easily available for the Swiss radiological community that summarizes MR safety information and recommendations while taking local Swiss realities into account. It was the goal of this work to compile and make available information on good practices regarding the safety of magnetic-resonance imaging (MRI) in Switzerland under consideration of local laws and regulations - in a joint effort of SGR-SSR, ASTRM-SVMTRA, and MR scientists (AMPEC).

Results: The document has been written in a collaborative effort of authors from the involved associations under attempts to reach consensus. It covers all aspects of MRI safety and, e.g., makes suggestions on how to deal with the the static-field exposure limit for pregnant employees that has been in effect since July 1, 2015.

The document is published at and can be downloaded from http://www.ampec.ch/publications/ as a PDF file, along with sample safety questionnaires for patients and employees in an editable format. So far the document exists in a German version only, but there are on-going efforts to translate it to English and possibly French and Italian.

Conclusion: A MR-safety guidance document has been compiled and made openly available for all interested parties. It is the intent of the authors and the involved associations to keep the document up-to-date and to develop it in whatever way deemed necessary for optimum usefulness. To this end, they solicit feedback and suggestions for improvement from the community.

Fresh tattoo artifact in MRI

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Purpose: Imaging artifacts associated with decorative tattoo are quite well documented today. Local heating and even some first and second degree burns were also reported.

Altought we understand that paramagnetic effect of some tattoo pigments containing various types of metal is responsible for the local magnetic field distortion, in one recent case we noted a very significant decay of this effect between the MRI examination with the fresh tattoo closely located and the late MRI control of the same area.

Methods and Materials: A 37 years old patient presents with a left wrist trauma. He underwent two MRI 3T studies, the first a few days after being tatooed on the injured wrist and the second one nine days after.

Results: A major susceptibility artifact is observed on the area of interest with the PD_fat-sat_SPAIR sequences. An alternative STIR sequences optimizing the quality was acquired. The use of contrast media was not possible due to the susceptibility artifact. Nine days later we repeated this exam on 1.5T MRI and no artifact was observed with PD_fat-sat_SPAIR sequences.

Conclusion: The reduction of susceptibility artifact with a lower magnetic field MRI was expected, but we were surprised to observe its total disappearance. We supposed that some unknown organic process (resorption ? chemical reaction) must occure during the period between this two examinations, diminushing the concentration of metal particles. A check on 3T MRI is organitezed and should confirm our assumption.

La place de l'IRM dans le diagnostic de l'appendicite aiguë

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Purpose: L'appendicite aiguë est une inflammation touchant principalement les jeunes mais aussi les femmes enceintes.

Le scanner étant l'un des premiers outils de diagnostic, son exposition aux rayonnements ionisants ainsi que sa performance sont remis en question dans plusieurs articles scientifiques.

L'IRM peut être un moyen de diagnostic avec une sensibilité plus forte et une irradiation nulle.

Quelle place peut occuper l'IRM dans le diagnostic de l'appendicite aigüe?

Methods and Materials: Pour répondre à notre question, nous effectuerons une étude de cas. Dans cette étude, un protocole sera élaboré avec l'aide d'un médecin radiologue et d'un ingénieur en application.

Nous souhaitons avoir un minimum 10 cas. Les cas seront définis suivant la clinique du patient et un tableau de prise en charge.

Notre échantillon regroupera les jeunes de moins de 45 ans, hommes et femmes confondus.

Une étude comparative CT-Scan et IRM nous permettra d'avoir un regard plus critique concernant la qualité. Ce qui implique que les patients devront effectuer les deux examens. Un protocole en ce sens sera établi pour tous les cas susceptibles de rentrer dans notre recherche.

Results: Le résultat de cette étude sera reporté en un tableau des avantages et des inconvénients de l'utilisation de l'IRM dans le diagnostic de l'appendicite. Nous aurons de plus, un protocole qui pourra être proposé pour cette indication.

Conclusion: Cette étude ne permettra effectivement pas un regard critique vu le nombre peu important de cas que nous aurons. L'objectif premier étant de montrer cette possibilité à tous les professionnels afin de pouvoir en faire évoluer l'opinion.

Magnetic resonance imaging of deep infiltrating and extra genital endometriosis in correlation to intraoperative and histopathological findings: a prospective, still ongoing study

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Purpose: To detect deep infiltrating endometriosis (DIE) and extra genital endometriosis (EGE) on pre-operative magnetic resonance imaging (MRI) and to show the correlation to intraoperative and histopathological findings.

Methods and Materials: Pelvic MRI was performed in 22 women with suspected Endometriosis in 2016. The protocol included administration of antiperistaltic agend, T2, T1, T1 fat sat and diffusion weighted sequences with the slice thickness of 3-5 mm and a 60 mm slice sequence to exclude the urinary tract dialtation. The MRIs were prospectively interpreted and reported by one urogenital radiologist. Gynecologic surgeons used the reports and the images to plan the surgery. Abdominal wall endometriosis (AWE) and subdiaphragmatic findings were demonstrated to surgeons preoperatively by the radiologist. Photo and video documentation were taken intraoperatively.

Results: Until now, 5 patients (mean age 30.6 years) were operated. In 2/5 the indication for the surgery was based on the MRI findings. 4/5 DIE and EG lesions were depicted on the preoperative MRI and confirmed histopathologically. In 3/5 patients the lesion was seen intraoperatively only thanks to the imaging. In one discordant case the suspected DIE lesion was intraoperatively only visible as scarred area retrocervical. AWE was very well predicted and located by MRI, whereas intraoperatively only a large scar like lesion was found and removed, histopathologically proven to be endometriosis.

Conclusion: MR imaging of endometriosis can be a helpful tool for the clinical and intraoperative work up, especially in detecting the extent of DIE and EGE, encouraging gynecologic surgeons to perform a complete excision of the lesions.

Extravasation de produit de contraste au scanner : une revue systématique des stratégies de prévention

N. Richli Meystre, C. Campeanu, G. Gullo, S. Ding; Lausanne/CH

Purpose: L'injection de produits de contraste iodés (PCI) est une pratique courante au scanner. L'extravasation de PCI au site d'injection est un évènement indésirable rare mais non négligeable. Elle se manifeste par des gonflements douloureux des tissus avoisinants. Dans de rares cas elle peut mener à un syndrome des loges voire une nécrose tissulaire. Notre étude avait pour but de réaliser une revue systématique de littérature sur les stratégies de prévention de l'extravasation de PCI au scanner.

Methods and Materials: Une recherche de la littérature a été conduite dans huit bases de données afin d'identifier les articles testant des interventions susceptibles de réduire la fréquence d'extravasation, son volume ou ses complications. La sélection des articles a été réalisée par quatre lecteurs indépendants.

Results: Près de 2000 études ont été identifiées. Suite au processus de sélection, 15 articles, sur les enfants et les adultes, ont été retenus. La qualité de ces articles a été jugée comme faible à modérée. Une augmentation du volume extravasé semble liée au débit et au site d'injection. Une augmentation de la fréquence des extravasations a été constatée chez les patients de sexe féminin et les patients hospitalisés. Les dispositifs de détection précoce de l'extravasation apparaissent prometteurs pour diminuer le volume de PCI extravasé.

Conclusion: Cette revue recense les divers moyens connus visant à prévenir les extravasations. Même si les preuves sont faibles et ne permettent pas de définir des stratégies précises, notre étude encourage la vigilance des professionnels face au risque d'extravasation de PCI.

La fluoroscopie de positionnement : raisons de son utilisation par le TRM

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Purpose: L'utilisation de la fluoroscopie de positionnement en radiologie conventionnelle fait débat autant dans la littérature que dans les différentes recommandations professionnelles au niveau international.

L'objectif de cette recherche est de mettre en évidence les intentions et la pratique réelle des techniciens en radiologie médicale (TRM) de Suisse romande quant à l'utilisation de la fluoroscopie de positionnement.

Methods and Materials: Une dizaine d'établissements publics et privés de Suisse romande ont participé à l'enquête.

Les TRM qui le désiraient ont répondu à un questionnaire en ligne. Celui-ci répertorie les différentes incidences ainsi que les raisons qui incitent ou inciteraient le praticien à utiliser ou non cette assistance.

Results: Le taux de participation des TRM s'élève à 33%.

39% des répondants utilisent ou souhaiteraient utiliser la fluoroscopie de positionnement.

Elle est principalement utilisée dans les centres privés et majoritairement pour des incidences du rachis, du genou et de l'épaule.

Les raisons évoquées quant à son utilisation, sont des éléments tels que la radioprotection, la morphologie du patient, le degré de collaboration du patient, la présence de matériel chirurgical et la qualité de l'examen.

Dans les arguments des opposants, on retrouve la question de la radioprotection et en plus l'idée que les TRM sont suffisamment formés et compétents pour s'en affranchir.

Conclusion: On retrouve le même débat dans la pratique des TRM interrogés en suisse romande que dans la littérature internationale.

Ce travail démontre la nécessité de continuer à explorer ce sujet afin de disposer de suffisamment d'éléments pour que les différents organismes impliqués en radiologie puissent se positionner.

Tomosynthese-gesteuerte VAB

M.P. Miller; Zurich/CH

Purpose: Warum Tomosynthese, warum T-VAB?
VorteileTomosynthese:
- Aufnahmen der Brust in mehreren Winkelschritten
- löst Parenchymüberlagerungen auf
- zeigt versteckte Läsionen
- bildet Mikrokalk deutlicher ab
- Mit Tomo-C-View rekonstruierte 2D-MGR aus 3D-Bilddatensatz synthetisch errechnet
Vorteile T-VAB:
- zeitsparend
- platzsparend
- einfache Bedienung
- Biopsie von Läsionen, die nur mit Tomosynthese darstellbar
- Dosisersparnis
Durchführung
Lagerungsmöglichkeiten
Präoperative Drahtmarkierung tomosynthesegesteuert

Methods and Materials:
Durchführung
- mit Selenia - Dimensions von Hologic und Affirm-Einheit
- EVIVA-Nadelsets mit Needle-Guide
- Hydromarker für Clipkontrolle
- Mamma-Pad, zur besseren Fixierung der Brust
Tomo-Guided Biopsy
- Tomo-Scout für die Markierung der Läsion
- Prefire-Pair zur Nadel-Lagekontrolle vor Ausschiessen der Entnahmekammer
- Postfire-Pair zur Lokalisation Entnahmekammer-Mitte Läsion
- Entnahme der Proben mit Vakuumsauggerät
- Clipeinlage Hydromarker
- Post-Biopsy-Tomo-Scout für Lagekontrolle Clip, Restkalk
Lagerungsmöglichkeiten
mit speziellem Lagerungsstuhl von Acris 1.RLM, 2.LLM, 3. RCC, LCC, 4.RFB, LFB
Präoperative Drahtmarkierung, tomosynthesegesteuert
- spezielle Nadelführungsschiene für Markierungsdrähte
- Duo-R-System mit 2 Needle-Guides
- Selenia-Dimensions Hologic und Affirm-Einheit
- Mamma-Pad
Procedere ähnlich wie bei T-VAB:
- Tomo-Scout Übersicht für die Markierung von Kalk oder Clip
- Nadel einfädeln durch die 2 Needle-Guides
- wenn Koordianten x,y,z auf Null, dann Nadel vorschieben
- mit Postfire-pair Lagekontrolle, dann Draht vorschieben bis Widerhaken im Gewebe verankert
- Lagekontrolle draht mit Post-Biopsy-Tomo-Scout
- auf Wunsch noch MGR in cc und ml erstellen
- Draht gut fixieren auf der Haut und Verband anlegen

Results: Brust-Zentrum AG Zürich:
- Tomosynthese in der Routine-Diagnostik (von > 10 000 MGR/Jahr ca. 3000 Tomosynthesen)
- Über 400 T-VAB pro Jahr
- davon ca. 30% frühzeitig entdeckte DCIS
- keine Komplikationen während oder nach dem Eingriff
- Seitenlage beliebter als Bauchlage (Fischertisch)

Conclusion: Tomosynthese / T-VAB
- zeigt Architekturstörungen
- zeigt Abstand Ziel - Haut - Tiefe
- bessere Planung des Zugangsweges
- vereinfacht Biopsie in disseminierten Läsionen

Du corps transparent au travail du corps

C. Schnegg, S. Rey, J. Jorge; Lausanne/CH

Purpose: Du point de vue des sciences sociales, les techniques d'imagerie médicale sont dotées d'un fort pouvoir de visualisation et d'objectivation du corps. Dans cette perspective, l'activité de mise en images menée par les TRM disparaît presque complètement de l'attention des chercheurs. Notre présentation revient sur cette activité et thématise la présence et le travail du corps des patients qui est pensé comme un intermédiaire entre la machine et l'image.

Methods and Materials: Notre enquête ethnographique associe l'observation des pratiques des TRM dans trois services hospitaliers (radiodiagnostic, médecine nucléaire, radio-oncologie) et des entretiens avec l'ensemble des équipes TRM.

Results: La production d'images et le ciblage du traitement en radiooncologie sont dépendants d'un travail d'équipement du corps des patients qui lui permet de «se livrer». Nos données remettent en cause le mythe du «corps transparent» qui se donne à voir naturellement grâce aux techniques d'imagerie. Les corps ne se résument pas à de la matière inerte: ils sont vivants, plus ou moins malléables et parfois résistants. Ils sont aussi habités par des patients dont la présence et la collaboration varient selon l'examen et le dispositif technique.

Conclusion: L'opposition classique entre versants «technique» et «relationnel» de l'activité des TRM n'est pas opérationnelle pour étudier les pratiques concrètes. L'analyse du travail des corps ouvre de nouvelles perspectives de réflexion sur l'activité des TRM et le développement de leurs compétences.

TRM-Experts : un besoin et un défi pour la profession

F. Riondel; Geneva/CH

Purpose: La mise en place de fonctions reconnues de TRM-Experts est un nouveau défi pour la profession, visant à répondre aux besoins des services et permettant d'offrir aux TRM des plans de carrière attractifs.
Suite à l'enquête réalisée par le CCTRM (Collège-des-Chefs-TRM-de-Suisse-romande) il s'avère que seules deux fonctions à caractère obligatoire (TRM praticien-formateur; TRM spécialiste-en-mammographie-de-dépistage) conduisent actuellement à un statut reconnu de TRM-Expert, alors que de nombreux TRM exercent ce type de fonction dans divers autres domaines de la profession, généralement sans cahier des charges, formation structurée, ni reconnaissance salariale.
Face à ce constat, le service de radiologie des HUG met en place deux fonctions d'Expert en 2017. Il s'agit d'un TRM-Spécialiste-d'application-en-IRM et d'un TRM-Expert-en-gestion-de-données-dosimétriques.
Methods and Materials: Retour sur l'enquête concernant les TRM-Experts réalisée par le CCTRM.
Processus de mise en place des deux fonctions de TRM-Experts aux HUG. Evaluation et analyse des cahiers des charges.
Results: Reconnaissance institutionnelle de deux nouvelles fonctions de TRM-Experts au sein des HUG à travers les cahiers de charges officiels et une reconnaissance salariale. Développement au sein du CCTRM d'outils d'aide à la mise en place de nouvelles fonctions de TRM-Experts.
Conclusion: La mise en place de fonctions de TRM-Experts est un défi essentiel que la profession doit relever; elle répond aux besoins des services et des institutions et permet de développer de nouvelles compétences et responsabilités à confier légitimement aux TRM.

Méthode de formation innovante au service d'un système de radiologie adapté aux pays en développement

J. Marquis, E. Fleury, A. Naimi, B. Stoll; Geneva/CH

Purpose: L'imagerie médicale est un outil de diagnostic encore inaccessible aux deux tiers de la population mondiale. En cause, l'inadéquation entre la technologie existante et le contexte des pays en développement, mais également le manque chronique de formation pour l'utilisation des appareils et l'interprétation des images.
Le projet GlobalDiagnostiX vise à développer un système de radiologie adapté pour pallier notamment au manque de formation des utilisateurs locaux.
Methods and Materials: Ra&D du système: La filière TRM-HEdS apporte son expertise métier afin que celui-ci réponde aux besoins des utilisateurs et respecte les aspects ergonomiques et de sécurité.
Formation: Des tutoriels intégrés au système (didacticiels, nouveau manuel de positionnement basé sur les prescriptions de l'OMS) renforceront la formation des utilisateurs notamment en positionnement radiologique et radioprotection. Un programme de formation continue initié par EssentialMed et l'Université de Genève offrira avec la filière TRM-HEdS des modules axés sur la pratique utilisant notamment la simulation. Un transfert de compétences supportera l'indépendance des formateurs locaux.
Results: Un premier prototype du système a été présenté en 2015 à l'EPFL, un second est visé pour 2018.
Des missions se sont déroulées au Cameroun pour tester un prototype d'interface informatique et récolter les besoins et attentes des prescripteurs d'imagerie. Les missions suivantes viseront à tester et valider des modules pédagogiques.
Conclusion: La filière TRM-HEdS contribue au développement d'un système de radiologie destiné aux pays en développement et participe à la formation d'utilisateurs locaux en travaillant sur des stratégies pédagogiques avec des supports innovants et des modules de formation axés sur les besoins du terrain.

Promouvoir la profession de Technicien en Radiologie Médicale (TRM) : organisation associative de portes ouvertes sur la profession dans toute la Romandie

P. Vorlet[1], K. Decitre[2]; [1]Savigny/CH, [2]Lausanne/CH

Purpose: La section romande de l'ASTRM constatant les points suivants décide d'organiser des portes ouvertes simultanées dans toute la Romandie. manque de reconnaissance du monde de la santé et du public pour la profession TRM, et ignorance de l'existence de la profession TRM. répondre aux objectifs stratégiques de la section romande: valoriser la profession auprès des professionnels de la santé et améliorer la communication auprès de la population. renforcer l'identité et la fierté des TRM
Methods and Materials: création d'un comité de pilotage (COPIL) ressources: secrétaire, experts en communication, audiovisuel et réseaux sociaux, graphiste. création documents promotionnels/gestion de projet, budget recherche d'instituts radiologiques partenaires recherche de sponsors gestion de 10 sites partenaires sur 1 année promotion vidéos, radio, télé-journal, journaux
Results: investissement incroyable des institutions partenaires, chefs TRM et TRM. 1700 visiteurs sur la Romandie plusieur dizianes de miliers de personnes atteintes par la promotion grande visibilité des sponsors fierté des TRM connaissance et reconnaissance de la profession améliorée
Conclusion: L'association a démontré qu'elle pouvait rassemblé institutions, TRM, et commerciaux autour du même cause, et qu'ensemble organiser des événements de grande envergure et atteindre des objectifs ambitieux est possible et nécessaire à la profession TRM.

Strahlenschutz-Compliance: Das Luzerner Modell

M. Heinrich; Lucerne/CH

Purpose: Das Luzerner Kantonsspital (LUKS) ist ein Zentrumsspital, das an vier Standorten über sechstausend Mitarbeiter beschäftigt. Bei mehr als eintausend beruflich strahlenexponierten Mitarbeitern ist es eine Herausforderung eine Strahlenschutz-Organisation zu implementieren, die sowohl einer übergeordneten Strategie folgt wie auch im Berufsalltag in den verschiedenen Kliniken greift und die die Einhaltung von Verhaltensregeln, Gesetzen und Richtlinien im Sinne der Compliance für Mitarbeiter wie auch für Patienten sicherstellt.
Methods and Materials: Der Strahlenschutz ist immer wieder ein Spannungsfeld, das Aufmerksamkeit und Engagement verdient und erfordert. Dies ist gerade in nicht-radiologischen Bereichen nicht immer einfach zu erreichen, und deshalb hat das LUKS einen innovativen und weitsichtigen Weg eingeschlagen, in dem 2012 die Stelle der Leitung Strahlenschutz geschaffen wurde. Durch Ansiedlung dieser Stelle im Risiko-und Qualitätsmanagement wird sichergestellt, dass die Leitung im Stab Medizin übergeordnet im Sinne einer klinikunabhängigen Position und fachspezifischen Vertretung für das Gesamtspital platziert wurde.
Results: In den vergangenen Jahren wurde eine lebendige und dem Betrieb angepasste Strahlenschutz-Organisation geschaffen, die Compliance als strategische Aufgabe und Teil der Unternehmenskultur versteht. In dieser Präsentation soll der Weg aufgezeigt werden, den das LUKS eingeschlagen hat, um die gesetzlichen und betriebsspezifischen Anforderungen gerecht zu werden.In jeder Klinik, in der mit ionisierender Strahlung gearbeitet wird, ist ein Sachverständiger Strahlenschutz ernannt, der die Umsetzung der Strahlenschutzverordnung sowie den internen Leitlinien Strahlenschutz beaufsichtigt und als Schnittstelle zwischen beruflich strahlenexponierten Mitarbeitern und der Leitung Strahlenschutz dient.
Conclusion: Der Aufbau einer prozessoptimierten Organisation ist integral für die Sicherstellung einer innovativen Strahlenschutz-Kultur, die auch für die Herausforderungen der Zukunft bereit ist.

Le coordinateur du Réseau de Veille Métier TRM, un salarié au service du développement de la profession TRM

P. Vorlet[1], X. Realini[2], K.M. Ducrot[3]; [1]Savigny/CH, [2]Lausanne/CH, [3]Prilly/CH

Purpose: Le Réseau de Veille Métier(RVM) TRM identifie les tendances d'évolution du métier de TRM, analyse les impacts de ces tendances sur le métier, et fournit des bases de décisions relatives à la politique professionnelle, au management du métier et à la formation.
Fort des recommandations du projet pilote, et dans un contexte de pérennisation et de développement de ce réseau, le comité de pilotage du RVM a mis au concours un TRM coordinateur.
Le TRM coordinateur devient ainsi le 1ère salarié de la section romande avec un taux d'activité fixe. Poste dédié à faire vivre et animer le RVM TRM et à gérer les projets de développement de la profession.
Methods and Materials: définir les carences du projet pilote définir les besoins pour pérenniser le RVM créer le profil/rôles du TRM coordinateur mettre au concours le poste et entretien d'embauche déterminer le choix du coordinateur
Results: Le TRM coordinateur: est le communicateur/le facilitateur entre le comité de pilotage, les parties prenantes, les experts et observateurs externes. organise/gère les groupes de travail suite aux recommandations projet pilote du RVM TRM. met à jour les sources humaines et électroniques d'informations du RVM TRM et participe aux cycles de veille métier TRM. organise des projets de politiques professionnels de la section romande.
Conclusion: Le coordinateur du RVM est un nouveau débouché professionnel pour les TRM, qui allie qualités de gestionnaire administratif/de projet, de communicateur, d'animateur et de marketing.
La section romande de l'ASTRM démontre qu'elle veut être un acteur du TRM de demain, et de ses compétences futures.

Compte rendu synthétique d'une observation ethnographique dans un service de scanner

M. Progin Liatti, E. González Matínez; Fribourg/CH

Purpose: Le présent compte-rendu fait état d'une recherche ethnographique ayant pour but de comprendre comment les techniciens en radiologie remplissent leur double mandat, de producteurs d'image d'une part, et de soignant d'autre part – compte tenu des aspects relationnels que ce dernier sous-tend.
Methods and Materials: Menée dans un service de radiologie, la recherche s'est déroulée à travers 160 heures d'observation directe auprès d'une équipe de techniciens/ennes en radiologie médicale, pour moitié dans un service de scanner. Les observations ont porté sur : la durée des interactions, leur type, la répartition des tours de paroles entre techniciens et patients, les différences d'interactions entre techniciens et techniciennes, le partage des espaces, et le découpage du temps au cours de l'examen.
Results: Les observations réalisées ont pu mettre en évidence des compétences masquées, peu reconnues et/ou peu formalisées (parfois, par les techniciens eux-mêmes), alors qu'elles sont prépondérantes dans la qualité de la prise en charge du patient.
Conclusion: Cette recherche a permis de mettre en lumière les compétences spécifiques – relationnelles aussi bien qu'opérationnelles – qui permettent aux techniciens d'assurer la relation au patient aussi bien que la production des images.

PO69

Withdrawn

PO70

Hygiène en imagerie médicale ; jeu des sept erreurs

H. Risacher; Vevey/CH

Learning Objectives: Les bonnes pratiques d'hygiène en radiologie sont d'une haute importance car il s'agit d'un service-carrefour où transitent des patients de différentes origines, hospitalisés comme externes, présentant des caractéristiques pathologiques diverses et variées.

les TRM ont pour devoir de respecter les précautions standard et spécifiques afin de tendre vers un risque zéro d'infection nosocomiale.

Les principaux dysfonctionnements récurrents dans ce domaine vont être présentés dans un poster "jeu des sept erreurs" sous formes de vignettes photos afin de rendre le public observateur et acteur

Background:

vignette 1/ bijoux présents aux mains et poignets

vignette 2/ tenue stérile mais cheveux dépassant de la charlotte et masque chirurgical en bandoulière sous le menton

vignette 3/ sondes d'échographie souillées rangées dans le porte sonde

vignette 4/ mixité de tenue de travail et tenue de ville

vignette 5/ pose d'un catheter veineux sans gants

vignette 6/ planning de rendez vous en radiologie avec en début patients infactés et en fin patients immuno déprimés

vignette 7/ embout distal de la tubulure de la seringue automatique qui traîne au sol

les réponses figureront au bas du poster.

Imaging Findings or Procedure Details: les vignettes photos mettront en scène mes propres collègues de l'hôpital RIVIERA CHABLAIS selon les scénarios explicités ci dessus.

Conclusion: L'objectif de ce poster est d'inviter le lecteur à une réflexion sur ses propres pratiques, éventuellement non conformes!

PO71

Biopsy MRI prostata

B. Leffe, S. Granchelli, D. Flagner, C. Colonneau, S. Ropraz, J. Saliji, M. Martins Favre; Geneva/CH

Purpose: We 'd like to describe the process to do a MRI biopsy prostate :

Methods and Materials:

- the patient selection
- to realise this exam
- to use the software Dynacad

Results: we have a good results with the technical

Conclusion: Biopsy MRI prostata is a technique of future

PO72

Transient global amnesia: hippocampal magnetic resonance imaging abnormalities: case reports and review of literature

R. Marasco, B. Pedrazzini, J. Heinkel, R. Monotti; Locarno/CH

Purpose: Transient global amnesia (TGA) is an episodic dysfunction of declarative memory that usually resolves withi 12 hours and whose underlying pathophysiolog mechanisms are still unclear.

Recent studies, on the basis of transient focal high-signal abnormalities in the hippocampus on diffusionweighted imaging (DWI), suggest involvement of memory circuits in the temporo-mesial region.

Methods and Materials: A 66-year-old right-handed woman experienced a sudden anterograde and retrograde short-term memory deficit that recovered on the next day.

Magnetic resonance imaging (MRI) showed a spotty high-intensity lesion in the right hippocampo in the diffusion-weighted and fluid-attenuated inversion recovery images.

We reviewd the literature on Pubmed from the first paper until 2016

Results: Transient global amnesia is characterized by a sudden onset of anterograde amnesia that disappears within 24 hours. The cause of transient global amnesia is still uncertain. Some studies with MRI showed small lesions in the hippocampus at 24-74 hours after the episode.

Hippocampal lesion suggests that TGA could have a multifactorial.

The presence of local susceptibility to neuronal metabolic stress emerges as a likely hypothesis

Conclusion: Transient global amnesia is characterized by a sudden onset of anterograde amnesia that disappears within 24 hours. The cause of transient global amnesia is still uncertain. Some studies with MRI showed small lesions in the hippocampus at 24-74 hours after the episode.

Hippocampal lesion suggests that TGA could have a multifactorial.

The presence of local susceptibility to neuronal metabolic stress emerges as a likely hypothesis

**Essential items for structured reporting of rectal cancer MRI:
2016 consensus from the Korean Society of Abdominal Radiology (KSAR)
Study Group for rectal cancer**
YoungSeo Cho

**Quantitative assessment of breast tumor vascularity using
Superb Micro-vascular Imaging (SMI) and Contrast-enhanced Ultrasound
(CEUS)**
Ah Young Park

**Imaging of neurologic conditions during pregnancy and the postpartum
period**
Yeon Su An

Comprehensive review of pediatric and adolescent breast lesions
Yubin Lee

Adnexal torsion – untwisted
Aruna Patil

**High resolution hand MRI: what should you look for in trauma of the
fingers?**
Jiwon Rim