ONLINE ABSTRACT BOOK

SCR'22

JUNE 23–25, 2022 | FORUM FRIBOURG

THE SWISS MEETING FOR MEDICAL IMAGING SPECIALISTS
DIAGNOSIS AND TREATMENT

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The Swiss Society of Radiology (SGR-SSR) is delighted about the high quality 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.

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SS101

Prevalence and time regression hypotesis of axillary lymphadenopathy (AL) in women undergoing a breast imaging examination at different time intervals after COVID-19 vaccination

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Purpose: To evaluate the prevalence of AL in patients for breast imaging examination at different time intervals after COVID-19 vaccination.
Methods and Materials: In this IRB approved study women undergoing breast imaging from July to Semptember 2021 for any indication were enrolled prospectively. Exclusion criteria was a known metastatic lymphadenopathy. COVID-19 vaccination status, timing and side of vaccination were recorded. AL was considered positive with one or more of the following features in at least one lymphnode ipsilateral to the vaccinated arm: diffuse cortical thickening >3 mm; eccentric cortical thickening; rounded hypoechoic node; complete/partial effacement of fatty hilum; short axis >1 cm; long axis >2 cm. Participants were divided in subgroups based on the following time intervals after COVID-19 vaccination: (a)<6weeks; (b)7-8 weeks; (c)9-10 weeks; (d)11-12 weeks and (e) >12weeks. Descriptive statistics and Chi-Square test with post-hoc comparison were performed to compare proportions. A p-value <0.05 indicated statistical significance.
Results: A total of 162 consecutive women (median age, 56 years; range 23-84 years) were included with the following number of cases at different time interval after vaccination (a) 34(21%); (b) 25(15.4%); (c) 31(19.1%); (d) 24(14.9%) (e) 48(29.6%). 44 women in total (27.2%) presented AL with: (a)19/44 (43.2%); (b)10/44(22.7%); (c)9/44 (20.4%); (d)4/44 (9%); (e)2/44 (4.5%). The differences were only significant for the time interval a and e (p-value (p<0.0001). The most common observed pathologic features were a diffuse or eccentric cortical thickening (41/44; 93.1%).
Conclusion: After COVID-19 vaccination AL has the highest prevalence in the first 6 weeks whereas after 12 weeks it is only rarely observed. As literature suggested, 6 weeks after vaccination AL should be regressed, so we advise to perform breast imaging in asyntomatic patients at least 6 weeks after the possible next vaccination.

SS102

Diagnostic and predictive value of cardiophrenic lymph nodes on preoperative CT in ovarian cancer patients.

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Purpose: To compare the FIGO stages, treatment choice and clinical outcomes of ovarian cancer (OC) patients with the number and size of cardiophrenic lymph nodes (CPLNs) detected on CT.
Methods and Materials: Retrospective single centre study of a university hospital: Of 188 patients with histopathological confirmed ovarian cancer, identified in the period from 2005 to 2017, 100 patients with given written general consent were included. Chest-abdominal-pelvis CT-Scans in venous phase are reviewed for number, size and three locations of CPLNs and compared with the clinically given FIGO state and selected treatment (neoadjuvant chemotherapy NACT/primary debulking surgery PDS). Under investigation is also the detection and reporting manner of the CPLNs on CT. The overall survival of the patients is still under investigation. For the statistical analysis, STATA/IC 12.1 and Excel 2016 are used.
Results: The majority of the patients (87%) were diagnosed in advanced stages FIGO III/IV. Of the patients, 40% (40/100) underwent PDS, 18% (18/100) / 33% (33/100) were treated with NACT and adjuvant chemotherapy respectively. In 13% (13/100), the treatments were considered as palliative. The number of detected CPLNs/patient varied between 0-12, the largest one showing the short axis of 23 mm. In radiology reports, CPLNs were not mentioned in over 50% of the cases. The data analysis as mentioned in materials and methods, inclusive the results of overall survival, will be closed.
Conclusion: The meaning of CPLNs on CT in OC patients are obviously underestimated and could play an important role in the accurate staging and treatment choice.

SS103

Computed Tomography based body composition in patients with ovarian cancer: association with chemotoxicity and prognosis.

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Purpose: To assess the association between computed tomography (CT) derived quantitative measures of body composition and chemotherapy-related complications, in terms of dose reduction, premature discontinuation of chemotherapy and cycle delays in patients with ovarian cancer.
Secondary purposes were to evaluate associations between sarcopenia and survival, and differences in body composition at baseline and after neo-adjuvant chemotherapy (NACT).
Methods and Materials: The study population was retrospectively selected from a database of patients with newly diagnosed ovarian cancer between 02.2011 and 03.2020. Clinical data were recorded, and CT images at the level of the 3rd lumbar vertebra were stored. By using specific software, skeletal muscle area (SMA), subcutaneous adipose tissue (SAT), visceral adipose tissue (VAT), and skeletal muscle density (SMD) were extracted. Skeletal muscle index (SMI) was calculated. Statistical analysis was performed by logistic regression models to identify body composition features predictive of dose reduction, premature end of chemotherapy and cycle delays. The log-rank test was used to determine differences in OS and PFS between sarcopenic and nonsarcopenic patients. Wilcoxon test was performed to compare body composition features before and after NACT.
Results: 69 pts were included. A significant association (p<0.05) was found between VAT and cycle delays, between SMA and early discontinuation of chemotherapy, and between mean SMD and cycle delays. No significant difference emerged for OS in sarcopenic and non-sarcopenic patients, nor in CT body composition features before and after NACT.
Conclusion: In ovarian cancer patients, CT-derived body composition profiling might predict the risk of chemotoxicity. In particular, VAT and SMD are associated with chemotherapy cycle delays, and SMA with early discontinuation of chemotherapy.

SS104

Automatic classification of post-operative clips in mammography using a U-Net convolutional neural network

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Purpose: As a result of the technical development in mammography screening the use of computer aided detection (CADe) and diagnosis (CADx) becomes more and more prevalent. While these systems can be a reliable tool for finding tumors, the discrimination between post-operative/post-biopsy clips and malign architecture disturbances, specifically microcalcifications can be very challenging.
Methods and Materials: Post-operative clips were manually annotated on conventional 2D Mammographies, as well as on reconstructed 2D Tomosythesis images. Based on the acquired cartesian image coordinates each annotated post-operative clip was auto segmented using a growing region algorithm. Mammographic images as well as the previously acquired segmented object maps were forwarded to a U-Net type architecture consisting of 4 encoded layers, bottleneck, 4 decoder layers and 4 skip-connections. With a total training set of 550 and validation set of 57 images the convolutional U -Net was trained for 120. The real-world test data set, previously excluded from the training and validation phase consisted of 35 images.
Results: In the test dataset we analyzed 35 images with a total number of 93 clips. Of these clips 88,2% were correctly identified while 11,8% were not found by the algorithm.
Conclusion: With this study, we show that post-operative/post-biopsy clips can be adequately identified by an explainable AI. In future this algorithm can perform as a user independent classification tool and automatically exclude cases from PGMI evaluation, thus accelerating the workflow.

Applied Machine Learning in spiral Breast CT: Can we train a deep Convolutional Neural Network for automatic, standardized and observer independent Classification of Breast Density?

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Purpose: The aim of this study was to investigate the potential of a machine learning algorithm to accurately classify parenchymal density in spiral breast CT (BCT) in a four-category classification system using a deep convolutional neural network (dCNN). Categories were based on the appearance of the parenchyma analogous to the American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS) atlas.

Methods and Materials: In this retrospectively designed study, 634 examinations of 317 patients were included. After image selection and preparation 5589 images from 634 different BCT examinations were sorted into a four-category system ranging from A to D using ACR BI-RADS like criteria. Four different dCNN models (differences in optimizer and spatial resolution) were trained (70% of data), validated (20%) and tested on a "real-world" dataset (10%). Moreover, dCNN accuracy was compared to a human readout by calculation of intraclass correlation and kappa values.

Results: The overall performance of the model with lowest resolution of input data was highest reaching an accuracy on the "real-world" dataset of 85.8%. The intra-class correlation of the dCNN and the two readers was almost perfect (0.92) and kappa values between both readers and the dCNN were substantial (0.71-0.76). Moreover, the inter-reader reliability between both readers for classification in either low (A/B) or high (C/D) density, regarding the requirement for additional ultrasound examination, was almost perfect (kappa 0.80) and the diagnostic performance between the readers and the dCNN showed very good correspondence with an AUC of 0.89.

Conclusion: Artificial Intelligence in the form of a dCNN can be used for standardized, observer independent and reliable classification of parenchymal density in a BCT examination.

Radiomics in Spiral Breast CT: Can we use Texture Analysis in the Classification of Breast Density?

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Purpose: The purpose of our study was to investigate whether features derived from texture analysis (TA) can distinguish parenchymal density in spiral breast computed tomography (BCT).

Methods and Materials: In this retrospective single-center study we analyzed 10000 images of 400 BCT-examinations of 200 patients receiving BCT in our institution. Images were categorized by visual impression using a four-level density scale (A-D) based on ACR BI-RADS like criteria. After manual definition of representative regions of interest (ROIs), 19 texture features (TF) were calculated to analyze the signal intensities in the included image area. Data was statistically evaluated using ANOVA and cluster analysis.

Results: Of the 19 features, four first order features and seven second order features showed significant correlations to the parenchymal density and were therefore selected for further analysis.
The majority of features systematically increased or decreased with denser breast tissue. skewness (-0.81), as a first order feature, as well as grey-level nonuniformity (GLN, -0.59), as a second order feature, showed the strongest correlation with breast density (BD). Mean values of skewness, and GLN decreased linearly from density-level A to D. Moreover, these features appeared to be independent of the other texture features and might serve as independent features in the distinguishment of breast-CT density (BCTD). Run-length nonuniformity (RLN), as a second order feature, also showed moderate correlation with BD, but was considered redundant because of its correlation with GLN and other TF. All other TF evaluated showed only weak correlation with BD (range -0.49 to 0.49) and were therefore neglected.

Conclusion: Texture analysis in BCT examinations might be a useful approach in the assessment of parenchymal density and may serve as an observer-independent, objective tool. TA might also be used in the breast cancer risk assessment by reflecting biological differences in fibroglandular tissue more properly.

A breast population study using 3-D breast CT images

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Purpose: The purpose of the study was to investigate the breast density changes in women according to the age.

Methods and Materials: 1,124 spiral breast CT examinations from 35-80 years old women (57±10 in average) acquired from August 2018 to December 2019 were evaluated in this study. The glandular distribution and breast density were analyzed in nine age groups with 5-year intervals from 35 to 80. The breast CT scans were segmented into adipose and glandular tissue, skin, and the nipple applying a dedicated breast segmentation method developed in the institute. The breasts were divided into four sectors – outer upper, inner upper, outer lower, and inner lower - based on the nipple location. The glandular distribution and density in each sector were compared.

Results: The volume of glandular tissue in every sector of the breast decreased with increasing patient age. The overall volume of the breast did not show a significant correlation to the age. The breast density decreased with age.

Conclusion: With increasing age, the breast glandular tissue homogeneously reduces and the breast density consecutively declines, which implies decreasing breast cancer risk with increasing age.

SS108

Comprehensive comparison of high b-values generated from improved DWI sequences in breast MRI

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Purpose: A prospective study to compare two innovative diffusion weighted imaging (DWI) sequences in breast MRI with regard to image quality, intracorporal noise, distortions, preferred calculated/measured high b-value and global sequence preference.

Methods and Materials: After a positive vote of the ethics committee, patients who were registered at our institute for a 1.5T MRI of the breast were filtered according to the inclusion criteria and included in the study after informed consent. The aim was to include patients who received a pre-therapeutic assessment in case of suspected tumors. Exclusion criteria were:
- Implants.
- Previous surgery.
- Refusal
- Incomplete data

Over a 10-month period, 40 patients were included. In addition to our clinically established standard sequence (ss-epi, b-values b50, b800) two non-product sequences were applied and extrapolated high b-values (e-b1500; e-b2000; e-b2500) derived:
- advanced ZOOMit (b50; b800)
- ss-epi-b1500 (b50; b800; b1500, using IR not SPAIR fat suppression)

Three readers rated the high b-values extrapolated from ss-epi and the non-product sequences as well as the measured b1500 (ss-epi-b1500) independently according to Likert scales (1 = nondiagnostic;...; 5 = perfect) regarding the following criteria:
- preferred sequence
- preferred b-value
- malignant lesion
- lesion detection
- lesion to background
- noise breast
- artefacts

Results: ZOOMit was the most preferred sequence (54%) followed by ss-epi-b1500 (46%). Significant differences between the preferred b-values were obtained (p<0.001). Overall, the raters preferred eb1500 (55%) followed by e-b2000 (44%). e-b2500 was only preferred in 1% of the cases. There is also a significant difference between the most preferred e-b1500 and the second preferred e-b2000 (p=0.017). The most preferred combination is the sequence ZOOMit with e-b1500.

Conclusion: The new sequences lead to improvements in image quality compared to the standard DWI. The technical improvements could increase the value of DWI in breast imaging.

SS109

Evaluation of the novel guided reporting strategy: Quality and time of radiology report creation in MR mammography using a dedicated software.

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Purpose: Unstructured free-text dictation (FT), the current standard in reporting on radiology examinations, is considered being too time-consuming and error prone. To assess usability and performance of a software-based guided reporting strategy (RadioReport pre-marketed v0.8, NeoQ, Germany) in MR mammography.

Methods and Materials: Eighty examinations evaluated previously (>8 weeks) with FT including mass, focus/non-mass enhancement, normal findings were reevaluated using guided reporting (GR) by three specialized radiologists. Usability was assessed by subjective feed-back, quality by comparing automatically generated GR to FT for completeness. Errors in GR were categorized and analyzed for debugging in marketed v1.3. Reporting time and learning curves were analyzed.

Results: Usability was rated high by all readers. No nonsense, omission/commission, and translational error were detected in GR. Spelling/grammar error were observed in GR in 3/80 patients (3.8%), exclusively in the free-text discussion section, and 36/80 in FT (45%). Content differences between FT and GR revealed no difference in 41 patients, minor difference (33 patients), major difference resulting in treatment change (6 patients). All patients with differences were categorized content omission error in v0.8, caused by insufficient software operation or error by missing contents in v0.8 but displayable with v1.3. Mean reporting time was 576 seconds (SD 327; minimum 155; maximum 1517 seconds). Mean times per reader were 485, 557, 754 seconds. Mean reported time for FT of MRI examinations was 1059 seconds and decreased by 42.3% using GR.

Conclusion: Overall time for GR was significantly shorter compared to references from FT process. Guided reporting allows complete reporting while minimizing error rate and significantly reducing time.

Detailed bone assessment of the sacroiliac joint in a prospective imaging study: Comparison between computed tomography (CT), zero time-to-echo (ZTE) and black bone (BB) magnetic resonance imaging (MRI)

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Purpose: To compare the value of zero time-to-echo (ZTE) and gradient echo "black bone" (BB) MR sequences for bone assessment of the sacroiliac joint (SI) using computed tomography (CT) as the reference standard.

Methods and Materials: This prospective study included patients between May 2019 and January 2021 that were referred to clinically indicated MRI scans using a 3-Tesla MRI with additional ZTE and BB sequences. The presence of a CT scan of the abdomen or pelvis within 12 months of the MRI was an inclusion criterion and served as the reference standard for the assessment of the SI joint. Two blinded readers with 8 and 9 years of experience in musculoskeletal imaging assessed seven different features of the SI joint (osteophytes, subchondral sclerosis, erosions, ankylosis, joint irregularity, joint widening, and gas in the SI joint) using a 4-point Likert scale for each feature and each side. Cohen k was used to evaluate inter-reader agreement. Differences in qualitative scores between the imaging modalities were assessed with Friedman tests and post-hoc sign tests. Krippendorff's alpha coefficients were used to quantify the agreement between qualitative scores of all imaging modalities. Qualitative scores were binarized to compute diagnostic accuracy parameters for the two MRI sequences relative to CT.

Results: Inter-reader agreement was largely good (k values: 0.5-0.83) except for the metric air in the SI joint, ZTE and BB showed similar performances of bone assessment of the SI joint relative to CT with an intermodality agreement being substantial to almost perfect. For the metric air in SI joint, ZTE exhibited significantly lower scores than both BB and CT (both p<0.001), while there were no significant differences between BB and CT (p=0.1).

Conclusion: Overall performance of the detailed bone assessment of the SI joint using ZTE and BB sequences was comparable to CT with the exception of gas using ZTE.

3D zero-echo time and 3D T1 gradient-echo MRI sequences for evaluation of the lumbar facet joints and lumbosacral transitional vertebrae – a prospective study using CT as reference standard.

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Purpose: To assess diagnostic performance and clinical applicability of 3D zero-echo time (3D-ZTE) and 3D T1 gradient echo (3D-T1GRE) MRI sequences for evaluation of lumbar facet joints (LFJ) and detection of lumbosacral transitional vertebrae (LSTV) using CT as reference standard.

Methods and Materials: Adult patients with CT of the abdomen with tri-plane bone reconstructions of the lumbar spine performed between 2017 - 2019 were included and additional MRI scanning of the lumbar spine with 3D-ZTE and 3D-T1GRE sequences was prospectively performed. Evaluation of degenerative changes of the facet joints at the level of L3/L4, L4/L5, and L5/S1 was performed by two independent readers using a 4-point Likert scale (0: no, 1: mild, 2: moderate, 3: severe degenerative changes). LSTV were classified according to Castelvi et al. Intra-reader, inter-reader and intermodality reliability were calculated using Cohen`s kappa statistic. Image quality was quantitatively measured using the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). An institutional review board was provided.

Results: 87 patients were included. Intra-reader agreement for 3D-ZTE, 3D-T1GRE and CT was 0.607, 0.751 and 0.856 and inter-reader agreement 0.535, 0.563 and 0.599, respectively. The intermodality agreement between 3D-ZTE and CT was 0.631 and between 3D-T1GRE and CT 0.665. 17 LSTV were identified in both MR sequences with overall comparable accuracy compared to CT. Mean SNR for bone, muscle, and fat was highest for 3D-T1GRE, and mean CNR was highest for CT.

Conclusion: 3D-ZTE and 3D-T1GRE MRI sequences are reliable methods for evaluation of the LFJ and LSTV and may serve as potential alternatives to CT in clinical routine.

Quantitative [23]Na-MRI of the intervertebral disk at 3T

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Purpose: Monitoring the tissue sodium content (TSC) in the intervertebral disk geometry noninvasively by MRI is sensitive measure to estimate the changes in the proteoglycan content of the intervertebral disk which is a biomarker of degenerative disk disease (DDD) and of lumbar back pain (LBP). However, application of quantitative sodium concentration measurements in [23]Na-MRI is highly challenging due to the lower in vivo concentrations and smaller gyromagnetic ratio ultimately yielding much smaller signal relative to [1]H-MRI. Moreover, imaging the intervertebral disk geometry places higher demands mainly because the necessary RF volume coils produces highly inhomogeneous transmit field patterns. For an accurate absolute quantification of TSC in the intervertebral disks, the $B1$ field variations have to be mitigated. In this study, we reported for the first time quantitative sodium concentration in the intervertebral disks at clinical field strengths (3T) by deploying [23]Na-MRI in healthy human subjects.

Methods and Materials: Five healthy volunteers were scanned on a 3T whole-body MRI scanner. The sodium $B1$ maps were calculated by using double-angle method and a double-tuned (^{1}H/[23]Na) transceive chest coil and the individual effects of the variation in the $B1$ field patterns in tissue sodium quantification were calculated..

Results: Depending on the disk position, the sodium concentration was calculated as 161.6 mmol/L to 347 mmol/L and the mean sodium concentration of the intervertebral disks varies between 254.6±54mmol/L to 290.1±39mmol/L. The smoothing effect of the $B1$ correction on the sodium concentration maps was observed such that the standard deviation of the mean sodium concentration was significantly reduced with $B1$ mitigation.

Conclusion: The results of this work provides an improved integration of quantitative [23]Na-MRI into the clinical studies in intervertebral disks such as degenerative disk disease and establishing alternative scoring schemes to existing morphological scoring such as Pfirrmann score.

SS113

Can Gadolinium Contrast Agents be Replaced with Saline for direct MR arthrography of the hip? A Retrospective Study with Arthroscopic Comparison

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Purpose: Although severe adverse events related to intra-articular injection of gadolinium-based contrast agents for direct MR arthrography (MRA) are extremely rare, use of a saline solution could bypass patient concerns and reduce costs. Thus, we compared image quality and diagnostic performance of direct MRA of the hip performed with gadolinium contrast agent and saline solution in patients undergoing hip arthroscopy.

Methods and Materials: IRB-approved retrospective study of 140 patients (mean age 34 years, 22% females) with hip pain due to femoroacetabular impingement. 70 patients who either underwent intraarticular injection of 15-20 ml gadopentetate dimeglumine 2.0 mmol/l ("Gd-MRA" group) or 0.9% NaCl solution ("saline-MRA" group) for preoperative hip MRA and subsequent hip arthroscopy were age and gender matched. 1.5 T MRI was performed using multiplanar non-fs PD-w TSE sequences including standardized application of leg traction (application of 15-23 kg, supporting plate for the contralateral leg) for both groups. One reader assessed image quality (labrum, femoral/acetabular cartilage, capsule) using a 5-point Likert scale (1 to 5, excellent-poor), labrum damage and femoroacetabular cartilage lesions. Arthroscopic diagnosis of chondro-labral damage served as reference. Likert scale and diagnostic performance (sensitivity/specificity) were compared between groups.

Results: Image quality was excellent (Gd-MRA mean range, 1.1-1.3 points vs 1.0-1.2 points for Saline-MRA) and comparable between groups (all p>0.05). Sensitivity/specificity was comparable between groups (all p>0.05) for labrum-(Gd-MRA 100%/25% versus saline-MRA 100%/25%), acetabular cartilage-(Gd-MRA 86%/80% versus saline-MRA 89%/85%) and femoral cartilage lesions (Gd-MRA 100%/91% versus saline-MRA 71%/ 94%).

Conclusion: Image quality and diagnostic accuracy of saline-MRA in assessing chondro-labral lesions was high and comparable to gadolinium-based MRA underlining the potential role of nongadolinium based hip MRA.

SS114

Deep Learning for Automatic Bone Segmentation of the Pelvis using MRI with T1 VIBE DIXON for FAI Patients

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Purpose: Femoro-acetabular Impingement(FAI) can cause hip pain and osteoarthritis(OA) in young patients of childbearing age.
Manual segmentation of MRI-based 3D-models is time-consuming, therefore automatic segmentation using deep learning was investigated. We aimed to investigate (1)the difference between manual and automatic MRI-based 3D-models of the pelvis and (2)correlate hip range of motion(ROM) and location of hip impingement.

Methods and Materials: An IRB-approved controlled retrospective study involving 30 symptomatic FAI patients (60 hips) and 19 asymptomatic volunteers (38 hips) was performed. All patients and volunteers underwent pelvic CT scans and 3 Tesla MRI of the hip(49 hips) including T1 VIBE DIXON of the pelvis. Mean age of the patients was 27±9 years and 50% underwent surgical treatment. Automatic segmentation of MRI-based 3D-models using machine learning was compared to manual(semiautomatic) segmentation. For automatic segmentation, convolutional neural network (deep learning) was used and 5-fold cross validation was performed. Dice coefficient was calculated for 98 hips using manual and automatic MRI-based 3D-models. Impingement-free ROM was compared between CT- and automatic MRI-based 3D models.

Results: (1)Dice coefficient of 30 FAI patients was 94% for the pelvis and 97% for the proximal femur. Dice coefficient of 19 volunteers was 93% for the pelvis and 96% for the proximal femur. (2)Correlation for Impingement-free flexion (r=0.93, p<0.001) and extension (r=0.99, p<0.001) was excellent for FAI patients. Mean difference for flexion and internal rotation in 90° of flexion was 3±4° and 3±4°.

Conclusion: Automatic MRI-based 3D-models can replace manual segmentation for patients with FAI. Based on these results, this enables the use of automatic MR-based 3D-models for future clinical routine.

SS115

Deep Learning Based Fully Automated 3D Models of Hip Labrum based on MR Arthrography are Feasible and Allow Detection of Differences in Labrum Volume among Different Hip deformities: A Pilot Study

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Purpose: To (1) develop and validate a deep learning approach for fully automatic labrum segmentation based on MR arthrography of the hip against manual segmentation; (2) compare labrum volume among different hip deformities.

Methods and Materials: Sixty patients (mean age 31±7 years, 67% female) with femoroacetabular impingement (FAI) and hip dysplasia (DDH) were included. All patients underwent direct 3T MR arthrography including high-resolution 3D T1-w MP2RAGE (0.5 x 0.5 x 1 mm). Patients were assigned to three subgroups based on acetabular coverage measured with lateral center edge angles (LCE): DDH (LCE<25°, n=20), cam deformity with normal acetabular coverage (LCE 25-39°, n=18) and pincer deformity (LCE>39°, n=22). Manual segmentations of labrum served as training data for the neural network (3D U-Net) to obtain an automated 3D labrum model. A 5-fold cross validation was performed and dice-coefficient as measure of overlap, Pearson correlation coefficient and mean bias were calculated. For morphological analysis of the labrum, ANOVA test was performed to compare labrum volume among groups.

Results: Mean dice coefficient was 75±6 %, corresponding to a mean non-significant difference of 24 mm³ (95%CI: -107–154 mm³, p=0.716) and a high correlation (rp=0.88, p <0.0001) in labrum volume. Mean labrum volume differed (p=0.040) among the hip deformities with 2840±1332 mm³ for DDH, 2064±744 mm³ for hips with normal coverage and 2223±755 mm³ for pincer hips.

Conclusion: Automatic segmentation of the hip labrum based on MR arthrograms using deep learning is feasible and accurate. Our results suggests that labrum volume adapts to acetabular coverage. Integrating these 3D models in the daily clinical workflow has the potential to improve surgical decision making.

SS116

Deep learning-based image reconstruction using PROPELLER technique in the assessment of the shoulder joint: Comparison of the standard and post-processed MRI sequences.

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Purpose: Compare image quality and diagnostic performance of standard and post-processed PROPELLER deep learning MRI sequences (DL) for assessment of the shoulder joint.

Methods and Materials: MRI examinations of the shoulder acquired prospectively between June and October 2021 were included. Image quality and diagnostic confidence of standard and DL sequences was assessed by 2 readers. Qualitative analysis of the shoulder structures including analysis of pathological findings was performed. Signal-to-noise (SNR) and contrast-to-noise (CNR) ratios were calculated. Interreader agreement for qualitative assessment of the shoulder structures was calculated using Cohen`s kappa statistic. An institutional review board was provided.

Results: 30 MRI examinations of shoulder joints were analysed. Mean acquisition time for standard vs. DL sequences was 19 min 18 s vs. 7 min 16 s. The average image quality and diagnostic quality for all structures was significantly higher with DL than standard sequences (p<0.05). There was almost a perfect interreader agreement in the qualitative assessment of rotator cuff muscles (K=0.895 and 0.840 for standard and DL sequences) and a substantial agreement for assessment labrum (K=0.711 and K=0.667). There was only a slight interreader agreement for assessment of the subacromial bursa by standard sequences (K=0.018) and fair agreement by DL (K=0.237), however in 61% of all cases the evaluation of the pathology of the bursa was possible only by DL sequences. Evaluation of other structures was possible by standard and DL sequences with no significant difference between sequences. SNR and CNR was higher for DL sequences.

Conclusion: Post-processed PROPELLER deep learning MRI sequences show a superior image quality compared to standard PROPELLER sequences resulting in higher diagnostic confidence. Pathologies of the shoulder can be assessed correctly in both sequences with only exception of the subacromial bursa, which is better evaluated using DL sequences.

SS117

Measuring glenohumeral centering on conventional radiographs is reliable and independent of rotation in shoulders with rotator cuff tears.

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Purpose: Decentering of the humeral head on radiographs is often used as indicator for the severity of rotator cuff tears and a predictor for clinical outcome after surgical repair. Data about the influence of shoulder rotation during radiography and the accuracy for measuring glenohumeral centering, however, are lacking.

Methods and Materials: 269 shoulders were included: 92 with MRI-confirmed supra- and infraspinatus tears (rupture) and 157 without tears (control). On radiographs in neutral position (NEUT) and external rotation (ER) we assessed three radiographic parameters to quantify glenohumeral centering: acromiohumeral distance (ACHD), craniocaudal distance of the center of the humeral head to the center of the glenoid (Deutsch), and scapulohumeral arch congruity (Moloney).

Results: The interrater correlation was excellent for ACHD (0.916–0.945), and moderate to good for Deutsch (0.709–0.782) and Moloney (0.737–0.841). The mean differences between NEUT and ER were <0.5mm for ACHD and <1mm for Deutsch both in rupture and control group. The differences for Moloney were >2.5mm. In the rupture group compared to control the mean ACHD was significantly lower by >2mm (p<0.005), whereas the differences for Deutsch and Moloney were <1.4mm and not consistently significant. None of the control but 12–21% of the shoulders in the rupture group had an ACHD <7mm. Neither for Deutsch nor for Moloney a similar clear-cut threshold separating rupture and control could be established. 90% of shoulders with an ACHD <7mm presented with a massive rotator cuff tear (in this study defined as ≥67% of the greater tuberosity exposed).

Conclusion: Glenohumeral centering assessed by ACHD and Deutsch is not affected by shoulder rotation in shoulders with and without rotator cuff tear, while the assessment by Moloney is not reliable. An ACHD of <7mm has a positive predictive value of 90% for a massive rotator cuff tear.

SS118

Comparison of AI-powered 3D Automated Ultrasound Tomography with Standard Handheld Ultrasound for the Visualization of the Hands – Clinical Proof of Concept

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Purpose: To assess the functioning of a newly developed AI-powered ultrasound 3D hand scanner and its ability to visualize joint structures in healthy hands and detect degenerative changes in cadaveric hands.

Methods and Materials: 12 individuals (6 males, 6 females, age 43.5±17.8 years) underwent four scans with the 3D ultrasound tomograph (right and left hand, dorsal and palmar, respectively) as well as four sets of handheld ultrasound of predefined anatomic regions. The 3D ultrasound tomographic images and the standard handheld ultrasound images were assessed by two radiologists with regard to visibility of bone contour, joint capsule and space, and tendons. In addition, three cadaveric hands were scanned with the 3D ultrasound tomograph and CT.

Results: Mean scan time for both hands was significantly faster with handheld ultrasound (10 min 30s±95s) compared to the 3D ultrasound tomograph (32 min 9s±6s; p<0.001). Interreader and intermodality agreement were moderate (0.4<κ≤0.6) to substantial (0.6<κ≤0.8). Overall visibility of joint structures was comparable between the modalities at the level of the wrist (p=0.408), and significantly better with handheld ultrasound at the level of the finger joints and the thumb (both p<0.001). The 3D ultrasound tomograph was able to detect osteophytes in cadaveric hands which were confirmed by CT.

Conclusion: The AI-powered 3D ultrasound tomograph was able to visualize joint structures in healthy hands and singular osteophytes in cadaveric hands. Further technical improvements are necessary to shorten scan times and improve automated scanning of the finger joints and the thumb.

SS119

Characterizing and Differentiating Crystals Using Spectral Photon Counting Detection – First Results From The First Clinical Scanner Of Its Kind.

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Purpose: to differentiate crystals related with gout (monosodium urate, MSU) vs. pseudogout (calcium pyrophosphate, CPP) in the first cinically approved spectral photon-counting CT (SPCCT), and to compare the diagnostic performance with dual-energy CT (DECT) scanners of the previous generation.

Methods and Materials: Agar-based (AG) gels mimicking the articular cartilage and synthetic suspensions of MSU and CPP at different concentrations (90-500 and 26-109 mg/mL, respectively) were inserted in a phantom. All samples were scanned with SPCCT (NAEOTOM Alpha, Siemens), dual-source (DS), single-source split-filter (SF) and sequential scan (SS) DECT at comparable dose levels (CTDIvol: 4.4-12.5) and tube potentials (80/140, 120, 140 kV). Post-processed DE overlay (DEO) maps were optimized for gout/MSU detection, used with dual-energy ratios as recommended by the literature (DECT) and vendor (SPCCT). Generated low/high kV HU-values and DEO values were measured for all samples by drawing same-sized ROIs on every second axial image for ten consecutive steps. Sample consistency and differences between doses and scanners were investigated for all separately for concentrations and materials, respectively, using ANOVA, t-testing and analysis of mean differences.

Results: All crystal suspensions showed excellent homogeneity (p=0.23-1). HU-values in SPCCT did not depend on radiation dose. Apart from that, all quantitative parameters differed between CT scanner types and dose levels (p<0.01). Mean differences were comparable interscanner [14.3-28.2]. CPP and MSU showed significant concentration-dependent differences in HU and DEO (all p<0.01). Concentrations higher than 195 mg/mL MSU and 47 mg/mL CPP could be reliably differentiated with all techniques (mean DEO SPCCT: -10.9±-7.4 vs. -36.7±-15.4).

Conclusion: Differentiation of MSU from CPP crystals at typical clinical concentrations is feasible with a clinical SPCCT system. First results may indicate better dose-related robustness in SPCCT for material decomposition tasks in the future.

SS120

Osteoclast development and activity are inhibited by Gadolinium based contrast agents

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Purpose: The use of Gadolinium-based contrast agents (GBCAs) in MRI is associated with Gadolinium (Gd) retention in bone tissue. To understand the long-term effects of Gd on bone metabolism, modulation of osteoclast (OC) development and activity by free and chelated Gd was studied *in vitro*.

Methods and Materials: OC development was analyzed by culturing murine osteoclast progenitor cells (OPC) in αMEM supplemented with colony-stimulating factor-1 (CSF1) and Receptor Activator of NF-kB Ligand (RANKL) together with Gd (12.5-100μM), nonionic-linear (Gd-DTPA-BMA) or macrocyclic (Gd-DOTA) GBCAs (100-2000μM). Cell viability (XTT assay) and differentiation (tartrateresistant acid phosphate, TRAP) of OPC and OC were analyzed on day 5. To study effects of Gd on the resorptive activity of OC, OPC were cultured with CSF1 and RANKL for 5 days and mature OC were collected and seeded on Gd spiked CaP layers. For that purpose, Gd was incorporated into amorphous CaP and measured by inductively coupled plasma mass spectrometry (ICP-MS).

Results: Exogenously added Gd between 12.5-100μM did not affect OPC and OC proliferation or differentiation significantly. The exposure to GBCAs (500μM and higher) resulted in a significant increase in cell viability of OPC and OC, whereas TRAP activity declined significantly. The resorptive activity of OC was reduced by 50 % when 50-100 μM of Gd was incorporated in CaP. The ICP-MS analysis showed no spontaneous release of Gd in cell cultures.

Conclusion: The present data suggest that GBCA supplementation leads to either enhanced proliferation or less apoptosis in OPC and OC, accompanied by partial inhibition of cell differentiation. This effect might be caused by the chelating complex, as Gd alone did not influence OPC and OC viability or differentiation significantly. The capacity of mature OC to dissolve CaP was reduced upon incorporation of Gd. The question whether the solubility of Gd spiked CaP differs from pure CaP or internalized Gd leads to a reduction of OC activity remains to be elucidated.

Swiss Pilot Low-Dose Computed Tomography lung cancer screening study

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Purpose: Low-dose computed tomography (LDCT) lung cancer screening has recently been shown effective in a large European randomized controlled trial. Nevertheless, the actual realization of a lung cancer screening program is challenging and depends on country-specific factors. This pilot study aimed to evaluate implementation, execution and performance of LDCT lung cancer screening in Switzerland.

Methods and Materials: Starting from October 2018, asymptomatic participants aged 55-74 years with more than 30 pack-years smoking history were enrolled. Participants with history of lung cancer, major health problems or those who had a thorax CT scan 18 months prior to enrollment were excluded. We evaluated lung cancer risk according NLST guidelines, as well as using the PLCOm2012 model risk calculator. Lung nodules were assessed according Lung-RADS 1.1.

Participants were recruited through flyers, a newspaper article and pulmonary specialists. Screening consisted of one LDCT-scan and follow-up was recommended for suspicious nodules only. LDCT assessment was performed by two radiologists, one of them a board certified chest radiologist.

Enrollment and follow-up are currently ongoing.

Results: To date, 105 participants with a median age of 62 years (interquartile range [IQR] 56-67 years) were included. The median number of pack years smoked was 49 (IQR 41-58) and 32 (30%) were female. The median PLCOm2012 6-year lung cancer probability was 3.7% (IQR 2.6-2.9%) and 19 (26%) participants had stopped smoking before enrollment. 77 (73%) were found to have calcified or non-calcified lung nodules. 9 participants required follow up imaging of suspect nodules which resulted in a recall rate of 8.6%. At baseline, lung cancer was found in 5 (4.7%) participants.

Conclusion: In this Swiss LDCT lung cancer screening pilot study using modified inclusion criteria, lung nodules were found in a significant number of participants of whom 4.7 % were diagnosed with lung cancer to date.

Diagnostic validation of a deep-learning nodule detection algorithm in low-dose chest CT: Determination of optimized dose thresholds in a virtual screening scenario

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Purpose: To evaluate the effects of dose reduction on the performance of a DL-based CAD system regarding the detection of pulmonary nodules in lung phantoms.

Methods and Materials: 68 anthropomorphic chest phantoms were equipped with 329 nodules (150 ground glass, 179 solid) with four different sizes (5 mm, 8 mm, 10 mm, 12 mm). The phantoms were scanned at 80 kV, 100, kV and 120 kV with tube currents of 25 mAs, 50 mAs and 100 mAs, which resulted in nine different combinations. The examinations were analyzed by a commercially available DL-based CAD system. The results of the different groups were compared by Cochran's Q test or Chisquared test. Logistic regression was performed to evaluate the impact of tube voltage, tube current, nodule size and nodule density.

Results: The combination with the lowest effective dose (E) and unimpaired detection rate was 80kV/50mAs (sensitivity: 97.9%, mean false-positive rate (FPR): 1.9, mean E: 0.66 mSv). Logistic regression revealed that tube voltage and current had the greatest impact on the detection rate, while nodule size and density had no significant influence.

Conclusion: The optimal tube voltage/current combination for the respective software proposed in this study (80kV/50mAs) is comparable to the reported combinations in similar studies, which mostly dealt with conventional CAD software. Modification of tube voltage and tube current has a significant impact on the performance of DL-based CAD software in pulmonary nodule detection regardless of their size and composition.

Quantum Iterative Reconstruction for Low-Dose Ultra-High-Resolution Photon-Counting Detector CT of the Lung

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Purpose: To characterize the image quality and to determine the optimal strength level of a novel iterative reconstruction algorithm (Quantum Iterative Reconstruction - QIR) for low-dose ultra-highresolution photon-counting detector CT of the lung.

Methods and Materials: 50 consecutive patients referred for low-dose, ultra-high-resolution chest CT and imaged on a first-generation clinical dual-source photon-counting detector CT (PCD-CT; NAEOTOM Alpha, Siemens Healthineers) were included. The PCD-CT system was run in ultra-highresolution mode with a detector collimation of 120x0.2 mm. Images were reconstructed with a Bl64 kernel by means of QIR (4 levels, QIR-1 to QIR-4) and without QIR (QIR-off). Quantitative analysis was performed with a fully automated computational pipeline and included the computation of the Global Noise Index (GNI) and the Global Signal-to-Noise Ratio Index (GSNRI) as two quantitative metrics to quantify the image quality in vivo across the whole lungs. The mean attenuation of the lungs was recorded. Two readers performed qualitative analysis by grading images with 5-point Likert scales in terms of overall image quality, image sharpness and image noise.

Results: Radiation dose was 0.94±0.46 mGy CTDIvol in patients. The GNI decreased linearly from QIR-off (202±34 HU) to QIR-4 (106±18 HU) (p<0.001) by 47.5%. GSNRI increased linearly from QIR-off (4.4±0.8) to QIR-4 (8.2±1.6) (p<0.001) by 86.9%. Mean CT attenuation of the lungs varied significantly among reconstructions (all, p<0.001) although with only minimal absolute differences in values between reconstructions (QIR-off: -849±53 HU to QIR-4: -853±52 HU). Interreader agreement ranged from substantial to almost perfect. QIR-4 performed best in terms of image noise (p<0.001), while QIR-3 performed best in terms of image sharpness and overall image quality (p<0.001).

Conclusion: For low-dose ultra-high-resolution photon-counting detector CT of the lung, QIR-3 provides an optimal tradeoff between high levels of noise reduction and improvements in SNR without compromising subjective image quality

Potential of Photon-Counting Detector CT for radiation dose reduction in the assessment of Interstitial lung disease in patients with scleroderma compared to Energy-Integrated Detector CT

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Purpose: To evaluate the potential of photon-counting detector computed tomography (PCD-CT) in radiation dose reduction compared to conventional energy-integrated detector CT (EID-CT) based on image quality and assessment of Interstitial Lung disease in Scleroderma (SSc-ILD).

Methods and Materials: Consecutive patients with scleroderma who underwent a non-contrast chest CT on a first-generation, clinical dual-source PCD-CT and a non-contrast split-dose EID-CT scan within one year were retrospectively included. Split-dose images on dual-source EID-CT were generated at a fixed tube voltage of 100kV and tubes were operated with different tube currents in order to obtain a 66% dose image and a 33% dose image. The 100% dose images were generated from the image information of the two "split-dose" images. PCD-CT scans were performed in the highresolution (HR) mode at 120kV. Image noise was measured manually in the subcutaneous fat and defined as the standard deviation of attenuation. Images were assessed by two independent readers rating overall image quality on a five-point likert-scale and evaluating for presence of SSc-ILD.

Results: Overall 50 patients (mean age 57, 9 male) were included. PCD-CT scans resulted in similar radiation dose than the 33% dose EID-CT scans (0.73 vs. 0.77 mGy*cm, p=0.177) while radiation dose was significantly higher in the 66% dose and 100% EID-CT scans (1.54 and 2.31 mGy*cm; p<0.001). Mean image noise of PCD-CT was comparable to the 100% dose EID-CT scan and performed significantly better than the 66% and 33% dose scan (p<0.001). Overall image quality of PCD-CT was comparable to the 100% dose EID-CT scan (4.72 vs. 4.71; p=0.874) and superior to the 66% and 33% dose scan (3.78 and 2.95; p<0.001). Detection of SSc-ILD in PCD-CT was comparable to the 100% dose EID-CT scan.

Conclusion: PCD-CT allows for a radiation dose reduction of 66% compared to EID-CT while maintaining image quality and diagnostic performance for the detection of SSc-ILD.

Performance of Virtual non-contrast images generated on clinical Photon-Counting Detector CT for lung parenchyma evaluation and emphysema quantification: Proof of Concept

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Purpose: To evaluate the performance of postprocessed virtual non-contrast images (VNC) compared to true non-contrast (TNC) images in photon-counting detector computed tomography (PCD-CT) for the evaluation of lung parenchyma and emphysema quantification.

Methods and Materials: Consecutive patients who underwent a three-phase (non-contrast, arterial and venous) chest CT on a first-generation, clinical dual-source PCD-CT were retrospectively included. Scans were performed in the multienergy (QuantumPlus) mode at 120kV with weight adjusted intravenous contrast agent. VNC were postprocessed from the arterial and venous phase and are further termed VNCart and VNCven, respectively. TNC and VNC images were assessed quantitatively (Global Noise Index (GNI)) and qualitatively by independent readers (overall image quality, emphysema assessment, delineation of small structures). Emphysema quantification was performed with a commercially available software tool at a threshold of -950 HU for all images. TNC images served as reference standard for emphysema quantification.

Results: Sixty-five patients (mean age 73 years; 48 male) were included in the study. GNI showed no significant difference between VNC images derived from the arterial and venous phase compared to TNC (p=0.546 and p=0.272; respectively). Subjective image quality (emphysema assessment and overall image quality) in VNCven was more similar to TNC images than VNCart. Both, VNCart and VNCven showed no significant difference in emphysema quantification relative to TNC (p=0.409 vs. p=0.093; respectively), although the VNCart images performed slightly but not significantly better (p=0.305). Contrast enhanced scans showed significant differences in emphysema quantification compared to TNC (p<0.001).

Conclusion: VNC imaging in PCD-CT is feasible and delivers similar results for emphysema quantification compared to TNC, performing best if arterial phase images for postprocessing are used.

CT Evaluation of Lung Infiltrates in the Two Months Preceding the Coronavirus disease 19 Pandemic in Canton Ticino (Switzerland): Were There Suspicious Cases before the Official First Case?

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Purpose: The main purpose of this study was to assess the presence of pulmonary infiltrates with computed tomography (CT) appearance compatible with infection by coronavirus disease 2019 (COVID-19), in Canton Ticino in the 2 months preceding the first official case. Secondary aims were: to search for pathological confirmation of the virus; to compare the number of chest CT scans in the same period 2020 and 2019.

Methods and Materials: The local Ethics Committee approved this retrospective study, asking for the informed consent of patients with CT findings compatible with infection of COVID-19.

Chest CT scans performed between Jan 1st and Feb 24th in 2019 and 2020, were collected and classified by COVID-19 Reporting and Data System (CO-RADS). Pathological presence of the virus was searched for when appropriate material was available.

Final cohort included 881 patients (mean age 68; standard deviation 14). For each patient included, date of birth and date of the CT scan were recorded. Examinations were randomly performed on one of the 5 CT scans available. CT acquisition protocol was adapted to the clinical indication.

Descriptive statistics included the number of records for each CO-RADS category; the most common clinical indications and the etiology of pneumonitis in CO-RADS 3 and 4 categories; the number of chest CT scans performed in the first two months of 2020 and 2019.

Results: CO-RADS 3 and 4 categories were 34 and 10 in 2020, and 42 and 3 in 2019. Among the CO-RADS 3 and 4 categories in 2020 (n=44), 30 patients had pneumonitis of unknown etiology.

Pathological specimens were available in 6 patients, and they were negative for COVID-19.

The number of chest CT scans in the first two months of 2020 was >12% compared to 2019.

Conclusion: Before the first official case of COVID-19 infection in Canton Ticino, 30 patients had lung infiltrates with CT appearance compatible with the infection. The number of chest CT scans in the first two months of 2020 was 11% higher compared to 2019.

Contrast-Enhanced Abdominal CT with Clinical Photon-Counting Detector CT: Assessment of Image Quality and Comparison with Energy-Integrating Detector CT

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Purpose: To determine the image quality of contrast-enhanced abdominal photon-counting detector CT (PCD-CT) compared to energy-integrating detector CT (EID-CT) in the same patients.

Methods and Materials: Thirty-nine patients (mean age 63±10 years, 10 females, mean BMI 26.0±5.7 kg/m2) were included who underwent clinically indicated, contrast-enhanced abdominal CT in portal-venous phase with first-generation dual-source PCD-CT and who underwent previous abdominal CT with EID-CT using the same contrast media protocol. PCD-CT was performed in QuantumPlus mode (obtaining full spectral information) at 120kVp. EID-CT was performed using automated tube voltage selection (reference tube voltage 100kVp). In PCD-CT, virtual monoenergetic images (VMI) were reconstructed in 10keV intervals (40-90keV). Tube current-time product in PCD-CT was modified in each patient to obtain same CTDIvol as with EID-CT. Attenuation of organs and vascular structures were measured, noise quantified, and contrast-to-noise ratio (CNR) calculated.

Two independent, blinded radiologists assessed subjective image quality (overall image quality, image noise, contrast, and liver lesion conspicuity).

Results: $CTDI_{vol}$ (p=0.984) and BMI (p=0.905) were similar between scans. $CNR_{parenchymal}$ and $CNR_{vascular}$ of VMI from PCD-CT at 40 and 50keV were significantly higher than EID-CT (all, p< 0.05).

Overall image quality of VMI was rated similar at 50 and 60keV compared to EID-CT (all, p >0.05).

Image noise was significantly higher for VMI at 40, 50 and 60 keV as compared to EID-CT (all, p<0.001) Subjective image noise was significantly higher at 40-50keV, contrast significantly higher at 40-60keV (all, p<0.05). Lesion conspicuity was rated similar on all images.

Conclusion: Our intra-individual analysis of abdominal PCD-CT indicates that VMI at 50keV shows significantly higher CNR at similar subjective image quality as compared to EID-CT at identical radiation dose.

Quantum Iterative Reconstruction for Abdominal Photon-Counting Detector CT – Assessment of Image Quality and Lesion Conspicuity in a Phantom and Patients

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Purpose: To investigate the image quality and the optimal strength level of a novel iterative reconstruction (Quantum Iterative Reconstruction (QIR)) for virtual monoenergetic images (VMI) and polychromatic images (T3D) in a phantom and patients in portal-venous abdominal photon-counting CT (PCD-CT)

Methods and Materials: In this retrospective study, noise power spectrum (NPS) was measured in a water-filled phantom. Consecutive oncologic patients who received a portal-venous abdominal CT on a PCD-CT between March-April 2021 were included. VMI at 60keV and T3D were reconstructed without QIR (QIR-off; reference standard) and with QIR at four levels (QIR1-4; index tests). Global noise index (GNI), contrast-to-noise ratio (CNR), and voxel-wise CT attenuation differences were measured. Noise and texture, artifacts, diagnostic confidence, and overall quality were assessed qualitatively. Conspicuity of hypodense liver lesions was rated by four readers. Parametric and nonparametric tests were used.

Results: In the phantom, NPS showed unchanged noise texture across reconstructions. Fifty patients (mean age, 59±16 years, 31 women) were included. GNI was reduced from QIR-off to QIR-4 by 45% for 60keV and by 44% for 60keV (both, P<.001). CNR of the liver improved from QIR-off to QIR-4 by 74% for 60keV and by 69% for T3D (both, P<.001). No evidence of difference was found in mean attenuation of fat and liver (P=.79–P=.84) and on a voxel-wise basis among reconstructions.

Qualitatively, QIR-4 outperformed all reconstructions in every category for 60keV and T3D (P<.001–P=.01). All four readers rated QIR-4 superior to other strengths for lesion conspicuity (P<.001–P=.04).

Conclusion: In portal-venous abdominal photon-counting detector CT, high levels of Quantum Iterative Reconstruction improved image quality by reducing noise and improving CNR and lesion conspicuity without compromising image texture or CT attenuation values.

Virtual Non-Contrast Imaging of the Liver using Photon-Counting Detector CT: A Systematic Phantom Study with In Vivo Validation

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Purpose: To compare the accuracy of virtual non-contrast images (VNC) from clinical photon-counting detector CT (PCD-CT) and energy-integrating detector dual-energy CT (EID-CT) in simulated liver and lesions as a function of phantom size, radiation dose, tube voltage combination, and different lesion properties.

Methods and Materials: An anthropomorphic abdominal phantom with a liver insert containing parenchyma and 19 lesions (background material: 35/45/54 HU, iodine content: 0/0.3/0.4/3/5 mgI/ml) was imaged in dual-energy mode on (A) a dual-source PCD-CT (NAEOTOM Alpha, Siemens Healthcare GmbH) and (B) a dual-source EID-CT (SOMATOM Force). Three different tube voltages (80/Sn150, 90/Sn150, 100/Sn150kV) were used for (B). For each setup, three phantom sizes (S, M, L) and three radiation doses ($CTDI_{vol}$: 5, 10, 15 mGy) were investigated. CT attenuation of VNC was measured in each lesion and in the parenchyma. The absolute error of CT attenuation (VNC_{error}) was calculated. Additionally, 15 patients with hypodense liver lesions imaged on PCD-CT were retrospectively included. Attenuation values in lesions and the liver parenchyma were compared between VNC from the portal venous phase and true non-contrast (TNC) scans in the patients.

Results: PCD-CT exhibited significantly lower VNC_{error} as compared to all tube voltage settings of EID-CT (p<0.001). Mean VNC_{error} was 4.1±3.9 HU for PCD-CT and 7.5±5 / 6.3±4.7 / 6.7±4.8 HU for 80/Sn150, 90/Sn150, and 100/Sn150kV of EID-CT, respectively. Radiation dose did not impact quantification accuracy (p>0.126). VNC_{error} increased significantly with lesion iodine concentration only for EID-CT (p<0.001). In patients, there was no significant difference between CT attenuation measured on TNC and VNC (p=0.093) with a mean VNC_{error} of 3.7 ± 2.2 HU.

Conclusion: PCD-CT allows for the computation of accurate virtual non-contrast images with higher quantification accuracy in liver parenchyma and lesions independent of lesions' iodine concentration as compared with EID-CT.

Virtual non-contrast imaging of clinical Photon-Counting Detector CT – Accuracy in the Abdomen

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Purpose: To assess the accuracy of virtual non-contrast images (VNC) of the abdomen acquired on clinical first-generation dual-source photon-counting detector CT (PCD-CT).

Methods and Materials: One hundred consecutive patients (mean age 72±10, 19 female) undergoing a triphasic examination on a dual-source PCD-CT (Naeotom Alpha, Siemens) were included. VNC images from the arterial and portal venous phases were reconstructed. CT attenuation was manually measured in the aorta, liver, spleen, kidney, urinary bladder, paravertebral musculature, and subcutaneous fat by two readers. Attenuation of the VNC images was compared to the true unenhanced images (reference standard). Absolute error of attenuation (HU_{error}) was computed. Image noise texture was assessed by measuring the noise power spectrum (NPS) in a phantom.

Results: NPS showed similar noise texture among VNC and true unenhanced images. Mean HU_{error} was less than 10HU for all regions except subcutaneous fat. Interreader agreement was nearly perfect (Krippendorff's α=0.92). Smallest HU_{error} was found in the liver (1.4±1.3HU and 1.5±1.2HU) for both the arterial and the venous VNC images. For liver and spleen, HU_{error} was less than 5HU in 93% of the cases. Highest HU_{error} was 24.6±3.3HU and 24.5±3.8HU in subcutaneous fat for arterial and venous VNC images, respectively.

Conclusion: Virtual non-contrast imaging of PCD-CT from arterial and portal venous phase demonstrated high accuracy with small error ranges compared with true unenhanced images in parenchymal organs of the abdomen.

Intra-individual comparison of liver fat fraction calculation using photon-counting CT in comparison to clinical MRI – first experience

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Purpose: To explore the liver fat quantification capabilities of a new photon-counting CT (PCCT) scanner in comparison with standard clinical MRI of the abdomen.

Methods and Materials: Eleven patients who had previously been diagnosed with fatty liver disease, according to their electronic health record, and received a clinical MRI of the abdomen were scanned on a new PCCT (Siemens NAEOTOM Alpha) on the same day. Fat fractions of their liver were calculated for four segments (I, II, IVa and VII) using in- and opposed phase on MRI ((Meanin – Meanopp)/2*Meanin) and using material decomposition analysis for PCCT (Siemens Syngo.Via VB60A). Statistical analysis was performed using RStudio (Version 1.4.1717), liver fat fractions were compared using two-sample t-tests with equal variance.

Results: The average age for the eleven patients was 60.6±13.2 years (range: 30-78), the mean BMI was 30.9±4.1 (range: 22.6-37.7) and the cohort contained 5 men and 6 women.
The fat fractions for the five patients were Patient 1: 13 vs 11%, Patient 2: 31 vs 30, Patient 3: 18 vs 16, Patient 4: 0 vs 2, Patient 5: 13 vs 12, Patient 6: 19 vs 3, Patient 7: 11 vs 9, Patient 8: 8 vs 6, Patient 9: 23 vs 20, Patient 10: 6 vs 6 and Patient 11: 5 vs 5% on MRI and PCCT, respectively. Patient 6 had concomitant iron overload from multiple blood transfusions, which may have influenced measurements on both MRI and PCCT.
There was no statistically significant difference between the fat fractions measured on MRI and on PCCT (P=0.09).

Conclusion: First experience shows very similar performance of liver fat fraction quantification for PCCT as for the current clinical standard of MRI, even in patients with low liver fat fractions. This may improve opportunistic screening opportunities for CT in the future.

Automated liver segmental volume ratio (LSVR) quantification on non-contrast T1 vibe Dixon liver MRI using an artificial neural network

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Purpose: To use an artificial neural network for automated liver segmental volume quantification and calculation of the liver segmental volume ratio (LSVR) on a non-contrast T1 vibe Dixon liver MRI.

Methods and Materials: A dataset of 30 liver MRI with a non-contrast 3mm T1-vibe Dixon sequence was manually labelled slice-by-slice by an expert for Couinaud liver segments by excluding the liver vessels. A state-of-the-art neural network (3D U-Net) was trained with nested cross-validation using 27 liver MRI for training and 3 liver MRI unseen by the neural network for validation in 10 different iterations. Liver segmental volumes were retrieved and LSVR was calculated as the liver segment volumes I-III divided by the liver segmental volumes IV-VIII. LSVR was compared with the expert manual LSVR calculation and the LSVR calculated on CT scans in 17 patients with CT and MRI within 3 months.

Results: The neural network model classified the Couinaud segments I-VIII with an average Dice score of 0.702+-.07, ranging between 0.495+-.06 (segment I) and 0.763+-.06 (segment IVb). The calculated mean LSVR with liver MRI unseen by the neural network was 0.328+-.13, as compared with manually quantified LSVR of 0.344+-.16, resulting in a mean absolute error (MAE) of 0.036. A comparable LSVR of 0.351+-.13 with a MAE of 0.048 resulted with the LSRV retrieved from the CT scans in the same patients.

Conclusion: A state-of-the-art artificial neural network allows automated liver segmental volume quantification and accurate calculation of LSVR based on a non-contrast T1 vibe Dixon sequence.

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Validation of Automatically Measured ΔT1 values Correlated with eGFR and Fibrosis of Allograft Kidneys

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Purpose: MRI T1-mapping is a non-invasive way to monitor Chronic Kidney Disease (CKD) prognosis. Recent studies show that the ΔT1 (cortex-medullary difference) has a strong positive correlation with fibrosis in CKD patients. We propose validation of the ΔT1 values measured from automatically segmented cortex and medulla correlated to eGFR and fibrosis.

Methods and Materials: In this study, 114 allograft kidney patients' data (ΔT1) were correlated to eGFR and fibrosis. Renal fibrosis was assessed quantitatively on kidney biopsy specimen using Masson's trichrome-stained kidney sections. The pathologist was blinded to other results, including eGFR and MRI.

MRI data were acquired on a Prisma 3T MR (Siemens AG, Erlangen, Germany) with MOLLI T1 sequence. Parameters were: Resolution: 2×2×5mm; TE/TR=1.2/1500ms; GRAPPA=2; FA=35o. The proposed U-Net was trained on a set of 2400 augmented (i.e. rotated) T1 map images and tested on unseen 114 T1 images. For training (implemented on Python 3.8, TensorFlow (Keras)), convolutional layer weights were initialized with a zero centric normal distribution and standard deviation=0.05. The loss function was minimized via an RMSprop optimizer with a learning rate of 1×10^{-4}. Training batch size=5; epochs=100 with early stopping criteria. The network required ~1.5 hours of training. Correlation of proposed network ΔT1 with fibrosis and eGFR were performed and compared with reference Gold Standard manually Drawn ROIs ΔT1 values (GSΔT1).

Results: The results show the proposed U-Net has better correlation values (r=-0.2, p=0.039) than the GSΔT1 (r=-0.19, p=0.0508) for eGFR. Also, the U-Net has comparable correlation values (r=0.25, p=0.007) to the GSΔT1 results (r=0.3, p=0.0013) with % fibrosis.

Conclusion: This work validated the automatically measured ΔT1 values of allograft kidneys. Our Unet approach is an alternative to the Manual ROIs method that could help to reduce analysis time and observer variability.

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Detection of early stage HCC with abbreviated gadoxetate MRI: comparison with ultrasound, pilot study.

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Purpose: To compare the diagnostic performance of AMRI compared to US for detection of early stage HCC in an at-risk population

Methods and Materials: This prospective study included 25 adult patients: 15 patients (M/F 19/6, mean age 59y) with cirrhosis and small HCC (<3 cm) diagnosed on recent cross-sectional imaging and 10 controls without HCC. US and gadoxetate AMRI were performed on the same day. AMRI included T2wi + DWI + T1wi at the hepatobiliary phase (HBP). No dynamic imaging was performed.

Serum AFP was available in 19 patients. US results were based on the clinical read. AMRI was read by two independent observers. Images were scored according to adapted LI-RADS scoring system: negative, subthreshold (<10 mm) or positive. Reference standard was based on routine contrastenhanced MRI performed within 1 month. Diagnostic performance of US and AMRI was calculated, without/with AFP.

Results: 15 patients presented early stage HCC (mean size 16mm, range 10–25mm), while 10 had no HCC (controls). Sensitivities were 54.5% for AFP alone [6/11, CIs: 23.4-83.3%], 60% for US [9/15, 32.3-83.7%] and 86.7% for AMRI (pooled data) [26/30, 69.3-96.2%], with no significant difference between modalities. Specificities were 100% [8/8, 63.1-100%] for AFP, 90% for US [9/10; 55.5-99.7%] and 80% for AMRI [16/20, 56.3-94.3%], with no significant difference between modalities. When combining US and AFP, sensitivity was 81.8% [48.2-97.7%] and specificity 87.5% [47.3-99.7], significantly higher compared to US alone (p=0.01). When combining AMRI and AFP, sensitivity was 100% [73.5-100%] and specificity 84.6% [65.1-95.6], significantly higher when compared to AMRI alone (p=0.02).

Conclusion: AMRI is accurate for early stage HCC detection. The addition of AFP to US or AMRI improved diagnostic performance for early stage HCC detection. The study will be extended to a larger sample size to confirm these initial results and evidence a difference in diagnostic accuracy between AMRI and US for the detection of early HCC.

Early MRI termination with major impact on the radiological interpretation: incidence, causes and at risk patients' characteristics

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Purpose: To determine the characteristics of patients who experienced early MRI termination to help identify at risk patients.

Methods and Materials: All consecutive adult patients (>16 year-old) in whom an MRI examination was requested in one of the 9 MRI facilities of our institution, during a 14-months period of time were included. The following information were obtained: demographics, in- or out-patient, emergent or elective examination, anatomical region, early termination of the examinations and their causes. An early termination was defined as the impossibility to answer the medical question, due to incapacity to enter the MRI or due to premature removal of the patient from the machine.

Results: 22 566 MRI examinations were performed during the study period, 10'792 (48%) men, 11'774 (52%) women, mean age 57 (range 16-103). An early MRI termination was reported in 183 (0.82%) of them, 99 men, 84 women, mean age 63. Of these 183 early termination, 103(54%) were due to claustrophobia, 80 (46%) to other problems (technical or morphological constraint, pain, noncompatible material).Early termination was more frequent for in-patients when compared to outpatients, for both claustrophobia (0.65% vs 0.36%, p=0.02) and non-claustrophobia related reasons (1.9% vs 0.6%, p=0.0001). Overall, early termination for non-claustrophobia related reasons was significantly more frequent in patients over 50 years (0.56% vs 0.25%, p=0.0016). Early termination for claustrophobia was less frequent (0.13%, 4/2937) for limbs when compared to other regions (0.50%, 99/19526), p=0.02.

Conclusion: Early MRI terminations due to claustrophobia or other reasons have become rare events, which mainly concern inpatients, patients over 50 and patients' position inside the gantry. This phenomenon may be explained by the recent technological improvements in MRI sciences.

Software-based evaluation of optimization potential for clinical MRI scanners in radiology

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Purpose: To analyze the examination and changeover times of two clinically highly applied MRI scanners at a Swiss university hospital with a specific software application to evaluate a possible optimization potential for examination planning.

Methods and Materials: Based on the newly developed software application „Teamplay Usage" (Siemens Healthineers, Germany), the examinations carried out on two MRI-Scanner (1.5T and 3T) within a time period of 12 months were investigated with regard to the type and duration of examinations. Compliance with the previously defined planning time (30, 45, 60 min) was analyzed as well as a possible influence of the exchange of MRI coils on changeover times.

Results: For the total of 7'184 examinations included in the study, the median examination time was 43:02 minutes. The ten most frequent types of examinations were completed within the predefined planning time with a percentage of 54.5% (1.5T) and 51.9% (3T). The majority of the examinations planned with 45 minutes were also completed within this time. Comparison between the planned time and the examination duration revealed an only minor potential for optimization (1.5T: 35 hours; 3T: 13 hours). Coil exchanges had a small, but statistically not significant effect on the median changeover time (p=0.062).

Conclusion: Utilizing a software-based analysis, a detailed overview of the type of examination, duration and changeover times of highly frequented clinical MRI scanners could be obtained. Overall, there was little potential for optimization of the examination planning. Coil exchanges for different types of examinations only had a small effect on the changeover times.

Prediction of PET positive lymph nodes with multiparametric MRI and clinical information in primary staging of prostate cancer

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Purpose: To predict the presence of PET positive pelvic lymph nodes in prostate cancer using quantitative parameters of multiparametric MRI (mpMRI) and clinical information.

Methods and Materials: This study included 35 patients with high suspicion for prostate cancer undergoing multiparametric prostate MRI and PSMA-PET/CT prior to MRI-guided biopsy. All MRI examinations were assessed by a radiologist and the Apparent Diffusion Coefficient (ADC, mean and volume), capsular contact length, volume and maximal diameter on T2-weighted sequences and parameters of dynamic contrast-enhanced MRI (iAUC, k_{ep}, K^{trans}, v_e) were calculated for the index lesion. Clinical data was extracted from the hospital information system to calculate the Briganti 2018 nomogram scores. PET examinations were evaluated by two board-certified nuclear medicine physicians and served as standard of reference.

Results: Quantitative imaging parameters of mpMRI mostly demonstrated mediocre to good performance in prediction of PET positive nodes (AUCs, ADC_{mean}: 0.74, ADC_{vol}: 0.55, iAUC: 0.42, k_{ep}: 0.71, K^{trans}: 0.64, ve: 0.37, $T2_{capsular}$: 0.59, $T2_{diameter}$: 0.58, $T2_{vol}$: 0.55), while the Briganti 2018 nomogram (including maximum diameter of the index lesion) reached an AUC of 0.78 (95%-CI: 0.61-0.95). Quantitative MR parameter did not provide added value to the Briganti 2018 model alone.

Conclusion: The Briganti 2018 model, which includes clinical/pathological data and the maximal tumor length of the index lesion on prostate MRI performed well in predicting PET positive lymph nodes and may serve as a tool to stratify patients for primary staging using PSMA-PET.

Attenuation-based Auto Prescription of paediatric head CT scan settings

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Purpose: To implement and evaluate a feature that automatically selects exposure settings by patient size for head CT in children.

Methods and Materials: Protocols appliyng a feature that automatically selects kV and mAs based on attenuation information from scout images were implemented for paediatric axial volumetric head CT on a 256-slice scanner (GE Revolution). Radiation dose (CTDIvol) and image quality were compared between 79 consecutive studies obtained with Auto Prescription protocols and 68 studies obtained previously with age-based protocols in 147 patients aged 1 day to 17.7 years (median age 6 years). Image quality was assessed by signal to noise ratio (SNR) of the basal ganglia, contrast to noise ratio (CNR) between gray and white matter and rated on a 4-grade Likert scale as 1 - unacceptable, 2 - limited, 3 - adequate and 4 - higher than needed. Comparisons were made with non parametric tests.

Results: Radiation dose from Auto Prescription studies was lower (CTDIvol 16.6±4.0 mGy) than from age-based protocols (CTDIvol 22.2±7.6 mGy) providing lower SNR (8.9±2.1 versus 11.9±3.5), lower CNR (1.5±0.6 versus 1.9±0.9) but still achieving adequate diagnostic image quality.

Conclusion: Attenuation-based Auto Prescription of scan settings allows for balanced radiation dose and image qualtity in head CT across the paediatric size range resulting in lower dose than with agebased protocols.

Imaging of post transplantation lympho-proliferative disorders in children

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Purpose: Post-transplant lympho-proliferative disorders (PTLD), a cause of significant morbidity and mortality, are slightly more common in children than in adults due to the higher level of EBV before transplantation. They present with a wide range of appearances, such as adenopathy or masses.

Methods and Materials: Protocols appliyng a feature that automatically selects kV and mAs based on attenuation information from scout images were implemented for paediatric axial volumetric head CT on a 256-slice scanner (GE Revolution). Radiation dose (CTDIvol) and image quality were compared between 79 consecutive studies obtained with Auto Prescription protocols and 68 studies obtained previously with age-based protocols in 147 patients aged 1 day to 17.7 years (median age 6 years). Image quality was assessed by signal to noise ratio (SNR) of the basal ganglia, contrast to noise ratio (CNR) between gray and white matter and rated on a 4-grade Likert scale as 1 - unacceptable, 2 - limited, 3 - adequate and 4 - higher than needed. Comparisons were made with non parametric tests.

Results: Ultrasound showed mesenteric lymphadenopathy (n=2), abdominal extra nodal mass (n=2), hepatic nodules (n=1), bowel wall thickening (n=2). FDG-PET confirmed these findings but showed additional sites: increased bowel activity in 4 patients not suspected on ultrasound, hypermetabolic mediastino-hilar lymph nodes in 3 patients. All patients had increased rhino-pharyngeal and cervical lymph nodes activity and one patient had a hypermetabolic lung focus.

Conclusion: The diagnosis of PTLD is challenging because the clinical signs are nonspecific. Infections such as EBV are rather common in this patients' group and should be considered in the differential diagnosis. Ultrasound is always the first line modality depicting the majority of abnormalities. FDG-PET was better in showing the extent of disease and useful in guiding biopsy, as well as in monitoring treatment once the diagnosis was confirmed.

A deep learning segmentation algorithm for pediatric MR urography

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Purpose: This work presents a deep learning algorithm used for the segmentation of renal parenchyma and collecting systems from MR urography.

Methods and Materials: A fully connected neural network (NN) was developed that accepted as inputs a representative mean time series from a user selected region of parenchyma and collecting system as well as a time series from a voxel of interest. The output is classification of the voxel of interest as belonging to the parenchyma, collecting system or other tissue.

The algorithm was trained on >100K observations from MR urography data (resolution 0.59 x 0.59 x1.4 mm) acquired from 10 subjects. Ground truths for validation were established from a further 12 subjects using a coronal 3D fast spin echo sequence (acquired resolution: 0.55 x 0.55 x 0.4 mm) reconstructed to 3 mm slice thickness and compared on a slice by slice basis with NN generated segmentations from MR urography data for the same subjects.

Outliers originated due to differences between alignment of the ground truth and MR urography sequences and were identified and removed when exceeding an absolute Z-score of 3.

Results: A total of 284 slices containing kidney parenchyma or collecting system segmentation were compared using Sorensen-Dice index.

After removing outliers, mean Sorensen-Dice index for the parenchyma and collecting system was 0.78±0.10 and 0.62±0.22 respectively. The inter-reader agreement was very good with Bland-Altmann analysis showing a bias of 5%, and standard deviation of the difference of 7%.

Manual correction of segmentations is very fast and represents a large time saving in the MR urography patient workup.

Conclusion: A neural network segmentation algorithm using only MR urography time series presents a large time saving for renal segmentation in the area of clinical MR urography. Not only is entire renal volume attained, but three dimensional compartment classification, necessary for functional analysis, is also provided.

Whole-body magnetic resonance imaging (WBMRI) in suspected child abuse

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Purpose: To analyze the added value of whole-body magnetic resonance imaging (WBMRI) to a skeletal survey in detecting traumatic lesions in suspected child abuse.

Methods and Materials: We retrospectively reviewed 35 children with suspected non accidental trauma who had a skeletal survey and WBMRI over a 11-year period. Five children were excluded from this study due to incomplete imaging workup. Finally the imaging of 30 children (13 F, 17 M; mean age 5.83 months, range: 1 to 21 months) were analyzed by 2 senior pediatric radiologists. Imaging consisted of a routine full skeletal survey and WBMRI. WBMRIs were realized on a 1,5 T Avanto machine with a 3D STIR sequence. The children older than 3 months were sedated. A supplementary follow-up skeletal survey was carried out according to the cases.

Only bone and soft tissue lesions were analyzed, brain and spinal cord lesions were not considered in this study.

On the initial skeletal survey, all bone lesions were recorded. On WBMRI, bone edema, edema in soft tissue, joint fluid and hematoma in abdominal organs were considered as positive findings.

We compared all lesions detected by the 2 imaging modalities to evaluate the added value of WBMRI in this medical context.

Results: No lesions were detected on the 2 imaging modalities in 14/30 children.

Among the 16 other children, the initial skeletal survey was positive in 16/16 children and the WBMRI was positive in 13/16.

Among these 13 children with lesions seen on MRI, 12 lesions were bone and/or soft tissue edema related to fractures seen on radiographs; 4 were bone and/or soft tissue edema in other musculoskeletal locations; 1 was a liver hematoma.

Skeletal follow-up at 10 days confirmed fractures corresponding to soft tissue edema detected on MRI in one case.

Conclusion: Although skeletal survey remains the gold standard for bony injuries in the literature for non-accidental trauma, WBMRI provides added value in the assessment of soft tissue traumatic injury.

Longterm Radiographic Followup of Patients with Slipped Capital Femoral Epiphysis that underwent modified Dunn Procedure

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Purpose: Patients with Slipped Capital Femoral Epiphysis (SCFE) are at risk for cam deformities and hip osteoarthritis.

Therefore, we report on (1) prevalence of cam-deformities, (2) prevalence of decreased femoral headneck offset and (3) progression to osteoarthritis at longterm followup in patients with SCFE.

Methods and Materials: We performed a retrospective radiographic analysis involving 32 hips (32 patients, treated between 1998-2010). Inclusion criteria were SCFE patients that underwent modified Dunn procedure.

We evaluated pelvic radiographs at mean followup time of 9±3 years to calculate alpha angle on AP and lateral radiograph, head-neck offset, signs for osteoarthritis, Articulo-trochanteric distance (ATD) and minimal joint space width.

Most patients had acute-on-chronic slip. The mean age was 13±2 years at time of surgery and all SCFE patients presented with moderate or severe slips. Four patients underwent subsequent hip preservation surgery for correction of cam-deformities.

Results: (1) Nine patients (28%) had cam deformities at followup. Seven patients (22%) had camdeformites (alpha-angle>60°) on ap radiographs. Two additional patients had cam-deformites (alphaangle> 55°) on lateral radiographs. Mean alpha-angle of SCFE patients was 51±2° on ap radiograph and 40±2° on lateral radiograph.

(2) Seven SCFE patients (22%) had reduced femoral head-neck offset<10mm.

Mean ATD was 40mm, two patients(6%) had ATD <20 mm.

(3) Osteoarthritic changes were present in two SCFE patients (OA Grade 2 according to Tönnis).

Minimal joint space width was 3.5mm±0.5. Five patients developed periarticular ossifications, one patient had bilateral osseous cysts of the proximal femur at followup.

Conclusion: Every fourth SCFE patients developed cam-deformities associated with femoroacetabular impingement (FAI). Although we found a low prevalence of osteoarthritis, patients with cam deformities are at risk for developping hip osteoarthritis. We recommend routine radiographic followup for SCFE patients.

MRI based measurement of femoral version for pediatric patients with slipped capital femoral epiphysis and Perthes disease with T1 VIBE DIXON

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Purpose: It is unclear, how many patients with Slipped capital femoral epiphyses (SCFE) have low femoral version (FV) or femoral retroversion. Therefore, we report (1) mean FV, (2) prevalence of femoral retroversion (3) side-to-side difference for SCFE patients.

Methods and Materials: A retrospective MRI analysis involving 52 hips (26 patients, 01/2017-10/2021) was performed at University Hospital. Inclusion criteria were pediatric hip disease (16 SCFE patients and 10 Perthes patients. Age at imaging ranged from 10-16 years of age.
We measured FV using the Murphy method on axial rapid T1 VIBE Dixon MRI sequence (AT 32-40 seconds for 3 Tesla and for 1.5 Tesla) of the pelvis and in the same sequence for the bilateral knee joints (was added to the routine MRI protocol). FV was compared to the contralateral side. Femoral Retroversion was defined as FV<0°, Five Perthes patients were treated surgically after MRI.
Twelve SCFE patients presented with moderate or severe slips and were treated surgically.

Results: (1) Mean FV of SCFE patients (1±2°) was significantly (p<0.001) lower compared to contralateral side (16±14°) and compared to Perthes patients (18±16°).
(2) Ten SCFE patients (63%) had FV>0°. Six SCFE patients (37%) had femoral retroversion (FV<0°).
Of the contralateral side, two patients (12%) had femoral retroversion. Two Perthes patients (20%) had femoral retroversion.
(3) Side-to-side difference of FV was higher for SCFE patients (17±16°) compared to Perthes patients (13±9°).

Conclusion: More than one third of SCFE patients undergoing surgical treatment had femoral retroversion and they had lower FV compared to Perthes patients. SCFE patients are at risk for femoral retroversion and this is problematic because this is associated with anterior extraarticular subspine hip impingement. Therefore routine mesurement of FV and radiographic followup is recommended for these patients. This could helpf for surgical decision making for SCFE patients.

Structured MRI reporting in Spinal Dysraphism

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Purpose: The purpose of this study is to provide a comprehensive, structured, template checklist-style format for reporting spinal dysraphism that can help inexperienced radiologists to systematically analyze and report all the significant and ancillary findings in cases of spinal dysraphism and efficiently communicate the findings to the treating physician/surgeon.

Methods and Materials: The study was approved by the institutional review board and informed consent was obtained from each patient undergoing the study. Ours was a cross sectional study and we scanned a total of 45 paediatric cases between the period of July '17 till December '18. The study was performed on a 1.5 T MRI scanner with 8-channel coils using mainly T1, T2, T2* and FatSat images. The obtained images were provided to trainee radiologists in 2 groups, one with the reporting template and the other group without the template.

Results: We were able to prepare a structured reporting template and found out that the first group of trainee radiologists with the template could accurately point out maximum findings in a sequential manner as compared to the group without the reporting template.
1. Vertebral body lesions – Vertebral count Formation anomalies, Segmentation anomalies, Mixed anomalies
2. Spinal canal-Low-lying conus/tethered cord, Filar thickness, Split cord, Syrinx, Dural ectasia
3. Posterior vertebral elements-Spina bifida
4. Linear sinus like lesion-Extent, Terminating structure, Intrathecal portion Attachment on the spinal cord, Meningitis
5. Caudal Cell mass
6. Skin Covering
7. Associated anomalies

Conclusion: The present study provides the first iteration of the utilization of a structured template to retrospectively analyze the cases of spinal dysraphism. We further envisage that the suggested reporting system can evolve after widespread prospective application of this template and gathering surgical feedback. Subsequently, the gathered data can be utilized to facilitate research in artificial intelligence (AI) and machine learning applications.

SS219

Liver T1 mapping to quantify heart failure in patients undergoing cardiac MRI

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Purpose: To evaluate the role of liver T1 relaxation time as a non-invasive imaging biomarker for the quantification of hepatic congestion in patients with heart failure.

Methods and Materials: Patients with cardiac MRI inlcuding mapping sequences (1.5 T) between 2017–2019 were enrolled. Hepatic T1- relaxation times were measured in the superior parts of the liver near the liver vein confluens and in the inferior parts of the liver. Mean, superior and inferior hepatic T1 relaxation times were compared between patients with elevated NT-proBNP levels (> 125 pg/ml) and patients with normal or no NT-proBNP levels, using the Mann-Whitney-U test.

Results: 414 patients were included (279 male, 135 female, mean age 52.5±18.8 years), 12 patients with chronic liver disease were excluded. The superior parts of the liver were measurable in all patients, whereas the inferior parts were measurable in 96 patients. 109 of 414 patients (27%) had an elevated NT-proBNP level. Patients with elevated NT-proBNP had significantly higher mean T1 relaxation times of the liver compared with patients with normal NT-proBNP values (p=.041). The differences between the groups were greater in the inferior parts of the liver (606 ms vs. 667 ms; p=.001) compared to the superior parts of the liver (579 ms vs. 595 ms; p=.041).

Conclusion: During the interpretation of a cardiac MRI, hepatic T1 mapping of the depicted liver parts can be used as an early imaging biomarker for heart failure. Inferior parts of the liver are more vulnerable toward hepatic congestion than the superior parts of the liver.

SS220

Pulmonary transit time as an easily obtainable and robust parameter in routine cardiac magnetic resonance (CMR) perfusion scans

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Purpose: Pulmonary transit time (PTT) is a robust and easily obtainable non-invasive biomarker of haemodynamics with very low inter-rater variability.

Methods and Materials: PTT is the time it takes blood to pass from the right ventricle (RV) to the left ventricle (LV) and as such is a surrogate marker of heart failure, pulmonary arterial hypertension and lung disease. Two physicians independently evaluated 78 routine CMR perfusion scans of patients with dyspnea and/or presumed myocardial ischemia. Regions of interest (ROI) were placed in the blood pool of the RV and LV. Time signal intensity curves of the RV and LV were determined, and the PTT was calculated as the time in seconds (s) between peak signal intensities.

Results: The median LV and RV ejection fractions (LVEF, RVEF) were 47% and 54% (interquartile range (IQR): 32 to 61% and 47 to 61%). The median PTT of the two physicians was 7.9s (IQR: 6.5 to 13.5s and 6.5 to 13.3s), resulting in an intraclass correlation of 0.99 (p<0.001). The median PTT of patients with severely depressed LVEF (<30%) was 12.3s (IQR: 8.7 to 20.0s) whereas the PTT of patients with normal LVEF (>=57%) was 7.5s (IQR: 5.4 to 8.8s) (p=0.043).
The median PTT of patients with severely depressed RVEF (<30%) was 15.8s (IQR: 10.3 to 18.0s) whereas the PTT of patients with normal RVEF (>=57%) was 7.7s (IQR: 6.3 to 9.6s) (p=0.023).

Conclusion: PTT is an easily obtainable and robust non-invasive biomarker of hemodynamics and might be helpful in the assessment of patients with dyspnea.

SS221

Myocardial scar detection in free-breathing Dixon-based fat- and water-separated 3D Inversion Recovery Late-Gadolinium Enhancement whole heart MRI

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Purpose: Cardiac magnetic resonance imaging is the gold standard for noninvasive detection and quantification of myocardial fibrosis and scars. The aim of this study was to investigate the diagnostic accuracy and reader confidence for late-gadolineum enhancement (LGE) detection of a novel free breathing, respiration-gated 3D LGE sequence with fat-water separation, in comparison to a free breathing motion-corrected 2D LGE sequence in patients with cardiomyopathy.

Methods and Materials: Patients undergoing cardiac MRI containing both sequences were enrolled.
Two independent blinded readers analyzed both sequences and compared them regarding image quality, LGE detection/quantification, SNR/CNR. Results were compared by Wilcoxon test for paired samples. For the LGE detection and confidence rating, a JAFROC analysis with fixed readers and random cases was performed, JAFROC figure of merit (FOM) calculated as the area under the AFROC curve.

Results: 47 patients were included (technical failure rate 5/47). The mean sequence times of the 2D sequence were significantly shorter compared to the 3D sequence (p<0.001). 3D-LGE sequences were significantly superior for evaluation of fine anatomical structures such as the atria or pericardium.
JAFROC analysis revealed a significantly higher FOM for the 3D LGE sequence (FOM=0.84) than the 2D LGE-sequence (FOM=0.77; p=0.003). There were no differences in overall image quality or all the other analyzed parameters.

Conclusion: 3D LGE imaging allows accurate LGE detection with higher confidence and better delineation of fine anatomical structures. Scan acquisition time for the 3D sequence just slightly longer than the 2D sequence. 3D LGE imaging is ready for implementation in clinical routine protocols.

Comparison of left atrium scar tissue thresholding on a prototype 3D LGE sequence using multiple cut-off values

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Purpose: Late Gadolinium Enhancement (LGE) Cardiac MRI is well established for myocardial lesions but less validated for atrial wall. Pericardial fat and respiratory synchronization are common sources of error. There is no recognized quantification threshold for left atrium scar. We investigated different thresholding strategies based on a 3D LGE Dixon water-fat separated and image navigated (iNAV) free breathing prototype sequence acquired at 3T (MAGNETOM Skyra, Siemens Healthcare & IMRIS).

Methods and Materials: 11 patients underwent 3D LGE MRI with a proposed prototype sequence (100% respiratory scan efficiency) (n=6) or diaphragm navigated IR product sequence (n=5).
Electroanatomic maps (EM) were generated after the MRI (CARTO system). Scar tissue ratio was calculated from the EM using a 0.1 mV bipolar voltage cut-off. Thresholds for atrium wall volumes (as % of the whole atrial wall) corresponding to scar tissue were: Full-Width at Half Maximum (FWHM), Mean myocardium Signal Intensity (SI) + 2-7 standard deviations (2-7SD), and Image Intensity Ratio-s (IIR) to blood 1.32 and 1.61.

Results: High resolution, high-quality images were obtained in 5 of 6 patients with the prototype, with residual motion artifact in one case. 4 patients had good quality product images with one case of inflow artifact. With the prototype the scar volume % were not significantly different for the Mean + 5-7 SD, both IIR and FHWM thresholds (18.8±18.7, 11.0±13.2, 5.8±8.3, 5.5±9.1, 0.9±1.9 and 32.0±9.7 respectively, p>0.2, for all), compared to the EM. With the product all the values based on the myocardium SI (p<0.001 for 2-4 SD, p<0.05 for 5-7 SD, 88.6±8.5, 81.6±11.7, 72.7±15.6, 61.2±20.9, 49.2±25.6, 37.0±29.5), and FWHM thresholds (49.5±24.4, p=0.034) were significantly higher.

Conclusion: Our preliminary study suggests that the new prototype sequence allows more accurate quantification of electroanatomic voltage mapped scar tissue in the left atrial wall, with either Mean + 5-7SD and both IIR and FHWM thresholds.

Extracellular volume quantification with cardiac late enhancement scanning using dual-source photon-counting detector CT

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Purpose: To evaluate the feasibility and accuracy of cardiac late enhancement (LE) scanning for extracellular volume (ECV) quantification with dual-source photon-counting detector computed tomography (PCD-CT).

Methods and Materials: In this IRB-approved study, 30 patients (mean age 79 years, 12 women, mean body mass index, 28 kg/m^2) with severe aortic stenosis undergoing PCD-CT as part of their preprocedural work-up for transcatheter aortic valve replacement were included. The scan protocol consisted of a non-enhanced calcium-scoring scan, coronary CT angiography (CTA) followed by CTA of the thoraco-abdominal aorta, and a low-dose LE scan 5 minutes after the administration of 100mL contrast media (all scans ECG-gated). Virtual monoenergetic (65keV) and dual-energy (DE) iodine images were reconstructed from the LE scan. ECV was calculated using the iodine ratios of myocardium and blood-pool of the LE scan, and additionally based on single-energy (SE) subtraction of the non-enhanced scan from the LE scan. 3D analysis was performed automatically for the wholeheart myocardial volume by matching a heart model generated from the respective coronary CTA data. Bland-Altman and correlation analysis were used to compare the ECV values determined by both methods.

Results: The median dose length product for the LE scan was 84 mGy·cm [interquartile range 69, 125 mGy·cm]. ECV quantification was feasible in all patients. The median ECV value was 30.5% [interquartile range 28.4%, 33.6%]. Two focal ECV elevations matched known prior myocardial infarction. DE- and SE-based ECV quantification correlated well (r=0.87, p<0.001). Bland-Altman analysis showed small mean errors between DE- and SE-based ECV quantification (0.9%, 95% confidence interval 0.1%, 1.6%) with narrow limits of agreement (-3.3%, 5.0%).

Conclusion: Dual-source PCD-CT enables accurate ECV quantification using a late enhancement cardiac dual-energy scan at low radiation dose.

SS224

Epicardial Fat as a Vanguard of Coronary Artery Disease: Automated Body Composition Analysis Allows Low-Cost Early-Stage Identification of Women at Cardiovascular Risk.

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Purpose: This study aimed to investigate if body composition analysis (BCA) can be used to measure pericardial fat (PCAT: epicardial and para-cardial adipose tissue, EAT and PAT) as part of individual cardiovascular risk-assessment in a large clinical cohort of patients with unspecific cardiovascular symptoms.

Methods and Materials: 966 patients (06/2013-02/2020, mean age: 59.3 ±9.6 y, 65% female) with intermediate Framingham-risk-scores for coronary artery disease (CAD) received coronary calcium scans because of unspecific symptoms and were included retrospectively using Siemens Dual Source CT-scanners (2x128 detector, 5mm reconstruction). The Coronary Artery Calcium Score (CACS) was extracted, and tissue quantification was performed by a deep learning network (DLN). The DLN was pre-trained on a set of 100 independent thoracic CT-scans. Kruskal-Wallis- and Pearson's test were conducted. A p-value of $p<0.01$ was considered significant. Ethical approval was obtained (ID: 20-9635-BO).

Results: While the DLN-based results on tissue quantification indicated no general correlation between EAT-volume and radiodensity compared to CACS (r=0.18, r=-0.09), they did however indicate that especially women with mild CACS (CACS 1–99) show significantly increased EAT and PAT volumes and radiodensities compared to asymptomatic patients ($p<0.01$). Notably, this difference remained insignificant regarding EAT attenuation in males. CACS-1–99 vs. CACS-≥100-categorypatients also remained below significance level (EAT volume: p=0.087, EAT attenuation: p=0.98). The DLN reached high accuracy (0.96 to 0.98 Dice scores for the various regions) and a processing time of 7 seconds per scan.

Conclusion: These findings support the hypothesis of PCAT being a risk factor for CAD which operates paracrinally and independently from visceral adiposity.

BCA is a resource-conserving method to extract biomarkers like PCAT within the diagnostic process of cardiovascular risk-stratification of women with unspecific symptoms receiving any kind of thoracic CTscan.

SS225

Epicardial Adipose Tissue Attenuation and Fat Attenuation Index: Phantom Study and In-Vivo Measurements with Photon-Counting CT

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Purpose: The aim of this study was twofold. First, the optimal VMI level to measure epicardial adipose tissue (EAT) attenuation was determined in a phantom study. Second, the attenuation of EAT including calculation of the fat attenuation index (FAI) from virtual monoenergetic images (VMI) on a first-generation dual-source PCD-CT in patients was assessed.

Methods and Materials: An anthropomorphic multi-energy CT phantom at two sizes with an insert mimicking adipose tissue was imaged on a first-generation PCD-CT and on an energy-integrating detector CT (EID-CT) at 120kV which served as reference standard. In addition, 30 patients who underwent ECG-gated unenhanced and contrast-enhanced coronary CT angiography with the same PCD-CT without or minimal coronary calcifications were retrospectively included. VMI from PCD-CT data were reconstructed at 55-80keV in 5keV-intervals. We measured fat attenuation in the phantom and EAT attenuation of patients in both unenhanced and contrast-enhanced scans. The FAI of the RCA, LAD, and CX were calculated in patients.

Results: In the phantom, attenuation values of fat increased with keV-level (between 55keV and 80keV: 34% increase for the small size, r=0.98,p<.001; and 22% for the large size, r=0.99,p< .001).

Fat attenuation values from 70keV VMI were similar to those measured with EID-CT. In patients, EAT attenuation was similar in unenhanced compared to contrast-enhanced scans at 60-80keV (for each keV-interval p >.05). Significant correlations were found between EAT attenuation and keV-levels in unenhanced (r=0.74,p<.001) and in contrast-enhanced CT scans (r=0.67,p<.001). Significant correlations were also found between the FAI and keV-levels for the RCA (r=0.38,p<.001), LAD (r=0.34,p<.001), and CX (r=0.24,p=.001).

Conclusion: Spectral behaviour of EAT determined with a dual-source PCD-CT indicates a dependency of attenuation on keV-levels and contrast enhancement. 70keV VMI are most appropriate for measuring pericoronary inflammation and yield comparability with polychromatic images.

SS226

Intra-individual comparison of coronary calcium score using photon-counting CT vs standard CT: Early experience

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Purpose: The purpose of this study is to assess the performance of a dual-source photon-counting CT (PCCT) system for the evaluation of coronary calcium in patients who receive clinical calcium scoring CT examinations.

Methods and Materials: Nine patients were included in the first weeks of patient scans on the PCCT system (NAEOTOM Alpha, Siemens Healthineers). All patients underwent clinical non-contrasted CT examination on a dual-source CT (FORCE, Siemens Healthineers) and were consented to a second scan on the PCCT on the same day (120 kVp, reconstructed with 3 mm slice thickness in filtered-back projection).
Calcium scoring was calculated using Syngo.Via (Siemens Healthineers) and radiation dose measurements (CTDIvol and DLP) were documented. Contrast to noise ratio (CNR) and signal to noise ratio (SNR) were calculated based on three consecutive ROIs placed in the pectoralis muscle and the subcutaneous fat of the patient's chest.
Agatston scores and radiation dose measures were compared using paired t-tests (RStudio).

Results: The demographics of the nine patients were: sex: 7 males, 2 females, age: 66 ± 8 years, BMI of 27.9 ± 8.0 kg/m^{2}, range: 21.8-47.7. Average Agatston score for clinical CTs was 748 ± 1407 (range: 0-4056) and 837 ± 1581 (range: 0-4530) for PCCT (P=0.17). The differences between Agatston scores in clinical CT and PCCT did not result in a change of coronary artery disease risk stratification (3=no risk, 2=mild risk, 1=moderate risk, 3=severe risk).
CNR (clinical CT: 9.2 vs PCCT: 8.1) and SNR (clinical: 3.0 vs PCCT 3.2) were similar. There were significantly lower radiation doses in PCCT (CTDIvol clinical: 4.8 ± 4.1 vs PCCT: 2.2 ± 0.9, (P=0.04); DLP clinical: 77.4 ± 58.9 vs PCCT: 39.7 ± 11.6, (P=0.03)).

Conclusion: Photon-counting CT delivers comparable calcium scores as clinical CT and results in this cohort did not change cardiovascular risk stratification. This work-in-progress project shows that the same image quality can be achieved at much lower radiation dose to patients than current clinical CT.

SS227

High-pitch Photon-counting Detector CT For Angiography Of The Aorta – Intraindividual Comparison To Radiation Dose-matched Energy-integrating Detector CT With Automatic Tube Voltage Selection

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Purpose: To compare objective and subjective image quality of high-pitch CT angiography of the aorta between clinical photon-counting detector CT (PCD-CT) and conventional energy-integrating detector CT (EID-CT) with automatic tube voltage selection (ATVS) in the same patients at equal radiation dose.

Methods and Materials: Patients with prior CT angiography of the thoracoabdominal aorta acquired on dual-source EID-CT in the high-pitch mode and with ATVS were included. Follow-up imaging was performed on a clinical dual-source PCD-CT in high-pitch and multi-energy (QuantumPlus) mode at 120 kV using the same contrast media protocol. Radiation doses were matched. Polychromatic images (T3D) for both EID-CT and PCD-CT and virtual monoenergetic images at 40, 45, 50, and 55 keV for PCD-CT were reconstructed. CT attenuation, noise, and CNR were measured. Subjective image quality (noise, vessel attenuation, vessel sharpness, and overall quality) was rated by 2 blinded, independent radiologists.

Results: Forty patients were included. There was no significant difference in BMI, effective diameter, or radiation dose between scans (all P's>0.05). Mean CNR was 17±8 for EID-CT and 22±7, 20±6, 18±5, 16±5, and 12±4 for PCD-CT at 40, 45, 50, 55 keV, and T3D, respectively. CNR was significantly higher for 40 and 45 keV of PCD-CT as compared with EID-CT (both P<0.05). Linear regression revealed that the CNR gain with PCD-CT was 34% higher for overweight as compared with normalweight patients. Subjective noise was rated significantly higher for 40 and 45 keV (P<0.001) and overall quality similar (P>0.05) between scans.

Conclusion: High-pitch PCD-CT angiography of the aorta with VMI at 40 and 45 keV resulted in significantly increased CNR compared with EID-CT with ATVS at matched radiation dose. The CNR gain of PCD-CT increased in overweight patients. Taking into account the subjective analysis, VMI at 45 to 50 keV is proposed as the best trade-off between objective and subjective image quality.

SS228

Low Volume Contrast Media Protocol for CT Angiography of the Aorta: Prospective Development and Evaluation with Photon-Counting Detector CT

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Purpose: To develop and evaluate low-volume contrast media (CM) protocol for thoracoabdominal CT-angiography (CTA) of the aorta with first generation photon-counting detector CT (PCD-CT).

Methods and Materials: 100 consecutive patients (mean age 74.5±8.4years, 17 women) were prospectively included who underwent thoracoabdominal CTA of the aorta with first-generation PCDCT at 120kV and who underwent previous thoracoabdominal CTA with energy-integrating detector (EID)-CT using automated tube voltage selection. Tube current-time product in PCD-CT was modified in each patient to obtain equal volume CT-dose-index ($CTDI_{vol}$) as with EID-CT. In PCD-CT, virtual monoenergetic images (VMI) were reconstructed (5keV-intervals, 40-55keV). Attenuation of the aorta, noise and contrast-to-noise ratio (CNR) was determined. Subjective image quality was rated. In the first cohort (40 patients), the same CM-protocol was used for PCD-CT and EID-CT (volume 70ml, flow rate 4ml/s, 370mg/ml). Increase of CNR in PCD-CT compared to EID-CT in this cohort was quantified and served as reference for CM-volume reduction in the second cohort (60 patients).

Results: Similar $CTDI_{vol}$ between PCD-CT and EID-CT was observed (both, 4.9±1.9mGy) (p>0.05). In the first cohort, VMI at 40-50keV showed significantly higher CNR compared to EID-CT (all, p< 0.05). VMI at 50 and 55keV showed highest subjective image scores. VMI at 50keV was selected as ideal keV-level (best trade-off between subjective and objective image quality), showing 25% increase of CNR compared to EID-CT. CM-volume in the second cohort was reduced by 25% (52.5ml, 3ml/s). In the second cohort similar CNR and subjective image quality was observed between VMI at 50keV from PCD-CT using low-volume CM-protocol compared with EID-CT using normal CM-protocol (both, p-value >0.05).

Conclusion: PCD-CTA of the aorta with generation of VMI increases CNR, which can be translated into a low-volume CM-protocol resulting in diagnostic image quality.

SS229

Dual-Energy Low-keV vs. Single-Energy Low-kV for CT Angiography of the Aorta – Prospective Randomized Assessment

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Purpose: To compare image quality between single-energy low-kV images (SEIs) and dual-energy low-keV virtual-monoenergetic-images (VMIs+) in CT angiography of the aorta (CTA).

Methods and Materials: In this single-center, prospective, randomized, controlled trial, 84 patients receiving CTA of the aorta after endovascular repair on a dual-source CT were allocated to either a low-kV single-energy (reference group; group A) or a dual-energy protocol (group B). Each protocol was adjusted to achieve equal radiation dose based on phantom scans. VMIs+ at 40keV and 50keV from dual-energy and linear-blended images from single-energy were reconstructed. For all three image sets, mean CT attenuation was measured in 6 regions of the aorta and image noise in the psoas muscle. CNR was calculated. Objective image quality was compared using non-parametric statistical tests.

Results: 46 and 38 patients were allocated to group A and B, respectively. There was no significant difference in radiation dose between groups (CTDIvol: 4.69±1.8 vs 4.74±1.3 mGy, p=0.67). Attenuation of the aorta was significantly higher for VMI+ at 40keV (833HU, p<0.001) and similar at 50keV (564HU, p=0.93) as compared to SEI (557HU). Noise was significantly higher for VMI+ (40keV: 42HU; 50keV: 32HU) as compared to SEI (26HU, both p<0.001). There was no significant difference in CNR between VMI+ at 40keV (19.7) and SEI (20.9, p=0.71) while VMI+ at 50keV (17.1) had significantly lower CNR (p=0.03).

Conclusion: Virtual monoenergetic images at 40keV can be used as a surrogate of single-energy low-kV images in CTA of the aorta yielding comparable objective image quality.

SS230

Virtually Augmented Self Hypnosis in Peripheral Vascular Interventions: Interim analysis of randomized controlled trial

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Purpose: The aim is to investigate the efficacy of Virtually Augmented Self Hypnosis (VA-HYPO) as an adjunctive non-pharmacological method for procedural pain and anxiety relief in Endovascular Interventions (EVI).

Methods and Materials: An immersive distraction experience featuring virtual reality using head mounted display is compared with the standard management (SM). Patients followed the "Aqua" module (OncomfortTM) consisting in a scuba dive and breath exercises allowing to reach a dissociative state similar to clinical hypnosis, without direct intervention of a professional, called digital sedation.
A total of 100 participants will be enrolled in a 1:1 randomized open study (VA-HYPO or SM). Anxiety is evaluated using the State Trait Anxiety Inventory (STAI) and Pain with Visual Analogic Scale (VAS) in 3 dimensions (1. sensory-discriminative = nociceptive mechanism intensity, 2. affective-motivational = unpleasantness sensation and 3. cognitive-evaluative = memory emphasizing the distress linked to prior procedures) at 3 different moments (pre, post and after 3 month of intervention).

Results: The interim analysis (62 included patients) showed a mean anxiety reduction (pre- vs. postprocedure) in both groups with a non-significant difference in difference of 3.5 points. Considering a binary threshold of 0.5 SD for responders and non-responders to anxiety lowering, the percentage of responders was higher (77%) with VA-HYPO than SM (59%). Post-procedure, the mean sensory-intensity and affective emotional pain wasn't significantly different between the groups. Regarding the pain intensity difference before vs. after the procedure, the minimal clinically relevant increase of 2 points was reached less frequently with VA-HYPO (13%) than SM (28%).
At 3 month, negative memories (difference of >1 VAS from post procedural reported pain intensity) where lower with VA-HYPO (25%) than SM (35%).

Conclusion: VA-HYPO improves procedural stress coping. It might change the management of pain and anxiety during EVI.

Feasibility and performance of free-hand single-photon computed tomography/ultrasonography (fhSPECT/US) for preoperative parathyroid adenoma localization: a pilot study

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Purpose: To evaluate the feasibility of a new hybrid imaging modality, the free-hand single-photon computed tomography/ultrasonography (fhSPECT/US) for preoperative localization of parathyroid adenomas and to compare its performances with recommended imaging modalities ultrasonography and SPECT/CT.

Methods and Materials: In this prospective pilot study, patients underwent ultrasound and parathyroid scintigraphy including SPECT/CT, followed by fhSPECT/US allowing real-time fusion between US and gamma-camera images manipulated free-handedly by the operator. Detection rate from all three imaging modalities were measured and correlated with histopathology results when available or with the imaging modality showing the highest number of lesions. Issues related to image acquisition and technique were also explored. Descriptive analysis of data and a McNemar test to compare performances were conducted.

Results: Twelve patients were included. Sensitivity of fhSPECT/US was 58% (95%CI: 32–81%) and 44% (23–67%) based on patients and lesions, respectively. Sensitivity results for fhSPECT/US were lower compared to US 75% (47–91%) and 63% (39–82%) and SPECT/CT 100% (75–100%) and 100% (81–100%), considering patients and lesions. The fhSPECT/US did not allowed the detection of 9 lesions in 5 patients due to a deeper localization of lesions (>4.5 cm); image fusion changed by the tissue compression; limited spatial manipulation of the probe; and spread of detected activity.

Conclusion: The use of fhSPECT/US for the localization of parathyroid adenomas is clinically feasible but requires technical improvements. Technical limitations were identified and were mainly related to the depth of adenoma localization and spatial manipulation of the SPECT mobile camera. Sensitivity of fhSPECT/US is lower than US and SPECT/CT.

Quantity adjustment of iodinated contrast agent determined by lean body weight for abdominopelvic computed tomography (CT): A systematic review protocol

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Purpose: The aim of this systematic review is to assess the potential of lean-body-weight-based (LBW) contrast media dosing to optimize the contrast enhancement during abdominopelvic CT protocol for different patient's size and weight.

Methods and Materials: A systematic review of quantitative studies including randomized controlled trials (RCT) and quasi-RCT was performed. PubMed, Embase, MEDLINE, CINAHL, Cochrane were searched for studies focusing on multi detector computed tomography published from 2002 to 2021 with no language limitation.

Participants of these studies are adults (18 years old) undergoing an abdominopelvic CT protocol with single contrast media injection. Clinical indications are oncologic follow-up and acute disease.

The review included studies that evaluate effectiveness of contrast media volume calculation based on LBW for optimal image quality. We considered all mathematical formula, electronic or medical imaging devices to measure patient LBW.

The comparators are other types of dose calculation: total body weight, fixed dose, body mass index, body surface area, blood volume and height. All identified citations were collated into EndNote X9 for deduplication. Titles, abstracts, and then full texts were screened independently by two researchers using Rayyan.

Results: Among 1956 studies found, 21 studies were included. Most of the author measured Hounsfield units (HU) in the liver or in the abdominal aorta to calculate enhancement variability between groups. Most authors placed region-of-interest in the liver and the aorta, and then compare various image quality indicators, such as signal-to-noise, contrast-to-noise or contrast enhancement index between the intervention and control groups.

Although this review is underway, the results of the included studies seem in favor to the LBW. They will be developed during the presentation.

Conclusion: LBW-based contrast media dosing for abdominal CT seems an appropriate protocol to optimise enhancement and reduce the injected volume of contrast media.

Insights from Alumni and Employers about Radiographers education, clinical skills and competences provided in Western Switzerland

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Purpose: This study aimed to explore Alumni and work market perspectives about current BSc education/training delivered in the "HES" and its impact on the job market as well as the development of professional skills expected for radiographers in 2031.

Methods and Materials: Two online surveys were designed, one targeting HES Alumni 2015-2021 and the other the market (Head Radiographers, Clinical Tutors, Imaging Modality managers, Industry).
The snowball sampling technique was employed, and the surveys were distributed through the researchers' networks and by Swiss Association of Radiographers Society on social networks (LinkedIn and Facebook). Descriptive and inferential statistics were performed using Excel and SPSS.

Results: A total of 172 valid responses were received (80 Alumni, 92 work market). The most expressed CanMED Roles in practice were professional, communicator, collaborator, expert. Radiographers' practice is not evidence-based (65.1%; 66.3% respectively) according to the participants and both groups expressed also low integration of research in practice (83%; 84.8% respectively). Most of Alumni (57.5%) and market representatives (53.8%) considered having medium level of autonomy in practice, with Alumni highlighting the interaction with patients and market referring the protocols selection/optimization. Regarding Education, Alumni suggested improvements in the content, pedagogical approaches and need of specialization, while the market representatives referred the need of a better link between education and practice, better patient care, and soft skills development.

Conclusion: A better link between education and practice can help on the integration of research on practice, necessary to progress the radiographers' profession. Un update of content is also a need to answer to market needs. The new curricula must encompass knowledge, clinical skills and competencies allowing the necessary changings in the professional postures of radiographers, integrating the CanMED Roles and increasing autonomy.

The role of conventional radiography in Western Switzerland for musculoskeletal studies

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Purpose: To identify the main projections used in conventional radiography in Western Switzerland and the main clinical indications presented in the referrals to better adapted the radiographers' education and training program to the market needs.

Methods and Materials: A survey was designed on LimeSurvey targeting the clinical tutors that collaborate with medical imaging programs in Western Switzerland to identify main projections and the clinical indications. The snowball sampling technique was employed, and the surveys were distributed through the networks & by Swiss Association of Radiographers Society. Descriptive & inferential statistics were performed using Excel and SPSS. Ethi cal approval was obtained (Ref2020-00311).

Results: Response rate was 56.5% (26/46). The humerus (92.3%), wrist (92.3%) and shoulder are the main anatomical area studied by conventional radiography with Neer projection referred as very frequent (92.3%). For the pelvis region, the AP (92.3%), AP for Surgical measurements (80.8%), and Lequesne (18/26) are being prescribed. The ankle (96.2%) and the foot (92.3%) radiographs are also solicited.
The Lateral Skull view (30.8%) and panoramic scanning dental X-ray are requited (23.1%). Cervical AP & Lateral views were identified as frequently requested (92.3%). The lumbar spine are assessed mainly with Lateral (88.5%) & PA upright (84.6%). For Skull, the Hirtz, Tangential Nose Bones, Worms and Caldwell's views are not being performed in practice. The main clinical justifications presented to require the performance of radiographies were trauma, degenerative and rheumatology.

Conclusion: Conventional radiography is still used to study upper and lower limbs, spine, & skull, with some projections disappearing from practice (skull views). Trauma is the main indication presented by the referrals. The training programs must focus the projections of upper and lower limbs with pedagogical scenarios integrating clinical cases of trauma to better prepare students for market needs.

Radiographers' plain radiography protocol adaptations in an ER department: Project

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Purpose: According to European Federation of Radiographers Society (EFRS), radiographers are able to interpret and analyze radiological prescription and have an important role in the justification and optimization of radiological demands. These skills combined with radiographers' ability to detect abnormalities, give them a central role in protocol adaptation and accurate projections choice. In Western Switzerland, a 3-year Bachelor educational framework establishes the legal guideline of minimal skill requirements for working radiographers. They must be able to identify possible anatomical-physiopathologicals anomalies and complete or correct the protocol and/or investigation parameters. An internal document of the University Hospital of the canton of Vaud (CHUV) describes that radiographers must be able to evaluate the accuracy between the medical exam prescription and the provided patient information. These skills are all in line with the Swiss Federal Law on Health Professionals (LPSan), stating that health professionals in the country must be able to determine whether the services they provide are efficient, adequate, economical and how to act accordingly. In clinical practice, this role seems often forgotten or unknown by other health professionals, and even radiographers themselves. The aim of this study is to assess radiographers' protocol adaptations in the emergency room (ER) of a University Hospital in Switzerland.

Methods and Materials: A cross-sectional study using a case report form in Excel will be used to explore protocol adaptation, concerned anatomical regions and adaptation reasons. According to variables nature adequate descriptive, associative and comparative statistics will be conducted.

Results: A total of 32 different radiographers filled out at least once the Excel sheet with data. [More results will be presented].

Conclusion: As this project is not yet finilized, a conclusion will be presented and established futher in time.

RSS06

Simulated magnetic resonance imaging (MRI) by radiographers to reduce the sedation of peadiatric patients: a systematic review

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Purpose: To develop updated evidence-based recommendations to perform simulation as strategy to prepare pediatric patients for MRI examinations reducing the use of sedation.

Methods and Materials: A systematic review using the Joanna Briggs Institute System for the Unified Management (JBI SUMARI) was performed to identify studies after 2010. Sedation, anxiety, pediatric*/child, mock MRI/play therapy were included in the search using 6S model. Consulted databases were National Guidelines Clearinghouse, Nice, HealthEvidence, JBI, Cochrane, Uptodate, Tripdatabase, PubMed, Cinhal and Google Scholar. Three independent reviewers assessed articles. Gradepro software was used to rate each recommendation.

Results: 5 out of 266 articles were selected: one systematic review, 2 randomized controlled trials and 2 quasi-experimental and observational studies. Two recommendations graded as B come up: Pediatric patients' preparation with a MRI simulation is efficient between 4 and 11 years old. The relative risk of sedation was reduced to almost 50% to the patients prepared with a simulated MRI compared to those without preparation. Modified Yale Preoperative Anxiety Scale (mYPAS) test was suggested as a tool to select the patients that can be exposed to a simulation, when the score is less than 33.

Conclusion: The simulation of MRI to prepare peadiatric patients for this examination is a strategy that can work but in specific circumstances and mainly for an age superior to 4 years old. Simulation can reduce anxiety ensuring a successful examination without sedation. Further studies, however, should be conducted to verify if this strategy can be applied to other imaging modalities even using the same simulation setting. Our main limitation is that only few studies were available.

RSS07

Person Centred Care in breast pathology management supported by breast imaging and artificial Intelligence

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Purpose: To summarize the state of the evidence in the use of Artificial Intelligence (AI) in breast imaging to provide person centered care (PCC).

Methods and Materials: A scoping review using the Joanna Briggs Institute methodology was applied to identify studies published between 2016-2021 in English or French. The search was performed through 6 databases: MEDLINE, Embase, Cinhal, Web of science, IEEE explore and arxiv. A combination of keywords and Medical Subject Headings terms (MeSH) related to breast imaging and AI were used. The selection on these criteria was carried out manually. Three independent reviewers screened articles. Systematic reviews, books or book sections were excluded.

Results: 79 articles out of 2324 studies mainly from 2 countries (China and United States of America) were included. The main imaging modalities explored in the included studies were mammography (34.2%), magnetic resonance imaging (MRI) (34.2%) and ultrasound (19%). Seven categories related to the PCC concept were identified: treatment assessment (16%), risk prediction/growth, prediction/false negative reduction (58%), unnecessary biopsies reduction (8%), specific populations (1%), patients' preferences (4%), tumour type prediction (5%) and other issues (9%). Only one study included male population. Women included were aged between 15-92 years. The studies were predominantly retrospective and some variations were present in the datasets used.

Conclusion: The use of AI in breast imaging is mainly focused on cancer prediction and disease management. It seems that AI facilitates personalised screening, taking into consideration the specific risks, benefits, as well as the identification of the most suitable precision treatment by analysing diverse data. There is a lack of studies yet that provide insights into personalised care to improve their experience during imaging acquisition, positioning, compression, optimization of quality/dose received, or faster acquisitions.

RSS08

Can artificial intelligence compete with radiographers in characterizing radiographs of the upper limb?

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Purpose: Artificial intelligence (AI) is transforming the landscape of radiology, including the curriculum and clinical practice of radiographers. This study focuses on the development of an AI system to characterize radiographs of the upper limb based on deep learning – by investigating its performances and applicability in a teaching environment.

Methods and Materials: 40'561 radiographs from the public MURA dataset were organized into main anatomical parts (shoulder, humerus, elbow, forearm, wrist, and hand). Furthermore, we categorized 8'379 shoulder radiographs into 5 standard projections: axial, Neers and AP internal/external/neutral rotations. A variant of the NASNet architecture was trained to classify the limb parts and shoulder projections. Part of the dataset was kept aside to compare the performances of 20 last year BSc radiographer students against the AI, during a hands-on workshop.

Results: In general, the AI correctly recognized anatomical parts (mean accuracy of 96.5%), and reached a good accuracy in classifying shoulder projections (84.2%) – excelling with axial radiographs (99.5%) while facing major difficulties with external rotations (59.4%).

Using the workshop dataset, AI performance in shoulder classification dropped to 75% while students collectively performed better (87.5%). Actually, AI and students were on par for axial, Neers and neutral rotation radiographs but the AI struggled with internal and external rotations. Interestingly, a class activation map technique showed that AI focused like humans on the humeral head to distinguish shoulder radiographs. The AI was clearly faster than students (~100x speedup).

Conclusion: The developed AI showed very promising classification capabilities, not for diagnosis support, but for automatic post-processing of radiographs (e.g., check/propose image description, support of billing systems). More importantly, by engaging radiographer students to compete against an AI, we raised student interest and awareness on the capabilities and limitations of AI.

Radiographers' percieved workload in Western Switzerland

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Purpose: The aim of this study was to assess radiographers' perceived workload.

Methods and Materials: For this cross sectional designed study, data was gathered via an online survey sent to diagnostic radiographers in Western Switzerland. Perceived workload was determined using the validated translated version of the NASA-RTLX which is composed of 6 subscales assessing different dimensions linked to perceived workload. Descriptive and cross statistics were established according to gathered data.

Results: Response rate was 23.9% (n=150). Radiographers' overall perceived workload was above average (6.48/0-10 scale). Mental demand, physical demand, temporal demand and performance all scored above 7 in this study, with temporal demand being the highest score. Diagnostic radiology is known to be guided by very short examination times. The increased number of examinations and the increased pressure to reduce time both have an impact on radiographers' perceived temporal workload. Misalignment between radiographers willingness to have more time with their patients and the induced time pressures, could lead to lower intent to stay in the profession and increase turnover.

Staff shortage can contribute to higher perceived workload since understaffing will automatically induce more work, and may lead to error and negative impacts on patient safety

Conclusion: These results show that radiographers have high perceived workload. To decrease perceived physical workload and strain, ergonomic principals must be encourage through adequate training and work organization. Departments must take actions that will increase staff in radiological departments in order to decrease perceived high workload and guarantee quality of care in the future

Diagnostic radiographers and radiation therapists professional role and interprofessional cooperation related to the therapeutic phase of breast cancer care – an integrative review and a qualitative study in four European countries

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Purpose: The European E- Breast II Strategic Partnerships project developed by Higher education institutions and University and Hospitals from Estonia, Finland, Norway, and Switzerland aim to produce new research knowledge and a better understanding of interprofessional collaboration of health professionals staff involved in breast cancer during the therapeutic phase of breast cancer care. The study combine an evidence-based approach and an interprofessional perspective and the research outputs will be integrate in an e-learning platform.

Methods and Materials: An integrative review and two open-ended online questionnaires addressed respectively to patients and health professionals concerned by breast care treatments were performed in the four participating countries. The integrative review explores four databases to identify the competencies of the 4 key professions involved in breast cancer care and treatments. Patient's and professional's viewpoints were collected.

Results: The review shows that nurses and RTTs competencies are required for high quality of care.

However, there is a lack of evidence regarding the expected competencies of radiographers and biomedical laboratory scientists that also play a key role in this specific phase of patient's care pathway. Patient's viewpoint are focused on staff-patient interactions, the quality of care, the treatment process and access and the flow of the process. Right content, timely information and the singularity of each patient are the key points of professionals viewpoints.

Conclusion: There is a need for a clear and explicit description of common and specific competencies. The role of diagnostic radiographers and biomedical laboratory scientists regarding the therapeutic phase of patient's breast cancer pathway where they play a key contribution like radiation therapists and nurses. A patient-centered approach needs the improvement of interprofessional cooperation based on a better recognition of the role and competencies of each professional involved in the process.

RSS11

Radiological patient care in carceral environments: Particularities & complexities

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Purpose: Prisons are among the least sanitary places in our societies. People are not only deprived of their liberty there, but are also exposed to threats such as violence, drugs, infectious diseases" (Austen Davis & al, 2001). The purpose of this presentation is to offer a wider understanding of the complexity of the carceral world (organization, security, ethics), of the provided healthcare services, various somatic and psychiatric pathologies encountered, a better understanding of prisoners' perspective on their experience during their incarceration. And finally, to discover the role of health professionals and in particular that of the radiographer in this specific context.

Methods and Materials: A literature search was conduct to identify the current practice with an extensive observation and description of health professional activity, particularly the radiographer's role in our prison.

Results: The activity of the radiographer is characterized by great autonomy. The medical staff made up of general practitioners and psychiatrists, the radiographer must pre-diagnose the images he takes, then transmit his observations to the doctors. Communicate clearly with nursing staff. Work close to physiotherapist and occupational therapist.

Conclusion: In this context, communication and collaboration skills are highly important. In order to respect medical confidentiality against detention officers, caregivers as well as radiographers are often alone with the detainee during an examination. This principe underlines not only a potential security issue for the caregiver but can also lead to tensions between staff as all wish to know detainees' potential health issues.

RSS12

Strategies, challenges, and enabling factors to manage autistic individuals in medical imaging practice, a crossectional survey of Swiss Radiographers

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Purpose: This study aims to highlight strategies used by Swiss radiographers when managing autistic individuals in medical imaging examinations (MIE) and to propose recommendations for clinical practice.

Methods and Materials: The study obtained ethical approval from the Swiss Ethics Committee Vaud (REQ-2019-01148). The study was prospective, exploratory with a mixed methods approach including a literature review, an online survey, and semi-structured interviews. The survey was distributed to radiographers working in Switzerland through the national newsletter of the ASTRM and CCTRM using RedCap® Software. Questions on demographics and management of autistic patients composed the survey. The interview guide was based on the results of the survey and other related studies. The survey was analysed using descriptive statistics with Stata 2014 for Windows and Excel 2016, and thematic analysis was employed for the interviews.

Results: A hundred responses from the survey were included as valid and five radiographers were interviewed. Sixty out of 100 radiographers had experiences of imaging an autistic person. The main strategies used to manage the patient were more time attributed to the explanation of the examination (91.6%) and adaptation of communication to the patient (81.6%). Most of the radiographers (81.6%) found very helpful the support received from the carer/accompanying person. The interviews reported that they adapted their management according to the patient and highlighted the role of the carer.

From the survey, 56% of the radiographers found the lack of training and knowledge about autism the most challenging factor, 38% highlighted the lack of guidelines. The interviews shared that an authentic training could facilitate their understanding of autism.

Conclusion: The patient's preparation is important to perform medical imaging procedures and the help of the carer to adap their MIE. Specific strategies in medical imaging departments and training about autism are needed to adequately manage autistic individuals.

One Stop Stroke Strategy

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Purpose: In acute stroke with large vessel occlusion, time delays in a hospital significantly influence the neurological outcome of the patient.
Methods and Materials: Endovascular treatment of acute stroke with large vessel occlusion is the latest standard of care. As shown 2015 in 5 large scale, prospective, randomized clinical trials (MR CLEAN, REVASCAT, SWIFT PRIME, EXTEND IA) The time from hospital admission to reperfusion is crucial. To reduce this time, we combine diagnostic imaging and stroke treatment together in the angiography suite. (so called: One Stop Stroke concept)
Results: Combining imaging and treatment in one place as well as concentrating the handling team with the one stop strategy, reduces the number of room and information transfers of the patient, thereby minimizing time delays. Selected cases will be shown to underline the procedure and its advantages, exemplary a case of door to reperfusion time below 60 minutes.
Conclusion: In well-selected patients with large vessel occlusion and the latest generation of flat detector CT, in-hospital reperfusion times can be shortened and the patient can benefit by subsequently improved clinical outcome.

Implementing a new patient care approach using hypnosis in MRI and interventional radiology

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Purpose: The well fare of hypnosis for patients in radiology has widely been demonstrated notably by bringing a safe solution to neutralize negative behaviour such as anxiety, claustrophobia, fear and pain. This approach emphasizes patient care based on empathy and humanity. Hypnosis is also a non-invasive technique that reduces waiting time for a procedure or exam that would have required anesthesia for the patient. Ultimately, this type of care could improve patient care through personalized examinations and treatments.
The aim of this presentation is to present to radiographers an example of the implementation of hypnosis in a radiologic department (specifically in MRI and interventional radiology), and how to emphasize positive communication with patients. It will also demonstrate the impact of using positive words between the patient and the radiographer based on the patient's needs.
Methods and Materials: In practice, the Ericksonian technique, which is a special conversation using metaphors, contradictions and symbols to influence indirectly the patient's behaviour is used. With this approach, a special link is created between the radiographer performing the hypnosis and receptive patients. This link is built during a first interview conducted prior to the examination.
Results: Through this implementation, adaptations, change in practice and a new state of mind was engaged. Reorganization within the department was possible thanks to the hospital initiative to encourage complementary medicine.
Conclusion: Hypnosis brings humanity and places the patient at the center of care. The patient becomes the principal actor of his-her own medical care. Combining light medicines and hypnosis is an interesting alternative to decrease general anesthesia for radiological examinations. This art of communication has a real place in order to truly perform patient centered care within our departments and improve patient experience.

Virtually Augmented Self Hypnosis in Peripherally Inserted Central Catheter (PICC) placement: Interim analysis of randomized controlled trial

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Purpose: The aim is to investigate the efficacy of Virtually Augmented Self Hypnosis (VA-HYPO) as an adjunctive non-pharmacological method for procedural pain and anxiety relief in PICC placement.
Methods and Materials: An immersive distraction experience featuring virtual reality using head mounted display is compared with the standard management (SM). Patients followed the "Aqua" module (Oncomfort™) consisting in a scuba dive and breath exercises allowing to reach a dissociative state similar to clinical hypnosis, without direct intervention of a professional (digital sedation) A total of 100 participants will be enrolled in a 1:1 randomized open study (VA-HYPO or SM) comparing endovascular procedures. Anxiety is evaluated using the State Trait Anxiety Inventory (STAI) and Pain with Visual Analogic Scale (VAS) in 3 dimensions (1. sensory-discriminative = nociceptive mechanism intensity, 2. affective-motivational = unpleasantness sensation and 3. cognitive-evaluative = memory emphasizing the distress linked to prior procedures) at 3 different moments (pre, post and after 3 month of intervention)
Results: The interim analysis (subset of 69 patients with PICC insertion) showed a mean anxiety reduction (pre- vs. post-procedure) in both groups with a non-significant difference in difference of 2.7 points. Considering a binary threshold of 0.5 SD for responders and non-responders to anxiety lowering, the percentage of responders was higher (76%) with VA-HYPO than SM (58%) Post-procedure, the mean sensory-intensity and affective emotional pain wasn't significantly different between the groups. Regarding the pain intensity difference before vs. after the procedure, the minimal clinically relevant increase of 2 points was reached less frequently with VA-HYPO (16%) than SM (23%).
At 3 month, negative memories (difference of >1 VAS from post procedural reported pain intensity) where lower with VA-HYPO (39%) than SM (45%).
Conclusion: VA-HYPO improves stress coping. It might change the procedural management of pain and anxiety

Improvement of CT-scan examination thanks to a double scout view with automatic dose modulation

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Purpose: Observing important dose variation in between the similar CT-scan examinations done for the same patients a few days apart. These doses could across 30% of dose value. How to explain such a huge scale.
Methods and Materials: Evaluation was performed on CT Siemens Somatom AS+ and measurement was made with anthropomorphic phantom Atom Winston. Comparative method was done using simple anteroposterior (AP) versus double scout view method, lateral followed by AP, combined to automatic dose modulation (CARE Dose 4D). The measurements were done for various table heights. Volume CT dose index (CTDIvol) and dose length product (DLP) were analyzed.
Results: The double scout view in comparison to the single scout view method showed an important dose reduction associated to a better image quality in favor of the double scout view method.
Conclusion: This result helped us to modify our work habit implementing the double scout view on majority of our protocols. We could measure the impact on the population CT-scan radiation dose which decreased on 30% due to better patient centering helps to double scout view method.

Forensic radiographer and 3D surface scanning on clinical cases

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Purpose: The forensic radiographer is developing his activity around the request of the legal medicine. Post-mortem cases are part of the daily routine, but the documentation of lesions on living patients is a growing activity.

Methods and Materials: The forensic radiographer uses a 3D-surface scanner to acquire the surface of a body in 3D. Additionally, photogrammetry is performed to complete the true to scale 3D model of the skin. Thanks to this process, a perfect spatial resolution is guaranteed, down to infra millimeters, with a handheld device and a high resolution in color contrast is added thanks to the photogrammetry.

The VX element software is used to acquire 3D-images with the Go!SCAN from Creaform, and for the photogrammetry, the data are imported to Agisoft Metashape software to reconstruct a 3D model.

Then both 3D models can be combined in Agisoft Metashape software by the engineer specialized in 3D modalities.

Results: This activity concerns clinical forensic medicine, with the goal to document and save data concerning a physical assault and the possibility to identify the compatibility of the offensive objects with the lesions observed on the body (shaped ecchymosis, in relief lesions, etc.).

Conclusion: This activity is an upgrade of the competence for the profession and takes the forensic radiographer out of his usual activity in legal medicine to work only with post-mortem cases.

How the COVID-19 pandemic affected HUG radiographers psychologically and physically at work and in private life.

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Purpose: The aim of this presentation is to determine which physical and psychological impact the radiographers are affected with the sanitary situation of COVID'19.

Methods and Materials: This prospective study is conducted in the radiology's services of Geneva University Hospitals. All the main indicators are identified and evaluated by MRI, CT, X-Ray angiography, ultrasound, pediatric, nuclear medicine and radio oncologic radiographers. A survey with some open questions will be used during the year 2022. A statistical analysis will be conducted on this data.

Results: The principal impact of the sanitary situation suffered by the radiographers is negative with fatigue, fear and stress. However, the challenge which we were exposed to, had some positive impacts. It has increased among others our pride, knowledge and interprofessional skills.

Conclusion: The radiographer is a profession highly impacted by the COVID'19 in his work and his life. However, these results are just recently measured. In the future, it will be interesting to repeat this study and evaluate the differences or if the results continue unchanged.

Development and clinical evaluation on the Unity MR-Linac of a 3D-printed immobilization support for head and shoulders cases

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Purpose: The Elekta Unity (Elekta, Stockholm) MR-Linac (MRL) allows on-line plan adaptation treatments based on daily Magnetic Resonance Imaging (MRI). This device can treat as many locations as a standard linac. However, to our knowledge, there is currently no suitable immobilization system for head and shoulder dedicated to the Unity machine. The aim of this work is to design and introduce an end-to-end clinical application of a MRL-compatible mask support for head and neck localizations. This support is manufactured with a 3D-printer.

Methods and Materials: The main constrain was to use the same masks "iCAST Precut Head and H&S" that we already use on our VersaHD (Elekta, Stockholm). Dimensions for the support were taken from the "Head-STEP IBEAM Evo extension" (Elekta, Stockholm) and adapted for Unity. The OpenSCAD software was used to generate a 3D model. The conversion to Gcode was done with Cura. Then, the support was printed using the Ultimaker 2 3D-printer (Ultimaker, Utrecht). A CT of the support was performed to determine the electron density for dosimetry purposes. The support can be used in Head-Only mode (HO) or in Head and Shoulders mode (HS). Finally, the support was clinically tested in both modes.

Results: The printing time for a HO support is less than 30 hours for a cost less than 30 CHF. The printing time for the HS support is less than 50 hours for a cost less than 45 CHF. Patients tolerated the restraint well. The fractions could be delivered in a safe way. The support is less sturdy than a commercial equivalent, but can be reprinted on demand.

Conclusion: The implementation of a 3D-printed support for head and neck treatments on an MRLinac is possible for clinical use. The fabrication is efficient and inexpensive. The support can be used with the MRL and also with a standard Linac. The immobilization system can be improved by making and design it more resistant to manipulation.

Interrelation between cardiac and brains small vessel disease: A quantitative PET-MRI study

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Purpose: Beyond large vessel occlusions, small vessel disease (SVD) plays a crucial role in cardiac and brain ischemia. However, little is known about potential interrelation between both. We aimed at assessing the interrelation between cardiac and brain SVD by using quantitative Rb-82 cardiac PET/CT and brain MRI.

Methods and Materials: We retrospectively evaluated 186 patients without cardiac/brain large vessel disease, of whom 29 had pure cardiac SVD and 157 had no cardiac SVD as defined by cardiac perfusion PET/CT and coronarography. All underwent both a cardiac Rb-82 PET/CT and a brain 1.5T or 3T MRI (Siemens Healthcare, Erlangen, Germany). Left-ventricle myocardial blood flow (LV-MBF) and flow reserve (LV-MFR) were recorded from Rb-82 PET/CT, while Fazekas score, white matter lesion (WMab) volume, deep grey matter lesion (GMab) volume, and brain morphometry using the MorphoBox prototype software were derived from T1-/T2-weighted images. Groups were compared with Kruskal-Wallis test, and the potential interrelation between heart and brain SVD markers was assessed using Spearman's correlation coefficient.

Results: Compared with healthy controls, patients with cardiac SVD had lower stress LV-MBF and MFR (p< 0.0019) but similar Fazekas scores and WMab volumes (p>0.45). In patients with cardiac SVD, but not in controls, increased rest LV-MBF was associated with left-putamen Z-score reduction (rho=−0.62, p=0.033), right-thalamus (rho=0.64, p=0.026) and right-pallidum (rho=0.60, p=0.039) GMab volume increase. Decreased stress LV-MBF was associated with left-caudate Z-score reduction (rho=0.69, p=0.014) while decreased LV-MFR was associated with left- (rho=0.75, p=0.005) and right- (rho=0.59, p=0.045) putamen Z-score reduction and increased right-thalamus GMab volume (rho=−0.72, p=0.009).

Conclusion: This retrospective study data supports the hypothesis of an association between cardiac and brain SVD, especially regarding deep grey matter alterations.

Ultra-low-dose coronary artery calcium scoring yields equivalent results compared to standard protocol: a study on 1511 consecutive patients

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Purpose: Recent studies featuring small patients' populations suggest that the assessment of coronary artery calcium scoring (CACS) with computed tomography (CT) with 80 kilovolt-peak (kVp) tube voltage yields comparable results to the standard 120-kVp protocol. However, these preliminary findings still need to be validated in larger patients' populations.

Methods and Materials: We included consecutive patients undergoing myocardial perfusion scintigraphy as part of clinical care. All underwent standard CT scanning with 120-kVp tube voltage and an additional scan with 80 kVp, which was also used for attenuation correction purpose. All patients had suspected but no prior diagnosed coronary artery disease. Mean body mass index (BMI) was $29 \pm 5.4\,kg/m^2$. CACS was calculated on both CT images, thus generating two datasets, which were compared with linear regression and Bland–Altman analysis. Risk-class (0-25, 25-50, 50-75, 75-90 and >90 percentiles) were recorded.

Results: 1511 patients were included (718 females, age 69±9.1). Estimated mean radiation doses were 0.6 mSv for standard CT and 0.2 mSv for the ultra low-dose CT, respectively. Median CACS from 120 kVp scans was 134 (IQR 8–625). 378 (25%) Patients had a CACS in the < 25% risk class, of whom 264 (17.5%) had CAC score = 0. Median CACS from 80 kVp scans was 52 (IQR 0–379). 591 (39.1%) patients had CACS in the >25% risk class, of whom 437 (29%) had a CACS= 0. Scores calculated with 80 kVp scans showed a very good correlation with those calculated with 120 kVp scans (r = 0.939, r2 = 0.883, p<0.001), with Bland–Altman limits of agreement of -495.9 to 739.4 and a bias of -121.7 The correlation across percentiles classes was also good (r = 0.865, r2 = 0.748, p<0.001).

Conclusion: In a large patient population, CACS calculated with ultra low-dose CT scan and those assessed with standard protocol correlated well regarding numeric CACS and CACS classes.

Myocardial Perfusion Rb-82 PET/CT with dobutamine stress agent to investigate anomalous aortic origin of a coronary artery (AAOCA) with inter-arterial course

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Purpose: Anomalous aortic origin of a coronary artery (AAOCA) with inter-arterial course is the one of the leading cardiovascular causes of sudden death in pediatric patients. There is a lack of guidelines regarding imaging and treatment options. Since the presence of ischemia is an indication for surgical management, myocardial perfusion imaging (MPI) assessment with physical stress test plays an important role in patient management. Dobutamine is an inotrope catecholamine, which can reproduce the cardiovascular hemodynamic changes seen during physical activity. We evaluated the impact of Rb82 PET/CT MPI using dobutamine as a stress agent on the therapy decision of patients with AAOCA.

Methods and Materials: We prospectively included three pediatric patients and one adult with AAOCA and inter-arterial course who underwent a Rb-82 PET/CT MPI using dobutamine as a stress agent to evaluate the hemodynamic impact on the myocardial perfusion. Myocardial perfusion was assessed semi-quantitatively using the 17-AHA segment, as well as quantitatively using the onecompartment model for absolute quantitation of myocardial blood flow (MBF).

Results: In total, 4 patients with AAOCA and inter-arterial course confirmed by CT-angiography were included. One patient showed ischemia on semi-quantitative analysis, with normal quantitative MBF parameters. The other 3 patients showed normal MPI, excluding hemodynamic impact of the coronary inter-arterial course on MBF. Dobutamine was well tolerated in all patients. Based on PET/CT results, the first patient underwent coronary artery bypass surgery, whereas the other three were treated conservatively, thus avoiding major cardiac surgery. On the clinical follow-up, all patients under conservative treatment did not show any clinical complication.

Conclusion: Rb82 PET/CT MPI using dobutamine is feasible in adult and pediatric patients with AAOCA and has a role in the clinical decision-making for conservative or surgical treatment strategy.

Prognostic value of myocardial perfusion scintigraphy inasymptomatic patients with diabetes mellitus at high cardiovascularrisk: 5-year follow-up of the prospective multicenter BARDOT trial

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Purpose: The Basel Asymptomatic high-risk Diabetics' Outcome Trial (BARDOT) demonstrated that asymptomatic diabetic patients with an abnormal myocardial perfusion scintigraphy (MPS) were at increased risk of major cardiac events (MACE) at 2-years follow-up. It remains unclear whether this finding holds true even for a longer follow-up.

Methods and Materials: Four hundred patients with type-2 diabetes, neither history nor symptoms of coronary artery disease (CAD) were evaluated clinically and with MPS. Patients were followed up for 5 years. Major adverse cardiovascular events (MACE) were defined as all-cause death, myocardial infarction or late coronary revascularization.

Results: At baseline, an abnormal MPS (SSS≥4 or SDS≥2) was found in 87 of 400 patients (22%).

MACE within 5 years occurred in 14 patients with abnormal MPS (16.1%) and in 22 with normal scan (1.7%, p=0.009); 15 deaths were recorded.

Patients with completely normal MPS (SSS and SDS=0) had lower rates of MACEs than patients with abnormal scans (2.5% vs 7.0%, p=0.032). Patients with abnormal MPS who had undergone revascularization had a lower mortality rate and a better event free survival from MI and revascularization than patients with abnormal MPS who had either undergone medical therapy only or could not be revascularized (p=0.002).

Conclusion: MPS may have prognostic value in asymptomatic diabetic patients at high cardiovascular risk over a follow-up period of 5-years. Patients with completely normal MPS have a low event rate and may not need retesting within 5 years. Patients with an abnormal MPS have higher event rates and may benefit from a combined medical and revascularization approach.

Perfusion and motion pattern on MPI in patients with positive DPD-scintigraphy

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Purpose: Cardiac amyloidosis shares diastolic dysfunction as a presenting feature with coronary artery disease (CAD). Therefore 99mTc-DPD scintigraphy (DPD) is often performed along with a myocardial perfusion nuclear imaging (MPI).

We assessed MPI for indicators of cardiac amyloid involvement using positive DPD as non-biopsy diagnosis of aTTr cardiac amyloidosis.

Methods and Materials: This restropspective study included 28 patients who underwent an MPI (myocardial scintigraphy or PET-CT) within 6 months of a positive DPD with Perugini grade 2 or 3 and age matched negative DPD controls (1:1) with Perugini grade 0.

Mean segmental uptake from perfusion (%), motion range (mm) and systolic thickening (%) were derived (Cedars QPS/QGS) for apex/apical and basal/mid-cavity regions and compared. Basal to apical gradient (BAG) was defined as apex/apical value exceeding basal/mid-cavity values. Analyses included Chi-square test and Student test with a significant p-value < 0.05 .

Results: Semiquantitative perfusion revealed a BAG in 9 patients overall in DPD-positive vs 12 in controls. Mean regional perfusion was respectively of 74 vs 77 % (p=0.30) for basal region and 79 vs 81% for apical region (p=0,51).

Gated analysis showed a BAG for motion range in 7 patients in DPD-positive vs 6 in controls, being 10 patients in DPD-positive vs 10 patients in controls for thickening. Mean regional motion of 5,7 vs 4,4 mm (p=0.21) for basal region and 6,6 vs 5,8 mm for apical region (p= 0.6). Mean regional thickening of respectively of 25,2 vs 37,4% (p=0,59) for basal region and 40,2 vs 37,4% for the apical region (p=0,72).

Values distribution between basal region and apical region revealed statistically significant difference between the two groups for motion and thickening (p <0.05).

Conclusion: BAG was common on MPI of patients with suspected cardiac amyloidosis referred for DPD scintigraphy with both positive and negative results with higher values in patients with positive DPD.

Quantitative SPECT/CT of cardiac amyloidosis: Determination of reference intervals and correspondence to Perugini's score

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Purpose: Transthyretin (ATTR) induced cardiac amyloidosis (CA) is an infiltrative cardiomyopathy resulting from the cardiac deposition of fibril protein derived from ATTR, with progressive thickening and dysfunction of the left ventricle. The utility of [99m]Technetium-Diphosphonate (^{99m}Tc-DPD) imaging for ATTR CA was demonstrated using a simple visual score on the three-hour planar image, namely the Perugini score (PS). Due to the visual assessment, an interobserver variation could limit the accuracy of the PS.

Our objective was to correlate various quantitative parameters, with the visual PS.

Methods and Materials: We retrospectively included consecutive patients with suspected ATTR CA, who underwent whole-body ^{99m}Tc-DPD imaging, with a heart centered quantitative SPECT/CT (xSPECT/CT), after laboratory exclusion of monoclonal gammopathy. We quantified the cardiac DPD uptake using SUV_{max} in a cardiac region on the myocardium. The relation between cardiac and bone SUV_{max} and PS was assessed using the Mann-Whitney ranksum test. We also determined reference values (defined by the 2.5[th] to 97.5[th] percentile interval) for the cardiac SUV_{max} for PS=0 and PS=2–3.

Results: Among the 34 patients included, ATTR CA could be reliably diagnosed in 14 patients based on the myocardial DPD uptake (PS=2–3), while it could be reliably excluded in 20 patients (PS=0).

The mean SUV_{max} value in patients without amyloidosis (CA−) was 2.2 [95%CI 1.8-2.6] vs. 14.3 [11.6–17.1] with amyloidosis (CA+) (p=0.0001). There was an excellent determination of ATTR CA status based on SUV_{max}. Cardiac SUV_{max} reference interval for PS=0 (absence of ATTR CA) was 1.3–4.9 and 6.0–23.5 for PS=2–3 (presence of ATTR CA), respectively.

Conclusion: Quantitative ^{99m}Tc-DPD xSPECT/CT in suspected ATTR CA patients is feasible, accurate and cardiac SUV_{max} reference intervals for absence and presence of ATTR CA were determined. Further studies are required to assess its prognostic value.

NSS107

18FDG-PET/CT Assessment of COVID-19-Induced functional changes of brain

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Purpose: In this study, we assessed cortical metabolic patterns in brain PET/CT of patients with neurological manifestations secondary to COVID-19.

Methods and Materials: Five patients with COVID-19 confirmed by PCR were included in this study with neurological symptom.

Patients fasted for 6 hours before receiving intravenous 18FDG, 4.6 MBq/kg. After an uptake time of 60 minute, The brain PET/CT was performed with sequential TOF-PET/CT (Discovery 690 PET/CT, GE Healthcare).

Results: The PET-CT images in two patients with persistent isolated anosmia for at least six weeks, suggested hypometabolism of the left orbitofrontal cortex. this finding is in contrast to higher metabolic activity of the same cortex in subjects with normal olfaction.

In third patient anosmia was gradually improving, she developed parosmia, decreased FDG uptake in the left insular and left inferior frontal cortex are seen which are responsible for processing the odor quality and identification.

A 67 yr old nonsmoker man with a 3-day history of fever, cough with Vernike aphasia. Brain MRI revealed low signal area in T1 and high signal in T2 in left parietal lobe. chest CT revealed a 15 mm nodule in LUL. 10 days later PET demonstrated decreased activity in left temporoparietal region,compatible with CVA in addition to low grade activity in the lung nodule.

Incidentally there were multifocal hypermetabolic ground glass opacities throughout in lung fields COVID-19 was confirmed by PCR. Thus role of coronavirus may be to activate endothelial cell and arterial occlusion.

In a 60 yr old man with sudden onset right sided facial nerve palsy and positive PCR for COVID-19, PET shows decreased FDG uptake in the right facial nerve, spanning from the cerebellopontine angle to the internal auditory canal.

Hypometabolism of the facial nerve may suggest a reduction in the blood flow to the nerve secondary to microthrombosis in the perineural arteriovenous plexus.

Conclusion: PET is useful as a one stop shop imaging in pulmonary and neurologic manifestations of COVID-19.

NSS108

Development of an ACE2-specific Imaging Agent to Investigate the Expression and Regulation of the SARS-CoV-2 Entry Receptor

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Purpose: The aim of this study was to develop and evaluate an ACE2-specific nuclear imaging agent to non-invasively quantify ACE2 expression and correlate it with severe outcomes of COVID-19.

Methods and Materials: DX600, a known ACE2-targeting peptide, was functionalized with a NODAGA-chelator and labeled with gallium-67/68. The octanol/PBS partition coefficient ($LogD_{pH7.4}$) of the radiopeptide was determined using a shake-flask method. Selectivity and affinity of the radiopeptide for ACE2 were assessed _in vitro_ using HEK cells transfected with the human ACE2 and ACE, respectively. For the _in vivo_ evaluation of the radiopeptide, a mouse model was used with HEKACE2 and HEK-ACE xenografts on their right and left shoulders, respectively. Imaging and biodistribution studies were performed 3 h after injection of [^{67}Ga]Ga-NODAGA-DX600 to assess

activity accumulation in each xenograft type as well as in normal tissue.

Results: [^{67}Ga]Ga-NODAGA-DX600 (25 MBq/nmol; >95% radiochemical purity) bound to ACE2 with relatively high affinity (K_D = 175 ± 35 nM) and was selectively taken up and internalized in HEK-ACE2 cells (37 ± 2% and 7.6 ± 0.3%, respectively) but not in HEK-ACE cells (<0.1%). The $LogD_{pH7.4}$ value was low (-3.0 ± 0.1) proving its hydrophilic character. SPECT/CT images showed high accumulation of the radiopeptide in the ACE2-expressing xenograft but not in the HEK-ACE-xenograft. Quantification of these findings in post-mortem biodistribution studies 3 h after injection of the radiopeptide revealed 12.4 ± 2% IA/g and 0.3% ± 0.1 IA/g uptake in the HEK-ACE2 and HEK-ACE xenografts, respectively.

No activity accumulation was found in normal mouse tissue except in the kidneys (28 ± 7.6% IA/g).

Conclusion: IThe results of this study confirm the ACE2-selective binding of [^{67}Ga]Ga-NODAGADX600, which is an essential prerequisite for the purpose of this radiopeptide. Current endeavors in our laboratories focus on the development of higher-affine cyclic peptides for ACE2-targeted PET imaging.

NSS109

Novel folate radioconjugates: Optimum combination of functional units to improve the tissue distribution profile

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Purpose: The chemical structure of a radiopharmaceutical critically influences its tissue distribution profile, thus, the aim of this project was to determine the most favorable combination of functional units of folate radioconjugates to obtain favorable pharmacokinetics.

Methods and Materials: Nine folate radioconjugates differing in the targeting molecule, linker entity and albumin binder were evaluated regarding their cell uptake and folate receptor (FR)-binding affinity using FR-expressing tumor cells. The albumin-binding affinity in mouse and human plasma was determined using an ultrafiltration assay. Biodistribution studies were performed in FR-positive KB tumor-bearing nude mice.

Results: All folate radioconjugates demonstrated FR-specific uptake and high affinity to the FR (1.4–5.6 nM). Affinity to albumin was strongly dependent on the utilized albumin binder and more pronounced when a lipophilic linker was incorporated. In vivo data indicated that folate radioconjugates modified with a strong albumin binder (4-(p-iodophenyl)butanoate) showed higher retention of activity in the blood pool (0.49–8.7% IA/g; 24 h p.i) than those with a weak albumin binder (4-(p-iodophenyl)pentanoate) (<0.2% IA/g; 24 h p.i.). Kidney retention was lower for folate radioconjugates with a strong albumin binder (12–70% IA/g; 24 h p.i.) than for those with a weak albumin binder (33–143% IA/g; 24 h p.i.). Tumor uptake was more favorable for 5-methyltetrahydrofolic acid radioconjugates than folic acid radioconjugates (26–47% IA/g vs. 14–20% IA/g; 24 h p.i.), whereas the incorporated albumin binder had only a minor impact.

Conclusion: The data of this study showed that even minor modifications in the structure of folate radioconjugates had a decisive impact on their distribution pattern and are, thus, options for finetuning the radioconjugates' pharmacokinetics. Clinical translation will be necessary to determine the relevant features of folate radioconjugates to enable safe and effective radionuclide therapy of FRpositive cancer.

Production and radiochemical purification of the radiolanthanide terbium-155 for potential application in SPECT imaging

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Purpose: In this study, the cyclotron production and radiochemical purification of terbium-155 ($T_{1/2}$=5.32 d, Eγ= 87 keV (32%) 105 keV (25%)) were investigated, to obtain a radiometal potentially useful for disease diagnosis via single photon emission computed tomography (SPECT).

Methods and Materials: Terbium-155 production was investigated via the ^{155}Gd(p,n)^{155}Tb and ^{156}Gd(p,2n)^{155}Tb nuclear reactions using enriched gadolinium-155 and gadolinium-156 oxide targets, respectively. After irradiation, the produced terbium-155 was separated from the target material using cation exchange and extraction chromatography. The chemical purity of the final product was investigated via radiolabeling experiments. Initial preclinical studies for uptake and internalization of [^{155}Tb]Tb-DOTATOC on AR42J tumor cells were performed. Furthermore, a SPECT/CT imaging study was carried out on one AR42J-tumor-bearing mouse at 1, 4 and 24 h p.i., respectively.

Results: The ^{156}Gd(p,2n)^{155}Tb nuclear reaction demonstrated higher production yields of up to 1.7 GBq after 8 hours irradiation. After radiochemical separation process, 1.0 GBq of [^{155}Tb]TbCl$_3$ solution (1 mL 0.05 M HCl), suitable for radiolabeling purposes, was obtained. High molar activities (up to 100 MBq/nmol) were achieved with DOTATOC. In vitro studies showed specific AR42J cell uptake (13% of added activity) and internalization (11% of added activity) of [^{155}Tb]Tb-DOTATOC after 4 hours. A SPECT/CT imaging study demonstrated excellent tumor visualization up to 24 h after injection and tissue distribution comparable to the previously reported for its ^{177}Lu-radiolabeled counterpart.

Conclusion: This work has shown two possible routes for the production of high activities of terbium-155 via proton irradiation and effective chemical separation thereof, which allowed preliminary in vitro and in vivo studies. The SPECT/CT imaging study demonstrated the applicability of terbium-155 for imaging purposes along with its application for prospective dosimetry with lutetium-177.

In Vitro Screening of Squaric Acid-based FAP Inhibitor Performance in Various Human Cancers

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Purpose: The tumor microenvironment (TME) influences tumor development, immune invasion, and metastasis. In TME, cancer-associated fibroblasts (CAFs) have a strong tumor-modulating effect.

Fibroblast activation protein (FAP) expressed on CAFs has been identified as a potential target for *in vivo* tumor imaging and therapy due to its overexpression on several epithelial tumors. Here, we investigated the *in vitro* cell binding of [^{68}Ga]Ga-DOTA.SA.FAPi in various human epithelial cancer cell lines. The FAP expression was verified by western blot analysis. The cell line with the highest FAP expression was used for the *in vitro* evaluation of [^{68}Ga]Ga-DOTA.SA.FAPi. The *in vivo* evaluation is underway.

Methods and Materials: DOTA.SA.FAPi was radiolabeled with [^{68}Ga]GaCl$_3$ in 0.15 M sodium acetate buffer (pH 4.0) for 5 min at 95 °C using a fully automated unit. FAP expression was verified by radioligand binding assay and western blot analysis. The saturation binding and internalization were further explored in human CAFs overexpressing FAP.

Results: [^{68}Ga]Ga-DOTA.SA.FAPi was radiolabeled with an average molar activity of 13 MBq/nmol with purity above 98%. The highest specific cell binding affinity was observed in the CAF cell line (23.7%) followed by U87MG glioblastoma (3.4%) while the affinity in A64 and Mia Paca cell lines was modest (0.1–0.2%) at 2 h. The western blot analysis exhibited a corresponding FAP protein at 90 kDa.

The affinity [^{68}Ga]Ga-DOTA.SA.FAPi towards FAP was in the low nM range (K_d = 0.82 nM) with saturated concentration (B_{max}) of 0.41 nM. High specific internalization (21.9%) was found in the CAF cell line, while the total specific surface-bound uptake was about 23.1% at 4 h of incubation.

Conclusion: Overall, this study provides important preliminary results of [^{68}Ga]Ga-DOTA.SA.FAPi behavior *in vitro* in various human cancer cell lines, which leads to the development of appropriate mouse tumor models for the investigation of FAP-targeted DOTA.SA.FAPi radiotracers *in vivo*.

Peptide Receptor Radionuclide Therapy in Meningioma Patients: radiolabeled Somatostatin Receptor Antagonist versus Agonist, first results of the phase 0 part of the PROMENADE study

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Purpose: Our aim was to compare the meningioma and organ doses of the new radiolabeled somatostatin receptor antagonist ^{177}Lu-DOTA-JR11 with the established radiolabeled somatostatin receptor agonist ^{177}Lu-DOTATOC in standard treatment resistant meningioma patients. Here we present the results of the first 3 patients.

Methods and Materials: In this retrospective, single-center, open label phase 0 study, 3 patients were included so far: 2 men and 1 woman (mean age 56.7 years, age range from 52 to 60 years). Patients received 5.8-7.1 GBq (7.4 GBq standard activity) ^{177}Lu-DOTATOC followed by 3.5-5.1 GBq (2 x BSA) ^{177}Lu-DOTA-JR11 in an interval of 10±1 weeks. Quantitative SPECT/CT was performed 24, 48 and 168 h after injection of the radiopharmaceutical in order to calculate meningioma and organ doses (3D dosimetry using Siemens Dosimetry Research Tool software).

Results: In 3 patients, the mean (range) meningioma and kidney dose of one treatment cycle was 18.7 (4.6-45.2) and 2.8 (1.2-3.8) Gy for ^{177}Lu-DOTA-JR11 and 5.9 (0.8-15.3) and 2.4 (1.1-3.7) Gy for ^{177}Lu-DOTATOC, respectively. According to the CTCAE v5.0 there was one grade 3 and one grade 4 adverse event in one patient (thrombocytopenia and lymphocytopenia) after ^{177}Lu-DOTA-JR11 treatment which resolved after a few weeks. No further grade 3 and grade 4 adverse events were observed.

Conclusion: The meningioma dose was 2.9-5.8 times higher with ^{177}Lu-DOTA-JR11 compared to ^{177}Lu-DOTATOC in the first 3 patients of this phase 0 study.

NSS113

Safety and efficacy of PSMA targeted radionuclide therapy with ^{177}Lu-ITG-PSMA-1 in metastatic castration resistant prostate cancer patients: Preliminary results of a Swiss wide prospective multicentre registry study

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Purpose: To assess the safety and efficacy of ^{177}Lu-ITG-PSMA-1 (^{177}Lu-PSMA I&T) therapy in patients with metastatic castration resistant prostate cancer (mCRPC), implemented in the day-to-day clinical practice in Switzerland.

Methods and Materials: Prospective data collection in a multicenter national register (EKNZ 2021-01271) for patients with mCRPC treated with ^{177}Lu-ITG-PSMA-1. The primary endpoint is safety, based on laboratory parameters monitored biweekly and adverse events graded according to CTCAE v5.0. Efficacy will be evaluated according to biochemical response (best PSA decrease ≥ 50%: PSA_{50}), imaging response (CT, MRI or PSMA PET/CT), time to progression, overall survival and quality of life (EORTC PR25, EORTC QLQ-C30, Brief Pain Inventory and Xerostomia Questionnaires). Descriptive and comparative statistics is used to evaluate therapy safety as well as treatment response/progression. Multivariate analysis will be performed to evaluate factors associated with treatment response, failure and toxicity.

Results: Preliminary analysis of the first 70 patients (mean age 74 ± 8 SD) treated since May 2020 with at least 1 cycle and 1 follow-up. Patients received a median [range] number of administrations of 3 [1-6] with a median [range] activity per cycle of 7.1 [1.8-8.1] GBq. Grade ≥3 anemia and thrombocytopenia were found in 9 (13%) and 2 patients (3%), respectively. Biochemical response (PSA_{50}) was achieved in 25 patients (36%) whereas any PSA decrease was observed in 42 (60%).

Conclusion: Our preliminary analysis shows that ^{177}Lu-ITG-PSMA-1 therapy is safe and well tolerated in most mCRPC patients. Anemia appears to be the most frequent, treatment related acute toxicity.

Treatment efficacy, measured as biochemical response, was recorded in 36% of patients.

Diagnostic accuracy of equivocal bone uptake on 68Ga-PSMA PET/CT for prostate cancer imaging

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Purpose: The presence and number of bone metastases have a major impact on treatment decision and prognosis of prostate cancer patients. Unspecific bone uptake has been frequently reported for 68-Ga PSMA PET scans. The aim of this study was to estimate the occurrence of equivocal lesions and the diagnostic accuracy of 68-Ga PSMA PET/CT in a single institutional cohort of patients.

Methods and Materials: From a cohort of 99 patients, we identified 54 patients with focal bone uptake on 68-Ga PSMA PET/CT. Lesions not clearly benign or malignant on CT were classified as equivocal. The maximum standardized-uptake-value (SUVmax) and the localization of each lesion were recorded. Correlation between the final diagnosis and imaging/clinico-biochemical parameters was tested with logistic regression or chi-squared test, as appropriate. The receiver-operatingcharacteristics (ROC) approach was used for the diagnostic accuracy.

Results: 234 bone lesions were identified; among these 103 (44%) were equivocal. Based on followup, 41.9% of these lesions were benign, 58.1% malignant and 9.7% remained equivocal. Equivocal lesions were more frequent on the ribs (33.3%) followed by the pelvis (31.2%). In the ribs such an uptake was benign in 74.2% while in the pelvis it was malignant in 75.9%. SUVmax and ISUP grading were significantly correlated to a malignant etiology of equivocal lesions. The AUC of the ROC curve of the 68Ga-PSMA SUVmax was 0.899 (95% CI: 0.832-0.965) and the cut-off to maximize sensitivity and specificity was 4.2.

Conclusion: Clinical and imaging features allow characterizing equivocal 68-Ga PSMA PET/CT bone uptakes with high diagnostic accuracy.

Ultra high sensitivity reconstruction in whole body PET-CT reveals better lesion visibility due to higher signal-to-noise ratio

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Purpose: The recent introduction of thefirst large axial field of view (LAFOV) PET scanners showed improved image quality, lesion quantification and signal to noise ratio (SNR). The LAFOV PETscanner with a routinely used maximum ring difference mode (MRD) of 85 (considered as high sensitivity mode (HS), Siemens Biograph Vision Quadra) was able to acquire accurate image quality which was comparable to a short axial field of view (SAFOV) scanner within two minute acquisition time, enabling faster PET acquisition without loss of quality.

We present first data of the newly developed ultra-high sensitivity (UHS) mode using a MRD of 322 on a LAFOV scanner and aim to compare this UHS mode (176cps/kBq) to the so far used HS mode (83.4cps/kBq) reconstructions with regard to SUV and SNR.

Methods and Materials: PET/CT of five different patients on Biograph Vision Quadra with a LAFOV of 106cm were analyzed. Four patients underwent F-18-FDG-PET/CT and one patient F-18-PSMA-1007 PET/CT. Lesion uptake and metabolic tumor volumes were calculated by placing a volume-of interest (VOI) around the lesion with 40% iso-contour approach. SUVmean [g/ml] and SUVpeak[g/ml] were used to compare HS and UHS mode with different acquisition times.

Results: The analysis of the four datasets acquired with F-18-FDG showed significantly increased uptake in the liver as the reference organ in UHS compared to HS reconstructions (6.17±1.97 vs. 5.98±2.00, p=0.004). The SNR SUVpeak/SUVmean bloodpool for tumor lesions was also significantly higher in UHS compared to HS (1.83±3.98 vs. 1.84±3.96, p=0.002). For F-18-PSMA-1007 we found significantly higher SUVmean values for the liver in UHS (15.37±3.20 vs. 14.00±2.64, p<0.001). The SNR for a PSMA-positive lesion was significantly higher for UHS (7.64±4.91 vs. 8.08±5.88, p=0.02).

Conclusion: Ultra high sensitivity mode acquisition of whole body PET/CT on the Biograph Quadra Vision showed a significantly higher F-18-FDG uptake and an improved SNR suggestive for a better lesion visibility compared to HS mode.

A whole-body, multi-organ normative database for [18F]FDG-PET imaging as a foundation for assessing functional homeostasis of the human body in health and disease.

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Purpose: Living organisms maintain homeostasis through systemic multi-organ interactions, which can be disrupted by pathologies. PET is a molecular probe of the functional state of all tissues. Today, few PET applications exploit multi-organ assessments of the human body. We propose a computation framework for a normative database (NDB) of whole-body (WB) [18F]FDG datasets to serve as a reference for quantifying multi-organ inter-stasis in health and diseases.

Methods and Materials: Our framework consists of: (1) a 3D-unet based multi-organ segmentation; (2) a multi-resolution diffeomorphic co-registration; and (3) an NDB of standardized uptake values (SUV) from healthy controls. For (1) we use 20 low-dose CT images (50-50 train-test). Eight experts delineated references of 13 key organs. A voting algorithm helped create the ground truth devoid of inter-variability. For training, low-dose CTs and their segmentations were passed to the self-adapting u-net (1,000 epochs). A preliminary NDB was built from 15 controls (26-78y, 53-112 kg, 6M/9F) from TB-FDG PET/CT (55-60 min pi) on an uEXPLORER PET/CT. Following (1), diffeomorphic coregistration was used to align the low-dose CT and the 50min pi PET images (2). Resulting 3D deformation fields were applied to the 13 organs for spatial alignment with the PET. Finally, (3) an NDB was constructed by calculating the SUVmean from different organs and averaging them across controls.

Results: A DICE coefficient of >0.85 was achieved for all segmented organs except adrenal glands (0.70). NormSUV in the reference organs were similar for M and F (except for brain); values agreed with sparse literature data on healthy controls. Variability of NormSUV was highest for brain and least for skeletal bone, and – for most organs – higher in F than M.

Conclusion: We propose a multi-organ NDB of [18F]FDG-PET, which will be available as opensource by 2022. It will assist in expanding the use of PET towards a holistic multi-/inter-organ analysis, while being applicable also to WB data today.

Imaging Characteristics and Diagnostic Accuracy of FDG-PET/CT, Contrast Enhanced CT and Combined Imaging in Patients with Suspected Mycotic or Inflammatory Abdominal Aortic Aneurysms

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Purpose: To evaluate the diagnostic accuracy and specific imaging characteristics of positron emission tomography/computed tomography with 18F-fluorodeoxyglucose (PET/CT), contrast enhanced CT (CE-CT), and a combined imaging approach (CE-PET/CT) in patients with infectious/mycotic (MAA), inflammatory (IAA), and non-infected, non-inflammatory abdominal aortic aneurysm (AAA).

Methods and Materials: All imaging data sets of 29 consecutive patients with clinically suspected MAA or IAA were anonymised with different, reshuffled identification numbers and retrospectively and independently analysed by two experienced readers, blinded to all clinical patient data. Readers determined the presence or absence and MAA, IAA and AAA and of predefined imaging characteristics (e.g. fluid collection), and measured metabolic activity and wall thickness of all aneurysms. A multidisciplinary team of specialists served as standard of reference and re-evaluated every clinical case, considering all clinical, laboratory, microbiological, histopathological and imaging results, including all follow-up examinations.

Results: Diagnostic accuracy was higher in PET/CT as compared to CE-CT in differentiating AAA from MAA and IAA: area under the receiver operating characteristic curve (AUC-ROC) *0.81 (95% confidence intervals 0.69-0.92)* and *0.63 (0.52-0.74) (P=0.027)*. Specific imaging characteristics were significantly associated with different types of aneurysms (P<0.05), i.e. very high metabolic activity and dorsal sparing of metabolic activity in PET/CT and wall thickening in CE-CT were indicative for IAA; fat stranding and fluid collections in CE-CT were associated with MAA; while low metabolic acitivity and absence of wall thickening in PET/CT, and less fat stranding and absence of wall thickening in CE-CT were indicative for non-infected, non-inflammatory AAA.

Conclusion: Specific imaging characteristics of PET/CT and CE-CT may be helpful in differentiating between MAA, IAA, and non-infected, non-inflammatory AAA.

A novel approach for fibrous dysplasia assessment using a combined planar and quantitative SPECT/CT analysis of Tc-99m-diphosphonate bone scan in correlation with biological markers and radiological outcomes

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Purpose: Fibrous dysplasia (FD) is detected on bone scintigraphy with Tc-99m-labeled diphosphonates, exhibiting markedly increased tracer uptake.

We investigated the role of Tc-99m DPD uptake quantification in FD lesions in correlation with biological markers of disease activity and scoliosis.

Methods and Materials: We retrospectively assessed 7 patients (49±16y) with confirmed FD. Quantitative SPECT/CT images (xSPECT/CT) were acquired (Symbia Intevo, Siemens Healthineers). SUV_{max} and SUV_{mean} were measured in all bone lesions.

Skeletal burden score (SBS) was assessed on planar scintigraphy for all patients and SBS_SUV_{max} and SBS_SUV_{mean} was generated by multiplying SBS by SUV_{max} and SUV_{mean}.

Planar and xSPECT/CT quantification outcomes were correlated (Spearman's correlation) with markers of disease activity: fibroblast growth factor 23 (FGF-23), alkaline phosphatase (ALP), procollagen 1 intact N-terminal propeptide (P1NP) and C-telopeptides (CTX) and measured scoliosis angle.

Results: 76 lesions were analyzed with an average SUV_{max} and SUV_{mean} (g/mL) of 13 and 8.

SBS, SBS_SUV_{max} and SBS_SUV_{mean} values were 30.8, 358 and 220.

Mean values of FGF-23 (pg/ml), ALP (U/L), P1NP (µg/L) and CTX (pg/ml) were 97, 283.5, 283.1 and 494.

Scoliosis was reported in all patients with a mean angle of 15.7°.

We found a very strong positive correlation between planar derived SBS and both ALP (r=0.94, p=0.005) and CTX (r=0.9, p=0.037). SBS_SUV_{max} showed a strong to very strong positive correlation with ALP (r=0.83, p=0.042), P1NP (r=0.89, p=0.007), FGF-23 (r=0.79, p=0.036) and CTX (r=1, p=0.002). No significant correlation was found between SUV_{max} and biological bone turnover factors or between bone scan quantification outcomes and measured scoliosis angle.

Conclusion: Bone turnover factors and DPD uptake on bone scan are significantly correlated using a combined quantitative approach of planar and xSPECT/CT scans.

Further analysis of bone scan quantitative data can better characterize FD and skeletal disease burden, guiding diagnosis and follow-up.

PO01

Acute ischemic stroke management: A comparison of three computed tomography perfusion softwares (Philips ISP, GE AW, and Siemens Syngovia) accuracy in identifying patients eligible for thrombolysis therapy.

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Purpose: In acute ischemic stroke, computed tomographic perfusion represents an interesting functional imaging modality to select which patients would benefit from reperfusion therapy. This method is used to differentiate the recoverable brain tissue (hypoperfusion) from the final infarcted volume (core).

Recent publications mentioned the RAPID software, that calculates the ratio between the two zones, to guide the clinicians' decisions to proceed to thrombolyzation within de window of 4.5 to 9 hours after the onset of the symptoms.

The aim of our study is to identify which of the three commercial perfusion CT software packages Philips (ISP), GE (AW) and Siemens (Syngovia) are as performant and able to compute the ratio with the same results as the RAPID software, which is considered the gold standard.

Methods and Materials: A single computed tomographic perfusion is acquired from patients suspected of sustaining acute ischemic stroke. The post post processed data allowed for comparison of hypoperfusion and ischemic core zones. The results were then analysed with the three different softwares and finally matched to the gold standard MRI and the RAPID software. We split the 30 patients in three different groups:
1. Thrombus in the medial artery with large mismatch, 12 patients
2. Small infarcts in the cortex or basal ganglia, 12 patients
3. Normal perfusion, 6 patients.
Currently our patients' treatment is decided based on the post-processing of Philips software ISP.

Results: Our version of the Phillips software uses MTT and CBV features to create the maps. While the calculation differs from RAPID's, it nonetheless produces maps with a good resolution.

GE's software was almost (92% of the stroke patients) always majoring hypoperfusion's volume due to technical imprecisions.

Conclusion: The Siemens-Syngovia software performance is satisfying regarding the mode of calculation, and its fairly most automatized process. We also noted stroke volumes match 83% compared to MRI and to the RAPID software.

PO02

AI-Assistant in the MRI-based Diagnostics of Small Intracranial Aneurysms

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Purpose: Small incidental aneurysms represent a clinical challenge, since it is often difficult to distinguish them other structures (e.g. infundibulary branch) using standard field strengths (1.5/3T MRI). The diagnostic gold standard in form of digital subtraction angiography (DSA) is associated with radiation exposure and potential co-morbidities.

On the other hand, tools based on artificial intelligence (AI) are becoming more accessible to support the radiologist in the assessment of MRI images. How such assistants perform in the most challenging cases remains unclear. Our first goal was to compare the evaluation of standard (1.5/3T MRI) images performed by the AI-assistant vs. radiological assessment and then compare these findings with a consensus reading performed with 7T-MRI.

Methods and Materials: Fifty patients with a suspected small-sized aneurysm in the standard 1.5/3T MRI examination (n=9/41) received 7T MRI examination for clarification based on the decision of the aneurysm-board.

The 1.5/3T TOF-images were analyzed with the mdbrain software (mediaire, CE-certified and authorized for routine diagnostic use) for aneurysm detection. The sensitivity, specificity and accuracy of the software vs. radiological report on the 1.5/3T MRI were compared. Subsequently a comparison with the 7T MRI evaluation done by the consensus and the aneurysm-board was performed.

Results: Twenty-one (42%) patients had an aneurysm confirmed by the 7T MRI (mean age = 53 years; m/f = 17/33). The sensitivity for aneurysm detection was higher in radiological assessment than in AI-based assessment (86% vs. 62%). The specificity was lower in radiological assessment than in AI (14% vs. 86%). Half of the evaluations done by physicians were false negative in this highly selected population. The accuracy was higher for the AI-based than for the radiological assessment (76% vs. 44%).

Conclusion: The use of AI in the diagnosis of small aneurysms as a support tool for physicians is promising, as it provides valuable support in image evaluation.

PO03

Automated evaluation of morphometric and diffusion striatum and thalamus remote changes after stroke: a feasibility study.

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Purpose: Automated morphometry has demonstrated to be useful assessing striatum and thalamus remote changes at the chronic phase of middle cerebral artery (MCA) stroke. We aimed at evaluating the potential of automated estimation of striatum and thalamus z-score and ADC values changes at the acute-subacute phase of a MCA stroke.

Methods and Materials: In this retrospective study, 42 patients (22 male; age 72.7±16.0y) admitted in our institution at the acute-subacute phase of a MCA stroke (< 21 days after onset) were included. All underwent a brain MRI on 3T scanners (Siemens Healthcare, Erlangen, Germany) including T1-MPRAGE and DWI sequences. T1-MP-RAGE was segmented using the MorphoBox prototype providing bilateral striatum and thalamus z-scores compared to healthy controls. After co-registration of ADC maps and MorphoBox masks, ADC mean values of the same structures were recorded. Difference between the ipsilateral and contralateral side were calculated and relation with the delay from stroke onset was assessed by polynomial regression to account for non-linear evolution.

Results: All brain structures were successfully segmented and values extracted. Compared to contralateral side, polynomial regression revealed ADC value decrease in the ipsilateral putamen and pallidum between day 2 and day 10 while ipsilateral thalamus and caudate did not change. On morphometry, ipsilateral caudate, thalamus and pallidum z-scores gradually decreased from day 2 up to two weeks.

Conclusion: Automated evaluation of striatum and thalamus morphometric and diffusion changes after a MCA stroke is feasible. Striatal and thalamus remote changes seem to appear as early as 2 days after stroke onset.

Normal Pressure Hydrocephalus as a "Thumbnail" Diagnosis

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Learning objectives: Patients with Normal Pressure Hydrocephalus are often being presented with an unclear and unspecific symptomatology, this "thumbnail" including different radiological signs with a diverse panel of images, will help caracterize the essential signs to not miss diagnosing PNH.

Background: The choroïd plexus produces 80% of the CSF, approximately 14-36 ml/h/day, the rest comes from Pia and sub-ependymal blodd vessels.

The principal functions of the CSF is to offer a liquid cushion for the brain, therefore reducing its effective weigh from 1300 to 45g, moreover it helps in the electrolithohomeostasis of the brain and its cleaning.

Hydrocephalus can have different causes, such as overproduction of CSF, diminution of CSF absorption, an obstacle, ex vacuo dilatation due to loss of brain volume and finally PNH.

It is important that an «NPH Screen» be Instituted by the attending physician prior to admission.

Imaging findings or procedure details: The diagnosis will combine clinical and radiological results:

- Clinically has been described the Hakim Triad with gait disorder, dementia and incontinence.
- Radiologically, we will describe 3 important signs as a "thumbnail": Evan's index>0.3, Callosomarginal

angle < 90° and loss of the sulci of the convexity.

Conclusion: Normal Pressure Hydrocephalus is an important diagnosis that can be easily missed due to an often unclear and unspecific presentation. This poster aims to give a thumbnail diagnosis including 3 radiological signs (Evan's index>0.3, Calloso-marginal angle < 90° and loss of the sulci of the convexity) in order to diagnose and treat early the patients.

The standard treatement for NPH is the inplantation of a ventriculo-peritoneal shunt.

Tube Voltage-Independent Coronary Calcium Scoring on a First-Generation Dual-Source Photon-Counting CT – A Proof-of-principle Phantom study

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Purpose: To evaluate the accuracy of coronary artery calcium (CAC) scoring at various tube voltages and different monoenergetic image reconstructions on a first-generation dual-source photon-counting detector CT (PCD-CT).

Methods and Materials: A commercially available anthropomorphic chest phantom with calcium inserts was scanned at different tube voltages (90kV, Sn100kV, 120kV, and Sn140kV) on a firstgeneration dual-source PCD-CT system with quantum technology using automatic exposure control with an image quality (IQ) level of 20. The same phantom was also scanned on a conventional energyintegrating detector CT (120kV; weighted filtered back projection) for reference. Extension rings were used to emulate different patient sizes. Virtual monoenergetic images at 65keV and 70keV applying different levels of quantum iterative reconstruction (QIR) were reconstructed from the PCD-CT data sets. CAC scores were determined and compared to the reference. Radiation doses were noted.

Results: At an IQ level of 20, radiation doses ranged between 1.18 mGy and 4.64 mGy, depending on the tube voltage and phantom size. Imaging at 90kV or Sn100kV was associated with a sizedependent radiation dose reduction between 23% and 48% compared to 120kV. Tube voltage adapted image reconstructions with 65keV and QIR 3 at 90kV and with 70keV and QIR 1 at Sn100kV allowed to calculate CAC scores comparable to conventional EID-CT scans with a percentage deviation of ≤5% for all phantom sizes.

Conclusion: Our phantom study indicates that CAC scoring with dual-source PCD-CT is accurate at various tube voltages, offering the possibility of substantial radiation dose reduction.

PO06

Pulmonary transit time derived from routine perfusion cardiac magnetic resonance scans for non-invasive assessment of hemodynamics

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Purpose: Pulmonary transit time (PTT) is a robust and easily obtainable non-invasive biomarker of haemodynamics.

Methods and Materials: Pulmonary transit time (PTT) is the time it takes blood to pass from the right ventricle (RV) to the left ventricle (LV) and as such is a surrogate marker of heart failure, pulmonary arterial hypertension and lung disease. Since PTT largely depends on heart rate, normalized values were used (nPTT = PTT x heart rate). N-terminal pro-brain natriuretic peptide (NT-proBNP) is an established blood biomarker for quantifying ventricular filling pressure in patients with presumed heart failure (normal value <125 ng/L). We evaluated cardiac MRI perfusion scans in 78 patients with dyspnea and/or presumed ischemia. All patients received simultaneous quantification of NT-proBNP.

Diagnostic performance was measured using the Area Under the Receiver Operating Characteristics Curve (AUC).

Results: The AUC of nPTT for exclusion of heart failure (NT-proBNP <125 ng/L) was 0.77 (p = 0.008).

An nPTT < 580 resulted in a specificity 89% and sensitivity of 60% to exclude heart failure. In patients with a preserved LV and RV ejection fraction (>= 50%) the AUC of nPTT for exclusion of heart failure (NT-proBNP <125 ng/L) were 0.83 (p = 0.035) and 0.79 (p = 0.016), respectively. For inclusion of heart failure (NT-proBNP >300 ng/L), the AUC of nPTT was 0.68 (p = 0.03).

Conclusion: nPTT as an easily obtainable and robust non-invasive biomarker of hemodynamics might help in the evaluation of patients with dyspnea and heart failure.

PO07

"Cardiomegaly" on CT scan: Are you sure about that?

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Learning objectives: To describe cardiac chamber enlargement on contrast-enhanced CT, beyond just reporting the presence of «cardiomegaly».

To understand the limitations of cardiothoracic ratio (CTR) on CT scan To accurately measure each cardiac chamber and know when to report dilatation.

To learn about the prevalence of cardiac chambers enlargement.

Background: Radiologists are well trained to evaluate the heart size on standard chest radiography (CR). « Cardiomegaly » is a radiographic term used to describe an enlarged cardiac silhouette, measured using the cardiothoracic ratio (CTR). However, the CTR does not correlate with left ventricular volume, mass, and size. Furthermore, the heart is easily overlooked on contrast-enhanced chest CT, and enlargement of one or multiple cardiac chambers is often referred to as "cardiomegaly".

This term oversimplifies the approach to cardiac analysis on CT. Indeed, cardiac enlargement can be due to dilation of one or multiple chambers, and each can be measured and described individually.

This is relevant clinical information, as various underlying pathologies can cause different chamber dilatations.

Imaging findings or procedure details: In this education exhibit, we report and illustrate established cardiac measurement techniques on CT. We discuss the prevalence of cardiac chamber dilation and report sex-specific thresholds to diagnose chamber dilatation on non-ECG-gated CT. Finally, we discuss the cardiothoracic ratio on CT and why it is outdated.

Conclusion: "Cardiomegaly" is a term that should be only used for chest radiography. Each cardiac chamber can be quickly and easily mesured to assess potential enlargement when evaluating the heart on CT. This can help the clinician assess the patient's condition better and drive downstream testing.

PO08

Magnet resonance imaging of congenital vascular malformations

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Learning objectives: To learn about
- the classification of vascular malformationsaccording to the ISSVA
- key sequences in CVM imaging and current improvements in morphological and functional imaging
- major findings of CVMs with regards to tissue composition, extent and hemodynamics
- post therapy changes and pit falls in treatment evaluation

Background: Congenital vascular malformations (CVM) are defects of the vascular system, which develop during angiogenesis in utero. CVMs are divided in high flow and low flow malformations and are classified according to the predominant diseased vessel type.

Magnetic resonance imaging (MRI) is the best method for the morphological characterization of CVMs, regarding extent, tissue involvement and lesion composition. The utilization of morphological T1w and T2w sequences allows tissue characterization of suspected vascular malformations, i.e. to differentiate between vascular and lymphatic components.

MR angiography (MRA) with Gadolinium-based contrast agents allows the visualization and assessment of the perfused vascular portion of malformations. The continuous acquisition using time resolved MRA allows semiquantitative analysis of the hemodynamics in vascular malformations.

Imaging findings or procedure details: CVM imaging requires multiplanary T2w sequences with fat saturation. T1w sequences prior and post contrast agent administration are important for the visualization of the vascular portion. Time resolved MR angiography allows the characterization of CVM hemodynamics.

The combination of these sequences allows to determine the extent, involved tissues and type of malformation and the identification of relevant features (i.e. thrombosis).

The combination of clinical and MRI findings can further help to identify syndromes like Klippel-Trenaunay or Parkes-Weber.

Conclusion: MRI is the most important modality for diagnosis and therapy monitoring of CVM. The correct classification and the detection of post therapeutic changes is crucial for the stratification of the best therapy option.

PO09

Large and medium sized arterial "string of pearls" sign: Recognize it and know the main diagnoses

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Learning objectives: Pictorial summary of the main differential diagnoses for the classic radiological sign "string of pearls " (SOP) applied to large and medium arteries.

Background: Caliber anomalies of large and medium sized arteries can present with a SOP appearance, first described on angiography, but also seen on CT and MR examinations. Starting from this sign, this poster summarizes the main diagnosis that can be suspected in case of SOP based on medical context, aspect and localization of lesions on CT or MR examinations, and on other abnormalities detected on imaging.

Imaging findings or procedure details: The SOP appearance is defined as the presence of aneurysmal dilatations alternating with stenoses detected in large and medium arteries. Arterial wall thickening, wall enhancement, occlusion and dissection may also be encountered. The main diseases associated with a SOP appearance are fibromuscular dysplasia (FMD), segmental arterial mediolysis (SAM), Ehlers-Danlos syndrome type IV, Takayasu arteritis and giant cell arteritis.

FMD is an idiopathic, non-inflammatory disease. The renal and the cervicocephalic arteries are most commonly involved presenting with the SOP appearance.

In SAM disease, a rare disease of unknown cause, the SOP appearance will be mostly detected on the visceral arteries.

Ehlers-Danlos syndrome type IV is a hereditary disease characterized by a defect of type III procollagen, leading to aneurysm formation and dissections in predominantly visceral and cervicocephalic arteries.

Takayasu and giant cell arteritis are granulomatous inflammatory vasculitides, most commonly affecting the aorta and its main branches. Imaging features include vascular wall thickening and enhancement in the active stage. Stenoses or aneurysmal dilatations are present in later stages.

Conclusion: Recognizing the SOP sign and knowing its different etiologies is important for the radiologist.

Is Multi-class Lesion Segmentation superior to Single-class Lesion Segmentation for assessing Severity in COVID-19 Patients?

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Purpose: How does a current AI-based automatic single-class lesion detection algorithm compare to multi-class expert segmentation on a multicenter dataset of COVID-19 pneumonia CT images?

Methods and Materials: CoV-2-Radiomics pipeline automates the lung and multi-class lesion segmentation for severity classification in covid-19. CT scans were acquired by 3 centers (Bern, Parma and Yale). Lung segmentation and multi-class lesion segmentation deep neural networks are trained using ground-truth, segmented by expert radiologists, manually segmenting ten equidistant slices per case. Segmented models were used for high-throughput segmentation of new subjects. A total of 107 radiomic features were extracted on a voxel basis from all imaging scans for each lesion class and for the lung. A LASSO trade-off for feature importance and random forest algorithm training is applied to classify intubation or non-intubation, which serves as a proxy for severity of a patient in acute COVID-19 pneumonia.

Results: AI-aided vs manual segmentation yielded a mean DC of 0.71 for GGO, 0.64 for CON, 0.57 for PLE and 0.29 for BAN.
Pyradiomics for severity assessment yielded a F1-score/AUC of 0.901/0.98 for multi-class and 0.704/0.84 for single-class lesion model.

Conclusion: Our AI-model shows promising preliminary results in automated multi-class lesion segmentation.
The use of multi-class lesion segmentation appears to be superior to single-class lesion segmentation in assessing severity.

First performance evaluation of an artificial intelligence-based computer aided detection system for pulmonary nodule evaluation in dual source photon-counting detector CT at different low dose levels

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Purpose: To evaluate the image quality and performance of an artificial-intelligence (AI)-based computer aided detection (CAD) system in photon-counting detector computed tomography (PCD-CT) for pulmonary nodule evaluation at different low dose levels.

Methods and Materials: An anthropomorphic chest-phantom containing 14 pulmonary nodules of different sizes was imaged on a PCD-CT and on a conventional energy-integrating detector CT (EIDCT). Scans were performed with each of the three vendor-specific scanning-modes (QuantumPlus [Q+], Quantum [Q] and High Resolution [HR]) at decreasing matched radiation dose levels by adapting image quality (IQ) levels. Image noise was measured manually in the subcutaneous fat at eight different locations. Subjective image quality was evaluated by two readers in consensus. Nodule detection and volumetry were performed using a commercially available AI-CAD system.

Results: Subjective image quality was superior in PCD-CT compared to EID-CT (p< 0.001) and objective image noise was similar in the Q+ and Q mode (p >0.05) and superior in the HR mode (p=0.01). Overall, the AI-CAD-system delivered comparable results for lung nodule detection and volumetry between PCD- and dose matched EID-CT (p=0.08-1.00), with a mean sensitivity of 95% for PCD-CT and of 86% for dose matched EID-CT. The HR-mode showed a sensitivity of 100% with a false positive rate of 1 even at the lowest evaluated dose level (IQ5; CDTIvol 0.41mGy).

Conclusion: PCD-CT was superior to dose matched EID-CT in subjective image quality while showing comparable to lower objective image noise. Fully automatized AI-aided nodule detection and volumetry are feasible in PCD-CT, but attention has to be paid to false positive findings.

Impact of contrast-enhancement and virtual monoenergetic image energy levels on emphysema quantification: Experience with photon-counting detector CT

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Purpose: To evaluate the impact of contrast-enhancement and different virtual monoenergetic image energies on automatized emphysema quantification with photon-counting detector computed tomography (PCD-CT).

Methods and Materials: Sixty patients who underwent contrast-enhanced chest CT on a firstgeneration, clinical dual-source PCD-CT were retrospectively included. Scans were performed in the multienergy (QuantumPlus) mode at 120kV with weight adjusted intravenous contrast agent. Virtual non-contrast images (VNC) as well as virtual monoenergetic images (VMI) from 40-80keV obtained in 10keV intervals were reconstructed. CT attenuation was measured in the aorta; noise was measured in subcutaneous fat and defined as the standard deviation of attenuation. CNR with ROI in the ascending aorta and SNR in the subcutaneous fat were calculated. Subjective image quality was rated by two blinded radiologists. Emphysema quantification (with a threshold of -950 HU) was performed by a commercially available software. VNC images served as reference standard for emphysema quantification.

Results: Noise and CNR showed a strong negative correlation (r=-0.98; p<0.01) to VMI energies. The score of subjective assessment was highest at 70keV for lung parenchyma and 50keV for pulmonary vessel evaluation (p<0.001). The best trade-off for the assessment of emphysema while maintaining reasonable contrast for pulmonary vessel evaluation was determined between 60-70keV. Overall, contrast enhanced imaging led to significant and systematic underestimation of emphysema as compared to VNC (p<0.001). This underestimation decreased with increasing VMI-energy. The least difference in emphysema quantification between contrast-enhanced scans and VNC was found at 80keV.

Conclusion: CT emphysema quantification was significantly affected by intravenous contrast administration and VMI-energy level. VMI at 80keV yielded most comparable results to VNC. The best trade-off in qualitative as well as in quantitative image quality evaluation was determined at 60/70keV.

PO13

Radiation exposure in patients undergoing radioscopy-guided abdominal interventions.

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Purpose: To determine the dose exposure for five types of fluoroscopically-guided abdominal interventions and to participate in the establishment of a national dose registry in the context of optimising patients' radiation protection.

Methods and Materials: For this retrospective analysis, we included the five most frequent types of abdominal procedures performed under fluoroscopy guidance at the CHUV from January 1st, 2018 to March 1st, 2020. The following procedures were analysed: biliary drainage, chemoembolisation, radioembolisation with macroaggregated albumin testing and angioembolisation. Data were collected by the commercial software DoseWatch®, which records various dosimetric and epidemiological parameters for each radiological interventional procedure since 2017, especially the air kerma and dose area product. This was completed by the review of clinical data and radiological reports for each included patient. Statistical analysis was performed using the R software (chi-squared and student's ttests).

Results: A total of 416 patients were included in the study (mean age 65 years; age range 17-95 years). They were divided into 5 groups according to the type of procedure.

Results revealed a statistically significant association between the dose exposure and the type of procedure, the patients' BMI (body mass index) and the radiologist's experience performing the intervention. A statistical tendency was additionally observed between the dose exposure and the complexity of certain procedures represented through well-defined parameters. The 75th percentile dose for each interventional procedure (diagnostic reference level) was found to be lower than those found in the international literature.

Conclusion: X-ray exposure necessary for performing the most common types of abdominal interventions depends on the complexity of the procedure, the patients' BMI, and the experience of the radiologist. Our 75th percentile values for dosimetric parameters appear to be lower than those reported previously.

Correlation of gastrointestinal perforation location and amount of free air and ascites on CT imaging

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Purpose: To analyze the amount of free abdominal gas and ascites on computed tomography (CT) images relative to the location of a GIT perforation.

Methods and Materials: We retrospectively included 172 consecutive patients (93:79=m:f) with GIT perforation, who underwent abdominal surgery (ground truth for perforation location). The volume of free air and ascites were quantified on CT images by 4 radiologists and a semi-automated software.

The relation of the perforation location (upper/lower GIT) and amount of free air and ascites was analyzed by the Mann-Whitney test. Furthermore, best volume cutoff for upper and lower GIT perforation, areas under the curve (AUC), and interreader volume agreement were assessed.

Results: There was significantly more abdominal ascites with upper GIT perforation (333 ml, range: 5 to 2000 ml) than with lower GIT perforation (100 ml, range: 5 to 2000 ml, p=0.022). The highest volume of free air was found with perforations of the stomach, descending colon and sigmoid colon.

Significantly less free air was found with perforations of the small bowel and ascending colon compared to the aforementioned. An ascites volume > 333 ml was associated with an upper GIT perforation demonstrating an AUC of 0.63±0.04.

Conclusion: Using a two-step process based on the volumes of free air and free fluid can help localizing the site of perforation to the upper, middle or lower GI tract.

Effectiveness of a state-of-the art neural network for liver parenchyma, portal and hepatic vein segmentation based on a standard non-contrast T1-vibe Dixon sequence

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Purpose: To evaluate the effectiveness of an artificial neural network for liver parenchyma and vessel segmentation based on a standard non-contrast T1-vibe Dixon sequence as single- or multi-modal input.

Methods and Materials: A dataset of 30 liver MRI with a non-contrast 3mm T1-vibe Dixon sequence was compiled and manually labelled slice-by-slice by an expert for the outer liver border, portal and hepatic veins. A state-of-the-art neural network (3D U-Net) was trained on the dataset with nested cross-validation. A series of experiments against unseen test data was carried out with single-modal and multi-modal input, using different combinations of the Dixon in-phase, opposed-phase, water and fat reconstructions. The accuracy of the neural network to segment liver parenchyma, portal and hepatic veins was compared between single- and multi-modal input.

Results: The neural network trained with the single-modal in-phase reconstructions achieved a high accuracy with average Dice scores of 0.935+-.01 for liver parenchyma, 0.628+-.06 for portal veins and 0.54+-.08 for hepatic veins. The single-modal water reconstructions yielded similar performance as the single-modal in-phase reconstruction for liver parenchyma (0.922+-.02, p=.059), but lower performance for the portal (0.544+-.12, p=.028) and hepatic veins (0.462+-.13, p=.033). The AI model could not benefit from a multi-modal input with similar Dice scores for liver parenchyma (0.928+-.02, p=.233), but lower Dice scores for portal (0.613+-.06, p=.155) and liver veins (0.51+-.08, p=.033).

Conclusion: A standard non-contrast T1-vibe Dixon sequence with single-modal in-phase input to a neural network achieved the best performance for automated liver parenchyma, portal and hepatic vein segmentation.

All things the Radiologists Need to Know about CT Colonography

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Learning objectives: To describe the clinical indications and patient preparation for CT Colonography (CTC).
To illustrate pathologic imaging findings and pitfalls leading to patient anxiety and sometimes unnecessary invasive procedures.

Background: CTC is known as an effective minimally invasive test for detecting colorectal polyps and cancers. Incomplete optical colonoscopy (OC), contraindication or refuse to OC are considered the main indications for CTC. CTC sensitivity ranges between 86% for the detection of polyps >6mm and 100% for colorectal cancers. Additionally, CTC is also appreciated for providing cancer-staging information.

Imaging findings or procedure details: CTC is performed in properly prepared and distended colon without the need of anaesthesia or sedation. Dilatation of colon is performed through the insufflation of CO2, which is preferred to room air due to its rapid mucosal absorption, thus greater patient comfort after the procedure. Since a uniform colon distension is difficult to achieve, both supine and prone acquisitions are required. After acquisition, the interpretation is realized by using 2D (axial images with MPR reconstruction) and 3D images, allowing an endoluminal evaluation with the advantage of wall dissection and electronic cleansing of stool. The encountered pitfalls can be either related to technique, e.g. retained fluid and fecal material, or anatomy, such as thickened fold and diverticular disease.

Conclusion: CTC can be considered an alternative for OC for the polys and colorectal cancers detection. Radiologists should be familiar with the interpretation of CTC, pathological and pitfall findings, in order to avoid misdiagnosis.

The Utility of Dual-energy CT in Routine Abdominal Imaging

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Learning objectives: To explain the technical performance of dual-energy CT (DECT)
To illustrate the utility of DECT in routine abdominal imaging

Background: DECT is a new generation of CT, which is now routinely performed in clinical practice due to its superior ability to increase tissue contrast and conspicuity of lesions, notably in an oncologic group of patients. In post-processing, material decomposition images, including iodine maps (IP) and virtual non-contrast (VNC) images, can be generated.

Imaging findings or procedure details: With conventional CT, small hypoattenuating liver lesions are concerns in oncologic patients that require further investigation. However, DECT permits to differentiate small liver cysts, frequently encountered, without needing a complementary MRI. The role of DECT is also appreciated in patients with local liver treatment, notably, post chemoembolization.

While residual tumoral enhancement can be obscured by hyperattenuating Lipiodol, VNC images, by Lipiodol subtraction, allow detection of subtle residual tumors. Concerning the pancreas, studies demonstrated the benefits of DECT for better delineation and more conspicuity of pancreatic lesions in patients with suspected pancreatic adenocarcinoma. The utility of DECT in the urinary system is highlighted by distinguishing a hemorrhagic cyst from a renal tumor by demonstrating the absence of Iodine uptake of cysts on IP. Additionally, the urine stones are detected on VNC images, avoiding a supplementary unenhanced acquisition. Finally, DECT is now recognized for its ability to better demonstrate intestinal wall enhancement in patients with suspected mesenteric ischemia due to IP reconstruction.

Conclusion: Adopting DECT in routine clinical practice will improve diagnostic accuracy, especially in oncologic patients, promoting more appropriate therapeutic approaches.

PO18

Accessory cavitated uterine mass (ACUM): a rare and under-recognized uterine malformation

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Learning objectives: To know the typical MRI patterns of accessory cavitated uterine mass (ACUM)
Recognize an ACUM on pelvic MRI
Review the differential diagnosis of ACUM
Understand the place of ACUM amongst the different uterine malformations

Background: The European Society of Human Reproduction and Embryology (ESHRE) and the European Society for Gynecological Endoscopy (ESGE) classify uterine abnormalities among six classes. This classification is different from those of the American Society for Reproductive Medicine, generally used by radiologists. One supplementary category from the ESHRE/ESGE classification is the "Unclassified cases" class (U6). The poorly known Accessory Cavitated Uterine Mass (ACUM) belongs to that class.
The ACUM is defined by the presence of a non-communicating accessory cavity within the myometrium, surrounded by smooth muscle, close to the round ligament insertion, with an otherwise normal genital tract. Patients are usually young women presenting severe dysmenorrhea and chronic or recurrent pelvic pain, related to menstruation.

maging findings or procedure details: Cavitated lesion within the uterine wall with T1 hyperintense content, persistent after fat saturation and sometimes with T2 shading.
Lateralized location, anterior to the uterine cornua, close to the round ligament insertion.
Cavity lined by a thin T2 mildly hyperintense lining.
Wall of the cavity appears thick and T2 hypointense.
Normal uterus.

Conclusion: ACUM is a rare and poorly recognized uterine malformation, probably because its lack of visibility on the American classification of Müllerian malformations. Women suffering for ACUM are usually highly symptomatic and unsuccessfully symptomatically treated till the identification of the malformation. Targeted therapy may then be applied and the problem solved.

Imaging of Foreign Body Ingestion in Children

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Learning objectives:
1. To review imaging of foreign bodies after ingestion in children.
2. To discuss what are the imaging recommendation at our institution and what are the current guidelines.
3. To compare BAG diagnostic reference levels (DRL) for radiographs of thorax and abdomen with average dose at fluoroscopy indicated for foreign body ingestion at our institution.
4. To discuss contraindications for foreign body detection in children using fluoroscopy..

Background: Ingestions of foreign bodies in children is an important cause of morbidity and mortality in young children. Foreign bodies can be quickly detected and localized with imaging so that the children can accordingly be directed to appropriate therapy.

Imaging findings or procedure details: In the current guidelines, radiographs of thorax and abdomen are recommended as the imaging of choice for foreign body ingestion in children. At our institution, we routinely use fluoroscopy as the first line imaging in pediatric population when metallic foreign bodies are swallowed (coins, batteries, magnets). In our educational poster, we will show what imaging modalities we use at our institution. We will also compare current BAG recommended DRLs for abdominal and thoracic radiographs with dose levels at fluoroscopy in our institution for different pediatric age groups. Furthermore, we will look at the types of materials that are well detected at fluoroscopy and discuss contraindications for performing fluoroscopy.

Conclusion: Imaging plays an important role in the detection and management of foreign bodies in children as some materials require urgent removal. In pediatric population, it is crucial to update the guidelines on a regular basis and to select imaging modalities with the lowest dose.

Diagnostic imaging of obstructed hemivagina and ipsilateral renal anomaly

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Learning objectives: The purpose of the poster is to provide background information and imaging findings from six cases of Obstructed hemivagina and ipsilateral renal anomaly (OHVIRA), also called Herlyn-Werner-Wunderlich Syndrome (HWWS), in order to raise awareness of this rare and often misdiagnosed syndrome.

Background: Obstructed hemivagina and ipsilateral renal anomaly (OHVIRA) is a rare congenital malformation. It is associated with serious complications if diagnosis and treatment are delayed beyond adolescence. OHVIRA is most often diagnosed using ultrasonography and magnetic resonance imaging after menarche, when a large haematocolpos has formed. Renal anomalies are normally diagnosed earlier during preventive foetal ultrasonography. In OHVIRA, early diagnosis is key to the prevention of complications. However, there is a lack of guidelines for the diagnostic proceedings after suspicion of a Müllerian anomaly.

Imaging findings or procedure details: We report four patients with OHVIRA identified in infancy and two patients who were diagnosed when they became symptomatic during adolescence. We demonstrate typical imaging findings of OHVIRA in infancy and adolescence and propose diagnostic imaging recommendations for female patients with unilateral renal agenesis. Diagnosis was mostly achieved using ultrasonography. Hydro- or haematocolpos, ipsilateral renal anomaly and uterine duplication were observed. MRI was able to correctly diagnose all cases, even when ultrasonography findings were inconclusive. Colposcopy or laparotomy was employed if the diagnosis was unclear after diagnostic imaging. One patient required surgical treatment before menarche.

Conclusion: OHVIRA is a rare malformation of the genitourinary tract, which is often misdiagnosed. Patients suffer considerably from delayed or wrong diagnosis. The findings presented on this poster will raise awareness of this syndrome and help avoid complications.

Imaging of congenital bronchopulmonary malformations in children: A pictorial essay

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Learning objectives: To illustrate, through examples, the pre and postnatal imaging findings of congenital bronchopulmonary malformations in children.

Background: Congenital pulmonary malformations are present in 1 per 2500 live births, 70 % of which are detected prenatally.

The most frequent congenital lung lesions are: congenital pulmonary airway malformation (CPAM), sequestration, congenital lobar overinflation, bronchogenic cyst, bronchial atresia, venolobar syndrome, other vascular malformations and hybrid lesions. Clinical manifestations can vary, ranging from hydrops prenatally, to respiratory distress or infection postnatally.

Results: We review the imaging features of the most common congenital lung malformations, based on US and MRI for prenatal imaging; X-ray, US, MRI and CT for postnatal workup. Chest x-ray is performed after birth. Then children are investigated by contrastenhanced chest CT between 3 and 12 months, unless early symptoms require urgent management.

With the rise of lung MRI, nowadays, depending on the surgical and radiological team, MRI can replace CT in the postnatal period. We will describe here the different parenchymal and vascular anomalies in various malformations. Malformation volume, residual pulmonary volume, mass effect and vascular supply provide valuable information for neonatologists, surgeons and pediatric pneumologists for perinatal, immediate postnatal care and follow up.

Conclusion: Radiologists should be familiar with the main features of lung malformations on ante and postnatal imaging to improve collaboration with clinicians for surgical planning as well as non surgical treatment and follow up. Structured imaging report should include the location and extent of the lesion, depict its cystic or solid aspect, the vascularization, presence of a mass effect for diagnosis, differential diagnosis and prognosis.

PO22

Gadolinium Tissue Distribution in a Large Animal Model after a Single Dose of Gadolinium based Contrast Agent

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Purpose: To compare gadolinium tissue concentrations in various organs 10 weeks after one injection (comparable to a clinically applied dose) of linear and macrocyclic GBCAs in a large-animal model.

Methods and Materials: In this prospective animal study conducted from March to May 2018, 36 female Swiss Alpine sheep (age range, 4–10 years) received one injection (0.1 mmol/kg) of macrocyclic GBCAs (gadobutrol, gadoteridol, and gadoterate meglumine), linear GBCAs (gadodiamide and gadobenate dimeglumine), or saline. Ten weeks after injection, sheep were sacrificed and tissues were harvested. Gadolinium concentrations were quantified with inductively coupled plasma mass spectrometry (ICP-MS). Histologic staining was performed. Data were analyzed with nonparametric tests.

Results: At 10 weeks after injection, linear GBCAs resulted in highest mean gadolinium concentrations in the kidney (502 ng/g [95% CI: 270, 734]) and liver (445 ng/g [95% CI: 202, 687]), while low concentrations were found in the deep cerebellar nuclei (DCN) (30 ng/g [95% CI: 20, 41]). Tissue concentrations of linear GBCAs were three to 21 times higher compared with those of macrocyclic GBCAs. Administered macrocyclic GBCAs resulted in mean gadolinium concentrations of 86 ng/g (95% CI: 31, 141) (P = .08) in the kidney, 21 ng/g (95% CI: 4, 39) (P = .15) in liver tissue, and 10 ng/g (95% CI: 9, 12) (P .99) in the DCN, which were not significantly elevated when compared with concentrations in control animals. No histopathologic alterations were observed irrespective of tissue concentrations within any examined organ.

Conclusion: Ten weeks after one injection of a clinically relevant dose of gadolinium-based contrast agents, the liver and kidney appeared to be reservoirs of gadolinium; however, despite gadolinium presence, no tissue injury was detected.

The effect of Platelet-rich-plasm injection on pain during and in very short term on tendinopathy and osteoarthritis

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Purpose: Platelet-rich-plasm (PRP) is an autologous blood product with high concentration of platelet. It's used in patients with osteoarthritis for cartilage disorders and for tendinopathy injuries. Pain throughout the injection is poor reported in the literature. The aim of our study is to assess pain during injection and correlation with pathology, anatomic localization and size of used needle as well as improvement of pain in very short term.

Methods and Materials: 124 (64 male, 60 female) consecutive patients addressed for PRP injection; were ruled out prospectively. 78 patients have tendinopathy and 46 have osteoarthritis. All injections were performed under ultrasound guidance and under local anesthesia in ambulatory. Pain during infiltration was evaluated using visual analogic scale (VAS). Correlation with pathology, anatomic localization and size of needle was analyzed. All patients were invoked in short term, with a median of 10-15 days to assess pain response using the same scale. Due to no Gaussian distribution, Mann Whitney and Kolmogorov-Smirnov tests were used to compare groups if unpaired and Wilcoxon if paired. Spearman r was used for correlation.

Results: Median of age was 47 for tendinopathy and 53 for osteoarthritis. The median of pain throughout injection was 6 in two groups (osteoarthritis and tendinopathy) without significant difference (p=0.128). Anatomic localization has no significant influence on recorded pain (for example 6 both in wrist and elbow (p=0.170)). The correlation between pain and needle size was as well not significant (p=0.782). Regarding improvement in very short term, significant values were found (p≤0.05).

Conclusion: Our study shows that PRP is susceptible to increase pain during injections regardless pathology, anatomic localization and material used. However, improvement of pain is noted in very short term, as reported in some studies.

Bilateral increased Femoral Version of Patients with Ischiofemoral Hip Impingement using CT or MRI with T1 VIBE DIXON of the pelvis for measurement of Femoral

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Purpose: Ischiofemoral hip impingement is a hip disease affecting mainly female patients and was associated with increased femoral version(FV). Increased FV was associated with posterior ischiofemoral extraarticular hip impingement. It is unknown, if these patients have bilateral or unilateral increased FV.

Therefore, we report (1) mean FV, (2) side-to-side difference (3) prevalence of >10° FV side-to-side difference for patients with ischiofemoral impingement.

Methods and Materials: A retrospective MRI analysis involving 46 hips (23 patients, 01/2013-01/2020) was performed. Inclusion criteria were symptomatic ischiofemoral hip impingement and treatment with femoral derotation osteotomy (22 female patients, mean age 26 years).

We evaluated FV using the Murphy method on CT or rapid bilateral T1 VIBE Dixon MRI sequence (AT 32-40 seconds for 3 Tesla and for 1.5 Tesla) of the pelvis and knee (was added to the routine MRI protocol). FV was compared to the contralateral side. All patients were treated surgically.

We evaluated FV of a control group of 19 asymptomatic volunteers (mean age was 27±3, range 21–33 years) with the same MRI sequences.

Results: (1) Mean FV of the symptomatic side (46±9°) was significantly (p<0.001) higher compared to control group(28±16°) and not different compared to contralateral side(40±9°).

(2) Side-to-side difference of FV was higher for the patients(8±6°) compared to control group (7±5°).

(3) Side-to-side difference of >10° FV was prevalent in 8 patients (35%), and in 5 volunteers (26%).

Conclusion: Most of the patients with ischiofemoral impingement undergoing surgical treatment showed symmetric deformity, but one third of patients showed asymmetrical deformity of increased FV and they had higher FV compared to asymptomatic volunteers. Therefore routine bilateral radiographic evaluation is recommended for these patients. These findings could be important for radiologists and hip surgeons.

Femoral Torsion measurement using MRI with T1 VIBE DIXON compared to CT-based measurement of adult FAI patients

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Purpose: Abnormal femoral torsion(FT) was described causing Femoro-acetabular Impingement (FAI). CT-based measurements of FT is the gold standard.

We asked (1) What is the reliability in terms of mean difference and correlation between MRI and CTbased measurements of FT? (2) What is the mean difference and correlation of CT-based and MRI based measurements between two readers?

Methods and Materials: A retrospective comparative radiologic study involving a total of 94 hips was performed.

Of them, 52 hips (46 patients) underwent standard MRI with a leg holder, while 42 hips had no leg holder and additional MRI sequence.

All patients (94 hips) had symptomatic FAI (mean age of 28 ± 10 years). All patients underwent pelvic CT scan and MRI (2016-2019).

In addition to the routine unilateral, multiplanar protocol for chondrolabral lesions, bilateral T1 VIBE Dixon of the pelvis and of the knee was acquired for 42 hips to measure FT. Two readers independently measured FT on both CT and MRI scans on two separate sessions according to the Murphy method.

Results: (1) Mean absolute difference between MRI with leg holder and CT-based measurements of FT was 6.0° ± 3 (-10–7) for Reader 1 and 8.4° ± 5 (-21–12) for Reader 2.

Mean absolute difference between MRI without bolstering and CT- based measurements of FV of 48 hips decreased to 1.3°±0.8 (0.2–3.0) for Reader 1 and 2.3°±1.9 (0–10) for Reader 2.

(2) Mean absolute difference of CT-based measurements of FV between two readers was 2.9°±2 (-0–8) and correlation was r=0.969 (p<0.001). Mean difference of MRI-based measurements without bolstering of FV between two readers was 3.3°±3 (0–10) and correlation was r=0.943 (p<0.001).

Conclusion: MRI-based measurement of FV is as accurate and reliable as CT-based measurements when using T1 VIBE DIXON and in patients with FAI. We recommend no bolstering during MRI based measurements for FV.

Imaging of intimate partner violence

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Learning objectives: To raise awareness for intimate partner violence (IPV) among radiologists, summarise imaging findings suggestive for IPV, and outline the role of radiology in cases suspicious for IPV.

Background: During the Covid-19 pandemic incidents and reports of IPV have surged. Periods of lockdown have intensified IPV due to isolation with an abuser, cramped living conditions, and movement restriction. There is evidence that victims of IPV who seek medical care often do not report their history of physical abuse.

Imaging findings or procedure details: Imaging findings from IPV fall into two main categories: injures to target areas (head and neck, and posterior chest) and injuries to defensive locations (forearm, hand, and fingers). Additional findings may include coexistent old injuries to different body parts and a history that is inconsistent with an injury pattern. The role of the radiologist is to provide an objective and complete report of all injuries. There is agreement in the literature that concerns regarding IPV should be directly discussed with the referring clinician.

Conclusion: By recognising imaging patterns suggestive for IPV radiologists may contribute to the detection of unreported cases of intimate partner violence and help victims of IPV to receive appropriate support and care.

Business radiology strategies in a complex and unstable environment

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Learning objectives:
Know the 3 main strategies in business radiology
Know the strenghts and weaknesses of each strategy
Know how to use the appropriate stategy in the approriate environment
Background: Radiology has become an indispensable speciality in medicine. The equipment is becoming more efficient, allowing precise and quick diagnoses. Nevertheless, these examinations have a cost which is reflected in the health system. Thus, in recent years, several tariff revisions have been made. Radiology has been particularly affected by these reviews. Therefore, it has been necessary to rethink the management and strategy in radiology area in order to compensate for these losses while maintaining quality services. Several strategies have been inspired by industrial economic models. Are these strategies adapted to medicine?
Imaging findings or procedure details: According to Dieter R. Enzmann, the 3 main strategies in radiology include operational excellence, product leader position and customer intimacy.
Operational excellence strategy is based on low cost operation. All costs are optimized. This strategy is suitable for company with limited resources.
Product leader position strategy is based on premium product and services. Radiology departments using this strategy have specialists for each subspeciality and the best devices. This strategy is suitable for university center or high tech clinic.
Customer intimacy is a strategy centered on patient. Therefore, radiologists are more implicated in patient care management. Radiologists are less considered as "consultants for others doctors".
Conclusion: The medical environment is becoming increasingly complex and unstable. This instability requires an adaptation of strategies, particularly in radiology. Different strategic models have been drawn from the economic field. The choice of a strategy will depend on many factors, but will always have to integrate the "human" element in order to avoid a dehumanised aspect of medicine.

Are contrast media always causative for adverse reactions?

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Learning objectives:
- To learn that apparent adverse reactions following the application of a contrast medium do not necessarily depend on the contrast agent.
- To realize that the correct designation of adverse events are important for prophylactic considerations.
- Exact documentation of adverse events is a challenge for clinical radiology.
Background: Adverse events in the context of a contrast injection can be either related to the contrast medium or not.
Imaging findings or procedure details: We present a medical comic featuring this topic in order to teach the radiological community. We report on a patient who acquired an adverse skin reaction following the application of a gadolinium-based contrast agent (GBCA). A family doctor informed us about a suspected so-called delayed contrast reaction. To exactly document the reaction, we asked for a photograph. Rather than a classic delayed (non-immediate) skin lesion, we diagnosed a so-called love-bite, which was unrelated to the previously applied GBCA. Had the initial suspected diagnosis been prevailed, the patient would very likely face burdening premedication for all future contrast agent supported radiological examinations. In addition, other factors like latex allergy, allergy to the drugs given as premedication or an activated immune system can also contribute to adverse events in radiology units.
Conclusion: Exact diagnosis and its documentation are mandatory to ensure adequate individual prophylaxis in the context of contrast-enhanced image guided diagnosis. In order to reinforce the message we use comics as stylistic to strengthen the case.

PO29

Combination of ^{18}F-FET PET/CT dynamic and texture analysis in prediction of glioma grade and IDH1 status.

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Purpose: Gliomas are the most frequent malignant brain tumors and are heterogeneous in histology, genetics, and outcome. Mutation in isocitrate dehydrogenase (IDH) 1 has been described by several studies as an independent predictor of survival and represents a target of new molecular drugs. A longer survival is observed in glioma patients carrying an IDH1 mutation. We aimed at evaluating the respective value of O-(2-[^{18}F]fluoro-ethyl)-L-tyrosine (^{18}F-FET) PET/CT dynamic and texture analysis in patients with untreated glioma to assess grade and IDH1 mutation status.
Methods and Materials: Seventy-five patients were included (male: 49, median age: 47 [35-59]) and underwent a ^{18}F-FET PET/CT for initial glioma evaluation. Thirty-five had a WHO grade 2 and forty a grade 3-4 glioma. IDH1 status was available in 62 patients. Time-activity-curve (TAC) type and 20 parameters (conventional, texture, shape and histogram derived) obtained from static analysis using the LIFEx software were recorded. Respective performance was assessed using receiver operating characteristic (ROC) curve analysis and stepwise multivariate regression analysis.
Results: TAC type was an independent predictor of glioma grade (AUC 0.84 [95%CI 0.76-0.93]; OR 21.3 [4.97-90.77], p<0.001). In low-grade but not in high-grade glioma, gray-level co-occurrence matrix (GLCM) correlation and coarseness, and Shape_surface additionally demonstrated good performance for IDH1 status identification (AUC 0.78 [0.57-0.98], 0.82 [0.64-1.0] and 0.76 [0.54-0.98] respectively).
On stepwise multivariate analysis, GLCM_correlation tended to be an independent predictor for IDH1 status in low-grade gliomas (OR 36.3 [0.95-1389], p=0.053), with higher value in IDH1 mutant.
Conclusion: Combining 18F-FET PET/CT dynamic and texture analysis may help predicting both glioma grade and IDH1 status, especially in low-grade tumors.

PO30

Comparison of Angiogenesis Imaging with ^{68}Ga-NODAGA-RGD PET/CT and Glucose Metabolism with ^{18}F-FDG PET/CT in Esophageal or Gastroesophageal Junction Cancers: A pilot study

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Purpose: The aim of this study was to compare in patients with esophageal or EGJ cancers the potential of ^{68}Ga-NODAGA-RGD PET/CT with that of ^{18}F-FDG PET/CT regarding tumoral uptake and distribution.
Methods and Materials: Nine prospectively included participants (1 woman; age 58±8.4 years, range 40–69) underwent ^{68}Ga-NODAGA-RGD and ^{18}F-FDG PET/CT using a dedicated PET/CT scanner.
Maximum SUV (SUV_{max}) and metabolic tumor volumes (MTV) were calculated. The Mann-Whitney U test and spearman correlation analysis (ρ) were used.
Results: ^{68}Ga-NODAGA-RGD PET/CT detected positive uptake in 10 primary sites (8 for primary tumors and 2 for local relapse suspicion), 7 lymph nodes and in 3 skeletal sites. ^{18}F-FDG PET/CT detected positive uptake in same sites but also in 15 additional lymph nodes and 1 adrenal gland. On a lesion-based analysis, SUV_{max} of ^{18}F-FDG were significantly higher than those of ^{68}Ga-NODAGARGD (4.9 [3.7–11.3] vs. 3.2 [2.6–4.2] g/mL, p=0.014). 1 patient showed a higher SUVmax in an osseous metastasis with ^{68}Ga-NODAGA-RGD compared with ^{18}F-FDG (SUV_{max} 6.6 vs. 3.9).
Correlation analysis showed weak positive correlation between ^{18}F-FDG and ^{68}Ga-NODAGA-RGD PET parameters (ρ=0.56, p=0.012 for SUV_{max}, ρ=0.78, p<0.001 for lesion-to-background ratios and ρ=0.58, p=0.024 for MTV). We noticed that ^{18}F-FDG uptake was homogenous inside all primary lesions (n=9). In contrast, ^{68}Ga-NODAGA-RGD PET showed heterogenous uptake in 6 out of 9 primary lesions (67%), seen mostly in the periphery of the tumor in 5 out of 9 primary lesions (56%), and showed slight extension into perilesional structures in 5 out of 9 primary lesions (56%).
Conclusion: In conclusion, ^{68}Ga-NODAGA-RGD has lower potential in the detection of esophageal or esophagogastric junction malignancies compared to ^{18}F-FDG. However, the results suggest that ^{68}Ga-NODAGA-RGD may provide complementary information, indicating that PET imaging of integrin αvβ3 expression could aid in cancer phenotyping.

PO31

Outpatient Yttrium-90 microsphere radioembolization: assessment of radiation safety and quantifcation of post-treatment adverse events causing hospitalization

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Purpose: Quantifcation of post-interventional adverse events of outpatient SIRT leading to hospitalization and quantifcation of radiation exposure.
Methods and Materials: In this single-center, retrospective cohort study, we reviewed 212 patients treated with SIRT (90Y-microspheres) for primary and secondary liver malignancies. We searched for adverse events (AEs) and serious adverse events (SAEs), defned as AE's causing hospitalization. Additionally, radiation exposure was measured in 36 patients.
Results: Seven patients had an SAE (3.3%), four patients had AE without readmission/hospitalization (1.9%) and 201 patients had no complications (94.8%). The mean ambient dose rate at 1 m distance from the source after administration of 90Y-microspheres was 1.88 µSv/h±0.74 (±SD) with a range from 4.3 to 0.2 µSv/h.
Conclusion: Outpatient radioembolization with 90Y-microspheres is safe and requires hospitalization only in a very small number of patients. The mean dose rate was low and met the national conditions for outpatient treatment.

PO32

A combination of genicular artery embolization and radiosynoviorthesis for treatment of severe joint effusions after knee arthroplasty: First experience

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Learning objectives: Combined treatment of massive recurrent joint effusions after knee arthroplasty with genicular artery embolization and subsequent Y-90-colloid radiosynoviorthesis.
Background: In patients with severe synovitis and massive recurrent joint effusions after knee arthroplasty, often no single treatment strategy promises effective and long-lasting treatment response. Clinical success rates of radiosynoviorthesis on average do not exceed 50% or 60% after repeated treatment. Genicular artery embolization is a minimally invasive treatment option after knee arthroplasty mainly used in cases with spontaneous hemarthros.
Methods and Materials: In this single-center, retrospective cohort study, we reviewed 212 patients treated with SIRT (90Y-microspheres) for primary and secondary liver malignancies. We searched for adverse events (AEs) and serious adverse events (SAEs), defned as AE's causing hospitalization. Additionally, radiation exposure was measured in 36 patients.
Imaging findings or procedure details: A 49-year-old male patient with left knee arthroplasty 3 years earlier presented with recurrent high-volume joint effusions and knee pain limiting his ability to work. There was no evidence of rheumatologic disorders, loosening or infection of the knee arthroplasty. Knee ultrasound revealed villous synovial thickening up to 7.5 mm.
Given massive effusions and activity of synovitis, even repetitive intraarticular instillations of Y90-Colloid were not expected to improve prospects of success with more than 50%. Therefore, a combined approach was chosen with embolization of 4 branches of genicular arteries of the left knee medially and laterally, reducing massive synovial hyperemia of the left knee. Six weeks later radiosynoviorthesis with 200 MBq Y-90-colloid was performed.
The patient experienced a gradual improvement after both procedures, with resolution of knee pain and minimal, tension free residual effusion in the widened knee capsule. He was able to resume work without significant limitation.
Conclusion: In patients with severe synovitis and recurrent massive joint effusion after knee arthroplasty, a combined treatment approach with genicular embolization and subsequent Y-90-colloid radiosynoviorthesis may offer improved treatment outcome.

Dysfunctional catheter? What happens inside?

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Purpose: Angiographic control of 951 dysfunctional CVAD's and 76[1] Picc-lines in University Hospital of Geneva by the radiology technicians' team.

Methods and Materials: Retrospective presentation of some troubleshooting CVAD/Picc-line cases studied at University Hospital of Geneva, in the angiography service, from January 2021 to December[2] 2021.

Using a fluoroscopic X-ray machine, the integrity of the catheter path is checked, by injecting a contrast product.

First of all, the injection in the catheter must be possible. Then, a chest x-ray is made to evaluate if the CVAD/Picc-line is in order to be injected. Is the position right? Is there any disconnection? Is the catheter kinked? If none of these problems are seen by the radiology technicians, an acquisition protocol of 3 images/second is used to make the injection, during about 10 seconds.

The anatomical substraction technique of the fluoroscopic x-ray machine, allows us to only visualize the contrast product inside the catheter.

Of course, in case of any doubt in the chest x-ray, no injection is made and a Radiologist is called.

Results: If everything is right with the catheter, the contrast product fills the lumen of the catheter in a straight line into the superior vena cava.

If not, the most common issue we see, is a contrast filling a fibrinous sleeve at the end of the catheter, no blood withdraw is possible most of the times, making it dysfunctional.

Conclusion: In conclusion, fibrinous sleeves are the most common issue of central venous catheters we control, in which a proteinaceous film encases the outer wall and endhole of the catheter, which can cause catheter malfunction and thrombosis. Some catheters are malpositioned, some are disconnected (for CAVD's like port-a-cath) and some are kinked. Further researches[3] would be needed to investigate the ratio of these complications. Also, this exam is a good example of the radiology technicians to develop their skills and autonomy.

Nuclear medicine contribution during COVID19 pandemic

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Purpose: The COVID-19 has turned our lives upside down and transformed our daily clinical practice. We live every day with COVID-19 positive patients, vaccinated and/or recovered patients. This changed our work routine. It is presents as two distincts cases: first for known positive COVID's patient in pulmonary thromboembolism and COVID long disease and secondly for "incidental" findings exams.

Methods and Materials: We reviewed the literature in nuclear medicine during COVID-19 for PET-CT and pulmonary scintigraphy exams. We particularly focused on incidental COVID-19 pathologies findings and long COVID in PET-CT. Those, on a secondary and subsidiary objective, we compared them with our own practice at Fribourg.

Results: In conventional nuclear medicine, with the increase of pulmonary thromboembolism, pulmonary scintigraphy is perform differently. Ventilation exams are not perform in those cases. Lymph nodes, cerebral hypofunction, autoimmune diseases, myocarditis and others pathology were visualize with the PET-CT exam.

Conclusion: We realized that our practices have changed. The management had to be adapted in relation to vaccinate or positive COVID-19 patients, anamnesis and image interpretation. The knowledge of those changes will help physicians in interpreting correctly the exams.

Spectroscopie par résonance magnétique – Applications en pédiatrie

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Learning objectives: Les examens cérébraux pédiatriques en imagerie par résonnance magnétique sont pratiqués régulièrement dans nos services à des buts diagnostiques. Les techniciens en radiologie médicale appliquent des séquences demandées par le radiologue selon la demande du prescripteur et du cas à examiner.

La spectroscopie, est parfois ajoutée en fin d'examen afin de caractériser une lésion ou de visualiser les différents métabolites contenus dans un tissu, ainsi que leurs concentrations.

Background: Les examens ciblés sont les IRM cérébrales chez le nouveau-né.

Six séquences mono et multivoxel sont couramment employées et proposées selon le type de pathologies recherchées. La programmation et le positionnement adéquats des voxels soit sur la substance blanche, soit sur les noyaux gris centraux ou sur une lésion focale sont nécessaires et doivent être adaptés à la pathologie suspectée. L'utilisation et la compréhension de l'apport des spectroscopies à différents temps d'écho est également indispensable pour visualiser et différentier certains métabolites pour orienter le diagnostic final.

Imaging findings or procedure details: Les critères de qualité d'un spectre ainsi que les avantages et inconvénients de la spectroscopie mono et multivoxel seront présentés.

L'aspect normal d'une spectroscopie et son évolution au cours de la 1ère année de vie seront illustrés, ainsi que les astuces pour reconnaître certains métabolites.

Les spectres réalisés et analysés permettent d'orienter le diagnostic vers un certain nombre de pathologies métaboliques touchant la substance blanche et les noyaux gris comme les maladies de la chaine respiratoire selon le taux des métabolites.

Conclusion: La réalisation de spectroscopie en IRM pédiatrique permet au radiologue d'orienter le bilan métabolique et génétique chez le nouveau-né présentant une suspicion de maladie métabolique.

Une bonne compréhension des techniques de réalisation et des spectres attendus est nécessaire au TRM afin d'optimiser le potentiel diagnostic de cette méthode.

Management of patients with breast implants for mammography examinations

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Learning objectives: The purpose of this presentation is to raise the awareness of radiographers for a better management of patients with breast implants in mammography.

Background: Breast augmentation with implants is a very common procedure and it is increasing in the last years. Indeed, this cosmetic operation is the most common and represents 15.8% of cosmetic operations worldwide according to the International Society of aestetic Plastic Surgery (2019). This event leads to an increase of breast implant mammography requests for screening and diagnostic purposes.

As a radiographer performing mammography, it is important to adapt the procedure to the patient considering the patient's emotional state, sensitivity and morphology for an adequate positioning (Ann Poulos, Gwynnyth Llewellyn, 2004). However, when the patient has breast implants other aspects must be also considered, which can promote a more complex examination and more anxiety even for the radiographer.

Imaging findings or procedure details: The examination in this context requires exchange of specific information with the patient, regarding the type of implant as well as the explanation about the technique that needs to be performed for a better visualization of breast tissues (Eklund Manoeuvre). Due to the risks associated to breast implant rupture, psychological aspect should be considered before starting the exam. An informed and reassured patient is important to facilitate the understanding of the procedure and to get patient's collaboration. The positioning technique is different when compared to standard techniques because the anatomy of the breast is modified. The exposure parameters for the image acquisition must be also adapted to the breast implants to guarantee adequate dose and image quality for the diagnosis.

Conclusion: Women with breast implants have a modified anatomy which demands changes in the information exchanged, as well as in the technique applied, positioning and exposure parameters.

MRI of the hip under traction

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Learning objectives: Presentation of a hip MRI protocol under traction after arthrography.

Background: Implementation of a hip arthrography protocol under traction increasing the benefit of intra-articular injection of contrast medium by a good distribution of the latter. Use of an adapted equipment allowing a traction in the axis in a safe, reproducible and well tolerated way.

Imaging findings or procedure details: After explanation, informed consent, disinfection and injection of the contrast medium in the arthrography room, the patient is installed on the MRI table for traction. We pay particular attention to:
- The precise, comfortable and stable installation of the patient.
- Adapting the weight of traction to the patient in a progressive manner.
- Obtaining the patient's cooperation by explaining the steps performed.
The acquisition of series of images under traction is performed by two complementary series in PD: sagittal and coronal for an optimal vision of the joint.

Conclusion: The combination of intra-articular injection of contrast medium linked to an efficient traction allows a good visualization of the articular cartilage and the labrum.
A very good tolerance, without pain, of the traction by the patient.
A simple, fast and adapted implementation for the radiologist technicien.

Imaging in suspected non-accidental trauma (NTA) in children

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Learning objectives: Emphasize the importance of optimal imaging in the assessment of suspected NTA in children.

Background: The current gold standard for NTA in children under 2 years of age is a high-quality whole body skeletal examination that consists of separate X rays of each region, in accordance with international guidelines (ESPR). We apply them in our department and perform the survey by two radiographers and in the presence of a pediatric radiologist to check the quality of the images. The X rays are done during normal working hours so we have the necessary staff. The NTA imaging protocol includes, in addition to skeletal assessment, brain imaging by CT and MRI (including the spine). The WB MRI is also part of our systematic protocol.

Imaging findings or procedure details: Through some examples, we will demonstrate the ideal technique to obtain quality images of the X rays, typical images such as metaphyseal, skull and rib fractures. We will highlight some of the pitfalls of skeletal radiographs. We show examples of brain lesions on CT and MRI as well as the limitations and advantages of WB MRI. Also the issue of fracture and brain damage dating will be discussed.

Conclusion: Radiographers should be reminded of their role in obtaining an adequate skeletal study of NTA, in order to depict lesions (sometimes quite subtle) that can have significant consequences for children. Precise radiological reports are part of a medico-legal context. Whole body MRI can add information to the survey, but has limitations.

Explanatory support for radiological examinations in pediatric radiology

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Learning objectives: On a daily basis, Radiographers are confronted with numerous questions from parents regarding radiation doses as well as the conduct of a radiological examination for their children.
EuroSafe Imaging Stars is an initiative designed by ESR to support and strengthen medical radiation protection in Europe with a globalist and inclusive approach.
In order to be "EuroSafe" accredited (guarantee of quality), various criteria must be completed in many areas.
One of the criteria is information to the patient:
"Easily accessible information materials on radiation protection principles and practices are available to patients" (Eurosafe).
And according to the Radiation Protection Ordinance (ORaP):
Section 4 Patients
Art. 38 Patient information
"Patients should be informed of the risks and benefits of their medical exposure."
This is why we decided to create an educational poster, mainly dedicated to young patients, as well as an information flyer for their caregivers.

Background: For the poster we had to find an impactful way of communication, aimed to both children and teenagers.
The chosen method was a comic strip which combines visual and written explanation.

Imaging findings or procedure details: We contacted a professional designer known for his books for young people and he agreed to participate to the project.
The flyer was created by a group made of radiographers and a radiation physicist. Before printing it in large quantities, we conducted a survey on a large sample of the population, the satisfaction survey was based on the design, understanding and relevance of the document.

Conclusion: Patients stay only in the waiting room for a very short time and therefore need to quickly understand the course of the examination. When questioning about x-rays and doses, the brochure distributed to parents proved to be a good method to reassure them.
The poster, much appreciated by children and their adult companions, is a simple and effective way to convey a message quickly understood by all.

MR Elastography – A starter guide for radiologic technologist

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Learning objectives: With this poster, radiologic technologists will learn about MR elastography, how it works and where it is used.
poster, mainly dedicated to young patients, as well as an information flyer for their caregivers.

Background: Various diseases such as cancer, fibrosis or calcifications are causing changes in tissue stiffness. A medical examination with palpation to check for stiffness or abnormalities is often limited. Standard CT/MRI/PET images provide information about morphology, function, anatomy, lesions but cannot measure elasticity. Elastography allows to examine stiffness or elasticity of tissue, even if the tissue is not as easy to palpate like mammae, and more enclosed like liver, pancreas and brain. Today there are two modalities for elastography available: ultrasound and MRI. Both generate sound waves, which are travelling through tissues, getting slowed down by different tissue types and get recorded.

Imaging findings or procedure details: Various vendors of MR-systems have implemented elastography tools in their product range. Besides the MR-system, elastography requires a driver and a vibration source, as well as the appropriate sequences. A driver has to be placed on the area of interest, connected to the vibration source and secured by an elastic band. Positioning and coil placement as usual, the MR Elastography can then be performed as additional sequences. The system will display images of soundwaves travelling through the tissue as well as automatically calculated stiffness-maps (elastograms). Scanning the whole organ will detect not only singular masses of different elasticity but also give a mean value of the stiffness of the organ.

Conclusion: MR Elastography is a great tool for imaging a diagnostic tissue property that wasn't possible before. Standardized values for organ stiffness/elasticity help to evaluate the progression of a disease or the efficacy of a treatment. Elastography can help to differentiate malign from benign masses and aid in deciding the precise biopsy site or even replace the need for a biopsy altogether.

MR Elastography – Useful for liver fibrosis evaluation

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Learning objectives: By reading this poster, radiologic technologists will see examples of MR elastography performed in the liver, why it is useful and how it adds information to a standard MR protocol.
poster, mainly dedicated to young patients, as well as an information flyer for their caregivers.

Background: Liver pathologies are fairly common, especially in developed countries with more sugar-/fat-based diets and regular alcohol consumption. Fatty liver disease, which describes an abnormal amount of fat in the liver can lead to steatohepatitis, where inflammation and scarring start to appear. Through progression this can lead to fibrosis and if left untreated, liver fibrosis might lead to cirrhosis, liver failure or even liver cancer. While healthy liver tissue is soft and elastic, the increase of scartissue reduces the elasticity of the whole liver. Through elastography we have the means to measure the stiffness of the liver. Studies have shown, that the results of the elastography of different stages of fibrosis correlate to those assessed by biopsy.

Imaging findings or procedure details: MR Elastography displays the continuous soundwaves travelling through the liver: stiffer tissue will prolong these soundwaves, while soft tissue has shorter waves. With this information, the software automatically calculates elastograms, which are color-coded maps, displaying the various levels of stiffness throughout the image. Radiologists can then analyze these results by defining regions of interests on some or all of the images. The stiffness is expressed in kilo Pascal (kPA): < = 2.5 kPa is seen as normal, while 2.9-5.0 kPa entails 3 stages of fibrosis and >5 kPa equals Stage 4 fibrosis/cirrhosis.

Conclusion: Only very advanced liver fibrosis leads to a tissue change detectable on conventional CT/MR images. Through MR Elastography even early stages of fibrosis can be detected through the increase of stiffness in the liver tissue. The results of MR Elastography correlate well with biopsy results for the different stages of liver fibrosis. Eventually elastography could replace the need for biopsy.