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DIAGNOSIS AND TREATMENT

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Reliability of radio-ulnar and carpal alignment measurements in the wrist between radiographs and 3D imaging

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Purpose: Conventional radiography is the first modality to investigate radio-ulno-carpal joint in the event of trauma or instability. This study sought to determine the reliability of cone beam computer tomography (CBCT) and scout of view in evaluating carpal alignment compared with conventional radiographs in order to assess influence of wrist kinematics on usual measurements.

Methods and Materials: We prospectively recruited 305 patients who successively underwent plain radiography and CBCT. 51 patients with prior acute unilateral wrist trauma were eligible for entry into the study (mean age of 39 years). Three blinded readers performed measurements separately. Axial method and bony axial lines defined previously in the literature were applied, with three categories of measurements performed, consisting of distal radio-ulnar, radiocarpal and radio/carpometacarpal measurements. Intraclass correlation coefficients (ICCs) for paired t-test were calculated to assess inter and intra-observer agreements.

Results: Inter-observer agreement was very high (>0.94) for all modalities. Intra-observer reliability between scout view and CBCT was almost perfect for all measurements. Intra-observer reliability between radiograph and scout view/CBCT was perfect for distal radio-ulnar measurements, substantial for radio-carpal and moderate for radio/carpometacarpal measurements.

Conclusion: In absence of a strict position control between two imaging acquisitions, only distal radio-ulnar measurements were shown perfectly reliable when using these two imaging methods, which is suggestive of a minor relevance of ulnar/radial deviation. Excepting for some angles, radio-carpal and radiocarpometacarpal measurements were shown to differ according to wrist position, being thus more sensitive to flexion/extension of wrist.

Increased detection of retropatellar cartilage lesions and shorter scan times using deep learning convolutional neural network reconstruction and radial k-space acquisition technique in MR imaging of the knee joint

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Purpose: To assess diagnostic performance of standard radial k-space (PROPELLER) MRI sequences and compare with accelerated acquisitions with deep learning-based convolutional neural network (DL-CNN) reconstruction for evaluation of knee joint.

Methods and Materials: Thirty-five MR exams of the knee at 1.5 T were prospectively included. Two readers evaluated image quality and diagnostic confidence of standard and DL-CNN PROPELLER MR sequences using a four-point Likert scale. Pathological findings (bone, cartilage, ligaments, menisci, joint) were analyzed. Inter-reader agreement (IRA) for image quality and diagnostic confidence was assessed using intraclass coefficients (ICC). Cohen`s kappa statistic was applied for assessment of IRA and agreement between MR sequences for pathological findings. Image quality was quantitatively evaluated by signal- (SNR) and contrast-to-noise ratio (CNR).

Results: Mean scan time of standard vs. DL-CNN sequences was 10 minutes 3 seconds vs. 4 minutes 45 seconds. DL-CNN sequences showed significantly superior image quality and diagnostic confidence. There was moderate and good IRA for assessment of image quality in standard and DL-CNN sequences with ICC of 0.524 and 0.830. Pathological findings of knee joint could be equally well detected in both sequences (κ = 0.8). Retropatellar cartilage could be significantly better assessed on DL-CNN sequences. SNR and CNR was significantly higher for DL-CNN sequences (p<0.05).

Conclusion: In MR imaging of the knee DL-CNN sequences showed significantly higher image quality and diagnostic confidence compared to standard PROPELLER sequences while reducing scan time. Both sequences perform comparably in the detection of knee joint pathologies, while DL-CNN sequences are superior for evaluation of retropatellar cartilage.

Presence of Gout Correlates with Reduced Psoas Muscle Quality: A Dual-Energy CT Study

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Purpose: Sarcopenia is characterized by progressive, generalized loss of muscle mass, strength and function, and correlates with physical disability, poor quality of life, and death. While uric acid has strong antioxidant properties which might prevent sarcopenia, gout could adversely impact muscle status from inflammation and other comorbidities. We assessed whether gout patients' muscle mass and quality differ from controls.

Methods and Materials: Patients with gout per ACR classification criteria and control subjects were recruited. Demographics, gout history, and serum urate(sU) were collected. All subjects underwent DECT of the lumbosacral spine to assess for monosodium urate(MSU) crystal deposition. Muscle mass (psoas muscle index) and quality (psoas muscle density) were measured at the L3 level.

Results: 75 subjects were enrolled, of which 68 were analyzed for muscle mass and quality. Groups were comparable in age(p=0.8) but differed in BMI(p=0.03). Gout patients had larger spinal MSU deposition than controls (controls, $2.2 \pm 1.2 cm^3$; gout $5.2 \pm 6.9 cm^3$, p=0.04). Psoas muscle quality was significantly higher in controls ($46.9 \pm 4.6 HU$) than gout patients ($43.1 \pm 5.4 HU$, p=0.002), whereas psoas muscle mass was comparable between gout patients ($7.95 \pm 2.55 cm^2/m^2$) and controls ($7.72 \pm 1.87 cm^2/m^2$; p=0.74). Reduced psoas muscle quality significantly correlated with gout (rho=0.31, p=0.01), but not with spinal MSU deposition (rho=-0.18, p=0.14). In contrast, reduced psoas muscle mass did not correlate with gout, but significantly correlated
with MSU deposition (rho=0.41,p<0.001). sU significantly negatively correlated with muscle quality (rho=-0.37,p=0.002), but not with muscle mass (rho=0.12,p=0.32).

Conclusion: Gout patients have significantly lower psoas muscle quality but comparable muscle mass than controls. Psoas muscle quality significantly and adversely correlated with gout and sU, but not with MSU deposition volume. These findings suggest deleterious effects from gout which may counteract the antioxidant properties of uric acid..

Metal artifact reduction in photon-counting detector CT: Quantitative evaluation of artifact reduction techniques

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Purpose: To quantitatively compare different metal artifact reduction techniques for clinical photon-counting detector CT (PCD-CT).

Methods and Materials: A multi-energy phantom was scanned on a first-generation dual-source PCD-CT with four different central inserts: water-equivalent plastic, aluminum, steel, and titanium. Acquisitions were performed at 120kVp and 140kVp. Images were reconstructed as virtual monoenergetic images (VMI) from 110keV to 150keV (at 10 keV increments), as T3D, and as "none", applying different quantum iterative reconstruction (QIR) levels (QIR-3 and QIR-off), two reconstruction kernels (Br36, Br56) and iterative metal artifact reduction (iMAR). A metal artifact quantification algorithm was used to calculate voxel-based relative percentages of metal artifacts and mean CT numbers of an adjacent water-equivalent insert. Repeated measures analysis of variances was performed for statistical analysis.

Results: Metal artifacts were strongest for steel (up to 67% of voxels), followed by titanium (up to 24%) and minor for aluminum (up to 3%). VMI, QIR, and iMAR had a significant impact on artifact reduction (all p< 0.05). Depending on the metal, average artifacts were reduced to 0.6-2.5% of voxels using iMAR, to 1.2-11.2% using VMI, and to 0.7-1.7% when combining iMAR and VMI. Average artifacts were 7.7% and 11% for QIRoff and QIR-3, respectively. Maximum reduction was found using VMI at 150keV with iMAR leading to a total artifact elimination for aluminum and titanium and residual artifacts of 0.1% for steel. Tube potential and reconstruction kernel did not show a significant impact on artifact reduction (p>0.064). CT numbers were significantly affected by iMAR, VMI, tube potential and reconstruction kernel (all p<0.0001), while QIR did not show a significant effect (p=0.47).

Conclusion: Metal artifact reduction with PCD-CT was strongest by combining iMAR and VMIs at 150 keV, while reconstruction kernel and tube potential had a limited impact.

Joint damage detected by preoperative MR arthrography under leg traction enables prediction of failure at 2-5 years following arthroscopic FAI surgery.

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Purpose: MR arthrography (MRA) combined with leg traction has been proposed for improved detection of cartilage damage but its prognostic value in predicting outcome of arthroscopic femoroacetabular impingement (FAI) surgery is yet to be evaluated. To assess the association between joint damage detected on preoperative traction MR arthrography of the hip with mid-term failure following arthroscopic FAI surgery.

Methods and Materials: IRB-approved retrospective cohort study of patients undergoing arthroscopic FAI surgery between 2016 and 2019 with preoperative traction MRA of the hip and biplanar radiographs and followup of 2-5 years (mean followup 4 years) postoperatively. 106 patients (60% men) with a mean age of 33 ± 10 years were included. Patients completed postoperative questionnaires for calculation of international Hip outcome scores (iHOT-12). Failure was defined as subsequent total hip arthroplasty (THA) or patients not meeting the patient acceptable symptom state (PASS) <60 points. Preoperative MR arthrography was performed at 1.5T using an MRI-compatible traction device. A radiologist retrospectively assessed presence of extensive acetabular cartilage damage (>2 hours on the clock-face), osteophytes, acetabular cysts on coronal, sagittal and radial MRA images. Association between imaging findings and failure of FAI surgery was assessed using odds ratios (OR) and positive- and negative predictive values (PPV and NPV).

Results: Twenty-six (25%) patients met at least one endpoint. Extensive cartilage damage yielded the highest odds (OR=39, p<0.0001) of failure of FAI surgery followed by femoral osteophytes (OR=9.8, p<0.001) and acetabular cysts (OR=5.1, p=0.0007). Prognostic accuracy in predicting failure was high for presence of extensive cartilage damage on MRA (PPV=87% and NPV=86%).

Conclusion: Joint damage detected by preoperative traction MRA enables prediction of failure at 2-5 years following arthroscopic FAI surgery and yields great potential to improve preoperative risk stratification.

Earlier non-invasive diagnosis of gout and calcium pyrophosphate deposition disease with multi-energy photon-counting CT

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Purpose: We aimed to assess whether multi-energy photon-counting CT (PCCT) can identify smaller deposits of monosodium urate (MSU) and calcium pyrophosphate (CPP) than dual-energy CT (DECT) for the diagnosis of gout and calcium pyrophosphate deposition (CPPD) disease.

Methods and Materials: We used a soft-tissue phantom with several synthetic crystal inserts with known concentrations of MSU (90-500 mg/mL) and CPP (26-109 mg/mL). Crystals were suspended in a crystal-free agar-based lipogel background densified to mimic the attenuation of the hyaline cartilage. The phantom was scanned using a last-generation DECT (Revolution Apex, GE Healthcare) operated at 70 and 140 kVp and a PCCT (MARS Extremity 5X120, Mars Bioimaging Ltd.) at 118 kVp. A comparable dose level of 3 mGy was used for both systems. Images were reconstructed using a voxel size of $0.22{\times}0.22{\times}0.625$ mm^3 for DECT and $0.1{\times}0.1{\times}0.1$ mm^3 for PCCT. The area under the receiver operating characteristic curves (AUCs) were computed for the MSU/CPP and MSU/crystal-free background pairs. We also calculated the minimum pixel sample size required to distinguish two crystal types within any crystal deposit.

Results: The performance of PCCT in identifying MSU and CPP was excellent (AUC=0.964+/-0.022) and comparable with DECT (AUC=1). For the identification of MSU in a dense crystal-free background (e.g. hyaline cartilage), PCCT (AUC=0.979+/-0.013) outperformed DECT (AUC=0.799+/-0.16). The minimum pixel sample size required to distinguish between MSU and CPP decreased from 3 pixels (0.6-mm diameter) with DECT to 2 pixels (0.2-mm diameter) with PCCT. To differentiate MSU from the crystal-free background, both systems needed a minimum of 4 pixels (0.8-mm diameter for DECT vs. 0.4-mm for PCCT).

Conclusion: PCCT can identify smaller volumes of MSU and CPP deposits with comparable accuracy to DECT. PCCT could enable the earlier diagnosis of gout and CPPD thanks to its higher spatial resolution.

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Fully automated machine learning-based framework for whole-body composition analysis for magnetic resonance images (MRI).

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Purpose: To develop and validate a novel machine learning-based and fully automated muscle-fat body composition assessment system that fully utilizes the combination of all four contrast mages generated by the Dixon technique in MRI and is feasible even with a limited amount of data.

Methods and Materials: To evaluate the performance of the proposed convolutional neural network (CNN) in this retrospective study, two different test datasets were used and the results of the model on these datasets were compared with some reference segmentation methods that are considered as state-of-the-art in biomedical image segmentation. A 3D U-Net based CNN was trained using the training data from these datasets and validated using the test data. For the whole-body MRI dataset, MRI scans (acquired with Dixon technology) of 14 patients (age 18-90 years) were used. 3D MRI scans were acquired using the 3T Magnetom vida fit (Siemens Healthineers, Erlangen, Germany) with a 3D two-point Dixon VIBE sequence. For brain tumor segmentation, the BraTS 2018 dataset was used. Each patient was scanned with FLAIR, T1ce, T1 and T2. Training set consists of 285 cases with ground truth provided. The validation sets and the testing set contain images of 66 and 191 patients with brain tumors, respectively.

Results: For whole-body MRI, the proposed method achieved an average mean dice coefficient of 0.86 across all classes.

For BraTs, due to hardware limitations, only 10% of all training data was used as the training set. To evaluate the initial experimental results, metrics were calculated for the whole tumor (WT), tumor core (TC), and enlarging tumor (ET). The proposed method achieved an average mean dice coefficient of 0.81 (range:0.75–0.88), sensitivity of 0.83 (range:0.71–0.95), and specificity of 0.98 (range:0.98–0.99) across all classes.

Conclusion: This study demonstrates the great potential that a system capable of performing high-quality, automated whole-body MRI segmentations could bring to a variety of medical imaging applications.

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Assessment of the clinical benefits of new-generation 0.55T low-field MR imaging in patients with hip pain after total hip arthroplasty.

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Purpose: Evaluation of the clinical value of dedicated MRI in patients with hip pain after hip arthroplasty using a newgeneration 0.55T low-field MR scanner system.

Methods and Materials: Between May 2021 and March 2022 48 patients (68±14 years, 23m, 25w) who presented to an outpatient orthopedic center with hip pain after total hip arthroplasty were prospectively included in this study. In addition to routine pelvic and axial radiographs, supplemental MRI were acquired using a new-generation 0.55T low-field system (MAGNETOM Free.Max, Siemens Healthineers). Two fellowship trained musculoskeletal radiologists evaluated MRI regarding the presence of findings, not identified on standard radiographs. These findings were classified according to their potential impact on patient health and therapeutic management (0 = none, 1 = unlikely, 2 = unclear, 3 = probable, and 4 = definite).

Results: In 60 % of cases (n=29), MRI findings classified as relevant for further patient management were detected (class 4 n=15, class 3 n=14). Findings included tendon/muscle ruptures with secondary hematomas (n=2), periprosthetic lysis (n=6), radiographically occult periprosthetic (n=3) or pelvic ring fractures (n=2) and suspected infection due to periprosthetic fluid collections (n=2). Other diagnoses were extensive fatty muscular atrophy of the gluteal muscles (Goutallier 3 or 4, n=26) and pathology of the iliopsoas tendon (tear, low-grade partial tear, and bursitis, n=13).

Conclusion: New-generation 0.55T low-field MRI provides the opportunity for detection of radiographically occult, clinically relevant findings in patients with painful hip arthroplasty.

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Hip-spine Relation: One third of patients with acetabular retroversion has reduced or almost horizontal sacral slope and are Hip users

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Purpose: Pincer-type femoroacetabular impingement (FAI) and acetabular retroversion were associated with decreased pelvic incidence(PI) and sacral slope(SS). But the hip-spine relation and sagittal balance for these patients are unclear.

We investigated frequency of patients with PI<40°, SS<35° and what types of SS are associated with acetabular retroversion and hip dysplasia.

Methods and Materials: A retrospective, IRB-approved, controlled study including 120 hips of consecutive patients with symptomatic FAI or hip dysplasia was performed. Sagittal images of Pelvic CT scans were reviewed for all hips to calculate parameters for sagittal balance (PI, SS and pelvic tilt). Frequency of patients with PI<40° ((lumbopelvic-complex (LPC) Type 1), SS<35° and types of sacral slope (Type 1-4 of Roussouly classification) was analysed.

The patients were allocated to the following groups: acetabular retroversion (41 hips), hip dysplasia (47 hips) and hips with cam-FAI with normal acetabular morphology (32 hips, control group).

Results: (1)Frequency of PI<40° (LPC Type 1) was significantly(p<0.001) increased in patients with acetabular retroversion (44%) or total acetabular retroversion (73%) compared to hip dysplasia (11%).

(2)Frequency of SS<35° (Roussouly Type 1 or 2) was higher (29%) of the patients with acetabular retroversion compared to patients with hip dysplasia (11%).

(3)Frequency of SS>45° (Roussouly Type 4) was significantly(p<0.001) higher of the patients with hip dysplasia (49%) compared to patients with acetabular retroversion (12%).

Conclusion: Acetabular retroversion was associated with low PI, similar to LPC (lumbo-pelvic-complex) type 1 and hip user. Decreased SS was associated with hip impingement due to acetabular retroversion. Decreased SS <35° was previously associated with reduced lumbar lordosis. This could help to better understand low back pain of these patients. Patients with acetabular retroversion and hip dysplasia have opposite hip-spine relation and sagittal balance.

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Combined femoral and acetabular version is sex specific and differs between patients with hip dysplasia and patients with FAI due to acetabular retroversion

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Purpose: Frequency of abnormal femoral and acetabular version (AV) and combinations are unclear in patients with developmental dysplasia of the hip (DDH). This study aimed to investigate femoral version (FV), the proportion of increased FV and femoral retroversion, and combined-version (CV, FV+AV) in DDH patients and acetabular-retroversion (AR).

Methods and Materials: A retrospective IRB-approved observational study was performed with 78 symptomatic DDH patients (90 hips) and 65 patients with femoroacetabular-impingement (FAI) due to AR (77 hips, diagnosis on AP radiographs). CT/MRI-based measurement of FV (Murphy method) and central AV were compared. Frequency of increased FV (FV>25°), severely increased FV (FV>35°) and excessive FV (FV>45°) and of decreased FV (FV<10°) and CV (McKibbin-index/COTAV-index) was analysed.

Results: Mean FV and CV was significantly (p<0.001) increased of DDH patients (mean±SD of 25±11° and 47±18°) compared to AR (16±11° and 28±13°). Mean FV of female DDH patients (27±16°) and AR (19±12°) was significantly (p<0.001) increased compared to male DDH patients (18±13°) and AR (13±8°). Frequency of increased FV (>25°) was 47% and of severely increased FV (>35°) was 23% for DDH patients.

Proportion of femoral retroversion (FV<10°) was significantly (p<0.001) higher in patients AR (31%) compared to DDH patients (17%). 18% of DDH patients had AV>25° combined with FV>25°. Of patients with AR, 12% had FV<10° combined with AV<10°.

Conclusion: Patients with DDH and AR have remarkable sex-related differences of FV and CV. Frequency of severely increased FV>35° (23%) is considerable for patients with DDH, but 17% exhibited decreased FV, that could influence management. The different combinations underline the importance of patient-specific evaluation before open hip preservation surgery (periacetabular osteotomy and femoral derotation osteotomy) and hiparthroscopy.

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Pelvis MRI for cinematic rendering of Pelvis 3D models using fast T1 images and deep learning

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Purpose: Pelvis MRI or hip MRI is performed for standard care of patients with femoroacetabular impingement (FAI). Cinematic rendering of pelvis 3D models enhance preoperative diagnosis. MRI-based 3D dynamic hip Impingement simulation enables patient-specific diagnosis of FAI.
We aimed to investigate (1) feasibility and accuracy of cinematic rendering of MRI-based 3D-models of the pelvis and (2)to correlate impingement-free hip range of motion (ROM).

Methods and Materials: An IRB-approved controlled retrospective study involving a total of 98 hips was performed. Of them, 30 patients with symptomatic FAI (60 hips) and 19 asymptomatic volunteers (38 hips) underwent 3-Tesla-MRI of the pelvis including rapid (AT 32sec) T1 VIBE DIX-ON with 192 slices. Mean age of the 30 patients was 27±9 years and 50% underwent surgery.
Machine learning for automatic segmentation of MRI-based 3D-models was performed with a convolutional neural network and 5-fold cross validation. Dice coefficient was calculated for 98 hips and Impingement-free ROM was calculated for 30 patients comparing manual and automatic MRI-based 3D-models.

Results: 1) Cinematic rendering of MRI-based 3D-models was feasible. Dice coefficient of 30 FAI patients was 94.1% for the pelvis and 97.0% for the proximal femur (95.5% and 97.5% for 19 volunteers).
(2) Detection of FAI showed no significant difference. Correlation for Impingementfree flexion (r=0.93, p<0.001) was excellent for the 30 FAI patients.

Conclusion: Automatic MRI-based 3D-models are feasible for cinematic rendering.
Based on these results, we will use automatic segmentation of MR-based 3D-models for future clinical routine. This allows fast, radiation-free and patient-specific preoperative surgical planning of hip preservation surgery and hip arthroscopy for FAI patients of childbearing age.

Patient satisfaction with digital mammography (DM) at a general radiology department: A Patient-Reported Experience Measurement (PREM)

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Purpose: This prospective survey study aims to evaluate overall patient satisfaction after DM by identifying personal, clinical, and procedural factors associated with patient assurance and acceptance of DM.

Methods and Materials: All women (n=885) who underwent DM for different indications between 01/22 and 07/22 at the radiology department (LUKS, Sursee) were asked to participate. Of those 565 (range 29-88y, mean 58.5y, SD 8.5) (63.8%) were included and filled in a PREM questionnaire. All women gave written informed consent and the study was ethically approved.

Overall satisfaction was recorded on a 7-point Likert scale. A binary variable was used to distinguish between "fully" (score 7) and "not fully satisfied" (score<7). The influence of personal, clinical, and procedural factors on satisfaction was analyzed between both groups using descriptive statistics. Fischer's exact tests, Kendall tau-b correlations, binary logistic regressions were used to identify relevant factors that altered satisfaction.

Results: 78% (429/550) of the study cohort was fully satisfied with DM compared to 22% (121/550) who was not.

Personal (p<0.008) and procedural factors (p<0.004) were significantly associated with patient satisfaction in both groups, whereas no significant difference was found for clinical factors (p>0.1). The most relevant factors influencing patients' concerns were anxiety of the imaging result (63%) and pain during DM (33%).

Fear and pain were negatively associated with satisfaction, reducing the probability of being satisfied respectively by 10% and 19% (pseudo R^2=0.3, Prob>chi2=0.00).

Conclusion: Anxiety and pain are important determinants of patient satisfaction in DM. Detailed information and techniques for pain reduction may improve patient assurance and acceptance of DM. This study helped identify targets for procedure optimization and may help increase DM attendance rates in a general hospital.

Short-time improvement in breast positioning performances using a dedicated AI-platform for real-time feedback on mammographic diagnostic quality

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Purpose: Purpose

Diagnostic quality is well known to affect cancer detectability in mammography. However, regular quality verification of the breast positioning in mammographic imaging is a challenge in the daily routine.

The aim of this study is to evaluate the added value of providing real-time feedback to the radiographers via a commercial software platform based on artificial intelligence (AI) for the automatic determination of the image quality following the "perfect", "good", "moderate", and "inadequate" (PGMI) criteria.

Methods and Materials: In this study, 4128 mammograms from our institution acquired in 2021 were analyzed. The quality of the breast positioning was assessed using a commercial AI software platform ("b-box" version 1.1, b-rayZ AG, Schlieren, Switzerland) for each breast. Craniocaudal (CC) and mediolateral oblique (MLO) projections were examined, according to the PGMI criteria.

Results:

	breasts	Perfect	Good	Moderate	Inadequate	mean	var
before	1816	22,02%	46,37%	16,63%	14,63%	2,75	0,93
after	2312	31,14%	46,63%	16,61%	5,62%	3,03	0,7

Percentage of breast images evaluated with the PGMI criteria before and after the implementation of the AI-driven software

1816 images were evaluated before the integration and 2312 images were evaluated 3 months after the integration of the software into the daily routine, in order to access the impact of the software on the acquired image quality.

After 3 months of software usage, the number of "perfect" examinations increased from 22% to 31%. The percentage of "inadequate" images decreased from 15% to 6%. Results are proven to be statistically significant with a p-value of < 0,01. Very experienced technicians as well as less experienced technicians both improved their positioning quality.

Conclusion: Automated and real-time quality assurance of mammograms in the daily routine significantly improved the image quality at our institution. The radiographer's professional development, as well as the institution's quality standards and documentation, can easily be assessed and tracked with a good software platform.

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Assessing microcalcifications in breast CT: A BI-RADS-based approach using a U-net convolutional neural network

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Purpose: The aim of this study was to investigate the potential of a U-net-based deep convolutional neural network (dCNN) to detect, segment, and classify microcalcifications in spiral breast CT.

Methods and Materials: 402 images of 63 patients were segmented and classified by one radiologist according to the BI-RADS classification system. For training of the U-net, BI-RADS 2 and 3 were merged into the class „probably benign microcalcifications" whereas BI-RADS 4 and 5 were merged into the class „suspicious microcalcifications". The data were split into an 80:20 proportion for training and testing. Six different models were trained, and performance on detection (pixel accuracy), segmentation (intersection over union, IoU), and classification (recall, precision, f1-score) were evaluated.

Results: U-net model 2 showed the best overall performance with a pixel accuracy of 99.4% on the test dataset. The model yielded high accuracy on segmentation with an IoU of 98.7%. With 3 false negatives and 1 true positive, model 2 yielded a recall of 92.3%, a precision of 97,5%, and the f1-score was 95,1% for classification. The interreader agreement on microcalcification classification between U-net model 2 and the radiologist was almost perfect with a Cohen's Kappa of 0.89.

Conclusion: U-net-based dCNN can be trained to detect, segment, and classify microcalcifications in breast CT according to the BI-RADS standard. Yielding high performance indices comparable to a radiologist, our U-net-based neural network can serve as an observer-independent and time-effective approach for evaluating breast-CT examinations consisting of more than 2000 images.

A-222

Systematic analysis of changes in radiomics features during dynamic breast-MRI: Evaluation of specific biomarkers

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Purpose: In this retrospective, single-center study we investigate the changes of radiomics features during dynamic breast-MRI for healthy tissue compared to benign and malignant lesions.

Methods and Materials: 60 patients underwent breast-MRI using a dynamic 3D gradient-echo sequence. Changes of 34 texture features (TF) in 30 benign and 30 malignant lesions were calculated for 5 dynamic datasets and corresponding 4 subtraction datasets. Statistical analysis was performed with ANOVA, and systematic changes in features were described by linear and polynomial regression models.

Results: ANOVA revealed significant differences (p <0.05) between normal tissue and lesions in 13 TF, compared to 9 TF between benign and malignant lesions. Most TF showed significant differences in early dynamic and subtraction datasets. TF associated with homogeneity were suitable to discriminate between healthy parenchyma and lesions, whereas run-length features were more suitable to discriminate between benign and malignant lesions. Run length nonuniformity (RLN) was the only feature able to distinguish between all three classes with an AUC of 88.3 %. Characteristic changes were observed with a systematic increase or decrease for most TF with mostly polynomial behavior. Slopes showed earlier peaks in malignant lesions, compared to benign lesions. Mean values for the coefficient of determination were higher during subtraction sequences, compared to dynamic sequences (benign: 0.98 vs 0. 72; malignant: 0.94 vs 0.74).

Conclusion: TF of breast lesions follow characteristic patterns during dynamic breast-MRI, distinguishing benign from malignant lesions. Early dynamic and subtraction datasets are particularly suitable for texture analysis in breast-MRI. Features associated with tissue homogeneity seem to be indicative of benign lesions.

A-272

Segmentation and classification of mammographic microcalcifications using a deep learning algorithm mimicking human decision-making.

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Purpose: Microcalcifications are a typical mammography finding of breast cancer; however, they can also be associated with benign changes. The differentiation between suspicious and benign microcalcifications is a tedious task requiring expertise, experience and routine.

An AI algorithm mimicking human decision-making could be useful to differentiate between benign and suspicious morphology of microcalcifications.

The aim of this study is to train and evaluate a multiclass U-Net for automated microcalcification segmentation and BI-RADS based classification.

Methods and Materials: In our study, we include 1288 digital mammograms and tomosyntheses from the University Hospital Basel with a corresponding radiology report stating suspicious microcalcifications. A radiology resident, segmenting and classifying microcalcifications as benign or suspicious, manually annotated the dataset. A multiclass UNet developed by the AI-software company b-rayZ was trained with 904 images, validated with 258 images, and tested with 126 images, and predicts segmented masks for benign and suspicious calcifications.

Segmented and classified calcifications were manually counted and compared to the human reading as the ground truth.

Results: Confusion matrixes of the network`s performance in the test dataset were built. In this mono-center test dataset, both benign and suspicious calcifications were mostly detected and correctly classified to the segmented mask. We could find an overall agreement of 76% between network`s output and human reading.

To further characterize the reliability of the network, next steps include external validation with mammograms from other centers and evaluation of interreader agreement with the network.

Conclusion: A multiclass U-Net was successfully trained and tested for automated segmentation and classification of microcalcifications into benign and suspicious categories.

It could support radiologists to deal with increasing numbers of images and boost the accuracy of diagnosis and quality of patients` care.

A-283

Upgrade rates of non-malignant breast papillary lesions diagnosed at core-needle biopsy: A meta-analysis of 5271 lesions

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Purpose: To perform a systematic review and meta-analysis of the upgrade rates to in situ and invasive cancer of nonmalignant breast papillary lesions diagnosed at core-needle biopsy.

Methods and Materials: Following the PRISMA checklists, the PubMed and EMBASE databases were searched for articles published up to December 31, 2021, reporting the upgrade to in situ or invasive cancer of non-malignant breast papillary lesions diagnosed at core-needle biopsy, with surgical pathology and/or follow-up as reference standard. Articles were selected in two rounds (title and abstract, then full-text) by two independent readers.

Random-effects meta-analyses of single proportions with the Freeman-Tukey transformation were performed on included articles.

Results: A total of 63 studies (5009 women, 5271 non-malignant papillary lesions) from 13 countries published between 1999 and 2021 were included in quantitative synthesis. The overall summary upgrade rate to malignancy was 11.1% (95% CI 9.1–13.5%), whereas the overall summary upgrade rate to in situ cancer was 8.5% (95% CI 5.7–12.1%) and the overall summary upgrade rate to invasive cancer was 2.2% (95% CI 0.7–3.3%). Among 1987 lesions specified to be without atypia (from 27 studies) the summary upgrade rate to malignancy was 3.6% (95% CI 2.6–6.8%), the summary upgrade rate to in situ cancer was 3.5% (95% CI 1.9–5.6%), and the summary upgrade rate to invasive cancer was 0.1% (95% CI 0.0–0.4%). Among 626 papillary lesions with atypia (from 25 studies) the summary upgrade rate to malignancy was 37.9% (95% CI 24.8–50.7%), the summary upgrade rate to in situ cancer was 22.4% (95% CI 13.0–30.9%), and the summary upgrade rate to invasive cancer was 4.6% (95% CI 0.7–7.9%).

Conclusion: The upgrade of core-needle biopsy-diagnosed breast papillary lesions to in situ cancer is 4- to 35-fold more frequent than the upgrade to invasive cancer.

A-334

MR conditional breast tissue expander: First in human multi-case application assessing MRI-related potential complications and image quality

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Purpose: To assess, in its first _in human_ multi-case application, potential complications and effects on overall MRI quality, with a focus on artifact-prone diffusion-weighted imaging (DWI) sequences, of a recently developed and tested _in vitro_ as "MRI conditional" breast tissue expander (Motiva FLORA®) with a passive radiofrequency identification (RFID) injection port.

Methods and Materials: We retrieved all patients that according to the study protocol underwent preoperative breast MRI on a 3TMRI unit before breast tissue expander exchange surgery. The MRI protocol included T1-weighted, T2-weighted and DWI sequences. Patients were monitored during and after MRI for the potential complications (expander heating or displacement, RFID component damage). A board-certified breast radiologist (6 years of experience in breast MRI) evaluated DWI sequences quality with a four-level scale ("Poor", "Sufficient", "Good", "Excellent") and measured maximum diameter of RFID-related artifact in T1-weighted and DWI sequences (the side with largest artifact in patients with bilateral expanders).

Results: A total of 23 MRI examinations were performed in 23 patients (median age 51 years, interquartile range 47–57), 11/23 (48%) with unilateral and 12/23 (52%) with bilateral expanders. All 23 examinations were completed without any complication related to expander displacement, heating, or RFID component damage.

DWI quality was graded poor in 1/23 (4%), sufficient in 6/23 (26%), good in 10/23 (43%), excellent in 6/23examinations (26%). The median maximum diameter of RFID-related artifact was 11 mm (IQR 9–12 mm) in T1-weighted sequences and 33 mm (IQR 29–35 mm) in DWI sequences.

Conclusion: No MRI-related complications and low negative effects on overall MRI quality were found in consecutive patients implanted with MR conditional breast tissue expander undergoing preoperative breast MRI.

Semi-automated volumetry of solid pulmonary nodules: Intra-individual comparison of standard dose and chest X-ray equivalent ultralow dose chest CT scans

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Purpose: To determine the performance of semi-automated volumetry of solid pulmonary nodules on X-ray equivalent ultralow dose chest CT scans (ULD) relative to standard dose (SD) chest CT scans and evaluate how kernel and iterative reconstruction selection impacts the results.

Methods and Materials: Ninety-four consecutive patients from a prospective single-center study recieved clinically indicated SD chest CT (1.9 ± 0.8 mSv) and additional ULD chest CT (0.13 ± 0.01 mSv). Reconstruction was carried out with a soft tissue (Br40) and lung (Bl64) kernel as well as with Filtered Back Projection (FBP) and Iterative Reconstruction (ADMIRE-3 and ADMIRE-5). One hundred and forty-eight solid pulmonary nodules were identified and semi-automated volumetry performed. Comparison of nodule volumes amongst all reconstructions focused on the agreement between SD and ULD scans.

Results: The nodule volumes measured ranged from 58.5 (28.8–126) mm^3 for ADMIRE-5 Br40 ULD reconstructions to 72.5 (39–134) mm^3 for FBP Bl64 SD reconstructions with significant differences between reconstructions (p < 0.001). Interscan agreement of volumes between two given reconstructions ranged from ICC = 0.605 to ICC = 0.999. Between SD and ULD scans, the highest agreement of nodule volumes was found for FBP Br40 (ICC = 0.995), FBP Bl64 (ICC = 0.939) and ADMIRE-5 Bl64 (ICC = 0.994). Reduced interscan agreement occured on ADMIRE-3 reconstructions (ICCs from 0.788 – 0.882).

Conclusion: Choice of kernel and reconstruction algorithm highly affects the interscan agreement of nodule volumes between SD and ULD. However, caution should be taken when comparing two image series that were not identically reconstructed.

AssessNet-19: An Artificial Intelligence Severity Assessment Model for Acute COVID-19 Pneumonia : Performance Evaluation

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Purpose: To compare and quantify the performance of an AI-based severity assessment model (AssessNet-19) between a single-class, multi-class lesion-segmentation model, and a qualitative score assessment by expert radiologists.

Methods and Materials: AssessNet-19 was trained in two stages in this retrospective study. First, we trained a 2D U-Net neural network to automate multi-class lesion segmentations, then extensive radiomic features were extracted from these lesions. The feature set was reduced through LASSO regression and then used to train an XGBoost algorithm to classify patient severity based on the WHO clinical progression scale (Marshall et al., THE LANCET. 2020). WHO severity scores were calculated using clinical data within ± 12 hours from CT acquisition establishing ground truth. Aggregating the WHO scores led to a 4-state severity scale: ambulatory mild, hospitalized moderate, hospitalized severe, and intubated critical. Two multi-center cohorts were collected: a development cohort of 145 subjects randomly stratified into a training and test set (118:27); each with 10 manually segmented axial slices. A validation cohort of 93 subjects with AI-generated segmentation. Three expert radiologists separately assessed qualitative severity scores. Finally, we evaluated and compared the severity assessment performance.

Results: AssessNet-19 yielded mean F1-score of 0.74±0.01 with a multi-class lesion model in the validation cohort and 0.72±0.02 in the development cohort while the single-class model yielded mean F1-scores of 0.52±0.03 in the development cohort and 0.63±0.01 in the validation cohort. The expert radiologists' qualitative score assessment yielded mean F1-scores of 0.45±0.09 in the development cohort and 0.62±0.03 in the validation cohort.

Conclusion: AssessNet-19 multi-class lesion model outperformed a single-class lesion model and an expert radiologists' qualitative score in patient severity assessment.

A-381

Potential of photon-counting detector CT with ultra-high-resolution and 1024-pixel image matrix for the assessment of interstitial lung disease in patients with systemic sclerosis

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Purpose: To evaluate the potential of ultra-high resolution and 1024 matrix in photon-counting detector computed tomography (PCD-CT) in the assessment of interstitial lung disease (ILD) in patients with systemic sclerosis (Ssc).

Methods and Materials: In this IRB-approved study, patients with Ssc referred for ILD-CT screening on a PCD-CT were included. All scans were performed at 100 kVp at an image quality (IQ) level of 15 with a matrix size of 512x512 and 1024x1024; each at a slice thickness of 1.5 and 0.22mm, respectively. Image noise was measured by placing a ROI in the trachea. Subjective image quality (overall image quality, image sharpness, image noise) as well as ILD-typical changes (groundglass opacities and coarse reticulations) were assessed by two blinded readers on a 5-point Likert-scale.

Results: 100 patients (mean age 55 years; 80 female) were retrospectively included. Mean CTDIvol was 0.68±0.15mGy. Least image noise was found at a slice thickness of 1.5mm and 512 matrix size (p<0.001;82.3HU±8.99). In subjective image quality interreader agreement ranged from fair to almost perfect (Krippendorff alpha: 0.266-0.857). Overall image quality was rated best at 1.5mm slice thickness with a 1024 matrix size (reader 1:4(4.4), reader 2:5(4.5)). Image sharpness at 0.2mm slice thickness significantly outperformed (p<0.001, median:5(5.5) for both readers at both matrix sizes) the 1.5mm reconstructions.

Overall image quality was rated best (p<0.001) for 1.5mm/1024 reconstructions and image noise was least (p<0.001) in 1.5mm/512 images. In the evaluation of ILD changes 0.2mm slices significantly outperformed (p<0.001) images with 1.5mm slice thickness while there was no significant difference between the matrix sizes.

Conclusion: Eventough objective and subjective image noise was significantly higher at a slice thickness of 0.2mm, image sharpness as well as visability of subtle groundglass opacities and coarse reticulations was superior compared to 1.5mm reconstructions without significant differences among matrix sizes.

Prospective evaluation of Tumor Regression Grade on MR (mrTRG) in pre-operative staging of esophageal cancer

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Purpose: To develop a mrTRG score tailored to restage esophageal cancer (EC) after neoadjuvant therapy; and assess its diagnostic performance for tumor response evaluation compared with pathological TRG (pTRG)

Methods and Materials: From 2018 to 2022, all consecutive patients with newly diagnosed EC and planned neoadjuvant treatment underwent two MR examinations for initial staging and restaging 4-6 weeks after adjuvant treatment. Two different mrTRG classifications, based on fibrosis and tumor residue rate, equivalent to the Mandard and Becker classifications, were developed. Two readers independently assessed the mrTRG grade, first on T2W and DW MR Images (unenhanced-MRI), and then with addition of enhanced T1W images (enhanced-MRI). mrTRG were compared with pTRG using percent agreement and weighted Cohen's Kappa.

Results: 28 patients (63±9.2 yo; 24 males) were included. Agreement between pTRG and mrTRG was moderate with a percent agreement (p)=88.4%, kappa (κ)=0.57 and p=84.5%, κ=0.52 for Mandard and Becker respectively on enhanced-MRI and p=87.5%, κ=0.54 and p=83.3%, κ=0.51, for Mandard and Becker respectively on unenhanced-MRI. Agreement was improved to substantial when grouping grades 1-2 for Mandard and 1a-1b for Becker with p=90.5%, κ=0.68 and p=89.3%, κ=0.65 respectively for enhanced-MRI and p=85.7%, κ=0.64 and p=83.9%, κ=0.62 respectively for unenhanced-MRI.

Conclusion: MRI-based tumor regression grading applying the principle of histopathology TGR on T2w and DW images is accurate for preoperative assessment of response to therapy in esophageal cancer, even more when grouping the 2 first grades.

Pseudoenhancement in cystic renal lesions with photon-counting CT – Impact of virtual monoenergetic images on lesion classification

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Purpose: To investigate the impact of virtual monoenergetic images (VMI) from photon-counting detector CT (PCDCT) on the enhancement and classification of cystic renal lesions.

Methods and Materials: In this retrospective IRB-approved study, consecutive adult patients (n=86; mean age, 74±9 years; age range, 51-92 years; 74 male, 12 female) with cystic renal lesions who underwent a triphasic examination on a first-generation dual-source PCD-CT between July 2021 and November 2021 were included. Only nonenhancing cysts (enhancement difference <10HU) between unenhanced and venous phase at 70 keV were included. VMI from 40 to 190keV with increments of 10keV were reconstructed from the venous phase. CT-attenuation was measured in each cyst and in adjacent parenchyma in unenhanced and venous VMI.

Enhancement between unenhanced and VMI was calculated to classify each lesion as non-enhancing (<10HU), equivocally enhancing (10-19HU), and enhancing (≥20HU). Classification changes as a function of VMI energy were assessed. Pearson correlation coefficient, the Kruskal-Wallis and the Chi-square test were used.

Results: 86 patients with 160 non-enhancing cysts (17.6±10mm) were included. CT attenuation of the cysts increased from higher to lower VMI-energies with a mean attenuation of 4±11 HU at 190keV to 36±17 HU at 40keV. Mean attenuation of the renal parenchyma was 43±4 HU at 190keV and 414±70 HU at 40keV. For each VMI-energy, no cyst exhibited enhancement from 70keV to 190keV. At 40, 50, and 60keV, 35%, 29% and 9% of cysts showed equivocal and 47%, 11%, and 0% definite enhancement, respectively. There was no influence of size (p=0.13) or cyst location (p=0.9) on enhancement classification.

Conclusion: VMI has a relevant impact on enhancement and classification of renal cysts. VMI at energy levels below 70 keV leads to misclassification in a large number of renal cysts.

The Future of Hepatocellular Carcinoma Screening: Non-Contrast Abbreviated MRI versus Dynamic Abbreviated MRI

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Purpose: To compare the diagnostic performance of 2 abbreviated MRI sets [non-contrast (NC)-AMRI, and dynamic (Dyn)-AMRI] to complete MRI for hepato-celluar carcinoma (HCC) detection in an at-risk population.

Methods and Materials: This retrospective study included 351 patients (M/F: 264/87, mean age: 58 y.o.) with chronic liver disease, who underwent extracellular contrast-enhanced MRI between 2014 and 2020 at our institution. Two reconstructed AMRI sets, NC-AMRI [T2-weighted imaging (T2wi) + diffusion-weighted imaging (DWI)], Dyn-AMRI [T2wi + dynamic T1wi] and complete MRI were assessed by 2 independent radiologists. Lesions were categorized using LI-RADS or an adapted LI-RADS score. Each exam was classified as HCC-positive or HCC-negative according to the reference standard, based on all available patient data. Interreader agreement was assessed. Diagnostic performance was compared including with combination with AFP

Results: The reference standard found 83/351 HCC positive patients (incidence 23.6%, median size: 22 mm, range:10-142mm). Interreader agreement was substantial for all sets. Sensitivity of Dyn-AMRI and complete MRI (both 92.8%) were similar (p=1), significantly higher than NC-AMRI (72.3%, p<0.001). Specificities were not different between sets. The combination of reading sets with AFP improved sensitivities (all p<0.05) of Dyn-AMRI (98.8%), complete MRI (98.8%) and NC-AMRI (92.8%). In a subgroup analysis of patients with small-sized HCCs (≤2 cm), sensitivities of Dyn-AMRI (85.3%) and complete MRI (88.2%) remained similar (p=0.564), further outperforming NC-AMRI (52.9%, both p<0.05). However, NC-AMRI with AFP had similar sensitivity to Dyn-AMRI (p=0.706).

Conclusion: Dyn-AMRI has similar diagnostic performance to complete MRI for HCC detection, while both outperform NC-AMRI, especially for small-sized HCCs (≤2 cm). The combination with AFP increases NC-AMRI diagnostic performance, making it similar to Dyn-AMRI and complete MRI alone.

O-RADS MRI: A meta-analysis of diagnostic performance and of category-wise malignancy rates

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Purpose: To systematically review and meta-analyze the diagnostic performance of pelvic MRI examinations performed to characterize US-indeterminate adnexal lesions and interpreted using the ADNEX-MR score and the Ovarian-Adnexal Imaging Reporting and Data System (O-RADS MRI), also meta-analyzing malignancy rates in each ADNEX/O-RADS MRI category.

Methods and Materials: A systematic literature search from May 2013 (publication of the ADNEX-MR score) to September 2022 was performed. Studies reporting the use of pelvic MRI interpreted with the ADNEX-/O-RADS MRI systems to characterize US-indeterminate adnexal lesions, with pathology and/or follow-up as reference standard, were included. Summary estimates of diagnostic performance were obtained with the bivariate random-effects model, while category-wise summary malignancy rates of ADNEX/O-RADS MRI 2, 3, 4, and 5 lesions were obtained with a random-effects model. Effects of covariates on diagnostic performance were investigated through meta-regression.

Results: Thirteen study parts from 12 studies (3731 women) met the inclusion criteria. Diagnostic performance metaanalysis on 4012 lesions found a 92% summary sensitivity (95% CI 88–95%) and a 91% summary specificity (95% CI 89–93%). The meta-analysis of malignancy rates on 3641 lesions showed a summary malignancy rate of 0.1% (95% CI 0–1%) among 1894 ADNEX/O-RADS MRI 2 lesions, of 6% (95% CI 3–9%) among 758 ADNEX/O-RADS MRI 3 lesions, of 60% (95% CI 52–67%) among 450 ADNEX/O-RADS MRI 4 lesions, of 96% (95% CI 92–99%) among 539 ADNEX-/O-RADS MRI 5 lesions.

Conclusion: The use of the ADNEX-MR/O-RADS systems to interpret pelvic MRI yields high diagnostic performance for the characterization of US-indeterminate adnexal lesions. Summary estimates of malignancy rates in the ADNEX/O-RADS MRI 4 and ADNEX/O-RADS MRI 5 categories were higher than predicted ones.

CT- based body composition in non-Hodgkin lymphoma patients: Changes after treatment and association with response and survival

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Purpose: Primary objective was to assess changes of bone mineral density (BMD) in non-Hodgkin lymphoma (NHL) patients treated with rituximab-cyclophosphamide-hydroxydaunorubicin hydrochloride-vincristine-prednisone (R-CHOP)-like chemotherapy regimen. Secondary objectives were to assess other body composition features changes, and the association of pre-therapy values, as well as body composition changes after therapy, with survival.

Methods and Materials: Inclusion criteria were age≥18 years; R-CHOP like regimen; availability of baseline and end of treatment PET-CT images; follow-up>12 months. Main clinical data were collected, including body mass index; date of last contact; date of progression and date of death. From the CT images of PET-CTs, BMD was assessed at the L1 level; the other body composition values were assessed through a dedicated software at the L3 level.

Descriptive statistics were reported as mean ± standard deviation or frequencies and percentages. Statistical comparisons of body composition variables were performed using the Wilcoxon rank test. For qualitative variables, the Fisher exact test was used. Log rank test was used to compare survivals.

Results: Eighty-two patients were included. The mean follow-up was 37.5±21.4 months. A significant difference was found in BMD before (131.2±45.3 HU) and after (113.9±46.9 HU) R-CHOP like treatment (p<0.0001). The same trend was observed for skeletal muscle area (SMA) (before: 129.5±34.6 cm², after: 123.0±30.5 cm², p=0.004) and skeletal muscle index (SMI) (before: 46.0±10.2 cm²/m², after: 44.0±9.1 cm²/m², p=0.006). No significant association was demonstrated between body composition values, progression free survival (PFS) and overall survival (OS).

Conclusion: The R-CHOP like treatment in NHL patients was associated with a significant loss of BMD, SMA and SMI.

Body composition as a predictor of chemotherapy-related toxicity in pancreatic cancer patients: A systematic review

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Purpose: The objective of this systematic review was to assess associations between quantitative body composition measures extracted from imaging examinations and chemotherapy-related toxicity in pancreatic cancer patients. A secondary objective was to evaluate the different definitions of sarcopenia across included studies.

Methods and Materials: This systematic review was conducted according to the PRISMA statement. A comprehensive literature search of three electronic databases was performed by two authors. For each eligible article, information was collected concerning the clinical setting; population characteristics; technical information; body composition features evaluated; CA19.9 tumor marker levels; chemotherapy drugs administered; toxicities (hematologic, nausea/vomiting, diarrhea, neuropathy, overall toxicity); association of body composition values with toxicities. The overall quality of the included studies was critically evaluated.

Results: After the initial retrieval of 1137 articles, the systematic review included 12 articles. The number of patients included ranged between 17 and 251; mean/median age ranged between 63 and 77 years; the percentage of sarcopenic patients ranged between 23 and 76%. The most frequent body composition parameter evaluated was skeletal muscle index. Chemotherapy regimens included gemcitabine (as monotherapy or in combination with other drugs); FOLFIRINOX and S-1. Among the trials including gemcitabine, 2/9 demonstrated an association with toxicity, whereas 7/9 did not; among those including FOLFIRINOX, 1 among those including FOLFIRINOX, only one demonstrated associated toxicity. Altogether, 4/12 papers demonstrated an association between the body composition values and the development of chemotherapyrelated toxicities.

Conclusion: There is a wide variability of results about the association of body composition and chemotherapy-related toxicity in PC patients. Cut-off values to define sarcopenia in PC patients are not yet uniformly defined.

Repeatability and reproducibility of MRI-derived liver surface nodularity across GE, Philips and Siemens scanners at 1.5T and 3T

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Purpose: Liver surface nodularity (LSN) can accurately detect cirrhosis [1], but its reproducibility across MRI systems has not been investigated.

Methods and Materials: A 10x10x10 cm phantom containing four surfaces was 3D-printed: one surface represents a flat plane and the rest were generated from CT-derived liver segmentations of three patients, whose liver surfaces were judged by a radiologist as smooth, having low-amplitude roughness and having large nodules, respectively.

The phantom was flood-filled with fluid (water doped with 0.15mM $MnCl_2$) and scanned twice with a specific T1-weighted 3D-SPGR sequence on GE (Voyager 1.5T, Premier 3T), Philips (Ingenia 1.5T, Achieva 3T), and Siemens (Avanto 1.5T, Skyra 3T) scanners. To measure LSN, the mean absolute difference between the surface, estimated with an active contour model, before and after smoothing was averaged over all axial MRI slices. Smoothing is performed in the Fourier domain (unlike [1] which used splines). LSN has units of tenths of a millimetre, though is conventionally quoted without dimensions [1]. Scan/rescan repeatability and cross scanner reproducibility (using Siemens 3T as reference) were measured using 95% limits of agreement (LoA).

Results: The median (range; coefficient of variation) LSN scores for each surface, over all scanners were 0.6 (0.3-0.7; 22%), 2.2 (2.0-2.3; 5%), 3.1 (2.9-3.1; 3%) and 7.5 (7.2-7.9; 3%). The scan/rescan and cross-scanner LoA lay in the ranges [-0.2,+0.3] and [-0.5,+0.5], respectively, which is below the image voxel dimensions.

Conclusion: MRI-derived LSN measurements from 3D-SPGR images had good scan/rescan repeatability and crossscanner reproducibility for a series of realistic synthetic liver surfaces with differing roughness levels.

[1] Smith, A. et al, Radiology 280.3(2016):771-781

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Body composition as a predictor of chemotherapy-related toxicity in ovarian cancer patients: A systematic review

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Purpose: The main objective of this systematic review was to examine the literature evaluating association of imagebased body composition with chemotherapy-related toxicity in ovarian cancer patients. A secondary objective was to evaluate the different definitions of sarcopenia across studies.

Methods and Materials: This systematic review was conducted according to the PRISMA-DTA statement and the protocol was registered on Prospero. A comprehensive literature search of 3 electronic databases was performed by two authors. For each eligible article, information was collected concerning the clinical setting; basic study data; population characteristics; technical aspects; body composition features; chemotherapy drugs administered; association of body composition values and toxicities. The overall quality of the included studies was critically evaluated.

Results: After the initial retrieval of 812 articles, the systematic review included 6 articles (5/6 studies were retrospective; one was prospective). The number of patients ranged between 69 and 239; mean/median age ranged between 55 and 65 years; the percentage of sarcopenic patients ranged between 25% and 54%. The cut-off values to define sarcopenia and the vertebral levels for evaluation of body composition were different. Five studies included chemotherapy based on carboplatin and paclitaxel, one study included chemotherapy based on pegylated liposomal doxorubicin. Among the studies including carboplatin and paclitaxel, 3/5 demonstrated an association with toxicity, whereas 2/5 did not. 4/6 papers demonstrated an association between the body composition values and the development of chemotherapy-related toxicities.

Conclusion: There is a wide variability of results about the association of body composition and chemotherapy-related toxicity in ovarian cancer patients. Further studies, possibly including a comprehensive assessment of body compartments and where the definition of body composition cut-offs is constant, are warranted to better understand this association.

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Evaluation of endometriosis according to the Enzian classification: Proposal for inclusion into an MR report

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Purpose: To assess the applicability of the surgical Enzian classification into an MR report

Methods and Materials: A non-systematic review of the literature published in English language until Aug 2022 was performed by searching PubMed using two search terms combinations: (1) endometriosis AND magnetic resonance imaging AND structured reporting; and (2) endometriosis AND magnetic resonance imaging AND Enzian classification. All abstracts were analyzed, pertinent articles and the references of all included articles were also evaluated. The use of the Enzian classification in endometriosis MR reports was evaluated; furthermore, a possible draft for a structured report was formulated.

Results: The literature search retrieved six structured reports for endometriosis MR (one including the Enzian classification) and one for deep endometriosis (according to Enzian classification). Five of the six structured reports, analyzed the pelvic structures into the usual anterior, middle, posterior, other compartments. The comprehensiveness of the information provided was variable, with adenomyosis specifically mentioned only in two structured reports, and round ligaments mentioned only in one. The literature review showed difficulties for MR in evaluation peritoneal implants and tubal involvement (P and T locations of the Enzian classification). Conversely, applicability of the Enzian classification to MR was considered high for locations on the ovaries; in the rectovaginal space, vagina, retrocervical area; in the utero-sacral ligaments; in the rectum; in the uterus wall (adenomyosis) as well as in the other extragenital deep locations. There was some heterogeneity regarding the nomenclature of anatomical spaces and other locations where endometriosis can be detected.

Conclusion: MR is a reliable technique to evaluate the endometriosis extent. Enzian classification can be applied to an MR structured report, with some limitations in the evaluation of peritoneal and tubal implants.

Association of MRI derived segmental nonfunctional liver volume and chronic liver disease

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Purpose: To analyze the association of MRI derived segmental nonfunctional liver volume and chronic liver disease (CLD).

Methods and Materials: In this IRB approved study, a total of 52 patients with multiparametric MRI at 3T, including parametric T1 mapping before and 20 min after intravenous injection of a hepatobiliary contrast agent (gadobenate dimeglumine) were included. T1 relaxation times were measured in the liver and in in the aorta. Total and segmental liver volume (Lvol) and liver segmental volume ratio (LSVR) was calculated. Functional liver volume fraction (FLV%) was calculated as:

$$FLV\% = (1 - \text{hematocrit}) * [(1/T1_{\text{liver post-contrast}} - 1/T1_{\text{liver pre-contrast}}) / (1/T1_{\text{blood pool post-contrast}} - 1/T1_{\text{blood pool pre-contrast}})]$$

Finally, total and segmental nonfunctional liver Volume (NFLV) was calculated as Lvol * (1-FLV%). The association of total and segmental Lvol, LSVR, FLV% and NFLV was compared between patients with and without CLD with a Mann Whitney U test and an ROC analysis.

Results: From 52 patients, 16 patients had CLD, while 36 patients had no CLD. There was no significant difference of total Lvol between patients with and without CLD (1410ml [1312, 1797ml] vs. 1394ml [1274, 1515ml]; p=.30). FLV% was significantly lower in patients with CLD than in patients without CLD (38% [31, 47%] vs. 50% [43, 55%]; p<.001), while NFLV was increased in CLD (910ml [761, 1034ml] vs. 662ml [547, 802ml]; p<.001). ROC analysis depicted an AUC=.59 (p=.29) for total Lvol, an AUC=.71 (p=.02) for LSVR and an AUC=.80 (p<.001) for FLV%. NFLV allowed to differentiate between CLD and no CLD with an AUC=.78 (p<.01) when the total liver was measured and even a higher AUC=.85 (p<.001), when only the NFLV of the segments I-III was measured.

Conclusion: MRI derived segmental nonfunctional liver volume (NFLV) is highly associated with CLD, notably when measured in the liver segments I-III.

Pelvic organ movements in asymptomatic and symptomatic premenopausal women with pelvic organ prolapse in dynamic MRI – a prospective feasibility study comparing midsagittal single-slice with multi-slice sequences

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Purpose: To compare multi-slice (MS) sequences of the pelvis at rest and straining to conventional single-slice (SS) dynamic sequences in the midsagittal plane for the assessment of pelvic organ prolapse (POP).

Methods and Materials: This prospective IRB-approved study compared symptomatic women with POP and asymptomatic women without POP between 2019-2021. MRI was performed on a 3T scanner in supine position at rest and straining to compare midsagittal SS TRUFI with MS sagittal PDw sequences. Organ points (OP) (bladder, cervix, rectum) were annotated on both sequences. Differences in OP measurements (OPM) between SS and MS sequences were compared with Wilcoxon signed rank test. Straining effort on both sequences was scored using a 3-point scale (good, suboptimal or no straining effort). Interobserver agreement was analyzed with intraclass correlation coefficient (ICC).

Results: Twenty-three patients with POP (mean age 39.2±4.5y, group 1) and 22 healthy volunteers (24.1±3.7y, group 2) were included. In group 1, differences between SS and MS were significant for all OPM at straining (bladder:+10.8±17.9mm vs. +3.5±16.9mm; p<0.001, cervix:-6.7±28.8mm vs. -14.1±25.7mm; p=0.011, rectum:+7.4±12.6mm vs. +3.9±13.2mm; p=0.042), but not at rest. In group 2, differences were significant only for the cervix at rest (-53.7±8.2mm vs. -50.1±6.6mm; p=0.003) and bladder at straining (-10.9±11.0mm vs. -14.7±9.9mm; p = 0.019). Straining effort was good, suboptimal and absent in 84.4%, 13.3%, and 2.3% on SS and 64.4%, 26.7%, and 8.9% on MS sequences. When excluding cases without good straining effort, only the bladder in group 1 and cervix in group 2 remained significantly different with a mean difference of 3.2mm and 1.4mm. Interobserver agreement was good to excellent (lowest ICC: 0.679).

Conclusion: MS and SS sequences were similar at rest. In group 1, differences in OPM between MS and SS increased during straining and were significant for all three OP, which was partly due to more suboptimal straining efforts on MS sequences.

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Prediction of advanced liver fibrosis on T1-weighted in-phase magnetic resonance images using a convolutional neuronal network

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Purpose: To assess the accuracy of liver fibrosis prediction from T1-weigted in-phase (T1W-IP) MR images using a convolutional neural network (CNN) with histopathology as a reference standard.

Methods and Materials: Local ethics committee approval was obtained for this retrospective study and the need for written informed was waived. Patients with suspected diffuse liver disease who underwent liver MRI between January 2012 and November 2019 and liver biopsy within 6 months were included. A pathologic unified fibrosis stage 5-point scoring system (F0-4), based on disease specific scoring systems (METAVIR, Batts-Ludwig, Brunt score) was used as a reference standard. MR images were acquired on 1.5T or 3T MRI scanner from different vendors. One radiologist placed 2D regions of interest (ROIs) in the liver parenchyma on axial T1WIP images. A pre-trained CNN was used to analyze the area within the ROIs and predict clinically significant (F≥2) and advanced fibrosis (F≥3) using binary categories (F0-1 vs. F2-4 and F0-2 vs. F3/4). 283 patients were included (185 male; median age 53.4y, IQR 43.1-63.6y) and split into a training (n=258) and test set (n=25). Diagnostic performance for the correct prediction of liver fibrosis in the test set was calculated using confusion matrix.

Results: Of the 25 patients in the test set (16 male; median age 53.8y, IQR 41.4-64.8y)), 5 had no fibrosis (F0), 5 F1, 5 F2, 5 F3 and 5 F4. The accuracy, sensitivity and specificity for the CNN to predict clinically significant fibrosis was 71.0%, 65.0%, 80.0% and 81.0%, 76.9%, 83.6% for advanced fibrosis, respectively.

Conclusion: Non-invasive prediction of clinically significant and advanced liver fibrosis from T1W-IP MR images using a CNN is feasible with moderate diagnostic accuracy. The proposed liver fibrosis assessment method could be easily implemented into standard liver MRI protocols without the need for additional costly hard- and software as is needed in other non-invasive methods for liver fibrosis assessment such as MR elastography.

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Developing and External Validation of a Deep Learning Model for Automated Estimation of Myelin Maturation on Pediatric Brain MRIs

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Purpose: Determination of myelin development is an essential part of pediatric neuroradiology practice. Our goal is to automate the estimation of myelin maturation with a deep learning model.

Methods and Materials: This study is approved by local ethics committee (EKNZ BASEC 2021-01682). Native T1- and T2 weighted sequences of brain MRI scans between 1.1.2011-1.1.2021 from 842 children aged 0-36 months were retrospectively evaluated

	Training set (n = 710)	Test set (n = 132)
Age (SD)	14.11 ± 11.77	10.71 ± 11.42
Normal	541 (76.1%)	26 (19.7%)
Ischemia/Infarct	43 (6.1%)	41 (31.1%)
Preterm	22 (3.1%)	6 (4.5%)
Congenital malformations	15 (2.1%)	7 (5.3%)
Intracranial hemorrhage	15 (2.1%)	9 (6.8%)
Tumors	4 (0.6%)	9 (6.8%)
Infection	8 (1.1%)	13 (9.8%)
Miscellaneous	62 (8.8%)	21 (15.9%)

Demographics of the study population. Pathologies listed by major subgroups. Data in parenthesis are percentages (SD = standard deviation).

An ensemble of 2D and 3D convolutional neural network model was trained to predict myelin age (MA), which is labelled by a pediatric radiology fellow for the entire data set based on age-specific milestones of myelin development. A 2D input was generated from side-by-side MRI slices of the whole brain. Images were randomly resized by 20% to prevent the network from learning the age-dependent brain size. 710 images with normal myelin maturation, where chronological age(CA) was identical to or within one month of MA, were selected for the training set. 132 images containing both healthy and sick subjects were chosen for the test set. The test set was also evaluated by two radiologists to compare the model's performance with that of the human rater. The resulted model then validated on an external dataset that contains 227 normal cases.

Results: If the difference between MA and CA is within one month, it is considered normal; if it is more than one month, it is considered delayed myelination (if MA<CA). The model had a mean absolute error of 1.5 months and achieved 93% accuracy in predicting myelin age in children with normal myelin maturation. On external validation dataset, the model performed very well and had a mean absolute error of 1.33 months and achieved 52% accuracy.

Conclusion: Our model can predict the corresponding myelin maturation age in infancy and early childhood with high accuracy.

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AI-Based 3D MRI Bone Reconstruction using ZTE Sequences in the Evaluation of the Mandibular Joint and Craniofacial Bones in Children with Juvenile Idiopathic Arthritis

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Purpose: Juvenile Idiopathic Arthritis (JIA) is the most common rheumatic disease in children and adolescents. In more than 50% of cases the mandibular joint ist affected. The inflammatory arthritis can lead to growth disorders of the ramus of the mandible, to facial deformities and to malocclusion with misalignment of the teeth. 3D reconstructions of the craniofacial bones are needed to evaluate these complications. MRI is the gold standard in detection of arthritis in the jaw. But so far, bone structures are not sufficiently visualized by traditional MRI technology and often aditional CT scans were performed to create 3D reconstructions. The aim of this study was to evaluate a novel zero echo time (ZTE) sequence wit AI-based image and 3D bone reconstruction in the diagnosis of osseous changes in children with JIA.

Methods and Materials: 3D ZTE sequences, optimized through deep learning algorithms, were evaluated by two independent experts for image quality (rated with 0-4 using a 5-point scale), for quantitative measurements and for detection of osseous pathologies of the jaws in comparison to established black bone sequences. Aditionally, a morphometric 3D analysis of the mandible was conducted.

Results: 21 patients (n=16 female, n=5 male; age 8.5 +/- 3.9 years) with JIA (n=13 active arthritis, n=3 postarthritic deformity) were retrospectively included in the study. No significant differences between ZTE and black bone imaging were found for image quality, quantitative measurement of the length of the ramus of the mandible, and detection of osseous pathologies. The AI-based 3D reconstruction and evaluation was sucessfully performed for each patient, the performance of the 3D reconstruction of ZTE sequences (12,7 seconds) was much faster than the 3D reconstruction of black bone sequences (>30 minutes).

Conclusion: AI-based image optimization and 3D bone reconstruction of ZTE sequences in children with JIA can successfully be performed with promising results. This technique could fullly replace CT scans in the future.

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UTE/ZTE Lung-MRI in the Diagnosis of Children with Tracheobronchial Stenosis

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Purpose: The gold standard in the diagnosis of tracheobronchial stenosis in pediatric patients is the performance of a Bronchoscopy in combination with a CT scan of the lung. The visualization of the lung parenchyma and the tracheobronchial system with traditional MRI sequences is only possible to a limited extent. While using novel ultrashot (UTE) and zero echo tim (ZTE) sequences, airfilled structures can be imaged sufficiently. The aim of this study was to evaluate the diagnostic performance and reproducibility of these novel pulse sequences in the preoperative planning of children with tracheobronchial stenosis.

Methods and Materials: All Lung-MRI studies performed since 1.1.2019 at a 1.5 T GE Signa Artist Scanner in a single center were retrospectively evaluated. Only patients with a stenosis of the tracheobronchial system secured bronchoscopically were included in the study. The diameters of the airways were measured by two independent radiologists on multiplanar reconstructions at the level of the stenosis, in the proximal trachea as well as in the right and left main bronchus. For 6 patients the quantified diameters of the MRI data were compared to those of the CT data.

Results: 15 patients in the age of 1-160 months (median 11.5, IQR = 43) were diagnosed with tracheobronchial stenosis. Ten children suffered from a pulsatile compression of the airways by vascular structures, two from a bronchial atresia, one from a Scimitar syndrome, one from a tracheomalacia after a repair of an tracheoesophageal fistula and one from an endobronchial tumor. A high agreement of the measurement of the diameters could be shown in the Bland-Altmann-analysis for the MRI and CT data. A high inter-rater reliability was seen.

Conclusion: UTE and ZTE imaging of children with tracheobronchial stenosis represents a novel radiation-free method with a high diagnostic performance and reproducibility.

Evaluation of the added value of postmortem magnetic resonance imaging in cases of pediatric deaths compared to postmortem computed tomography and autopsy

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Purpose: Nowadays, autopsy is the gold standard to identify the cause of death in children. However, forensic imaging methods are getting important in the field of forensic medicine. Post-mortem computed tomography (PMCT) is an ideal technique for analyzing the skeleton, but is limited in detecting major pathologies in pediatric cases (poor contrast of soft tissues, impossibility to perform a PM-angiography). Post-mortem magnetic resonance imaging (PMMR), is known for its excellent sensibility concerning the analysis of the soft tissues/organs. We purpose to investigate the added value of PMMR in cases of pediatric deaths and compare its diagnostic yield to PMCT and autopsy finding.

Methods and Materials: 37 cases (16 male, 21 female, <5y, sudden unexpected, perinatal/fetal deaths, trauma, drowning, multiple diseases) underwent a PMCT (64-row), a PMMR (1,5T) before autopsy. Imaging data were acquired as part of the medico-legal investigation and were evaluated by a forensic pathologist, a radiologist and a pediatric radiologist with experience in forensic medicine. Firstly, PMMR data were compared to PMCT data and secondly to autopsy data.

Results: PMMR had an excellent concordance with autopsy in detecting congenital malformations and other fetal/neonatal causes of death. In 1 case, it allowed to analyze a fetal cerebral malformation more precisely than PMCT and autopsy. It was able to detect retinal hemorrhage in 2 cases of shaken baby syndrome. In cases of perinatal death, it allowed to detect signs of cerebral ischemia, hemorrhages and contusions.

PMMR was superior in assessing the anatomy of the heart and for detecting soft tissues infiltrations and cavity effusions. Fractures were better seen by PMCT and autopsy, but PMMR was helpful in dating the fractures.

Conclusion: PMMR is an important asset to PM-imaging and autopsy in pediatric deaths, esp. in cases where child abuse, medical liability or congenital malformation are suspected. It provides evidence of specific findings, which can be helpful before starting the autopsy.

Assessment of image quality and radiation exposure of pediatric ECG-triggered cardiac CT in patients with congenital heart diseases

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Purpose:
1. To assess image quality and radiation exposure of ECG-triggered cardiac computed tomography (CCT) in infants with congenital heart diseases (CHD).
2. To assess the effect of various injection sites on contrast-to-noise ratio (CNR)
3. To define an optimization margin to decrease patient exposure using a Deep Learning Image Reconstruction (DLIR) algorithm on anthropomorphic phantoms.

Methods and Materials: We evaluated 56 ECG-triggered CCT of infants <6 months old. Quantitative analysis of the images were done calculating contrast-to-noise and signal-to-noise ratios in ascending aorta and pulmonary trunk. Two pediatric radiologists performed a subjective analysis. Radiation dose were interpreted through computed tomography dose index CTDI, Dose-Length-Product (DLP) and effective dose. The effect of injection site on the CNR was assessed. Detectability and discrimination analyses were performed on an anthropomorphic phantom with iterative and deep learning reconstructions.

Results: Enhancement in ascending aorta and pulmonary trunk were 510.7 ± 165.9 and 497.8 ± 187.8. CNR in both structures were similar 32.4 ± 16.2 and 32.5 ± 15 with no statistical difference. The three injection site had no effect on CNR.
Image quality was subjectively described as very good globally. Mean values for CTDIvol, DLP and effective dose were respectively 2.35 ± 0.53 mGy, 21.8 ± 5.67 mGy.cm and 0.81 ± 0.20 mSv. Detectability analysis provided a 64% optimization potential thanks to deep learning image reconstructions (AUC = 0.995).

Conclusion: Our current practice provides high quality images. There is a potential to optimize our protocol by reducing radiation doses and contrast media while maintaining a good diagnostic image quality.

Ultrasound shear-wave elastography and attenuation imaging compared to histology in pediatric patients.

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Purpose: To gain experience with and evaluate the role of quantitative liver ultrasound for characterisation of liver disease in children.

Methods and Materials: In this ongoing study, shear wave elastography (kPa), shear wave dispersion slope [(m/s)/kHz] and attenuation imaging (dB/cm/MHz) measured with an 8MHz matrix convex array transducer (Aplio i800, Canon Medical System) are compared to clinically indicated liver biopsy. Since December 2021, quantitative US data are compared to histology reports in 10 children (age 12.5 +/- 2.5 years, range 8.3 years to 16.7 years) with descriptive statistics.

Results: All 8 children with inflammation in liver biopsy showed an increased dispersion slope (> 12.5 [(m/s)/kHz]). 4 patients had increased attenuation (> 0,63 dB/cm/MHz) correlating to steatosis seen in the liver biopsy in 3 out of 4 children. One patient showed a steatohepatitis with increased attenuation (0,79 dB/cm/MHz) and dispersion (13 [(m/s)/kHz]). All 3 children with elevated shear wave elastography showed either fibrosis or cirrhosis.

Conclusion: These preliminary data show that quantitative US imaging of the liver may predict inflammation, steatosis and fibrosis on histology of the liver. Further study is needed also for defining normal values of quantitative liver imaging in the pediatric population.

Paediatric bone age estimation from lateral elbow radiographs using a machine learningmediated approach.

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Purpose: To develop a machine learning-mediated approach to compute bone age from the lateral elbow radiograph in pediatric patients.

Methods and Materials: Two-projections radiographs of the left elbow from 2013 to 2020 from 4 different hospitals were analyzed by five experienced radiologists who assigned bone age scores according to the Sauvegrain method (using two projections) and the Dimeglio method (using only the lateral projection). For both methods, the Olecranon Apophysis Score (OAS) was computed. This annotated dataset was used to train a machine learning-based system that computes OAS by solving a regression problem. Then, OAS was mapped to bone age using a polynomial interpolation of the curve presented in the Dimeglio method, tailored for girls and boys. A separate dataset, including the standard projections of the left elbow performed for bone age estimation in 2021, was selected to validate the system. For this dataset, five reviewers scored the images using the Souvegrain and Dimeglio method with the highest agreement to estimate bone age. To evaluate the accuracy of this dataset, the mean absolute error with respect to the manually annotated OAS and bone age was computed. The machine-learning approach was applied also to the validation dataset.

Results: The machine learning-mediated estimation of OAS showed a mean difference of 0.43 +- 0.17 points, compared to the OAS of the radiologist. This corresponded to a mean difference of 4 months compared to the Dimeglio method applied manually and 4.7 months compared to the Sauvegrain method.

Conclusion: The proposed machine learning-mediated determination of bone age was able to assign bone age with a negligible difference compared to the radiologists, thus helping to disambiguate cases not precisely falling into a pre-defined category.

Post-mortem fetal imaging: added value of post mortem-CT versus babygram radiograph

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Purpose: Post-mortem fetal imaging is performed in different clinical situations (miscarriage, interruption of pregnancy for medical reasons or death in utero) and includes plain radiograph, ultrasound, CT (PMCT) and MRI (PMMRI). The purpose of this study is to evaluate the added value of PMCT versus babygram radiograph for the detection of bone anomalies.

Methods and Materials: This study included 153 fetuses (GA: 12 to 40 weeks). After consent of the mother, postmortem imaging was performed before autopsy: AP and lateral whole-body radiographs (babygram) and non-contrast whole body CT (64 W-GE).
The imaging was analyzed by 2 pediatric radiologists who were blinded to autopsy results. Bone abnormalities were revealed on radiographs and CT with MIP and 3D reconstructions. The skull was not analyzed because it was often deformed during delivery.

Results: Of the 153 fetuses, 10 were excluded: 6 had no CT and for 4, the babygram was difficult to analyze [maceration (n=2), early gestational age ≤ 13 weeks (n=2)]. Finally, 143 fetuses were included in this study.
For 89 fetuses, the babygram and the CT were normal. In 53 cases, the babygram revealed bone abnormalities which were also visible on the CT. In one case, the babygram showed metaphyseal irregularities that the CT did not detect. CT did not show any other bone abnormalities, but 3D and MIP reconstructions improved the description of bone abnormalities as vertebral malformations or measurement of the fronto-nasal angle in Binder's syndrome.

Conclusion: In post-mortem fetal imaging, babygram radiographs are essential and CT does not provide significant additional information on bone structure, but CT reconstructions and analysis in the 3 planes improve the description of certain anomalies. On the other hand, fetus PMCT without injection does not prove useful for analyzing poorly differentiated soft tissue.

Improved differentiation between delayed and reduced cerebral blood flow in children with moyamoya vasculopathy using a multi-delay eASL compared to standard ASL

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Purpose: The aim of this study was to assess whether transit corrected evaluation of cerebral blood flow (CBF) using multi-delay arterial spin labeling (ASL) improves differentiation between delayed and reduced CBF in comparison to single-delay ASL, providing important information for the choice of therapeutic regime and time point for intervention.

Methods and Materials: Retrospective study with institutional review board approval and informed consent. A total of 24 patients (11.8±3.1 years, 2.7-18.6 years, 11 female/13 male) were included between 06/21 and 06/22. Imaging was performed at 1.5 T (SIGNA Artist, GE Healthcare; n=6) or 3 T (DISCOVERY MR750 or SIGNA Premier, GE Healthcare; n=18). Standard single-delay 3D pCASL (sASL) acquisition with spiral readout (single post-label delay of 1525 ms, label duration 1450 ms) was compared to a prototype time-encoded 7-delay 3D pCASL with spiral readout termed enhanced ASL (eASL) using different PLDs (range (1000-3582) / (1000-3658) ms in 1.5/3T). Transit corrected CBF maps and transit delay maps were also calculated from the eASL data. In each patient 10 areas (major arterial territories (ACA, MCA, PCA), anterior and posterior watershed areas) were evaluated in both sequences regarding reduced CBF. Fisher's exact test was used to compare the results.

Results: Moyamoya vasculopathy was present bilaterally in 13, unilaterally in 11 cases. A total of 151 areas with reduced CBF were identified on sASL, whereas only 75 areas were detected on the transit corrected CBF map of the eASL (all 75 areas also reduced on sASL, p<0.001). The mean arterial transit delay for the 76 areas with reduced CBF only on sASL was 2055.9±226.3ms, range 1517-2739ms.

Conclusion: Transit corrected CBF evaluation reduces arterial transit time artifacts due to delayed perfusion compared to single-delay ASL in children with moyamoya vasculopathy, and may be a future alternative to perfusion PET/CT and DSC-enhanced perfusion.

Temporal bone cone beam CT in children: Preliminary experience in Geneva

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Purpose: To evaluate cone beam CT (CBCT) versus multislice CT (MSCT) for the diagnosis of temporal bone pathologies in a pediatric population, concerning the resolution of the images and the irradiation.

Methods and Materials: This retrospective study included 43 children with temporal bone CBCT examinations (7G, Newton©) seven of whom had previously also undergone a CT scan (Somatom Definition Edge,Siemens©). Median age was 10 years (range: 6-16). Clinical indications included: conductive hearing loss, suspected cholesteatoma, aural atresia and post-surgical follow-up. Two experienced radiologists reviewed the CBCT scans of 85 ears (42 right, 43 left) and the CT scans of 16 ears (8 right, 8 left). Analysis of these clinically relevant structures was assessed using a 3-point Likert scale (0 = not visible, 1 = poorly visible, 2 = well visible): modiolus, malleus, incus, stapes and facial nerve canal. Radiation dose was registered for both techniques.

Results: The acquisition time with CBCT was longer than with MSCT (about 25s versus 13s). Only one CBCT examination could not be interpreted because of movement artefacts. The analysis of all anatomically relevant structures was better on CBCT than MSCT: mean ± SD score (CBCT: 1.94 ± 0.24; MSCT: 1.68 ± 0.54, p= 0.007). The spatial resolution and the contrast-to-noise perception were subjectively higher at CBCT than MSCT. The stapes was particularly well visualized on the CBCT in cases of middle ear opacification.

The values of CTDI and DLP were not significantly different between both techniques (CBCT: 19.72 mGy and 118.6 mGy.cm, MSCT: 17 mGy and 96.6 mGy.cm).

Conclusion: This study shows the feasibility of CBCT for temporal bone imaging in clinical practice in children. CBCT was superior to MSCT for the assessment of anatomical relevant structures of the temporal bone in children.

Technical CBCT parameters could be improved in the future to further reduce radiation dose.

Assessment of missed incidental pulmonary embolisms on chest CT with an AI-algorithm

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Purpose: Retrospective assessment of incidental pulmonary embolism (iPE) missed by radiologists on chest CT with an artificial intelligence (AI) algorithm including prevalence, anatomic distribution pattern and daytime of diagnosis of the CT scans..

Methods and Materials: This IRB approved, retrospective single center study included 1966 chest CT scans acquired during venous or arterial contrast, performed due to other reasons than suspected PE, analyzed by a FDA-approved AI algorithm for diagnosing iPE (Aidoc Medical). The appearance of iPEs, their location and the studytime were retrieved from the radiological reports and compared to all positive findings of the AI algorithm, verified by an experienced radiologist, serving as the gold standard. For statistical analysis SPSS was used (Version 28, 2021).

Results: Of the 1966 cases 64 suspicious iPEs were displayed by the AI of which 47 were true iPEs (Sensitivity 96%, Specificity 99%). Prevalence of iPE was 2,4%, while half of the positive cases were missed by radiologists (PPV: 75%; NPV: 99%). In nearly 61% (15/23) the retrospectively identified missed iPEs were allocated in the right lower lobe, while the non-missed iPEs showed a nonspecific distribution affecting all lung segments.

Most of the reports which missed an iPE were generated between 1:00 and 5:00pm (57%).

Conclusion: Nearly 50% of cases with iPE were missed by radiologists, which indicates the need for a robust AI solution.

Secondly, this study can pave the way for a better understanding of iPEs with regard to their anatomic distribution pattern and different external influences in order to prevent future misdiagnosis.

The main limitation of this investigation was the retrospective design as well as the unclear therapeutic relevance of incidental pulmonary embolisms. Prospective investigations combined with an analysis of the clinical outcome are required.

Ultra-High-Resolution Coronary CT Angiography with Photon Counting Detector CT

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Purpose: To evaluate the feasibility and quality of ultra-high-resolution (UHR) coronary CT angiography (CCTA) with photon-counting detector (PCD)-CT in patients with a high coronary calcium load and determine the optimal reconstruction parameters.

Methods and Materials: In this IRB-approved study, 20 patients (6 women; age 79±10 years) undergoing ECG-gated UHR PCDCCTA were included. Images were reconstructed using 8 vascular kernels (Bv40, Bv44, Bv56, Bv60, Bv64, Bv72, Bv80, Bv89), quantum iterative reconstruction at strength 4, and a slice thickness of 0.2 mm. Image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and vessel sharpness were quantified. Two blinded readers assessed image noise, overall image quality, and delineation of calcified plaques and vessel lumen using a 5-point visual scale. A phantom scan served to characterize image noise texture for every kernel.

Results: In the phantom, maximum spatial frequency gradually shifted to higher values for reconstructions with the Bv40 to Bv64 kernel (0.15 to 0.56 mm-1), but not with the Bv72 to Bv89 kernel. UHR CCTA was feasible in all patients (median calcium score 479). With higher kernel sharpness, SNR and CNR decreased, while image noise and vessel sharpness increased. Images with the Bv40 kernel showed lowest image noise (25.3±3.3 HU), highest SNR (18.7±3.8) and CNR (22.5±4.5), while images with the Bv89 kernel provided highest vessel sharpness (2446.6±849.9 ΔHU/mm). Both readers perceived image noise in agreement with the objective measurements. For overall image quality, images with the Bv44 and Bv56 kernel (both, median score 5) were rated best for both readers. For delineation of coronary artery plaques and the adjacent vessel lumen, images with the Bv64 and Bv72 kernel (both, median score 5) were favored by the readers.

Conclusion: UHR CCTA with PCD-CT is feasible and enables the visualization of calcified coronaries with excellent image quality. Optimal coronary plaque characterization is achieved using the Bv64 kernel.

Cardiac Virtual Noniodine Images for Calcium Quantification with Photon Counting Detector CT

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Purpose: To assess the accuracy of aortic, mitral annular, and coronary artery calcification quantification and risk stratification using virtual no-niodine images (VNI) from contrast-enhanced cardiac photon-counting detector (PCD) CT as compared with true noncontrast images.

Methods and Materials: This retrospective, IRB-approved study evaluated patients undergoing PCD-CT prior to transcatheter aortic valve replacement between January and August 2022. VNI were reconstructed from cardiac late enhancement scans at 60, 70, and 80 keV using quantum iterative reconstruction (QIR) strength levels 2 to 4. Aortic valve calcifications (AVC), mitral annular calcifications (MAC), and coronary artery calcifications (CAC) were quantified on VNI and compared with true non-contrast images using Bland-Altman analyses, regression models, intraclass correlation, and Wilcoxon tests. Agreement between categories for severe aortic stenosis likelihood and for CAC scores determined on VNI and true noncontrast images was assessed by weighted Kappa analysis.

Results: Eighty-four patients were included (39 women; mean age 81±8 years, BMI 26 ± 5 kg/m^2). There were no differences between scores determined on true noncontrast images and VNI at 80 keV for AVC and MAC regardless of QIR strength level, and VNI at 70 keV with QIR 4 for CAC (all, p > .05). Calcium scores achieved best results using VNI at 80 keV with QIR 3 for AVC (mean difference -23; ICC = .983; r = .97), at 80 keV with QIR 4 for MAC (mean difference 12; ICC = .997; r = .99), and at 70 keV with QIR 4 for CAC (mean difference 30; ICC = .996; r = .99). Agreement between categories was excellent on VNI at 80 keV with QIR 3 for AVC (K = .973) and on VNI at 70 keV with QIR 4 for CAC (K = .963).

Conclusion: Virtual noniodine images from cardiac photon-counting detector CT enable precise calcium quantification and risk stratification of aortic, mitral annular, and coronary artery calcifications.

Impact of Optimized Gantry Rotation Time on Coronary Computed Tomography Stenosis Assessment: Experimental Validation

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Purpose: Accumulating evidence advocates coronary CT angiography as a safe, non-invasive test for coronary artery disease. However, motion artifacts can impede diagnosis, especially in arrhythmic patients and those with contraindications to beta-blockers. We aimed to experimentally evaluate the impact of reducing gantry rotation time to 0.23s, especially at a higher heart rate.

Methods and Materials: We used a coronary artery stenosis module containing calcified and non-calcified plaques with stenoses ranging from 10 to 90% and filled with iodinated contrast (300 HU ;120 kVp). A motion platform simulated heart rates of 60 and 80 bpm and electrocardiogram signals. We scanned the module at 0.23, 0.28, and 0.35 s rotation time. Vessel area accuracy and precision were measured using a thresholding method. Two independent readers assessed motion artifacts qualitatively (4-point Likert scale). Ratings were merged for analysis, interrater agreement was evaluated with the weighted kappa coefficient.

Results: Accuracy was similar across all rotation times at 60 bpm; p>0.08. At 80 bpm, 0.23 s/rot yielded significantly more accurate segmentation (0.40 mm^2) than 0.28s (1.02mm^2) and 0.35s (1.15 mm^2), p≤0.02. Precision was similar across all rotation times at 60 bpm; p>0.29. At 80 bpm, 0.23 s/rot time yielded significantly more precise segmentation (0.31 mm^2) than 0.28s (0.78 mm^2) and 0.35 s (1.16 mm^2), p≤0.001. Post hoc analysis showed significant differences between 0.23 and 0.28 s/rot (p=0.006), but not between 0.28 and 0.35 s/rot (p=0.646). Interrater agreement was substantial (k=0.66) for calcified and moderate (k=0.55) for non-calcified stenoses.

Conclusion: Compared with the current standards of 0.28 - 0.35 s/rot, faster (0.23 s/rot) gantry rotation reduces motion artifacts and provides significant incremental value on cross-sectional segmentation accuracy and precision at 80 bpm.

Diagnostic accuracy of virtual non-iodine imaging in photon-counting detector CT angiography for endoleak detection after endovascular aortic repair

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Purpose: To compare diagnostic accuracy for endoleak detection after endovascular abdominal aortic aneurysm repair between a triple-phase CT with true non-contrast (TNC) or a dual-phase CT with virtual non-iodine images (VNI) on photon-counting detector CT (PCD-CT).

Methods and Materials: Adult patients after endovascular aortic aneurysm repair who received a triphasic examination (TNC, arterial, venous phase) on a first-generation dual-source PCD-CT between August 2021 and July 2022 were retrospectively included. Endoleak detection was evaluated by two blinded radiologists on two different readout sets (TNC-arterial-venous vs. VNI-arterial-venous). VNI were reconstructed from the venous phase scans. The radiologic report with additional confirmation by an expert reader served as reference standard for endoleak presence. Image noise of TNC and VNI was assessed objectively calculating the noise power spectrum (NPS) in a phantom and subjectively by one radiologist in patients using a 5-point scale.
Sensitivity, specificity and interreader agreement (Krippendorf α) were calculated.

Results: 110 patients with 41 endoleaks were included. Endoleak detection was comparable between both readout sets (sensitivity/specificity: 0.95/0.84 (TNC) vs. 0.95/0.86 (VNI) for reader 1 and 0.88/0.98 (TNC) vs. 0.88/0.94 (VNI) for reader 2). Interreader agreement for endoleak detection was substantial (TNC: 0.716, VNI: 0.756). Subjective image noise was comparable between TNC and VNI (4; [4, 5] vs 4; [4, 5], p=0.44). In the phantom, peak spatial frequency of the NPS was similar between TNC and VNI (f_{peak}=0.16/mm vs. 0.16/mm). Objective image noise was higher in TNC (12.7 HU) as compared to VNI (11.5 HU).

Conclusion: Endoleak detection and image noise were comparable using virtual non-iodine images in dual-phase CT as compared to true non-contrast images in triple-phase CT. This offers the possibility to omit the TNC scan consecutively reducing patients' radiation exposure.

Cine CMR using self-gated radial bSSFP at 0.55T

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Purpose: The aim of this work was to assess high-temporal high-resolution cine cardiovascular magnetic resonance imaging (CMR) using self-gated radial bSSFP in a group of healthy volunteers at 0.55T.

Methods and Materials: A free-running radial cine bSSFP with tiny golden angle increments was implemented on a 0.55T MR-system (Siemens MAGNETOM Free.Max) with low-performance gradients (26mT/m amplitude, 45 T/m/s slew rate).
Five healthy volunteers were scanned using two setups: free-breathing cine CMR with 3 min acquisition time and breath-hold cine CMR with 22.5 s acquisition time. The scans were performed in short axis and four-chamber views. No ECG-triggering nor breathing belts were used. Main sequence parameters were as follows: TE/TR = 2.25/4.5 ms, field-of-view = 290 mm × 290 mm, in-plane resolution = 1.6 mm, slice thickness = 5 mm, bandwidth = 927 Hz/px, flip angle = 70°, 5'000 radial projections for breath-hold and 40'000 for free-breathing scans. The study was approved by the local ethics committee and written informed consent was given by the volunteers. The acquired data was binned into different cardiac and respiratory phases. Data reconstruction was performed offline using compressed sensing with total generalized variation regularization applied along the binning (temporal) direction. The GPU-accelerated reconstruction took 30s for breath-hold and 2min for free-breathing datasets.

Results: All CMR scans were performed successfully and provided diagnostic quality with 25 frames per cardiac cycle. Compressed sensing reconstruction helped to mitigate residual streaking artifacts arising from data undersampling. Due to low field of 0.55T no off-resonance artifacts were visible in the chest.

Conclusion: We have shown the feasibility of cine CMR using free-running self-gated radial bSSFP on a low-field 0.55T MR-system. CMR with bSSFP is especially attractive at low fields due low SAR and reduced sensitivity to off-resonance artifacts.

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A Deep Learning-Based Approach to automatically choose a protocol of Cardiothoracic CT Examinations: Understanding the Decision Process Using a Rate-Distortion Framework

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Purpose: To automate the protocolling process of cardiothoracic CT examinations based on clinical questions and to identify the most relevant terms used for the decision process by a neural network.

Methods and Materials: 66,173 consecutive CT examinations performed in our cardiothoracic imaging section from 01/2010-10/2021 were included. Protocol assignment performed during clinical routine as one of 30 standardized cardiothoracic imaging protocols served as ground-truth. The 1,000 most common terms were extracted from all clinical questions, serving as input for a deep neuronal network. This was trained for 100 epochs on 80% of the examinations. The remaining 20% were used for validation.

A rate-distortion framework, explaining neuronal network decisions, was employed to assess the most important terms for automated protocol assignment. A term was regarded as important if distortion (change of the neuronal network prediction using squared distance) increased strongly when ignoring it.

Results: The trained neuronal network had an 87% accuracy on the training dataset and a 61% accuracy on the validation dataset.

Accuracy of automated CT protocol assignment by the neural network in the validation dataset were as follows: non-contrast chest CT (n=3,639): 79%; CT pulmonary angiogram (n=2,897) = 88%; Contrastenhanced chest CT in arterial phase (n=2,650) = 44%; Contrast-enhanced CT Chest/Abdomen in venous phase (n=549) = 48%; ECG-gated CT-Angiogram Chest/Abdomen (n=619) = 66%.

Using a rate-distortion framework, the clinical question "rule out infiltrate" led to the assignment of a noncontrast chest CT protocol, and "infiltrate" was marked as important. The terms "angiography", "exclusion" and "pulmonary embolism" were marked as important for the assignment of the CT pulmonary angiogram protocol.

Conclusion: Preliminary results from this neuronal network may support the CT protocolling process given its comprehensible decision process based on important key terms.

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Living kidney donor evaluation and coronary risk assessment with low radiation dose computed tomography as a one stop shop examination

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Purpose: To compare a standard triple phase CT protocol with a combined dual-energy, split-bolus CT protocol with cardiothoracic assessment in living kidney donor candidates.

Methods and Materials: This was a secondary analysis of a prospective registry of living kidney donor candidates in a kidney transplantation tertiary center. CT scans of donor candidates were analyzed and compared between patients with A) a standard abdominal triple phase CT acquisition, B) an abdominal dual phase CT acquisition with virtual non-contrast reconstruction and a split-bolus contrast medium administration for assessment of the urinary tract and C) protocol B with additional cardiothoracic CT acquisition. Cardiothoracic and abdominal CT findings, as well as CT dose estimations were compared between the groups using a Fisher's exact tests for categorical variables and a Kruskal Wallis test for continuous variables.

Results: A total of 90 kidney donor candidates were included. The highest radiation dose was observed with the standard CT protocol (DLP 1088 mGy*cm; CTDI 24.1 mGy, n=)19), while radiation dose was significantly lower in the dual energy, split bolus CT protocol (518 mGy*cm; CTDI 11.8 mGy, n=21), even when combined with the additional cardiothoracic CT acquisition (DLP 736 mGy*cm; CTDI 18.0 mGy, n=50; p<.001). 17 / 50 (34%) donor candidates with the combined cardiothoracic and abdominal CT protocol had coronary artery calcifications, while 3 / 50 (6%) had a previously unknown significant coronary stenosis that led to subsequent invasive coronary angiography and coronary stent insertion. Other relevant cardiothoracic findings included aortic root ectasia (12%), bicuspid aortic valve (2%) and pulmonary emphysema (8%).

Abdominal CT findings were not significantly different between the three groups (p=.81 – p>.999).

Conclusion: Combined cardiothoracic and abdominal CT assessment with low radiation dose is feasible and shows a relevant prevalence of clinically significant cardiothoracic findings in living kidney donor candidates.

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3D segmentation and ruler-based volumetry of extra-cranial venous malformations in MRI with MRA

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Purpose: Aim of this study is an intraindividual comparison of 3D segmentation against ruler-based measurement based on T2 weighted imaging and contrast enhanced MRA (ceMRA) for therapy monitoring of venous malformations (VM).

Methods and Materials: In 33 patients with VM semi-automated 3D segmentations and manual ruler-based measurements were performed to obtain the volume in T2w and ceMRA images as part of a 3T MR protocol. Volumes were obtained before and after treatment by sclerotherapy using well established open source software.

Results: Morphologic T2w volume was significantly reduced after therapy with 3D segmentation (50.3±79.84 vs 35.3±59.8 ml, p<0.01) and with the ruler-based approach (101.4±158.4 vs 76.2±117.1 ml, p<0.05).
Functionally perfused volume in ceMRA was drastically reduced after therapy with 3D segmentation (23.2±35.2 vs 8.1±11.7 ml, p<0.01) and the ruler-based approach (63.2±107.8 vs 9.3±16.0 ml, p<0.01).
Results from both methods highly correlated with each other: r2 before/after treatment in T2w 0.93/0.93 and in ceMRA 0.90/0.81.

Conclusion: 3D segmentations and ruler-based measurements of VM are both feasible methods for volumetric therapy monitoring highly correlating with each other. However, 3D segmented volumes were significantly smaller compared to ruler-based findings indicating that 3D segmentation is the more precise approach to represent the polygonal shape of VM.

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Epicardial adipose tissue dispersion at CT and recurrent atrial fibrillation after pulmonary vein isolation

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Purpose: We aimed to investigate the association of LA EAT dispersion with AF recurrence after pulmonary vein isolation (PVI).

Methods and Materials: In a secondary analysis of a prospective registry of consecutive patients (between 08/2018 and 12/2019) undergoing first PVI, mean EAT attenuation values were measured on contrast-enhanced cardiac CT scans in hounsfield units (HU) within low (-195 to -45 HU) and high (-44 HU to -15 HU) threshold EAT compartments around the left atrium (LA) and the coronary arteries. EAT dispersion was defined as the difference between the mean HU values within the two EAT compartments. Continuous variables were compared between groups using the Mann-Whitney-U test and cox proportional hazard models were used to calculate hazard ratios of predictors of 1-year AF recurrence.

Results: A total of 208 patients were included, 135 with paroxysmal AF and 73 with persistent AF. Patients with persistent AF had a significantly lower LA EAT attenuation both in the low (-76.6 vs. -79.2 HU; p<0.001) and high threshold EAT (-26.3 vs. -26.6; p=0.004). LA EAT dispersion was significantly larger in patients with persistent compared to paroxysmal AF (52.6 HU vs. 49.9 HU; p=0.001). After 1 year of follow-up, AF recurrence rate was 76/208 (37%). LA EAT dispersion above the mean was associated with a higher risk of 1-year AF recurrence (HR 2.3, 95% CI 1.5-3.6; p<0.001). It retained its predictive value when corrected for age, sex, body mass index, LA volume and AF type (HR 2.8, 95% CI 1.6-4.6; p<0.001).

Conclusion: A larger LA EAT dispersion on contrast enhanced cardiac CT scans, reflecting EAT heterogeneity, is independently associated with AF recurrence after PVI.

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CT-based textural assessment of the myocardium in patients with coronary heart disease

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Purpose: To assess different methods for detection of myocardial abnormalities using CT in patients with coronary heart disease (CAD).

Methods and Materials: Using an automatic segmentation of the myocardium, HU-values and attenuation based colormaps of the myocardium were analyzed in two different patient cohorts:
First, a low to intermediate risk group was assessed with Rubidium-PET/CT and ECG-triggered CT angiography (CCTA) in 366 patients.
Second, 95 patients with suspected high risk of CAD underwent invasive coronary angiography (ICA) and CCTA in an emergency setting. Coronary artery stenosis was used as reference.
Radiomics were extracted from the myocardium for HU-values and colormaps and a gradient boosting classifier was established as a prediction model.

Results: For patients receiving Rubidium-PET/CT, a significant decrease in HU-values was detected for ACD territory (p < 0.01). Based on radiomics features, an increase of non-uniformity for HU-values for >75% (p < 0.05) and >50% (p < 0.0001) stenosis was documented. Furthermore, colormaps indicated an increased inhomogeneity of the myocardium for a stenosis > 50% (p < 0.0001).
For patients receiving ICA, a significant decrease was detected in RCX territory (p < 0.05) in colormaps. The gradient boosting classifier achieved an accuracy of 0.81 to predict a stenosis >95% using total myocardial radiomics for HU-values and an accuracy of 0.73 using colormaps. An increase of non-uniformity for HU-values (p < 0.05) and for colormaps (p < 0.0001) was shown for >95% stenosis implying an increased inhomogeneity for severe stenosis.

Conclusion: Radiomics based myocardial texture analysis may be a useful approach to detect high-grad stenosis in patients with suspected high risk of CAD as well as low-grad stenosis in patients with suspected low to intermediate risk of CAD.

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Diagnostic performance of a deep-learning model to detect coronary stenoses on CTA images in emergency patients presenting with acute chest pain

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Purpose: Aortic CT angiography (CTA) is a critical tool in the work-up of patients with acute chest pain (ACP). Our goal was to evaluate the performance of a deep-learning model (DLM) for the detection of significant coronary stenoses in emergency patients presenting with ACP and explored with CTA.

Methods and Materials: One hundred and eighty-one patients presenting with ACP and examined by ECG-gated CTA of the aorta between January 2021 and may 2022 were retrospectively included. With regard to the emergency setting, no premedication (beta-blockers or nitrates) was administered. For each of the 3 coronary arteries, 9 radially acquired curvilinear MPR images 40° apart were classified by the DLM in 2 groups: CAD-RADS 0-1-2 (<50% stenosis) or 3-4-5 (≥ 50%). Two readers in consensu separated the patients in two groups depending on the overall presence of motion artifacts and read the cases regarding significant stenoses (< 50% vs. ≥ 50%).

Results: In patients without artifacts on CT images (n=89, 49%), all significant stenoses (CAD-RADS 3-4-5) detected by human readers were correctly identified by the DLM. Diagnostic performances of the DLM were: sensitivity 100%, specificity 66%, positive predictive value (PPV) 56% and negative predictive value (NPV) 100%. Among patients with artifacts (n=92, 51%), 19 (27%) had significant stenoses following human analysis but were misdiagnosed by the DLM resulting in poorer diagnostic performances: sensitivity 78%, specificity 75%, PPV 98% and NPV 14%.

Conclusion: The DLM showed adequate performances for the identification of significant stenoses on CT images without artifacts, advocating the potential of such a system to help radiologists in their daily routine in patients with ACP. The presence of artifacts reduced its performances and required human supervision.

Assessment of cerebral microbleeds with low-field magnetic resonance imaging: A prospective direct 0.55T-1.5T-scanner comparison

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Purpose: Evaluating the diagnostic performance for the detection of cerebral microbleeds (CMB) of a whole-body lowfield MRI in a prospective cohort of suspected stroke patients compared to an established 1.5T MRI.

Methods and Materials: A prospective scanner-comparison was performed including 27 patients, of whom 3 patients were excluded because the time interval was >1 hour between acquisition of the 1.5T and 0.55T MRI. All SWI-sequences were assessed for the presence, number, and localization of CMBs by two neuroradiologists and additionally underwent Likert-rating with respect to image-impression, resolution, noise, contrast, and diagnostic quality.

Results: Twenty-four patients with a mean age of 74 years were included of whom 11 patients were female (46%).

Both readers detected the same number and localization of microbleeds in all 24 datasets (sensitivity and specificity 100%; interreader reliability κ=1). Likert-ratings of the sequences at both field strengths regarding overall image quality and diagnostic quality did not reveal significant differences between the 0.55T- and 1.5T-sequences: (p=0.942; p = 0.672). For resolution and contrast the 0.55T-sequences were even significantly superior: (p < 0.0001; p < 0.0003) whereas the 1.5T-sequences were significantly superior (p < 0.0001) regarding noise.

Conclusion: Low-field MRI at 0.55T has the same accuracy as scanners with higher field-strength for the detection of microbleeds and thus has great potential as a resource-efficient alternative in the near future.

AI-based prediction of onset of intracerebral hemorrhage (ICH): Potential and limits

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Purpose: Intracerebral hemorrhage (ICH) is associated with high mortality and long-term morbidity and thus has a significant overall health-economic impact. The overall outcome is especially poor if the onset of ICH is unknown, but reliable radiological methods to determine this exactly do not exist. Therefore, the aim of our work was to investigate a machine learning (AI)-based age-prediction of ICH.

Methods and Materials: We selected 7421 CT-datasets with proven ICH and trained an automated ICH-segmentation-algorithm.

Afterwards, for 622 datasets (bleeding age<48h) a comparison of our AI-based age-prediction with the anamnestically known onset-times of ICH was performed. Additionally, we performed manual age-prediction by two radiologists from 117 datasets and compared the results with the AI-based approach.

Results: Age-prediction by both AI and radiologists was only partially accurate with a mean absolute error (in hours) of 9.77 (95%CI [8.56-11.06]) for the AI-model, 13.38 (95%CI [11.21-15.74]) for rater1 and 11.21 (95%CI [9.61-12.90]) for rater2. Thus, the human (rater) was significantly inferior (*p*=0.0067 rater1; *p*=0.0453 rater2) to the AI. However, the performance of the AI was equal (with no significant difference, *p*=0.3104) to simply taking the mean bleeding age of the dataset (15 hours) as prediction.

Conclusion: To our knowledge, such an AI-based approach has never been performed. Nevertheless, our results confirm the assumption that, in principle, no data on ICH-age can be extracted exactly from the image information of a CT-dataset. Possible therapy decisions (blood-pressure regulation, drug-therapy approaches) can thus only be derived to a limited extent. It is possible that follow-up-studies with a significantly larger dataset can provide further relevant information.

Medical hypnosis for MRI examinations of claustrophobic patients: Preliminary results of a prospective observational study

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Purpose: To assess the impact of medical hypnosis on exam completion and image quality of MRI examinations of claustrophobic patients.

Methods and Materials: This preliminary analysis of an ethics committee-approved prospective study considers the group of claustrophobic patients aged ≥18 years that agreed to undergo MRI under medical hypnosis instead of pharmacological sedation. Before MRI, the 26-item Claustrophobia Questionnaire (Claustrophobia-score, range 0–104) was administered to each patient, considering Napp's cutoffs for claustrophobic events prediction (men, 4 points; women, 15 points). After MRI, the examination success rate (i.e., completion of MRI with sufficient image quality for diagnostic purposes) was recorded and patients filled a 5-item satisfaction questionnaire (Satisfaction-score, range: 0–25). Two experienced radiologists independently rated image quality with a Likert scale (0=non-diagnostic; 1=poor; 2=fair; 3=good; 4=excellent), inter-rater reliability being assessed with linear-weighted Cohen's κ. Spearman's ρ was used to evaluate correlations between image quality, Claustrophobia-score, and Satisfaction-score.

Results: All 47 enrolled patients undergoing MRI under medical hypnosis (30/47 females, median age 58 years, IQR 50–64) had a Claustrophobia-score above their sex-specific cutoff (median 65, IQR 48–82). The examination success rate was 100%, with 34/47 patients (72%) reporting the highest Satisfaction-score (overall median 25, IQR 24–25). No examination had an image quality rate <2 according to either reader (median 4, IQR 3–4 for both readers), with substantial overall reliability (κ=0.77; 95% CI 0.63–0.91) and 30/47 examinations (64%) rated 4 by both readers. No significant correlation was found between image quality and Claustrophobia-score (ρ=0.09, p=0.532) or Satisfaction-score (ρ=-0.03, p=0.823).

Conclusion: Medical hypnosis allows claustrophobic patients to successfully undergo MRI. Image quality was rated "excellent" in 64% examinations, with generally high patient satisfaction.

DTI in the corticospinal tract in the cervical spinal cord of patients with neurodegenerative diseases involving upper and lower motor neurons

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Purpose: Assessment of diffusion tensor imaging (DTI) in the corticospinal tract (CST) in cervical spinal cord (SC) of controls and patients with neurodegenerative diseases involving upper motor neurons UMN (hereditary spinal paralysis HSP, primary lateral sclerosis PLS), both UMN and lower motor neurons LMN (amyotrophic lateral sclerosis ALS), and primarily LMN (spinal muscular atrophy SMA, post-polio syndrome PPS).

Methods and Materials: Healthy controls (n=13, age 25-76 y), patients with SMA (n=13, 19-58y), PPS (n=2; 63,72 y), HSP (n=2; 34,52y), PLS (n=2; 50, 52y) and ALS (n=7, 40-83 y) were recruited. The study was approved by Ethikkomission Nordwestschweiz. DTI data were acquired at 3T using a research reduced field-of-view single-shot spin echo 2D EPI sequence: TE=75 ms, TR=760 ms, 64 diffusion sampling directions, b-value 800 s/mm², in-plane resolution 0.73 mm, acquisition time 4-5 min, pulse-triggered, 5 slices (4 mm thick) independently positioned perpendicular to the SC on disc levels C2C3 to C6C7. DTI images were calculated with DSI studio (dsi-studio.labsolver.org). Processing of the maps was done fully-automatically using SCT (spinalcordtoolbox.com): The PAM50 template was coregistered and mean values were derived for fractional anisotropy (FA), mean diffusivity (MD), radial and axial diffusivity (RD, AD) in the CST in white matter over the 5 slices.

Results:

	group 1 (HSP, PLS, ALS)	group 2 (SMA, PPS)	controls	p group 1 vs.control	p group 2 vs.control
FA	0.61 (0.58 0.63)	0.64 (0.60 0.68)	0.67 (0.65 0.72)	0.002*	0.153
MD [10-3 mm²/s]	0.99 (0.96 1.03)	1.04 (0.96 1.07)	1.00 (0.97 1.05)	0.817	0.519
RD [10-3 mm²/s]	0.59 (0.58 0.66)	0.58 (0.51 0.67)	0.55 (0.47 0.58)	0.024	0.097
AD [10-3 mm²/s]	1.78 (1.71 1.92)	1.90 (1.86 1.93)	1.95 (1.93 1.98)	0.001*	0.027

Demographics of the study population. Pathologies listed by major subgroups. Data in parenthesis are percentages (SD = standard deviation).

There was no significant difference between patients with LMN diseases and controls. FA and AD were significantly different between patients with diseases involving UMN and controls.

Conclusion: UMN degeneration leads to axonal degeneration and loss in CST in SC white matter, whereas LMN degeneration occurs in SC grey matter. This explains that significant differences in CST in cervical SC white matter were seen in FA and AD in UMN but not in LMN diseases.

Golden-Angle Radial Sparse Parallel DCE-PWI and DSC-PWI to differentiate true Progression from Pseudoprogression in Glioblastoma patients after first line therapy

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Purpose: Perform a diagnostic accuracy analysis of combined T1w and T2* perfusion to distinguish progressive disease (PD) from pseudoprogression (PsP) in glioblastoma patients after first line therapy.

Methods and Materials: Retrospective study of patients with glioblastoma between 01/2019-12/2021 at the University Hospital of Basel, with suspicion of PD within/after 12 weeks following tumor resection and combined radiochemotherapy (RCT) who received Grasp DCE-PWI (dynamic contrast-enhanced perfusion weighted imaging with golden angle radial sparse parallel technique) and DSC-PWI (dynamic susceptibility weighted PWI).

All MRIs were performed at 3T (Magnetom Skyra, Siemens Healthineers, Erlangen, Germany) using a 20-channel head-neck coils. Precontrast : T1W MPRAGE, DWI, SWI and post-contrast: DCE/Grasp-PWI and DSC-PWI with split bolus technique, T2 TSE, FLAIR, T1 vibe. The study was approved by the Ethics Committee EKNZ (BASEC-Nr. 2022-00913).

Results: We performed a longitudinal analysis of 14 patients (86 MRIs, 27 perfusion studies) and assigned them to two groups: progressors (n= 8) versus pseudoprogressors (n= 6).

A diagnostic accuracy analysis of the perfusion parameters at two timepoints: within 12w post-RCT (FU1) and at Baseline (12w after RCT) was done to distinguish PD from PsP.

At the FU1, the rCBV (relative cerebral blood volume) threshold 1.75, showed the highest accuracy 0.429 [0.129, 0.775] followed by Vp (plasma volume fraction) threshold 0.15; accuracy 0.286 [0.053, 0.659]. At Baseline both parameters showed a higher accuracy, 0.8 [0.444, 0.963] for rCBV (threshold 1.29) and 0.8 [0.444, 0.963] for Vp (threshold 0.05).

The type of permeability curve and the peak enhancement, signal enhancement ratio at both time points were also analyzed.

Conclusion: Our preliminary results show that rCBV and Vp values and their longtudinal dynamic between the FU1 (within 12w after RCT) and at Baseline (12w after RCT) together with the semiquantitative analysis of permeability curve could accurate differentiate PD from PsP.

Emergency intracranial stenting for the treatment of an acute ischemic stroke due to a large vessel occlusion refractory to traditional mechanical thrombectomy

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Purpose: Acute ischemic stroke caused by a large vessel occlusion (LVO) due to underlying intracranial atherosclerotic disease (ICAD) is an important clinical problem as it is often refractory to stent-retriever based mechanical thrombectomy (MT) and associated with worse outcomes. In this study we report our initial experience with emergency intracranial stenting of patients with an LVO due to underlying ICAD.

Methods and Materials: We retrospectively screened all patients undergoing MT in the year 2022 (date of screening 25. November 2022) at our center. All patients with an intracranial vessel occlusion refractory to stent-retriever based MT due to ICAD were included in our study. Primary endpoints were final reperfusion results (measured with the mTICI score). Secondary endpoints were the modified Rankin Scale (mRS) at discharge,in-hospital mortality, and complications during the procedure.

Results: Six patients (5 women, median age 66.5 years [Range 53 – 89]) were eligible for our study. Median NIHSS at admission was 5 [3-9] and the occlusion locations were M1 segment of the middle cerebral artery (3), distal internal carotid artery (1), P1 segment of the posterior cerebral artery (1) and the V4 segment of the vertebral artery (1). Patients underwent 3 to 6 (median 4) unsuccessful revascularization attempts prior to intracranial stenting. Stenting resulted in successful reperfusion (mTICI ≥ 2b) in all patients and five patients (83.3%) achieved perfect or near perfect reperfusion (mTICI ≥ 2c). At discharge three patients had an mRS of 1, two patients of 2 and one patient died within the hospital. No procedural complications were noted during the procedure.

Conclusion: Based on our initial experience emergency intracranial stenting for the treatment of ICAD related LVO seems to be a safe and effective procedure. The further evaluation of this treatment approach in large randomized controlled trials is warranted.

Endovascular Treatment of Intracranial Aneurysms with the WEB Device: The Lausanne Experience

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Purpose: The Woven EndoBridge (WEB) is a unique device that both fills the intracranial aneurysm and provide flowdiversion properties in a single implant. The objective of this study is to report our experience with the WEB device.

Methods and Materials: We performed a retrospective study of all ruptured and unruptured aneurysms that were treated or intended to treat with a WEB device (WEB SL or WER SLS) between April 2017 and November 2022. Outcome measures included the feasibility of the implantation, the angiographic outcome, procedural complications and the clinical outcome.

Results: One-hundred-five aneurysms in 99 patients, including 29 ruptured aneurysms, underwent treatment with the WEB device. The median age of patients was 58 years (range 12 - 86); 31/99 (31%) were men. The mean aneurysm neck was 3.5±1.2mm (range 1.7 – 9.4), the mean aneurysm height was 5.6±2.0mm (range 2.5 – 12.5) and the mean aneurysm width was 5.2±1.7mm (range 2.5 – 10.8). The device could be deployed in all patients and was implanted in 100/105 (95%) cases. We changed the size of the WEB device in 13/100 (13%) cases. Procedural related complications occurred in 7/105 (7%), comprising 3 thromboembolic events, 2 aneurysms ruptures, 1 rebleeding from a cerebral hematoma and 1 femoral artery bleeding. None of these had clinical sequelae. MRA follow-up was available for 75/100 (75%) aneurysms treated by WEB device, median follow-up was 282 days (IQR: 378). A favorable occlusion (Raymond – Roy 1 or 2) at follow-up was achieved in 68/75 (91%) aneurysms, 3/75 (4%) aneurysms were retreated.

Conclusion: The treatment of intracranial aneurysms using WEB device proved to be feasible, effective and safe.

However this new device requires a learning curve to master the deployment technique and to choose the appropriate size. Prospective controlled studies comparing WEB device to traditional endovascular techniques (balloon or stent-assisted coiling) should be encouraged.

Diagnostic performance in 3D MR neurography using a deep-learning based reconstruction algorithm

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Purpose: To assess a deep learning-based reconstruction method in 3D MR neurography for clinical evaluation of the brachial and lumbosacral plexus.

Methods and Materials: Under IRB approval, patients who underwent routine MR neurography of the brachial and lumbosacral plexus for clinically suspected neuropathy between January and September 2022 were retrospectively included. All patients were scanned on the same 1.5 Tesla MRI System. Bilateral 3D T2-weighted short tau inversion recovery fast spin echo with variable flip angles sequences were obtained as part of the standard protocol. In addition to the conventional reconstruction, the raw k-space data was reconstructed offline with a vendor-supplied prototype of a deep convolutional (DL) neural network.

Quantitative comparison was performed by measuring the signal-to-noise ratio (SNR) and contrast-to-noise ratios (CNR) between nerve, muscle and fat. Additionally two readers blinded to reconstruction status subjectively scored image quality and diagnostic confidence on a 4-point scale (0 to 3, poor – perfect), assessing nerve branches, muscles, fat suppression, artifacts and pathology.

For comparison of quantitive analysis paired sample Student's t-test, for visual scoring results nonparametric paired sample Wilcoxon signed-rank test was performed.

Results: 35 exams (18 brachial and 17 lumbosacral plexus) were retrospectively evaluated in 34 patients (mean age: 49 ± 12 years, 15 female). The DL reconstruction achieved significantly higher SNR and CNR than the standard method (p<0.05). Image quality and diagnostic quality were scored significantly higher with DL across all categories in the brachial and lumbosacral plexus by one reader (p<0.05). Result analysis from the second reader is yet to be finalized, corresponding results including interreader agreement will follow.

Conclusion: Our results suggest that DL reconstructed 3D MR neurography can improve image quality compared to the standard reconstruction, resulting in increased diagnostic confidence.

Proposed DRLs for Mammography in Switzerland

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Purpose: The aim of this study is to propose Diagnostic Reference Levels (DRLs) values for Mammography in Switzerland.

Methods and Materials: The data was obtained by means of a survey. A total of 31 centres including 5 University hospitals, several cantonal hospitals, and large private clinics, covering all linguistic regions of Switzerland participated in the data collection. The data gathered contained all the necessary technical information: manufacturer and model of the device, mean glandular dose (MGD), etc. The data collected was considered to be representative of the practice in Switzerland.

Results: Information was received from 36 mammography units (6 different manufacturers represented) and 24762 acquisitions. Those not having their mammography unit connected to a DMS weren't keen to participate. The data collected was sorted into the following categories: 2D projection or 3D digital breast tomosynthesis (DBT) examination, craniocaudal (CC) or mediolateral oblique (MLO) projection, and 8 different categories of compressed breast thickness (CBT) ranging from 20mm to 100mm in 10mm width intervals. The analysis showed that the data obtained reflects of the practice in Switzerland, and the most frequently used units are represented in this study. The main results revealed that the MGD is larger for 3D than for 2D acquisitions for the same CBT. When the CBT increased from 20mm to 100mm, the 75th percentile of the MGD values obtained increased from 0.81mGy to 2.96mGy for 2D examinations, and from 1.22mGy to 4.04mGy for 3D examinations, for both projections (CC/MLO). The results obtained were compared with the DRLs values of several other countries and are in agreement.

Conclusion: Swiss diagnostic reference values (DRLs) can be proposed according to the examination type (2D/3D), projection (CC/MLO) and CBT. The proposed values compare well with those obtained in the literature that have been performed using the same methodology.

Breast-CT and conventional mammography: dose comparison with phantoms

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Purpose: Dedicated spiral breast-CT systems with photon counting detectors have been developed, with the aim to significantly increase the amount of information provided in the images. One potential application is screening for breast cancer, which is the worldwide leading cause of cancer-related death for women.

However, before breast-CT systems can be included as part of screening programs, concerns about dose exposure (which is usually higher in CT systems) must be addressed. The objective of this work was to investigate and compare the actual breast dose for a mammography device and a spiral breast-CT, depending on different breast size and density.

Methods and Materials: This work used 3D-printed phantoms of three different sizes (247, 640 and 1085 cm3) filled with four mixtures simulating different breast densities. The phantoms were scanned on both machines with standard protocols used in the clinical routine and the surface dose was measured by means of MOSFET dosimeters.

In addition, a Monte Carlo simulation was performed to validate the mammography measurements. The values for the surface dose and the calculated average absorbed dose were compared across the two modalities for the corresponding phantom sizes and densities.

Results: The measured surface dose and the calculated average absorbed dose showed similar results in the comparison between the mammography and the breast-CT measurements, displaying a higher dependence of the dose values on the phantom size and density in the mammography case. In terms of absolute dose values, the breast-CT scan resulted in some cases in similar or lower dose compared to conventional mammography, particularly in case of small phantoms or high glandularity.

Conclusion: The dose values for a breast-CT scan can be close to those of a conventional mammography scan, depending on breast size and glandularity.

Air KERMA is not a risk estimator for deterministic effects in the skin due to interventional radiology procedures

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Purpose: Air KERMA (Kar) is used routinely to predict the risk associated to the apparition of deterministic effects in the skin of patients treated in interventional radiology procedures. This is based on the fact that Kar is always greater than the peak skin dose (PSD) for optimized procedures and modelized patients. The use of Kar as real time risk estimator in a clinical trial for interventional cardiology is evaluated.

Methods and Materials: The correlation of PSD and Kar for 75 interventional procedures is evaluated. The PSD is measured using Gafchromic films. The software DOSITRACE (DACS) as predictor of the PSD is compared to real measurements using Gafchromic films.

Results: We found no correlation (p>0.05) of Kar with PSD and that Kar cannot predict the risk band for deterministic effects. We found that Kar overestimates the risk for patients with BMI<25, and underestimates the risk for patients with BMI>40. We found a strong correlation (p<0.05) between the results of PSD calculated by DOSITRACE and those measured by Gafchromic films.

Conclusion: PSD, either measured or calculated, shall be utilized to estimate the risks of deterministic effects instead of Kar. Due to high cost of Gafchromic films, a software solution like DOSITRACE is recommendable to be used to estimate the PSD.

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Evaluation of dose and image quality in Inner ear imaging: Comparison between computed tomography and 3D rotational angiographic acquisitions

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Purpose: An intercomparison was made to evaluate the relationship between radiation dose and image quality of two different diagnostic modalities carried out on inner ear diagnostic studies, both simulated on two different phantoms, made by a multi-detector computed tomography (MDCT) scanner with respect to the same examinations carried out with an interventional angiography system, which can perform 3D rotational acquisitions (3DRA) reconstructed with CT-like advanced techniques.

Methods and Materials: All radiological images were acquired both using a 256-slice MDCT scanner and a biplane interventional angiography system integrated with 3DRA. Image quality for radiological systems was evaluated both using a CT Catphan phantom and a head anthropomorphic phantom. Dosimetric measurements were also performed using a head-CTDI phantom and a pencil-type CT chamber connected with a calibrated electrometer. Dosimetry evaluation were done taking into account CTDI, DLP, DAP and effective dose calculated, for both MDCT and 3DRA acquisitions, using two different Monte Carlo systems to convert dose parameters to effective dose. Image quality was assessed, on phantom images, with an interventional radiologist evaluating high contrast spatial resolution, image noise and details detectability.

Results: Effective doses calculated with Monte Carlo systems, for both MDCT and 3DRA image acquisitions, are comparable in terms of numerical absolute values. The measures, carried out with the support of a penciltype CT chamber, provide a slightly higher value for the images acquired using the interventional angiography system compared to the MDCT acquisitions. 3DRA images showed a higher general image quality level.

Conclusion: Evaluations of image quality, for both the CT Catphan phantom and head anthropomorphic phantom, are in favour of the 3DRA. The dosimetric comparisons show a substantial equivalence between the two types of imaging modalities.

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BackWards – Where the Brain Processes Sensory Information from the Back

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Purpose: Although chronic low back pain (CLBP) is one of the most common health conditions world-wide, surprisingly little is known about the neural representations of sensory information from the human back. In particular, there is no fine-grained cortical mapping of the sensory afferents of the young and healthy back. Yet, such a baseline characterization, reflecting the supraspinal state before any pain-related changes have set in, seems crucial to understand the trajectory and clinical relevance of neuronal reorganization processes which may occur during development and maintenance of CLBP.

Methods and Materials: 41 healthy and pain-free adults (25 women) below 40 underwent functional magnetic resonance imaging while vibrotactile stimuli were randomly applied bilaterally across nine segmental levels along the back's thoracolumbar axis using frequencies of 20 and 80Hz. A representational similarity analysis was performed using a whole-brain searchlight approach in combination with explanatory models to investigate the back's cortical representations. A random model was used as a control. Significant clusters of voxels were identified with permutation based (N=5000) threshold-free cluster enhancement. The study was approved by the Ethics Committee Zurich and all participants gave written informed consent.

Results: A segmental model, reflecting the spatial proximity of neighbouring segments, revealed significant clusters across sensorimotor cortices compared to a random model for both frequencies with peak z scores in medial parts of the right primary somatosensory cortex (80Hz: peak z = 2.47; 20Hz: z = 1.36; $p < 0.05$).

Conclusion: We present the first detailed cortical map of paraspinal afferents across the thoracolumbar axis. The current findings constitute a basis to further explore cortical reorganization and its potential pathological meaning in CLBP patients.

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Operator dose evaluation using the RaySafe i3 live dosimetry system in interventional radiology

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Purpose: Operators working in the interventional radiology suite are exposed to elevated levels of ionizing radiation. A combination of structural means for radiation protection, appropriate personal shielding The RaySafe i3 live dosimetry system was used for the analysis of the application and usefulness of radiation protection measures during fluoroscopy guided interventions at different institutions with different teams.

Methods and Materials: Operators and assisting personal in the fluoroscopy suites were equipped with a total of 4 active dosimeters from the RaySafe i3 live dosimetry system. Additional dosimeters were place on the patient side and the operator side of the ceiling mounted radiation protection shield for reference purposes. All dosimeters were synchronised prior to the start of the interventions.

The interventions were filmed in time lapse using a GoPro Hero 4 video camera which allowed the subsequent synchronisation of the film and the dosimeter dose rate data for further analysis.

Results: Cumulated operator doses varied widely in correlation with patient dose as well as position of the considered person.

The ratio of operator dose to patient dose could be estimated to be between less than 0.1 µSv/Gycm^2 for assisting personal standing at a greater distance and up to 20 µSv/Gycm^2 for the reference dosimeter on the patient side of ceiling mounted lead shield positioned close to the patient.

The effectiveness of the ceiling mounted leaded shield could be estimated to be up to over 90% when used correctly. Incorrect use of the leaded shield diminished this protection considerably.

Conclusion: The RaySafe i3 live dosimetry system combined with video material provides an adequate basis for the analysis of the usefulness of the provided means for radiation protection. It also allows for retrospective analysis of personal behaviour and discussion of difficult situations in means of radiation protection.

Awareness can be raised by discussing the acquired material with the involved persons.

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Monitoring of Medical Population Dose in Switzerland – How to move forward

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Purpose: Imaging procedures are indispensable for diagnostics and patient treatment, but they also involve health risks due to the use of ionising radiation. Therefore, the FOPH monitors the radiation exposure of the Swiss population. The frequency of diagnostic examinations performed is recorded and the mean effective dose is estimated. This monitoring helps to recognize emerging changes and trends at an early stage. Due to the digitalisation in medicine, the data required for the monitoring is now partly available in electronic form. This work demonstrates the feasibility of future automation.

Methods and Materials: Possible data sources for the collection of the frequency of the different modalities are identified, their coverage is reported, automated access to the data is demonstrated and the connection to the previous surveys assured. The results are used to propose an update on the CT population dose.

Results: Relevant data sources are available that allow to estimate the frequencies of the different examinations. Modalities used and anatomical regions examined can be derived from billing or classification codes: TARMED for outpatients, Swiss surgical classification (CHOP) for inpatients.

Retrospective calculation of the frequencies up to and including 2013 allow the linkage to the previous monitoring. Initial estimations carried out for selected modalities show comparable trends.

Conclusion: The periodic survey of medical radiation frequencies in Switzerland is feasible for some modalities. A major advantage of this method is the use of existing data sources, which will enable publishing results at shorter intervals. The data sources allow for evaluations by canton or large region, age group and gender.

Furthermore, analyses according to service provider characteristics, such as a breakdown by practices and hospitals, are possible.

Certain limitations result from the nature of the data used. Only billed activity examinations are recorded. They do not necessarily correspond to the examinations actually carried out.

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Implementation of a Quality Assurance Program for X-Ray Protective Apparel

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Purpose: The Swiss Radiation Protection Ordinance requires annual quality assurance (QA) for protective apparel of personnel working with radiological equipment, as damage of the inner protective layer may lead to unrecognized exposures. This study reports on the 2022 QA in our hospital.

Methods and Materials: In total 631 garments (vests, skirts, aprons) and 224 thyroid collars from 15 departments were assessed over the annual period, comprising visual, tactile and radiographic inspection. Radiographic assessment was performed by means of CT, using a localizer radiograph with 35 mA, 120 kVp and scan length up to 1024 mm. Images were sent to PACS and assigned by a qualified medical physicist into three categories: green = no defects, yellow = non-critical defects (for garments holes $\emptyset$ <29 mm, tear <46 mm in non-critical or overlapping areas, $\emptyset$ <4.3mm, tear <7mm over critical organs; for thyroid collars $\emptyset$ <3.8mm and tear <5.9mm [1]), red = severe defects detected.

Results: Protective apparel was generally in good condition and critical defects were detected in only 1.9% of the garments and in 2.2% of the thyroid collars. These "red" marked items were immediately disposed. Items assigned to the yellow category (3.8% garments, 3.6% collars) remained in use with a new evaluation recommended after 6 months. Interestingly, two design issues were incidentally uncovered in the process: Too wide armpits and small frontal overlap. While the latter might not represent a design issue per se as long as the overlap is not necessary for correct lead equivalent, a big overlap contributes unnecessary weight. It also became apparent that in two departments much fewer thyroid collars (0.2 per vest+skirt set) are available, emphasizing the need for proper inventory and allocation of protective apparel.

Conclusion: The implemented QA program ensures high quality standard of the protective apparel and compliance with the legal requirements. Improper design choices were depicted and the importance of an inventory was emphasized.

F-18-FDG imaging with long axial field-of-view Biograph Quadra Vision PET/CT in patients with high blood glucose – a matched pair analysis

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Purpose: Interpreting oncologic F-18-FDG PET/CT can be difficult in patients with high blood glucose (hBG), especially when tumour uptake is low and lesion conspicuity is limited. Aim of this study was to analyse if long axial field-of-view (LAFOV) PET/CT is of advantage in patients with hBG by improving image quality.

Methods and Materials: In this retrospective matched pair analysis, 62 oncologic patients examined on the Biograph Quadra Vision PET/CT (FOV 106cm) were included. hBG (12.5±1.2mmol/l) were compared to normal BG patients (nBG) (6.1±0.9mmol/l). Images were reconstructed in 1,2,4,6min acquisition time (AT) in ultra-high sensitivity mode (UHS) and in 1,2min AT in high sensitivity mode (HS) as simulated standard axial FOV (sSA-FOV). Tumour SNR (tSNR) and tumour to background ratio (TBR) were measured using tumour SUV_{peak} and liver SUV_{mean}/SD. As interpretation is dependent both on TBR and SNR, an image quality (IQ) criterion was defined by the product of tSNR and TBR. Additionally, SUV_{max} in muscles and brain were measured.

Statistical analysis was performed using Students' T-Test.

Results: tSNR increased with increasing AT without significant differences in both cohorts (hBG: 28±10.6; nBG: 37.06±13.51, p=0.26). TBR in hBG was significantly lower (2.88±0.03; 3.61±0.04, p<0.001), resulting in significantly higher IQ in nBG. However, nBG sSAFOV was comparable to hBG UHS 4min AT (HS 2min: 99.30 vs. UHS 4min: 105.65, p=0.05) and 6min AT was revealed significantly higher IQ (HS 2min: 99.30 vs. UHS 6min: 130.42, p=0.04). SUV_{max} of brain and muscle were significantly higher in hBG.

Conclusion: As expected, we found generally higher uptake in brain/liver/muscle and reduced tumour uptake in hBG patients. However, the better count statistics of the LAFOV system resulted in similar image quality to sSAFOV acquisitions in nBG patients. Reducing background noise with LAFOV PET/CT might therefore compensate to some degree the increased background uptake in cases of hBG and be helpful in reading those scans.

xSPECT-based myocardial perfusion scintigraphy: feasibility of myocardial uptake quantitation in patients with suspected coronary artery disease – a pilot study

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Purpose: Myocardial perfusion SPECT (MPS) is generally analyzed for the presence of relative regional perfusion defects. Absolute myocardial blood flow (MBF) quantification to assess for balanced ischemia and microvascular dysfunction is challenging with SPECT/CT. An independent, standardized, and reliable parameter able to quantify perfusion defects in clinical practice is highly warranted. A quantitation of myocardial uptake (MU) at the "steady state" may fit this need. We performed a pilot study in phantoms and humans.

Methods and Materials: MPS imaging was acquired with a quantitatively calibrated Symbia Intevo 16 (Siemens Healthineers) using a prototype of xSPECT Cardiac (xSc). xSc employs retrospective gating, automated motion correction, and data driven respiratory motion correction and yields voxelized uptake in Bq/ ml. Phantom-studies with simulated ECG-gating assessed consistency of quantified MU. Initial human studies included 15 patients (10 males, age 50-84yrs). All underwent on the same day a stress/rest 82Rb-PET/ CT, Ca-score CT and Stress 99mTc-Sestamibi quantitative MPS. A quantitative rest-MPS was performed on the following day. Quantified MU (Bq/ml, SUVmax and SUVpeak) was calculated (40% threshold segmentation). MPS-based coronary reserve (MPS-CR) was defined as stress-SUVmax/rest-SUVmax. Quantified Sestamibi MU was compared to PET-derived global MBF.

Results: MPS-Stress-SUV had a good correlation to PET-Stress MBF (r=0.73), MPS-CR had a fair correlation to PET-coronary reserve (r=0.67)

	Patients without CAD	Patients with CAD	p
n.	13	2	
PET-Stress-EF (%)	78.0±7.9	32.5±16.5	<0.01
MPS-Stress-MBF (ml/g/min)	3.4±0.6	1.4±0.7	<0.01
PET- Coronary Reserve	2.9±0.7	1.5±0.7	<0.01
MPS-Stress-SUVmax	8.2±1.5	7.2±0.9	0.56
MPS-CR	1.21±0.1	0.85±0.04	<0.01

Patients with unremarkable PET had both higher stress MBF and MPS-CR compared to the patient with 3-vessel disease. Stress-SUVmax was not different.

Conclusion: Absolute quantitation of MU is feasible using the defined protocol and xSPECT Cardiac prototype. MPS-CR may be able to differentiate between patients with and without CAD. Further larger studies are needed to show whether this improves diagnostic accuracy over standard MPS.

Prognostic significance of ^{18}F-PSMA PET/CT quantitative parameters in mCRPC patients before 177Lu-PSMA therapy

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Purpose: Lutetium-177 prostate-specifc membrane antigen -617 (Lu-PSMA) therapy is a promising targeted treatment for metastatic castration resistant prostate cancer (mCRPC) patients. ^{18}F-PSMA-1007 PET/CT (PSMA-PET) performed prior to therapy could provide additional information to predict patients outcome. The aim of this study was to evaluate whether quantitative parameters are able to predict early biochemical failure (EBF) during treatment and overall survival (OS).

Methods and Materials: Patients with mCRPC who performed PSMA-PET before Lu-PSMA therapy were retrospectively included in the study. All PSMA avid metastases were semi-automatically segmented, using a threshold of 40% of SUVmax. The reference lesion with higher SUVmax value (RL-SUVmax), total PSMA tumor volume (tPSMATV) and TLQ (quotients of tumor volume and SUVmean summed over all metastases) were collected. OS and biochemical response were available for all patients. Sum rank test and receiver operating characteristics curves were performed for statistical analysis.

Results: Thirteen patients were included in the analysis and a total of 371 lesions were segmented on PSMA PET. In our population 6/13 patients died and 10/13 had biochemical failure during Lu-PSMA therapy. Among semiquantitative parameters, RL-SUVmax was statistically diferent in patients with EBF compared to patients without EBF during Lu-PSMA treatment (median 33.6 [range 20-184] vs 74.5 [47-94] ; p-value= 0.05). At ROC analysis, RL-SUVmax correctly classifying patients with EBF with a sensitivity and specifcity of 80% and 100% respectively using a cut-of value ≤ 39.7 (AUC 0.867, 95% CI 0.569 -0.987, p=0,0006). RLSUVmax, TLQ and tPSMA-TV were not statistically signifcant prognosticator of OS, despite a trend of data.

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.

Impact of myocardial inflammation on quantitative myocardial perfusion at long-term follow-up – A descriptive hybrid PET/MR myocarditis study

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Purpose: Whether myocardial inflammation causes long-term sequelae potentially affecting myocardial blood flow (MBF) remains unknown. We aimed to assess the effect of myocardial inflammation on quantitative MBF parameters, as assessed by 13N-ammonia positron emission tomography myocardial perfusion imaging (PET-MPI) late after myocarditis.

Methods and Materials: Fifty patients with a history of myocarditis diagnosed at least 6 months ago underwent cardiac magnetic resonance (CMR) imaging at diagnosis and hybrid PET/MR imaging at follow-up. Segmental MBF, myocardial flow reserve (MFR), and 13N-ammonia washout were obtained from PET, and segments with reduced 13N-ammonia retention, resembling scar, were recorded. Based on CMR, segments were classified as remote (n=469), healed (inflammation at baseline but no late gadolinium enhancement [LGE] at follow-up, n=118), and scarred (LGE at follow-up, n=72). Additionally, apparently healed segments but with scar at PET were classified as PET discordant (n=18).

Results: Compared to remote segments, healed segments showed higher stress MBF (2.71mL*min-1*g-1 [IQR 2.18-3.08] vs. 2.20 mL*min-1*g-1 [1.75-2.68], p<0.0001), MFR (3.78 [2.83-4.79] vs. 3.36 [2.60-4.03], p<0.0001) and washout (rest 0.24/min [0.18-0.31] and stress 0.53/min [0.40-0.67] vs. 0.22/min [0.16-0.27] and 0.46/min [0.32-0.63], p=0.010 and p=0.021, respectively). While PET discordant segments did not differ from healed segments regarding MBF and MFR, washout was higher by ~30% (p<0.014). Finally, 10 (20%) patients were diagnosed by PET-MPI as presenting with myocardial scar but without corresponding LGE.

Conclusion: In patients with a history of myocarditis, quantitative measurements of myocardial perfusion as obtained from PET-MPI remain altered in areas initially affected by inflammation. In a minority of patients, increased washout, arguably induced by inflammation, translates into PET findings, namely areas with apparent scar but without a corresponding substrate on CMR.

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18F-FDG-PET/CT imaging on the Biograph Vision Quadra PET/CT in patients with suspected large vessel vasculitis: reference values and diagnostic performance.

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Purpose: 18F-FDG-PET/CT is an important diagnostic tool in suspected large vessel vasculitis (LVV). However, reference values and diagnostic performances are still unknown for PET-scanner with ultra large field of view.

Methods and Materials: Images of 16 Patients with suspected LVV were retrospectively evaluated. All underwent 18F-FDG PET/CT on Biograph Vision Quadra 60 minutes after injection of 3.5 MBq/Kg FDG. Semiquantitative parameters were calculated for supra-aortic vessels (temporal, carotid and subclavian arteries) and aortic/infra-aortic vessels (thoracic and abdominal aorta, external iliac and femoral arteries). Ratios to liver and bloodpool were also calculated.

Results: Six of 16 Patients (37.5%) had a diagnosis of LVV. Both for supra-aortic and infra-aortic vessels, SUVmax, Ratio SUVmax-to-liver and Ratio SUVpeak-to-liver were higher in patients with LVV. In patients with supraaortal LVV, SUVmax was 5.1±2.2 vs 2.8±0.7 (p=0.002), SUVmax-to-liver was 0.9±0.5 vs. 0.7±0.1 (p=0.02) and SUVpeak-to-liver was 0.9±0.3 vs 0.7±0.1 (p=0.02). In regard to aortic and infra-aortal vessels, SUVmax in patients with LVV was 5.8±2.9 vs 3.8±1.0 (p=0.03), SUVmax-to-liver was 1.3±0.4 vs 0.8±0.2 (p<0.001) and SUVpeak-to-liver was 1.01±0.2 vs 0.8±0.2, (p=0.006).

For supra-aortal LVV the best threshold values were 4.83 for SUVmax (AUC 0.79), 0.89 for SUVmax-to-liver (AUC 0.75) and 0.78 for SUVpeak-to-liver (AUC 0.75). For aortal/infra-aortal LVV threshold values were 4.06 for SUVmax (AUC 0.71), 1.07 for SUVmax-to-liver (AUC 1.00) and 0.85 for SUVpeak to liver (AUC 0.86).

Conclusion: Our results confirm the usefulness of FDG-PET/CT in the diagnostic workup of LVV. However, thresholds for semiquantitative values may differ from those reported in literature for different scanners. Hence, studies with larger samples are warranted to implement new reference values in clinical practice when using Biograph Vision Quadra PET/CT scanners.

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Quantitative ^{99m}Tc-DPD-SPECT in patients with suspected cardiac ATTR amyloidosis: diagnostic accuracy and predictive value

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Purpose: ^{99m}Tc-DPD SPECT/CT is a robust diagnostic tool in patients with suspected ATTR-related cardiac amyloidosis (CA) and previous studies showed a strong correlation between quantitative SPECT parameters and visual assessment scores. We now aimed to assess the diagnostic performance of quantitative parameters and their predictive value.

Methods and Materials: We retrospectively evaluated 137 patients with suspected CA. All underwent ^{99m}Tc-DPD SPECT/CT.

XSPECT-QUANT software was used to calculate SUVmax and SUVpeak for the whole myocardium. Tobone normalized values (nSUVmax and nSUVpeak, respectively) were also calculated. Diagnostic performance and threshold values were determined by means of ROC-curves analysis with calculation of area under curve (AUC). For the evaluation of the predictive value, all-cause death was set as endpoint. To that end, data were analyzed with logistic regression and Kaplan-Meier curves.

Results: Ninety-five patients (69.3 %) were diagnosed with CA. All quantitative values were higher in patients with CA compared to normal (see table).

	Without CA	With CA	p	Threshold	AUC
SUVmax	1.84 ± 0.78	12.81 ± 5.20	< 0.001	3.88	0.998
SUVpeak	1.67 ± 0.73	11.98 ± 4.90	< 0.001	3.60	0.998
nSUVmax	0.25 ± 0.12	2.20 ± 1.14	< 0.001	0.55	0.997
nSUVpeak	0.23 ± 0.12	2.15 ± 1.12	< 0.001	0.54	0.997

At follow-up 17 patients (12%) died after a median of 420 days. None of the quantitative parameters was
predictive of all-cause death.

Conclusion: Quantitative ^{99m}Tc-DPD SPECT/CT confirms its excellent diagnostic performance in suspected CA. Further studies should clarify a value of this method in the prediction of adverse cardiac events.

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Increased Ga-68-DOTATOC uptake in the uncinate pancreatic process in new digital PET/CT machine and potential association with clinical and histologic factors in NET patients.

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Purpose: Increased uptake of ^{68}Ga-labeled somatostatin analogues PET tracers in the uncinate pancreatic process (UP) has been reported and might be higher in new generation PET/CT machine. We assessed the uptake of UP in patients with neuroendocrine tumors (NET) undergoing latest-generation digital SiPM PET/CT. We investigated associations between UP uptake and various clinical, imaging and pathological factors.

Methods and Materials: NET patients were recruited from March 2019 to June 2022 in this retrospective, single-centre study. They underwent digital SiPM PET/CT 90min after injection of 2 MBq/kg of ^{68}Ga-DOTATOC. We measured SUV$_{max}$ in UP and patients with suspicious uptake were excluded. We used Mann-Whitney test to investigate UP uptake according to primary NET site (pancreas/other), patient gender (female/male) and tumor grade (grade 1-2 versus 3). We assessed the correlation between SUV$_{max}$ values in UP with Ki-67 and SUV$_{max}$/SUV$_{mean}$, TLA and MTV measured in the primary NET tumor.

Results: We recruited 112 patients and UP uptake was measured in 85 patients with average SUVmax of 19.8±9.8 higher than those in the literature [SUVmax 6.4 to 12.6]. There were no differences for SUVmax in UP according to the site of the primary NET (p=0.4/p=0.34) but there was higher uptake in patients with grade 1-2 NET (SUVmax 21±13.5 versus 11±6.8; p=0.046) and in female patients (SUVmax 21.4±17.9 versus 11.1±9.5; p=0.02). There were only significant associations between UP uptake and SUVmax and SUVmean in the primary tumor (ρ=0.32/0.31; p<0.03).

Conclusion: We confirmed the higher UP uptake in the latest-generation generation PET/CT. This is important to know to prevent unnecessary investigations in NET patients. Additionally, though the primary site of NET did not affect UP uptake, there were significant associations with tumor grade of the primary tumor as well as patients' gender suggesting that both physiological and pathological parameters affect its uptake.

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Pilot study to test the feasibility of IV injected Tc-99m-tilmanocept for imaging of M2-like tumor associated macrophages in metastatic melanoma

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Purpose: Despite the success of checkpoint inhibitor (CI) therapy in melanoma, many patients do not benefit from this treatment. Several attempts have been made to predict outcome to CI treatment, but many open questions remain and until today, no satisfactory, site-specific predictive markers are available. An important mechanism of resistance lies in the tumor microenvironment (TME), mainly mediated byimmuno-suppressive immune cells. In the TME, tumor associated macrophages (TAMs) seem of particular importance. Especially the alternatively activated M2 polarized phenotype (M2-like) is an established indicator of poor patients' outcome. CD206, also termed as MRC1, is an M2-like macrophage marker. We aim to present here a firstin-class human SPECT study to visualize CD206 positive M2-like tumor associated macrophages (TAM).

Methods and Materials: This prospective diagnostic open label, non-randomized, exploratory trial aims to visualize the local presence of CD206 positive M2-like TAMs by Tc-99m-tilmanocept-SPECT (Lymphoseek™) in melanoma patients scheduled for or under immunotherapy. All patients will undergo dynamic scintigraphic acquisition followed by a planar whole body acquisition and a quantitative SPECT/CT at 1 and 3 hours post-injection. Results of quantitative imaging at 3 hours are compared to clinically indicated biopsy results including the macrophage markers CD68/CD260, standard of care imaging and lesions specific outcome under continued immunotherapy.

Results: The study is currently onging. First results will be presented at the congress.

Conclusion: This trial aims to site-specifically visualize immune-suppressive M2-like macrophages in melanoma patients using CD206-targeted imaging. We strongly believe characterizing an immune-suppressive tumor microenvironment might play an important role in the future of anticancer immunotherapy.

Comparative *in vitro* and *in vivo* preclinical evaluation of three gallium-68 labeled radiotracers for fibroblast activation protein (FAP) targeting

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Purpose: Fibroblast activation protein (FAP) is key player in cancerogenesis by promoting tumor cell migration, invasion and angiogenesis. It is overexpressed in malignant tissue on activated fibroblasts on several kind of cancers while is less abundant in healthy tissue. Therefore, FAP-specific radiotracers may become a universal tool for in vivo tumor imaging and/or radionuclide-based therapy. Within the frame of the current study, we evaluated the *in vitro* and *in vivo* performance of three FAP radioligands assessing their potential to serve as diagnostic tools for tumors with a FAP-positive stroma.

Methods and Materials: The squaric acid-coupled FAP inhibitor, UAMC1110, in order to be labeled with gallium-68, was coupled to the chelators DOTA, DATA[5m]-3[t]Bu and DOTAGA, respectively. The precursors DOTA.SA.FAPi (**1**), DATA[5m].SA.FAPi (**2**) and DOTAGA.(SA.FAPi)$_2$ (**3**), labeled with gallium-68, were evaluated *in vitro* (lipophilicity, protein binding, saturation and internalization studies) and *in vivo* (biodistribution and PET studies) on U87MG xenografts.

Results: [68Ga]Ga-**1**, -**2** and -**3** were prepared in a radiochemical purity >95% and molar activities in the range of 15 GBq/μmol with a logD$_{octanol/PBS}$ of -3.4, -3.7 and -1.7, respectively. Human serum protein binding after 30 min of incubation was 9% for [68Ga]Ga-**1**, and -**2**, and 18% for [68Ga]Ga-**3**. In cell studies with cancer-associated fibroblasts, [68/nat]Ga-**1**, -**2** and -**3** exhibited high affinity with K$_d$ values of 0.41±0.03 nM, 0.92±0.23 nM and 1.15±0.26 nM, respectively. We determined an internalization rate of 93% of the total cell associated activity after 1h of incubation. Tumor uptake in biodistribution studies 1h p.i, was 7.2±0.5, 6.6±1.6 and 7.1±0.6 % IA/g for [68Ga]Ga-**1**, -**2** and -**3**, respectively. PET data was in line with the biodistribution data.

Conclusion: The developed squaric acid-based FAP inhibitors herein showed the potential to serve as a PET probes for tumor stroma imaging, verified by promising *in vitro* and *in vivo* data.

Exploring the human functional connectome using total-body [18F] FDG-PET imaging and the software framework ENHANCE-PET

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Purpose: Thanks to the recent introduction of total-body PET (TB-PET) systems with axial fields-of-view of up to 2m, synchronous quantitative imaging of multiple organs has become possible. We present a software framework to automatically explore human body homeostasis and disease-induced inter-organ metabolic perturbations using [18F]FDG TB-PET images.

Methods and Materials: To date, 15 healthy volunteers (26-78y, 53-112kg, 6M/9F) underwent TB-PET examinations on an uEXPLORER PET/CT system following an injection of 372±17 MBq of [18F]FDG. The ENHANCE software framework was built to explore connectivities between different organs. The framework has four components: a segmentation tool to segment 13 different organs from low-dose CT; an algorithm to perform motion correction using diffeomorphic registration; a module to analyse multi-organs metabolic patterns and identify group connectivity based on correlations; and a tool to create TB normative databases from healthy controls and identify voxel-specific aberrations in patients. A Fisher's Z-transformation was used on the derived data to create a group-averaged normative correlation network for both male/female volunteers.

Results: Following automated data analysis using ENHANCE-PET, our pilot data suggest differences in the nodal size of brain, heart, liver, bone, and lung between the male and female cohort when using graphic analysis methods. The differenes are indicative of differences of inter-organ connectivity between fe/male populations. In a network (chord) plot, the nodes indicate the organs, and the thickness of the curves indicate the strength of the correlation. The node length of an organ depicts its degree of connectivity to other organs.

Conclusion: TB-PET and adequate data processing can support the investigation of the inter-organ functional connectome of the human body. Our framework, ENHANCE, is applicable to PET data from any TB-PET system, and supports the investigation of inter-organ connectivities in an approach to perform whole-person research.

Multimodality imaging and professional practices in oncological imaging: PET-CT procedures from a management perspective.

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Purpose: In this management study, we tried to address the appropriation problematic of an hybrid imaging technology shared by 2 independent medical communities.

Methods and Materials: Between 1st January 2022 and 30th June 2022, using a qualitative methodology with an interpretative perspective, we conducted and recorded a series of 24 semi-structured interviews (average interview length: 70.2±17.7 minutes) among French healthcare professionals working in 6 different nuclear medicine (NM) departments. Informed consents of stakeholders were previously gathered. Data were collected and triangulated by 3 researchers. After integral transcription of data, coding and qualitative assisted data analysis (nVivo) were conducted.

Results: 22 NM physicians and 2 chief NM technologists were interviewed (m/f sex ratio: 1.4; 41.3±8.5 years old). 77.3% of professionals reported an initial training in radiology (6 months minimum) and 14.7±6.7 years of experience in NM.

Our survey demonstrates professional practice variations in terms of imaging protocols and medical interpretation. In one hand, due to an absence of national guidelines or consensus, injection of iodine contrast agents are not systematically performed in any clinical situations where an added value might be expected. Injection decision seems to be obviously emphasized by clinical context, but also by individual and collective random variables.

On the other hand, due to variations in terms of radiological expertise and/or knowledge from oncologist expectations, anatomical information (e.g relation to organs of interest) and measurements (e.g tumor volume) are not systematically provided in NM medical reports.

Conclusion: In France, a strict division of territories and medical competences between the 2 medical specialities of NM and radiology lead to inequalities in the multimodality approach of PET-CT. Our results support the adoption of an integrated expertise model between NM physicians and radiologists in multimodality imaging, for instance such as in Switzerland.

Radiolabeled Somatostatin Receptor Antagonist versus Agonist for Peptide Receptor Radionuclide Therapy – A Phase 0 Basket Study

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Purpose: Our aim was to compare the tumor 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 the same treatment resistant somatostatin receptor positive tumors. Here we present preliminary results.

Methods and Materials: In this retrospective, single-center, open label phase 0 study, 15 patients with metastatic neuroendocrine tumors (NET) of the lung/thymus, gastroenteropancreatic NET, paraganglioma and medullary thyroid cancer were included so far: 11 males and 4 females (mean age 61.3 years, age range from 40 to 82 years).

Patients received 5.1-7.4 GBq (standard activity) ^{177}Lu-DOTATOC followed by 2.7-4.8 GBq (2GBq/m^2 x body surface area) ^{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 tumor and organ doses (3D dosimetry using Olinda).

Results: The median (range) of the mean tumor and kidney doses of one treatment cycle were 11.7 (7.5-30.1) and 2.9 (1.1-3.4) Gy for ^{177}Lu-DOTA-JR11 and 4.8 (3.4-12.6) and 1.9 (0.9-1.9) Gy for ^{177}Lu-DOTATOC, respectively. There was one grade 3 adverse event (Lymphocytopenia) after therapy with ^{177}Lu-DOTATOC, and two grade 3 adverse events (Lymphocytopenia) after therapy with ^{177}Lu-DOTA-JR11, see table below. In all patients the reported adverse events resolved after a few weeks.

Adverse events

CTCAE v5.0	After one cycle 177Lu-DOTATOC	After one cycle 177Lu-DOTA-JR11
Grade 1	8	8
Grade 2	5	5
Grade 2	1	2

Conclusion: These preliminary ^{177}Lu-DOTA-JR11 results, administered with a 1.5-2.1 lower activity than ^{177}Lu-DOTATOC, show 2.2-2.4 times higher tumor doses with similar toxicity compared to ^{177}Lu-DOTATOC.

Early response monitoring with quantitated SPECT/CT predicts outcome of ^{177}Lu-PSMA therapy.

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Purpose: Tumor response assessment with quantitated SPECT/CT after two cycles ^{177}Lu-ITG-PSMA-1 therapy in patients with metastatic castration-resistant prostate cancer (mCRPC).

Methods and Materials: Single center, retrospective study analyzing collected data as part of a national cancer registry between 07.2020 – 04.2022 (EKNZ: 2021-01271). The patient cohort consisted of 79 mCRPC patients with at least two cycles (mean age: 74y, standard deviation: 8y, range: 57-91y).

Seven GBq ^{177}Lu-ITG-PSMA-1 was administered every 6 weeks. After the first and second cycle quantitated SPECT/CT (Symbia Intevo, Siemens) was acquired 48h after injection (5s/frame) and reconstructed using xQuant® (48i, 1s, 10 mm Gauss). Image analysis: The total tumor volumes (TTV) were semi-automatically delineated using a SUV threshold of 3 with MIMencore® (version 7.1.3, Medical Image Merge Software Inc.). ΔTTV and highest ΔSUVmax between cycle 1 to 2 were calculated and grouped into a) Δ ≤ 0 or b) Δ > 0 and correlated with PSA-progression free survival (PFS) and the overall survival (OS) using the Kaplan-Meier methodology (log-rank test). Statistical analysis was done using GraphPad Prism (version 9.4.1, GraphPad Software).

Results: ΔTTV ≤ 0 (n = 60) at cycle 2 was associated with a significant increase in OS (p value: 0.0061; Hazard Ratio (HR): 0.19, 95% Confidence Interval (CI): 0.06 – 0.63) and a borderline significant increase in PFS (p value: 0.0500; HR: 0.49, 95% CI: 0.23 - 1.0) compared to ΔTTV > 0 (n = 19). For the ΔTTV > 0 group, median OS was 6.4 months and the median PFS 4.2 months. For the ΔTTV ≤ 0 group, median OS could not be reached and median PFS was 9.2 months. A reduction of SUVmax was not correlated with longer OS (p value: 0.52) or PFS (p value: 0.61).

Conclusion: Decreasing TTV after the first 177Lu-PSMA I&T therapy is associated with a significant increase in OS and PFS.

PET-QA-Net: A Comprehensive Clinical Evaluation of Artificial Intelligence-based Artifact Detection and Disentanglement Towards Routine PET Image Quality Assurance

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Purpose: Different categories of PET image artifacts have been organized, including PET images (halo-artifact), the interface between PET and CT/MR images (mismatch, misregistration, and motion artifact in different regions), and CT/MRI artifacts propagated to PET images (e.g., metal, contrast agent, and truncation). PET image artifact jeopardizes the diagnostic and prognostic ability of PET image. It results in useless images, financial cost losses, excessive radiation dose, and the need to repeat image acquisition. Furthermore, some of these artifacts are inevitable and cannot be corrected by repeating image acquisition. In this study, we provided an artificial intelligence-based algorithm that could be potentially embedded in clinical routine or PET image artifact detection and disentanglement

Methods and Materials: The network was trained and evaluated using 1000 patients with artifact-free images and fine-tuned and evaluated on eight difference center datasets (384 patients). The developed model was quantitatively assessed using image metrics and 22 volumes of interest placed in different regional bodies to calculate SUV metrics. Two hundred cases of clinical images and PET-QA-NET images were analyzed blindly in terms of the presence of artifacts, diagnostic confidence, detection, and the number of lesions by two nuclear medicine physicians for different body regions.

Results: In different VOIs, The Mean Absolute Error MAE (SUV) of 0.13±0.04, 0.24±0.1, and 0.21±0.06 were reached for SUV_{mean}, SUV_{max}, and SUV_{peak}, respectively. Qualitative analysis by physicians showed a general trend of increased image quality, image confidence, and decreased image artifact in PET-QA-NET compared to CTbased algorithms. We reported different artifacts that were detected and corrected using the proposed framework.

Conclusion: We have built a highly effective and fast quality assurance tool that can be embedded routinely to detect and correct PET image artifacts in the clinical setting to improve PET image quality and quantification.

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Safety and efficacy of PSMA targeted radionuclide therapy with ^{177}Lu-ITG-PSMA-1 in metastatic castration resistant prostate cancer patients: Update on the prospective, multicentre, Swiss registry study

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

Methods and Materials: Prospective, multicenter register study (EKNZ 2021-01271) of mCRPC patients treated with ^{177}Lu-ITGPSMA-1. The primary endpoint is safety, assessed by biweekly laboratory parameters, adverse events (CTCAE v5.0) and a xerostomia questionnaire (XQ). Treatment efficacy is assessed by: best PSA decrease ≥50% from baseline (PSA_{50}), best imaging response (clinical assessment of CT, MRI, PSMA-PET/CT or PSMA-SPECT/CT), time to progression and overall survival. Descriptive statistics will be used to evaluate therapy safety and response. Multivariate analysis and Kaplan-Meier statistics will be used to evaluate timeto-outcome events and prognostic factors.

Results: So far 128 patients (age: 74±8, mean±SD) treated since 05/2020 until 11/2022 with at least 1 cycle (number of cycles, median [IQR]: 3 [2-5]) and 1 follow-up were analyzed. The activity per cycle (median [IQR]) was 7.1 [6.5-7.5] GBq. Treatment related ≥G3 anemia, leucopenia and thrombocytopenia were found in 19 (14.8%), 4 (3%) and 4 (3%) patients, respectively. Analysis of the XQ-score (0-80) in the first 75 patients showed an increase from 7±10 to 10±11 (mean±SD) between the first and the last cycle (p=0.009, paired ttest), while an increase ≥10 was observed in 16 patients (21%). PSA_{50} was achieved in 51/126 (40%) whereas any PSA decrease occurred in 85/126 (67%) patients. Partial imaging response (PR) was found in 47/89 patients (53%). PR occurred at cycle 2 in 68% (32/47), while only 6/47 (12%) responded after the 3rd cycle. The median time to progression and OS will be presented.

Conclusion: Our preliminary analysis shows that ^{177}Lu-ITG-PSMA-1 therapy is well tolerated in most mCRPC patients.

Anemia appears to be the most frequent treatment related toxicity. Treatment response, measured as any biochemical response, was recorded in 67% of patients.

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Bone health under [223Ra]Radium chloride treatment

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Purpose: [223Ra]Radium chloride is approved for the treatment of painful osseous metastases in prostate cancer. In 2018, the ERA223 trial found increased risks of fractures and premature deaths from [223Ra]RaCl$_2$ when combined with abiraterone and prednisolone. Ever since, we closely monitored serologic markers of bone metabolism in patients undergoing [223Ra]RaCl$_2$ treatment. In this case series we offer evidence that bone health is grossly unaffected by [223Ra]RaCl$_2$ and the adverse effects observed in ERA223 were likely due to the combination regimen used.

Methods and Materials: Available records were screened for patients who underwent at least two cylces of [223Ra]RaCl$_2$ treatment while the aforementioned policy was in effect. Levels of beta-Crosslaps (β-CTx), intact N-terminal procollagen type 1 (P1NP) and alkaline phosphatase activity (AP) were obtained from the laboratory database. Demographical information was extracted from patient files. Statistical analysis was performed in IBM SPSS Version 28.

Results: 40 patients met eligibility criteria, of which 18 patients had undergone six or more cycles. Median age at the start of treatment was 73.4 years. β-CTx levels did not change significantly under treatment (median +8 pg/ml, 95% CI -2.3 to 18.3), neither did P1NP (median -0.3 µg/l, 95% CI -5.9 to 5.3). AP activity significantly declined (median -27 U/l, 95% CI -34.7 to -19.3, p<0.0001). At the time of writing, 30 patients had expired at a median age of 74.5 years (median survival 296 days after the last cycle).

Conclusion: Markers of osteoblastic and osteolytic activity did not change under treatment with [223Ra]RaCl$_2$, while AP activity significantly declined. This suggests overall bone turnover is not affected by [223Ra]RaCl$_2$ and the excess of adverse events observed in ERA223 was due to the combination regimen, with prednisolone being a likely culprit. Lowering AP levels may reflect lessening osseous tumor burden. These results encourage efforts to broaden the use of [223Ra]RaCl$_2$ to other entities and diseases.

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Radiolabeled Somatostatin Receptor Antagonist versus Agonist for Peptide Receptor Radionuclide Therapy in Patients with Therapy-resistant Meningiomas – Phase 0 Part of the PROMENADE Study

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Purpose: Our aim was to compare the meningioma and organ absorbed doses of the new radiolabeled somatostatin receptor antagonist ^{177}Lu-DOTA-JR11 with the established radiolabeled somatostatin receptor agonist ^{177}Lu-DOTATOC in the same patients with meningiomas that are refractory to standard treatment.

Methods and Materials: In this prospective, single-center, open label phase 0 study (NCT04997317), 6 patients were included: 3 men and 3 women (mean age 63.5 years, age range from 40 to 83 years). Patients received 6.9-7.4 GBq (standard activity) ^{177}Lu-DOTATOC followed by 3.3-4.9 GBq (2 GBq/m^2 x body surface area) ^{177}Lu-DOTAJR11 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 Olinda).

Results: The median (range) of the mean meningioma and kidney absorbed doses of one treatment cycle was 11.1 (4.7-22.7) and 3.3 (1.6-5.9) Gy for ^{177}Lu-DOTA-JR11 and 3.4 (0.8-10.2) and 2.7 (1.3-5.3) Gy for ^{177}Lu-DOTATOC, respectively (*P*=0.03). According to the CTCAE v5.0 there were one grade 2 adverse event in two patients after therapy with ^{177}Lu-DOTATOC (lymphopenia) as well as two grade 2 and one grade 3 adverse events in three patients after therapy with ^{177}Lu-DOTA-JR11 (lymphopenia and neutropenia). In all patients, the reported adverse events resolved after a few weeks. No grade 4 adverse events were observed.

Conclusion: ^{177}Lu-DOTA-JR11 shows 2.2-5.7 times higher meningioma absorbed doses with similar toxicity compared to ^{177}Lu-DOTATOC despite 1.4-2.1 times lower injected activity. Therefore, larger studies with ^{177}Lu-DOTAJR11 are warranted in meningioma patients.

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Evaluation of ^{18}F-FDG lung uptake in pulmonary fibrosis with digital SiPM (dPET) and conventional PET/CT (cPET).

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Purpose: ^{18}F-FDG is a marker of pulmonary inflammation and active fibrotic processes. We aimed to evaluate ^{18}F-FDG PET/CT in fibrosis compared to physiological lung uptake using dPET and cPET.

Methods and Materials: Twenty-eight patients (12W/16M; aged 68±11y) referred for routine ^{18}F-FDG PET/CT work-up, were retrospectively included. Sixteen patients with known pulmonary fibrosis (7 dPET+ 9 cPET) were included in the fibrosis group and 12 patients matched for age in the control group (6 dPET+6 cPET/CT).

SUV_{max}+SUV_{mean} were measured fibrotic changes, posterobasal subpleural lower lobe parenchyma of the control group and in lung background for both groups. SUV+ratio SUV_{max}/background SUV_{mean} (rSUV) were compared between fibrosis vs. control groups, and between dPET vs. cPET.

Results: In total, 71 regions of fibrosis were analysed. Mean lung fibrosis SUV_{max} and SUV_{mean} (g/ml) were significantly higher than posterobasal normal uptake (2.2±0.4 and 1.4±0.4 versus 1.0±0.2 and 0.8±0.7, p<0.001 and p=0.008, respectively). rSUV was higher in fibrosis compared to the control group (5.6±2.5 versus 2.9±0.8, p=0.001), without significant difference for lung background SUV_{mean} (0.6±0.4 versus 0.4±0.1, p=0.088). We found no difference in rSUV or lung background SUV_{mean} between dPET and cPET in the fibrosis group (3.2±0.7 and 0.7±0.5 vs. 2.5±0.9 and 0.5±0.2, p=0.240 and p=0.197, respectively).

Conclusion: ^{18}F-FDG PET/CT detected an increased uptake in pulmonary fibrosis with SUV_{max}, SUV_{mean} and rSUV using both dPET and cPET. This might help quantifying pulmonary fibrosis inflammation and response to therapy and will require further analyses in larger cohorts.

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Impact of clinical protocol optimization in SPECT and PET: A multi-center and multi-device study

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Purpose: The support of the medical physicist in the image quality (IQ) optimization is a key task according to the Art.36 of the Swiss Radiological Protection Ordinance. We evaluated the potential of IQ optimization of clinical protocols in SPECT and PET, based on a multi-center and multi-device study.

Methods and Materials: We performed a multi-center study (N_C=15) based on NEMA phantom experiments for ^{99m}Tc SPECT (N_S= 17) and for ^{18}F-FDG PET (N_P=11) examinations. The activity concentrations in the phantoms were representative of bone and MAA scans for SPECT and of oncologic FDG for PET. The hot inserts vs. background activity concentration ratio was 10:1. The image noise (COV) was evaluated on the phantom main volume (background), while the signal recovery in terms of contrast-to-noise ratio (CNR), hot contrast (Q_{hot}) and recovery coefficients (RCs) was computed on the phantom spherical structures. We assessed the impact of varying the number of iterative updates, the post-reconstruction filters and the possible reduction of the acquired signal statistics. Optimized protocol setups were compared with standard clinical ones.

Results: In SPECT, important improvements over local clinical protocol setups were possible by optimizing the number of iterative updates and adapting the level of image smoothing, resulting in improved hot contrast (up to +80%) and CNR (up to +30%), while preserving a reasonable IQ (COV<20%). In PET, acquired statistic reductions up to a factor 2 were possible while preserving RC_{mean} and RC_{max} variations within ±10%.

Conclusion: The medical physics support in optimizing SPECT and PET clinical protocols is useful to improve patient radiation protection (reducing the administered activity) and comfort (reducing the scan time) while preserving the required IQ. In the IQ optimization process, a tight collaboration between physicians, technologists and medical physicists is fundamental.

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Dual energy computed tomography acquisition to ensure lower contrast media volume injection for oncologic imaging follow-up

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Purpose: Dual-Energy computed tomography (DECT) with low Kev image reconstruction is used to improve lesion detection by enhancing contrast-to-noise ratio (CNR). The aim of this study is to define the virtual monochromatic spectral imaging (VMSI) providing the best image quality in oncologic imaging. The second objective is to compare image quality and radiation dose of single-energy computed tomography (SECT) protocol with the new dual energy protocol with reduced iodinated contrast media injection.

Methods and Materials: 44 adult patients requiring thoraco-abdomino-pelvic (TAP) in portal phase for an oncologic indication from february and march 2021 were retrospectively included . Two scan protocols were compared: a conventional single-energy CT (SECT) (Protocol A) and DECT protocol with a pre-contrast scan in upper abdominal region added (Protocol B). For protocol A, CM dosage corresponded to body weight + 30 in mL and only body weight for protocol B. VMSI sets from 40 to 80 keV at 5 keV intervals were reconstructed. Quantitative analysis were done measuring enhancement in left/right liver lobe, portal vein and muscle. Contrast-to-noise and signal-to-noise ratios were calculated. A subjective analysis were done to assess the best VMSI reconstruction in term of enhancement, noise and overall image quality.

Results: CNR were significantly higher in MonoE at 40 keV than the other level (6.67 ±1.92) and SNR at 80 keV (12.41 ± 2.33). Both raters assessed significantly higher the enhancement at 40 keV (5.0 ± 0.0 vs. 4.83 ± 0.4; p > 0.01), the noise at 80 keV (4.98 ± 0.15 vs. 4.95 ± 0.21; p > 0.01) and the overall image quality at 65 keV (4.59 ± 0.59, vs. 4.55 0.71). CNR were significantly higher in DECT protocol than in SECT protocol (p =0.00).

Conclusion: The optimal image quality were observed at 65 keV with subjective and quantitative analysis. GSI protocol probably provides just as good enhancement as the standard one saving a significant amount of contrast media.

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Swiss Radiographers' opinion and knowledge about artificial intelligence influence in clinical practice

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Purpose: To explore the opinion and knowledge about the influence of AI on radiographers' practice and profession in Switzerland based on the opinions of radiographers, teaching-staff, students, physicians (radiologists/nuclear/radio-oncologists).

Methods and Materials: A survey previously validated in the UK was translated (French and German) and disseminated through the professional bodies (ASTRM/SSNM/SSRO/SSR) and social media using snowball sampling targeting Swiss radiographers from clinical practice, educators, students, radiologists, nuclearists, radio-oncologists. The survey had 5 parts: i) demographics, ii) AI-knowledge, iii) skills and iv) c onfidence in AI and v) perceptions about the impact of AI on practice. Descriptive, association statistics, qualitative thematic analysis were conducted.

Results: Responses from 243 participants were obtained (89%radiographers/11%physicians) highlighting that AI is being used in clinical practice by 43% of them. The confidence on AI-terminology was weak for 63.8% of the participants. AI is seen as an opportunity by most (57.2%), while some (18.5%) see it as a threat. The opportunities were associated with streamlining repetitive tasks, minimizing human errors, increasing time allocated to patient-centered care, research, IQ and patient safety. The most important threats identified were related to the loss of skills, decreased job satisfaction, professional politics. Most of the professionals (68.3%) did not feel well trained/prepared to implement AI in their practice, by emphasizing the non-availability of specific training (87.6%) and 93% had mentioned that AI education should be included at Bachelor.

Conclusion: Even with AI being considered as an opportunity, the need for more knowledge was identified as well as the importance of increasing confidence in the tool. Specific training on this topic needs to be implemented to improve practice and understanding on AI.

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Role of Artificial Intelligence in Radiographers' field of competence

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Purpose: To identify in which radiographers' fields of competence Artificial Intelligence (AI) is established or under development, type of AI used and tasks covered to estimate the changes that need to be introduced in radiographers' training.

Methods and Materials: Joanna Briggs Institute methodology was used to perform the scoping review. The search strategy was conducted on Pubmed, Embase and Cinhal during November 2021 and included peer-reviewed studies in French and English published between 2016-2021. Combination of keywords and Medical Subject Headings terms related to AI and Radiographer were used. Two independent reviewers screened all abstracts, titles, and eligible full-text. The origin of the studies, the type of AI used, domain or imaging modality, workflow and skills improved by AI were extracted and presented.

Results: 73 original articles were included mainly from Europe, Asia and America, with approximately one third from each continent. 34 papers were dedicated to Radiotherapy and 33 papers were dedicated to workflow planning and 30 for the processing. The CNN was the most (33/73) used AI.

Conclusion: AI is mainly used on treatment planning for radiotherapy and dose optimization. AI is poorly represented for the tasks regarding radiographers' interactions with the patient for person-centered care or explainability.

Normative values of the superior vena cava system. Interim analysis

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Purpose: Venous lengths are a major determinant for choosing optimally central venous catheters. The purpose was to determine normative data of the superior vena cava (SVC) system based on CT centerline vessel measurement (CL) in realistic geometry to optimally select central venous catheters.

Methods and Materials: Multiphase postmortem CT angiography (MP-MCTA) imaging data were used to reconstruct volumic 3D images of the SVC system (from SVC to axillary vein) and surrounding bony structures. From the 3D images, CL measurements of the different SVC system segments were acquired and analysed in order to obtain representative normative values (mean, standard deviation (SD), min, max, coefficient of variation (CV)). Radiological imaging data were completed by demographic data allowing multiple regression analysis. We retrospectively planned to include 255 subjects with MPMCTA realized between January 2018 and October 2020

Results: The interim analysis (162 included patients with 145 complete data) showed the following CL mean length [mm] ± SD, and CV Right axillary vein 74.1 ± 17.8, CV 24; Right subclavian 30.5 ± 6.9, CV 22; Brachiocephalic vein 47.1 ± 9.4, CV 20; SVC length 65.5 ± 11.9, CV 18; Innominate vein 90.4 ± 14.7, CV 16; Left subclavian 34.5 ± 7, CV 20; Left axillary vein 75.7 ± 16.9, CV 22. There was a statistical difference of 5cm between right and left side (total of the cumulated sections): right 217.2 ± 24.1, CV 11; left 266.1 ± 26, CV 10; p<0.001 The prediction model based on height and sex had a significant regression equation (F(2,142) = 21.83, p<0.001), with a R2 of 0.224

Conclusion: Results showed large interindividual variations in the SVC segments. Height and age where soft predictors of vessel length. However, the obtained normative values are expected to improve catheter length selection for optimal placement of central venous catheters with non-fluoroscopic guidance. Further studies are required to evaluate the impact of the current findings in catheters selection.

TI optimization for postmortem FLAIR MRI: First evaluation

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Purpose: To date, MRI is gaining in importance in the field of forensic medicine and different sequences are tested in post-mortem (pm) in order to evaluate their potential and their difference to ante-mortem cases. When performing a FLAIR sequence for pm cases a wide variety of image contrast is observed, different from that encountered in living patients. We aimed at evaluating the impact of two variables (temperature and delay from death) suspected of having an influence on the optimal inversion time (TI) value, which allows obtaining the living patient-like image contrast.

Methods and Materials: Brain MRI was performed and 3D FLAIR sequences with TI varying from 1660 ms to 900 ms each 110 ms were acquired in 24 postmortem cases. Two radiologists independently evaluated the images and were asked to choose which TI corresponded to the image of a living patient-like FLAIR contrast. Rectal temperature and delay between death and MRI were recorded. Pearson 's correlation tests between the mean TI value, temperature and delay between death and MRI were performed, Evaluation of the inter-observer reliability with the Prevalence-Adjusted and Bias-Adjusted Kappa (PABAK).

Results: Body temperature ranged from 5.7° to 29.0° while the death-MRI delay ranged from 13.05h to 768h. Optimal TI value ranged from 1330 ms to 1100 ms, with moderate interobserver reliability (PABAK=0.56, 95%CI [0.28-0.84]). Optimal TI value was significantly correlated with the temperature (Pearson R=0.70; p=0.0014) and the delay from death (Pearson R=-0.67; p=0.00027). Rectal temperature was inversely correlated with the delay from death (Pearson R=-0.79; p<0.00001).

Conclusion: Postmortem brain FLAIR imaging contrast is significantly related to body temperature and the delay from death. Both parameters should be taken into account to adapt TI value to obtain a living patient-like image contrast. A larger study cohort is ongoing to confirm these preliminary results.

Total hip arthroplasty can be planned by using MRI for younger populations

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Purpose: To evaluate if MRI examinations can be used to plan total hip arthroplasty (THA) surgery to determine which prosthesis is the most adequate to each patient.

Methods and Materials: High-resolution pelvis, hip, knee and ankle images were acquired as required to plan THA surgeries by using a multicentric data collection covering 3D DP TSE and 3D T1 GRE sequences. Protocols were optimised to enhance image quality and reduce acquisition time. The final protocol was validated with 19 healthy volunteers with different BMIs and by using two different MRI equipment, a 1.5T and a 3T. Five radiographers and radiologists performed the image visual assessment using the ViewDEX software. Visual Grading Analysis (VGA), Intraclass Correlation Coefficient (ICC) and Visual Grading Characteristics (VGC) were performed to analyse data

Results: The obtained VGA scores showed that the best image quality was achieved with the 3D DP TSE and 3D T1 GRE sequences at 3T and the 3D DP TSE sequence at 1.5T after optimisation. All relevant anatomy that is necessary to plan the surgery was well represented, being possible to identify all important landmarks. The protocol proposed had a maximal duration of 24 minutes, which is suitable for clinical practice. The ICC analysis showed a moderate to good agreement between the participants for the optimised sequences at 0.749 (95% CI 0.69-0.79), while for the DP at 3T the agreement was good to excellent at 0.846 (95% CI 0.72-0.91). VGC analysis showed that the 3D DP TSE sequences performed statistically better than the 3D T1 GRE at 1.5 and 3 T (p-value≤0.05). 3T sequences showed a statistically better performance compared to 1.5 T sequences (p-value≤0.05).

Conclusion: According to the results, MRI can be an approach used for preoperative planning for THA, mainly for younger populations to avoid exposure to ionizing radiation. However, it is important to conduct further research to fully validate these results. Other equipment, sequences, and a larger population should be tested.

The meaning of radiographers work as a lever for the performance and attractiveness of a radiology department.

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Purpose: The ageing of the population, the increase in chronic illnesses, the rise in health care costs and the growing budget deficits of health care institutions are prompting cantonal policies to reduce budgets and invest in improving performance. At the same time, the radiographer labour market is experiencing a shortage and it is vital to be able to at least retain staff and be more attractive. This study aims to demonstrate that, on the contrary, by enhancing the value of radiographer human capital rather than controlling it or reducing its costs, a strategy based on a culture of meaning in the work of radiogrpahers promotes the performance of a radiology department, retains his staff and becomes more attractive.

Methods and Materials: The data collection is based on the comparison of the results of two organisational diagnosis tools, on the literature review and on periodic individual interviews with the employees. First, concepts are theorised, then the diagnostic tools are used to determine the strategic projects and the impact of the results. Finally, actions and recommendations are proposed for implementation in practice.

Results: To create meaning in the work of radiographers we need to: define the higher purpose of the institute, develop research, develop a quality and safety strategy, develop a strategy for communication, develop careers for radiographers, exploit the potential of medical delegations, better involve radiographers in departmental projects, map radiographers priorities, prioritise autonomy, accountability and equity.

Conclusion: Employees mobilised by a strategy to promote meaning at work produce performance. This requires strong leadership, a lot of resources, and the willingness to reorganise to create a virtuous circle of continuous improvement and a culture of meaning at work. Conversely, the loss of meaning in radiographer work leads to absenteeism, disempowerment, lack of reflexivity and abandonment of the profession.

Know everything that happens on a daily basis in your department or network at no cost, while improving the collaboration of your management team

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Purpose: Have an accurate picture of the situation in their department or network of sites every morning to manage and anticipate the organisation, staff and clinical activity as well as distribute important or urgent information top-down and bottom-up. Forcing managers to find out about the state of their territory. Focusing communication on one moment to save managers' time. Increase collegiality and collaboration between managers.

Methods and Materials: The concept is to take up and adapt the idea of the telephone cascade of Intermountain CEO Marc Harrison and to insert a new communication tool based on the 4Ps (in french: Personnel, Panne, Problème, Particularité). At a fixed time every morning, the Chief Radiogrpaher or Director of Care calls the local managers or site managers by telephone conference. The local managers or site managers have to find out about their organisation to report staffing concerns, breakdowns, other problems and particularities during the phone call. During the call solutions are shared and improved together by the management team.

Results: Out of 48 calls on working days, there were only 6 times when there was nothing to say, problems with unpredicted staff absences were solved 34 times, 11 breakdowns were announced and dealt with, 7 problems and 13 particularities were stated and discussed.

Conclusion: All managers have a common picture of the situation and receive the same information. Collaboration leads to collegiality and reduces the silo effects of the sites or divisions. Optimal solutions are found in a short time to deal with the emergency or the day.

The impact of the Covid-19 on radiography clinical education: Radiography student's perspectives

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Purpose: The aim of this study is to explore the impact of the pandemic on diagnostic radiography clinical education from the perspective of radiography students internationally.

Methods and Materials: A qualitative approach was used to explore students' experience of clinical placement during the pandemic. A total of 16 European (n=14) and non-European (n=2) radiography students were recruited during an international radiography research program. Three semi-structured focus groups allowed to gather rich qualitative data (5 to 6 students per focus group). Thematic analysis was used to extrapolate themes from the participant's experience and to understand the specific context of clinical education during the pandemic. Braun & Clarke's six-phase framework was followed for the analysis of the collected data.

Results: This study results highlighted five main themes related to clinical education during the COVID-19 pandemic, namely, 1) emotional impact, 2) coping mechanisms, 3) challenges to meet required clinical learning outcomes, 4) impact of online education on clinical readiness and 5) unequal access to personal protective equipment (PPE). Fear of transmitting COVID-19 to friends and family was underlined by multiple students, as well as the pressure to get vaccinated before clinical education. Furthermore, students indicated confusion with infection control guidelines information, respect, and application of personal protection equipment (PPE).

Conclusion: Key challenges were identified by radiography students which should receive consideration by academic and clinical educators to ensure students are appropriately supported and prepared for clinical placement in order to achieve their clinical learning outcomes in a safe and propitious environment.

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Perspectives of students and educators on the impact of COVID-19 on radiography education

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Purpose: The COVID-19 pandemic has significantly affected healthcare education. Suddenly, Traditional teaching and learning methods were modified, and new pedagogical approaches were implemented. This study aimed to investigate how the pandemic affected diagnostic radiography education from the perspective of radiography students and educators internationally.

Methods and Materials: A qualitative approach was used to investigate radiography students' and academics' experiences of radiography education during the pandemic. A total of 19 participants, students (n=16) and educators (n=3), were purposively recruited during an international radiography summer school. Data was collected through four semi-structured focus groups, which permitted to gather data from a rich discussion group setting. Data analysis was based on Braun & Clarke's six-phase framework thematic analysis to identify themes from the participant's experiences of radiography education during the pandemic.

Results: Key and common themes emerged for both students and educators concerning challenges in i) technology issues, ii) vaccination requirements, iii) pedagogy approach adaptation, and iv) university support for mental health and logistic problems. Students highlighted isolation feeling during online teaching and decreased interest in learning. While educators indicated an increase in workload and stress during the pandemic. Furthermore, the sudden conversion of face-to-face lectures to hybrid or online classes was indicated as a big challenge for educators who lacked remote learning experience and time. Some participants indicated that the university lacked psychological and logistic support, while others indicated that they were offered adequate support.

Conclusion: Participants identified some key topics which require consideration by radiography education institutions to implement adequate and supportive teaching and learning environments for radiography students and educators.

A-413

QualiTRM: qualitative indicators of radiographers activity

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Purpose: The quality of radiographers procedures in the context of medical imaging is difficult to evaluate and quantify. However, a quality analysis can help to highlight the risks associated with the overall care of the patient and thus reduce the occurrence of incidents. Therefore, the objective is to list the relevant and measurable quality determinants and indicators related to radiographers activity within the radiodiagnostic department.

Methods and Materials::

In 4 phases:
1) Documentary research on quality in health and what makes the quality of radiographer work
2) Discussions with radiographers and unit managers to qualify the quality of radiographer work
3) Discussions with unit managers to find relevant and extractable indicators
4) Solutions for collecting these indicators

Results: Each modality has its own list of quantifiable and measurable quality indicators to highlight the importance of the role of radiographers in the overall care of patients. The data collection platform is being developed and the collection of measurements will start in January 2023. In June 2023, we will be able to provide the first concrete results.

Conclusion: These indicators are important for the profession because they will allow the recognition of the competences specific to the radiographer profession. Above all, they will improve the quality and safety of patient care, while reducing the risk of incidents. This will inevitably lead to an increase in patient satisfaction.

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Definition of the workload and arduousness of radiographers activities in a university radiodiagnostic department

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Purpose: Define indicators of task arduousness for planning and evaluating radiographer workloads with the aim of establishing indicators for workload distribution adapted to the resources available. Attempt to standardise the model for application to all types of radiology departments.

Methods and Materials: Solicitation of the CHUV work health and safety unit. A service contract was signed and an ergonomist and an work psychologist were made available for this project. Creation of a steering group with the radiographers managers, the r radiographers quality-safety coordinator of the department and the ergonomist and the work psychologist. Creation of a radiographers working group Multiple daytime and evening observations of the radiographer activity in order to determine typical activities in terms of risk exposure of employees, taking into account mental, physical, emotional and other exposures related to the work environment.

Results: Observations completed and working groups with radiographers to define standard activities started. The end of the project is planned for March 2023. In June 2023, the results can be presented at the Swiss Congress of Radiology.

Conclusion: The radiodiagnostic service at the CHUV is taking steps to find a model for distributing the workload to the resources available and to give itself a chance to put the brakes on the race for profitability and to restore some sense to the work of radiographers.

RISGO Project

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Purpose: The aim of the RISGO project is to reduce the number of adverse events related to the activity of the radiology staff employed in our Institute. The focus is particularly centered on the prevention of radiological events. The project aims to link an operational checklist to the essential elements that develop during normal daily activity, increasing safety for patients and situational awareness of operators.

Methods and Materials: An analysis of the events recorded in our CIRS made it possible to identify some macro areas of possible intervention. The sharing of analyzes with our stakeholders has allowed us to work by priority, thus defining useful contents for the patient safety campaign, thanks also to interprofessional work.

Results: The first data collected allowed us on the one hand to better understand the incidence of some events, on the other to measure the appropriateness of some corrections within the production processes of our business.

Conclusion: The RISGO project has allowed us to:
- analyze our adverse event registry in detail, especially from the perspective of radiological events.
- highlight the appropriateness of our activity, correlating it with other realities or with the evidence base.
- demonstrate the relevance of some process fixes.
- think about further tools to be implemented to increase the situational awareness of our collaborators.

Patient handling for computed tomography examinations can lead to Work-related Musculoskeletal Disorders (WRMSDs) symptoms in Radiographers

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Purpose: On the one hand the aim was to understand the physical demands of patients handling regarding computed-tomography/(CT) examinations, and on the other hand to understand which postural factors put radiographers at risk of developing MS disorders/symptoms.

Methods and Materials: The study applied mixed methods, namely: 1) organisational analysis which was complemented by a semi-structured interview; 2) survey based on the Nordic-Musculoskeletal-Questionnaire/(NMQ); 3) posture analysis using activity simulation to handling the patients from wheelchair and stretcher to the CT table examination to measure main body segments' angles and to classify them according to the European-standards/(EN1005–4:2005+A1:2008); 4) individual self-confrontation interviews. Descriptive statistics and content analysis were performed.

Results: The origins of dissatisfaction at CT scan reported by radiographers concerned workload, technical device, environmental working conditions and social environment. The high workload perception was attributed to the number of available human resources to carry out examinations and not to the number of patients/examinations itself. Handling patient from wheelchair or stretcher to the examinations-table were identified as the most awkward postures, being classified as "not acceptable" for upper arms, head/neck and/or trunk. Radiographers unawareness regarding postures assumed when handling patients was highlighted by Self-confrontation interviews. Lack training for prevention of WRMSDs was also identified.

Conclusion: Working in awkward postures are required when patient handling that can lead to WRMSDs symptoms. To reduce the risk related to patient mobilisation and transfer better training of radiographers is critical. Further studies must be conducted to identify strategies that allow a WRMSDs risk reduction.

Phantom study for exposure parameters optimisation of Thoracic spine X-rays in Antero-Posterior and Lateral positions

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Purpose: To identify the best set of exposure parameters for antero-posterior/(AP) and lateral thoracic spine x-ray that allow an effective dose reduction while keeping an adequate image quality (IQ) to characterize all relevant anatomical details.

Methods and Materials: An anthropomorphic phantom was used to acquire 48 radiographs by varying positioning (AP/LAT), source-to-detector distance/(SDD) (100 ;130 ;150cm), tube potential (AP:70;81;90kVp/ LAT:81;90;102kVp), grid in/out and focal spot (fine/broad). IQ was assessed by 6 observers using ViewDex and Effective Dose (ED) was estimated using the PCXMC 2.0 software. Descriptive statistics paired with intraclass correlation coefficient (ICC) were performed for data analysis.

Results: The ED increased with higher SDD, with a significant difference (p=0.038) but the IQ did not change. For both AP and LAT, the use of a grid had a significant effect on ED (p<0.001). The images acquired without grid had lower ED compared with the images with the grid in. Even having images with a reduced quality when the grid was removed, the observers considered the IQ as adequate for clinical use. A 20% reduction in ED (from 0.042mSv to 0.033mSv) was observed when increasing the kVp from 70 to 90 in the AP with the grid. The ICC ranged from moderate (0.5-0.75) for lateral projection to good (0.75-0.9) for AP projection.

Conclusion: All images were classified as suitable for diagnostic purpose even using low-dose settings. A SDD of 115cm, 90kVp and the use of grid are recommended for this specific context to have an adequate IQ and the lowest dose possible. Further studies must be conducted to test other equipment and SDD.

Optimisation of Technical Parameters for Obese Patients' Bedside Thorax and Abdominal Radiographs

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Purpose: To identify the most adequate combination of exposure parameters to acquire AP chest (CXR) and AP abdominal X-rays at bedside regarding obese patients.

Methods and Materials: Twenty-nine X-ray images of 4 corpses (BMI >30) investigated in a forensic imaging department (CURML) were acquired varying tube potential (Tx:90-130kVp/Abd:100-120kVp), beam intensity (TX:0.9-9.2mAs/Abd:10.9-22mAs); the source-to-detector distance (SDD) (Tx:98-109cm/Abd:98-101cm), grid in/out taking in consideration the body thickness and BMI. Image quality (IQ) was assessed by 5 observers using ViewDex software and Effective Dose (ED) was estimated. Descriptive statistics, intraclass correlation coefficient (ICC) and Visual Grading Characteristics (VGC) were used to analyse data.

Results: The VGC results for CXR showed that the medium-energy setting (100-110kVp/1.2-6.9mAs) performed statistically better than the low-energy setting (90-100kVp/1.7-9.2 mAs) (0.02 p-value) or the high-energy setting (120-130kVp/0.9-4.1mAs) (0.013 p-value). For Abdomen images, VGC results showed that high-energy setting (120kVp/10.9mAs) performed statistically better than low-energy (100kVp/22mAs) (0.01 p-value) or medium-energy setting (110kVp/15.8mAs) (<0.05 p-value). This indicates that abdominal radiographs of obese patients acquired with higher kVp/lower mAs reduced patient dose and offered better image quality.

Conclusion: The exposure parameters setting of 100-110kVp/1.2-6.9mAs presents the best IQ at lower dose for CXR. Abdominal radiographic examination with higher kVp/lower mAs combination (120kVp/10.9mAs) is the most adequate method to keep image quality while reducing dose.

Dose and Image Quality Optimisation for Obese Patients' Bedside Pelvis and Knee Radiographs

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Purpose: To optimise exposure parameters to acquire radiographs of obese patients at bedside for pelvis and knee regions at the lowest dose possible and adequate image quality to identify all relevant anatomical structures.

Methods and Materials: Four corpses (BMI>30) investigated in a forensic imaging department (CURML) were imaged to acquire 27 X-rays by varying the tube potential (Pelvis:80-120kVp/Knee:70-90kVp), beam intensity (Pelvis:5.1-39.2mAs/Knee:2.2-8.3mAs); source-to-detector distance (SDD) (Pelvis:105-110cm/Knee:115-116cm), grid in/out. Image quality (IQ) was assessed using Viewdex by 5 observers and Effective Dose/(ED) was estimated using a Monte Carlo-based program. Descriptive statistics, intraclass correlation coefficient (ICC) and Visual Grading Characteristics (VGC) were performed to analyse data.

Results: VGC results obtained from pelvic X-rays analysis showed that low energy setting (80-90kVp/22.9-39.2mAs) performed statistically worse than low/medium beam energy (90-100kVp/ 14.3-16.48mAs), medium/high beam energy (100-110kVp/8.9–16.48mAs) and high beam energy setting (110-120kVp/5.1-8.7mAs) (<0.05 p-value). These results indicate that pelvis radiographs with a mobile system on obese patients should be acquired with higher energy and lower beam intensity. This allowed a dose reduction to the patient and a better IQ. The knee X-rays assessment showed through VGC that the high kVp setting (90kVp/2.2mAs) performed statistically better than low kVp (70kVp/8.3mAs) and medium kVp (80kVp/4.1mAs) (<0.05 p-value).

Conclusion: This study's results indicate that higher beam energy and lower beam intensity allows a dose reduction to the patient while keeping adequate IQ to explore relevant anatomy for pelvis and knee areas. Ideal parameters to image the pelvis of obese patients are 110-120kVp/5.1-8.7mAs and respectively 90kVp/2.2mAs for the knee while using mobile x-ray systems. Further studies must be conducted to analyse other type of equipment and positioning.

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Experience in the disposal of lead protection for patients in radiology: practical aspects and communication to the population and healthcare professionals

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Purpose: Patient shielding is a common practice in diagnostic imaging while although growing scientific evidence suggests that their use brings negligible or no benefit, potentially increase the dose to patients and loss of diagnostic information of images. Education of staff, patients and caregivers before abandoning their use is essential for practical and psychological reasons. An effective communication plan is mandatory for stakeholders, population and healthcare professionals.

Methods and Materials: Scientific articles, statements and positions of national and international associations were reviewed. Discussion with professionals and meetings with public and private institutions were conducted. Information and education for practitioners and operators about scientific and practical aspects were performed. Professional societies and other pertinent organizations were involved in the development of a communication plan and procedure instructions. Communication to population and patients was accomplished through webinar, poster, oral communications, articles published on several newspaper and websites, as well as through flyers coded in "easy language" (level B1) reviewed by specialized associations.

Results: Good feedback was obtained during dedicated training and information with associations of citizens and professionals, parent-child assemblies, Swiss-Italian patient associations, local healthcare department, elderly association, medical radiographers associations, medical practice assistants, healthcare professional schools and orders of physicians, medical doctors and dentists.

Conclusion: Shielding discontinuation was concluded with success and without significant impact on patients, work practice and staff members. A rigorously planned communication strategy should be organized to help the population, professionals and patients to understand the reasons and effects of discontinuing lead shielding without impacting activities and diagnostic exams.

A-397

The art and the way of being in vein...Peripheral venous catheter under echo-guidance

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Purpose: Peripheral venous catheter placement is increasingly performed under echographic guidance, particularly in settings where access is difficult as in some geriatric patients with reduced venous capital. If a catheter is placed for a radiological exam with contrast media, like CT or MRI, a minimal catheter size is often required to resist increased flow rates and pressures. Echo-guidance not only helps to visualize profound veins but can also confirm the correct intravascular position of an inserted catheter.

Methods and Materials: Difficult venous access was evaluated clinically and following the criteria of the predictive additive difficult intravenous access (A-DIVA) scale. We included patients with a score of ≥3. Echographic scanning was used to explore the regional +/-deep venous networks including neither visible nor palpable veins. The optimal skin puncture site was determined and ultrasound used to real-time monitor the catheter trajectory during catheter advancement. A presumably correct position of the catheter was then confirmed injection tests where a turbulent flow could be observed within the vascular lumen ("pulsed" test).

Results: In a first retrospective evaluation of 100 ultrasound-guided venous catheter placements in a geriatric radiology division, we found lower-than-average rates of contrast media extravasation and hematoma formation at the puncture site. The procedure enabled us to perform contrast-enhanced exams in patients where the clinical placement of a large-diameter catheter was not possible or would have resulted in a significant increase in preparation time, the mobilization of additional staff, or increased pain..

Conclusion: This preliminary report of our experiences with echo-guided peripheral venous catheter placements by at trained radiographer in a population of geriatric patients, with usage of the formerly described A-DIVA scale for patient inclusionIn our particular group of patients, we observed a lower rate of complications when comparing with standard catheter placement.

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Correlation of Volumetry and Apparent Diffusion Coefficient Values with Lateralization and Duration Of Seizures Based on the Magnetic Resonance Imaging Characterization of the Hippocampi Iin Patients with Temporal Lobe Epilepsy (TLE) Iin Chong Hua

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Purpose: To know the correlation of volumetry and apparent diffusion coefficient (ADC) values with lateralization and duration of seizures based in the magnetic resonance imaging characterization of the hippocampi in patients with temporal lobe epilepsy in Chong Hua Hospital, Cebu City, Philippines.

Methods and Materials: This is a retrospective cross-sectional survey conducted at Chong Hua Hospital, Cebu of 37 patients with history of seizure and MRI of the brain showing temporal lobe atrophy from January 2018 to March 2022.
Demographic profile of all patients were reviewed from the chart which included the age, gender, history and duration of the seizures. Estimated volume of hippocampus was manually measured bilaterally and Apparent Diffusion Coefficient (ADC) were taken and correlated accordingly.

Results: There were a total of 37 patients comprising of 20 males of 54% and 17 females or 46%. Most of the patients has the duration of seizure within the category of 0 – 24 months, seventy-three percent (73%).A total of 41% (n=15) patients had focal seizure on the right side, 38% (n=14) on the left side, and 21% (n=8) had bilateral sided seizures. Left hippocampus has a mean of 2391.8919 while the Right hippocampal has a mean of 2433.5135. Moreover, the left ADC has a mean of 951.8649 while the right ADC has a mean of 941.9189. All of the respondent are positive for hippocampal atrophy and majority of the respondents have 1 as an MT score. The left and right hippocampi show significant relationship with the Left and Right ADC. Furthermore, both hippocampi also show significant relationship with the duration of the seizure. There is also a significant relationship between sex and Duration of Seizure.

Conclusion: The quantitative estimation of HV and ADC values in MRI study can illustrate the existence and laterality in TLE with accuracy rates that exceed those achieved by visual inspection alone. Thus, quantitative MRI provides a beneficial means for translating volumetric analysis into clinical practice.

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Imaging Based Differentiation of Glioblastoma, CNS Lymphoma and Metastasis using 3D Convolutional Neural Networks: Model Development and Validation

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Purpose: To develop and validate deep learning (DL) based 3D Convolutional Neural Networks (3D-CNN) pipelines for AI-based three-class classification of glioblastoma (GBM), metastatic disease (MD) and primary CNS lymphoma (PCNSL).

Methods and Materials: Institutional cancer registries were screened for index cases with pathologically proved GBM and PCNSL, as well as cases with known primary malignancy and neuroimaging compatible with MD. A total of 502 cases (208 GBM, 67 PCNSL and 227 MD) were included. External data from another institution consisted of 86 cases (27 GBM; 27 MD, 32 PCNSL). All cases were co-registered, resampled, denoised and intensity normalized using the same pipelines. Lesions were segmented using inhouse semi-automated software to 3D segment the enhancing tumor (ET) and peritumoral edema (PTE). 3D masks were used for DL pipeline.
A total of 11 pipelines were evaluated, five consisting of both the ET and PTE mask derived from the same sequence (T1W, T2W, FLAIR, ADC and T1-CE), and additional six pipelines derived from a combination sequences and masks. All pipelines were trained evaluated with 5-fold cross-validation on internal data followed by external validation. Model performance was evaluated using Hand and Till method for multi-class AUC-ROC analysis. Brier scores were also calculated.

Results: The top performing models on the external dataset were derived from (a) ET-T1-CE mask and PTE-T2 mask (AUC: 0.853; Brier score: 0.45); (b) ET-T2 and PTE-T2 (AUC: 0.844; Brier score: 0.47) and (c) ET-T1-CE, ET-ADC with PTE-F (AUC: 0.85; Brier score: 0.44), all of which had similar performance. On the internal
dataset, the models had AUC's of 0.932, 0.868 and 0.860 respectively.

Conclusion: DL models derived from 3D-CNN show robust performance for a three-class classification in neuro-oncology, similar to the previously published literature using machine learning pipelines.

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Quantitative Plaque Characterization with Ultra High Resolution Coronary Photon Counting CT Angiography

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Purpose: To assess the effect of ultra-high-resolution (UHR) coronary CT angiography (CCTA) with photon-counting detector (PCD) CT on quantitative coronary plaque characterization.

Methods and Materials: In this IRB-approved study, 22 plaques of 20 patients (7 women, age 77±8 years, BMI 26.1±3.6 kg/m^2) undergoing ECG-gated UHR PCD-CCTA were included. Images were reconstructed with a smooth (Bv40) and a sharp (Bv64) vascular kernel, with quantum iterative reconstruction strength 4, and with a slice thickness of 0.6 mm, 0.4 mm, and 0.2 mm. Reconstructions with the Bv40 kernel and a slice thickness of 0.6 mm served as the reference standard. After identification of a plaque in coronary arteries (vessel diameter >2 mm), plaque composition was determined using a semi-automated plaque quantification software. Total plaque, calcified, fibrotic, and lipid-rich plaque components were quantified in all datasets.

Results: Median plaque volume was highest (23.5 mm^3, interquartiles 17.9–34.3 mm^3) for reconstructions with the reference standard and lowest for UHR reconstructions with a slice thickness of 0.2 mm and the Bv64 kernel (18.1 mm^3, 14.1–25.8 mm^3, p<.001). Reconstructions with the reference standard showed largest calcified (85.1%, 76.4–91.1%) and smallest lipid-rich plaque components (0.5%, 0.0–1.5%). Smallest calcified plaque components (75.2%, 79.9–80.8%) and largest lipid-rich components (6.7%, 5.1–8.4%) were found for UHR reconstructions with a slice thickness of 0.2 mm and the Bv64 kernel. At an identical slice thickness, volume of calcified components was always lower, and volume of lipid-rich components was always higher for reconstructions with the Bv64 kernel compared with reconstructions with the Bv40 kernel (all, p<.001).

Conclusion: This patient study indicates significant differences of UHR CCTA with PCD-CT on quantitative coronary plaque characterization. Reduced blooming artifacts may allow improved visualization of fibrotic and lipid-rich plaque components with the UHR mode of PCD-CT.

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Coronary Stenosis Quantification with Ultra-High-Resolution Photon Counting Detector CT Angiography – Preliminary Experience

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Purpose: To assess the accuracy of stenosis quantification using ultra-high-resolution coronary CT angiography (CCTA) with photon-counting detector CT (PCD-CT) compared with invasive quantitative coronary angiography (QCA).

Methods and Materials: In this IRB-approved, retrospective study, nineteen patients (7 women, mean age 78±9 years) undergoing ECG-gated ultra-high-resolution CCTA with a dual-source PCD-CT and QCA before transcatheter aortic valve replacement were included. CCTA images were reconstructed with a slice thickness of 0.6 mm using a smooth vascular kernel (Bv40) representing the reference standard, and with a slice thickness of 0.2 mm using a sharp vascular kernel (Bv64). Degree of stenosis was evaluated using QCA (reference standard) and CCTA. Stenoses were classified as minimal (1-24%), mild (25-49%), moderate (50-69%), and severe (70-99%).

Results: In total, 137 coronary artery segments were assessed. QCA showed minimal, mild, moderate and severe stenoses in 109, 20, 4, and 4 cases, respectively. Stenosis grading on CCTA showed small differences and strong correlation to QCA (mean error 1%, limits of agreement (LoA), -11%/12%, r=.89 and mean error 1%, LoA -8%/10%, r=.94 for the reference standard and with the highest spatial resolution, respectively).

Agreement was almost perfect between stenoses categories determined on ICA and reference standard CCTA images (=.864, reclassification of 18/137 segments) and further improved with images at a slice thickness of 0.2 mm using the sharp vascular kernel (=.909, reclassification of 13/137 segments).

Conclusion: Ultra-high-resolution coronary CT angiography with photon-counting detector CT allows for a more accurate stenosis quantification and categorization using a slice thickness of 0.2 mm compared with QCA.

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Excellent Coronary In-Stent Lumen Visualization with Ultra High Resolution Photon-Counting CT

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Purpose: Coronary stent imaging remains limited with conventional CT scanner technology. In this patient study we evaluated the quality of ultra-high-resolution (UHR) coronary CT angiography (cCTA) with clinical photoncounting-detector CT (PCD-CT) for coronary stent imaging.

Methods and Materials: In this IRB-approved retrospective dual-center study, 18 patients with 34 coronary stents who underwent UHR cCTA with PCD-CT were included. UHR images at a slice thickness of 0.2mm were reconstructed with kernels of eight sharpness levels (Bv40, Bv44, Bv56, Bv60, Bv64, Bv72, Bv80, and Bv89) and adapted matrix sizes. Images with the Bv40 kernel at a slice thickness of 0.6 mm served as the reference standard.

Image noise, contrast-to-noise-ratio (CNR), in- stent diameter, and differences of in-stent attenuation compared with adjacent coronary segments were measured. Stent strut sharpness was quantified by calculating the metrics sharpness and kurtosis using data derived from line profiles. Subjective in-stent lumen visualization was rated by two blinded, independent readers.

Results: At increasing kernel sharpness, CNR decreased, in-stent diameter increased, and stent sharpness and kurtosis increased. Differences of in-stent attenuation decreased from the reference standard to the Bv56 to Bv80 kernels at 0.2mm, being non-significantly different from zero ($p > 0.05$). There were no associations between stent angulation and in-stent diameter or differences of in-stent attenuation ($p > 0.05$). Qualitative scores increased from suboptimal/good for the reference standard to very good/excellent for the Bv64 and Bv72 kernels at 0.2mm.

Conclusion: UHR cCTA with clinical PCD-CT enables excellent in-stent lumen visualization of coronary stents at a slice thickness of 0.2mm and using a sharp vascular reconstruction kernel.

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Pelvic venous congestion syndrome: Causes and treatment options

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Learning objectives:
- to acknowledge and recognize the different causes of pelvic venous congestion syndrome.
- to describe typical CT, MRI and angiographic features.
- to give an idea of the best non surgical treatement options according to the underlying cause.

Background: Pelvic venous congestion syndrome (PVCS) is a challenging cause of chronic pelvic pain especially in women, often underdiagnosed. Attention must be paid to some of the most common causes of PVCS such as:

incompenent gonadal vein valves, Nutcracker syndrome, May-Turner configuration, arterio-venous fistulas;

as these different entities involve different non surgical treatment options which can lead to the resolution of pelvic pain.

Imaging findings or procedure details: We will describe the most common or important causes of PVCS, typical imaging and treatment options, including:

Incompetent gonadal vein valves, whether acquired or congenital, typically treated with minimally invasive catheter-based embolization and sclerotherapy.

Nutcracker syndrome caused by compression of the left renal vein between the aorta and the superior mesenteric artery. In a symptomatic patient, treatment is typically surgical. Placement of a stent in the left renal vein also has been described.

May-Thurner configuration occuring when there is compression of the left common iliac vein by the right common iliac artery. Symptomatic May-Thurner configuration more commonly manifests as thromboembolism and worsening stenosis, which may be treated by endovascular stenting.

AVM corresponding to abnormal shunt between arteries and veins without intervening capillary beds, classified into acquired or congenital. This entity is rare and treatment consist of transcatheter arterial embolization.

Conclusion: This educational poster aims to discuss the most common and important causes of PVCS, which remains an underdiagnosed entity with potential clinical impact on young women.

Different entities can engender this syndrome, each leading to a specific treatment that can have positive impact on patient's pain.

Non-invasive morphological imaging of renovascular hypertension

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Learning objectives: The purpose of this educational exhibit is to enable the reader to:
- Identify potential secondary hypertension and its most common underlying causes
- Recognize the clinical signs of renovascular hypertension
- Understand the advantages and limitations of the different non-invasive morphological imaging techniques used to identify renovascular hypertension
- Understand the role of accessory renal arteries in the pathophysiology of renovascular hypertension.

Background: Secondary hypertension accounts for about 10% of hypertension cases and should be suspected in specific clinical situations, such as the appearance of hypertension in a <30 or >60-year-old person. It should be suspected in the presence of signs and symptoms of certain diseases (endocrine diseases, sleep apnea, nervous system diseases, etc.). Amongst the underlying causes of secondary hypertension, renovascular disease, related to a narrowing of the renal artery has a special place, as it is potentially treatable. The recognition of its pattern is therefore crucial for prompt diagnosis and treatment. Knowledge of the possible non-invasive morphological imaging techniques, along with their advantages and limitations, is essential in order to make a reliable diagnosis.

Imaging findings or procedure details:
- Definition of a renal artery stenosis
- Physiopathology of renovascular hypertension
- Identification of a stenosis using:
- Angio-CT
- MRI
- Doppler-ultrasound
- Value of the different imaging techniques
- Identification and evaluation of an accessory renal artery

Conclusion: Understanding of the advantages and limitations of the different non-invasive morphologic imaging techniques for suspected renovascular hypertension may help in early diagnosis and prompt management and treatment of this disease.

Acute chest pain in the emergency department: The importance of myocardial evaluation on CT

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Learning objectives:
- To discuss CT acquisition protocols for suspected aortic or cardiac pathology
- To emphasize the importance of analyzing the myocardium on arterial and delayed phase images
- To review relevant ischemic and non-ischemic myocardial disorders potentially causing chest pain

Background: Acute chest pain is one of the emergency room's most frequent clinical symptoms. Depending on the patient's history, clinical examination, laboratory, and ECG (electrocardiogram), a diagnostic workup using a cardiac or aortic CT angiography is recommended when PE (pulmonary embolism) is not primarily suspected. In such cases, it is essential to perform a dedicated protocol that allows a detailed analysis of the aorta, the coronary arteries, and the myocardium. Indeed, acute myocardial disorders tend to be overlooked on a conventional chest CT acquisition.

Imaging findings or procedure details: The recommended protocol is a triphasic ECG-gated CT consisting of non-enhanced, arterial, and delayed phases, which must cover the aorta and the heart.

Thus, we are not only able to assess any acute aortic and coronary pathology but also myocardial density or motion abnormalities. The latter should be analyzed according to their topography, as well as their coronary vascularization territory.

Through this educational poster, various acute heart disorders, either of coronary (atherosclerotic and dissection) or myocardial origin (Tako-tsubo cardiomyopathy, myocarditis, mycotic pseudoaneurysm, aneurysm or pseudoaneurysm after myocardial infarction) will be presented to make radiologists aware of these entities that may be challenging to pick up.

Conclusion: Depending on the clinical suspicion, and when PE is not first suspected, it is critical to perform a triphasic chest CT acquisition with ECG-gating for suspected acute cardiovascular disease. In case of acute chest pain and absent coronary or aortic disease, the delayed phase centered on the myocardium may be crucial since it allows the adequate diagnosis of a possible underlying myocardial pathology.

Aortic Pathologies in Emergency Radiology

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Learning objectives: Diagnostic imaging findings of acute aortic dissection, penetrating atherosclerotic ulcer and intramural hematoma.

Background: Patients with acute aortic pathologies make up a decent amount of admissions to the emergency department.

It is essential to diagnose acute aortic pathologies fast and confidently especially for residents within their first nightshifts or rotation to the emergency department.

Imaging findings or procedure details: Aortic pathologies show distinct imaging findings, which lead to right diagnosis.

Conclusion: Acute aortic pathologies (acute aortic dissection, atherosclerotic aortic ulcer, intramural hematoma) show distinct imaging findings which are key to right diagnosis of a potentially life threatening disease.

Knowing of these findings is essential for residents in their first nightshifts or rotation to the emergency department.

A-316

Deep learning reconstruction technique for coronary artery calcium quantification: Comparison with filtered back projection and hybrid iterative reconstruction in vitro and in vivo

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Purpose: This study aimed to assess the influence of filtered-back projection (FBP), hybrid IR (hybrid iterative reconstruction), and three levels of deep learning reconstruction (DLR) for coronary artery calcium (CAC) quantification in vitro and in vivo.

Methods and Materials: This study aimed to assess the influence of filtered-back projection (FBP), hybrid IR (hybrid iterative reconstruction), and three levels of deep learning reconstruction (DLR) for coronary artery calcium (CAC) quantification in vitro and in vivo.

Results: In vitro study, the calcium volume was equivalent (p=0.949) among FBP, hybrid IR, DLR_{mild}, DLR_{std}, and DLR_{str}. In vivo study, the image noise was significantly lower in DLR_{str} compared with FBP, hybrid IR, DLR_{mild}, and DLR_{std}, p<0.001. There were no significant differences in the calcium volume (p=0.987) and Agatston score (p=0.991) among FBP, hybrid IR, DLR_{mild}, DLR_{std}, and DLR_{str}. The highest overall agreement of Agatston scores was found in all different strengths of DLR with 98% while it was 95% in Hybrid IR compared to standard FBP reconstruction.

Conclusion: The quantification of CAC was equivalent among the different image reconstructions including FBP, hybrid IR, DLR_{mild}, DLR_{std}, and DLR_{str}. The DLR_{str} resulted in the lowest bias of agreement in the Agatston scores and is recommended for the accurate quantification of CAC.

A-356

Cardiovascular devices on chest X-rays : What the radiologist should recognize

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Learning objectives:
- To identify important cardiovascular devices on chest X rays,
- To recognize normal and abnormal anatomic location of device,
- To assess devices integrity,
- To be aware of associated complications.

Background: The number of implanted cardiovascular devices has increased in recent years. Radiology, especially chest X-Rays, plays an important role in the initial assessment and follow-up of these devices. However, it is not always easy to recognize which device is which, as many types and models exists nowadays. Moreover, some devices can be mispositioned or subject to subtle complications that are not easy to identify, with a potential impact on patient outcome. The aim of this educational poster is to sensitize the radiologist of the most common types of cardiovascular devices on chest X-ray and how to identify correct or incorrect position as well as associated complications.

Imaging findings or procedure details: We illustrate how to check on anatomic location, device integrity, complications for 12 of the most frequent or important cardiovascular devices:
- Biventricular pacemakers
- Epicardial pacing leads
- Implantable cardioverter-defibrillators
- Micra device
- Loop recorders
- Mechanical and bioprosthetic valves
- Transcatheter aortic valve repair
- MitraClip
- Amplatz closure device
- Coronary stents
- Intra-aortic balloon pump
- Left ventricular assist device

Conclusion: Through a set of 12 illustrative cases, this presentation reminds how a radiologist should analyses chest Xrays of patients treated with an implanted cardiovascular device as well as how to assess correct positioning and potential complication.

Non-tumoral lesions of the trachea on CT-scan

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Learning objectives:
- To give an overview of the main diagnoses of benign tracheal lesions.
- To put up radiological tips to distinguish them and propose a diagnostical decisional tree
- To sensitize radiologists about the eventual medical issues and their responsibility

Background: Upper respiratory tract is a major functional and anatomical part of the respiratory system, which could frequently present incidental abnormalities on chest CT-scan. Despite this, radiologists often overlook the analysis of the trachea, which is sometimes regarded as less important than the bronchi, mainly due to the lack of information and teaching about it. Nonetheless, detection of upper respiratory tract lesions may avoid life-threatening complications such as stenosis and asphyxia, hence could imply the radiologist's responsibility.

The aim of this educational poster is to describe the main non-tumoral lesions in the trachea and point out the typical associated pitfalls.

Imaging findings or procedure details: We discuss seven diagnoses which are tracheomalacia, osteochondroplastic tracheopathy, granulomatosis with polyangiitis, relapsing polychondritis, amyloidosis, tracheobronchial tuberculosis, iatrogenic complications.

We compare them to highlight radiological diagnostic clues such as posterior membrane involvement or sparing, calcifications, nodularity and stenosis.

We also mention several complications induced by these diseases and explain what strategy the radiologist should follow to take care of the patient, according to the degree of emergency.

Each diagnosis is illustrated by a typical case.

All diagnoses are summed up in a table including typical signs and complications of every tracheal abnormality.

Conclusion: Tracheal analysis through CT scan is often neglected.

Although tracheal lesions are rarely isolated, they can help the radiologists to make a diagnosis of a systemic disease and above all prevent vital complications.

This poster explains how to distinguish the main tracheal diagnoses and precises their relative prognosis.

Quantitative CT Analysis of Lung Parenchyma to Improve Malignancy Risk Estimation in Incidental Pulmonary Nodules

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Purpose: To assess the value of quantitative computed tomography (QCT) of the whole lung and nodule-bearing lobe regarding pulmonary nodule malignancy risk estimation.

Methods and Materials: 251 subjects (median [IQR] age, 65 (57-73) years; 37% females) with pulmonary nodules on non-enhanced thin-section CT were retrospectively included. 20% of the nodules were malignant, the remainder benign either histologically or at least 1-year-follow-up. CT scans were subjected to in-house software, computing parameters such as mean lung density (MLD) or peripheral emphysema index (pEI). QCT variable selection was performed using logistic regression; selected variables were integrated into the Mayo Clinic and the parsimonious Brock Model.

Results: Whole-lung analysis revealed differences between benign vs. malignant nodule groups in several parameters, e.g. the MLD (-766 vs. -790 HU) or the pEI (40.1 vs. 44.7 %). The proposed QCT model had an area-under-the-curve (AUC) of 0.69 (95%-CI, 0.62 - 0.76) based on all available data. After integrating MLD and pEI into the Mayo Clinic and Brock Model, the AUC of both clinical models improved (AUC, 0.91 to 0.93 and 0.88 to 0.91, respectively). The lobe-specific analysis revealed that the nodule-bearing lobes had less emphysema than the rest of the lung regarding benign (EI, 0.5 vs. 0.7 %; p<0.001) and malignant nodules (EI, 1.2 vs. 1.7 %; p=0.001).

Conclusion: Nodules in subjects with higher whole-lung metrics of emphysema and less fibrosis are more likely to be malignant; hereby the nodule-bearing lobes have less emphysema. QCT variables could improve risk assessment of incidental pulmonary nodules.

Qanadli Vascular Obstruction Score in Pulmonary Embolism: Calculation Method and its Use in Risk Stratification

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Learning objectives:
- How to calculate the Qanadli Score and convert it to an Index
- Discuss its use in risk stratification
- Discuss the importance of PE severity between patients with and without risk factors

Background: Pulmonary embolism (PE) is the 3rd cause of cardiovascular mortality especially with patients having risk factors such as: age over 70, congestive heart failure and chronic obstructive pulmonary disease. CT pulmonary angiography (CTPA) is the gold standard exam to diagnose it. The clot burden can be assessed with scoring systems such as the Qanadli Vascular Obstruction Score. The later is calculated in points and then converted in an index that will provide information about the residual pulmonary vasculature. Right sided heart failure, which is strongly related to death in patient with PE, can be assessed by measuring dilatation in right cardiac cavities on CT. Thus, CTPA and the Qanadli Score can be used to diagnose PE and provide an objective and reproductive. Once the clot burden is calculated, it can be used to determine risk stratification and eventually to monitor treatment efficacy.

Imaging findings or procedure details: In this educational poster, we explain the calculation the Qanadli Score in patients with PE and its conversion in an index. We detail how pulmonary arteries are segmented and how each point should be given depending of the degree of the vessel obstruction. We illustrate the process with clinical examples as well as schematics. We also provide a graphic example of how this score is useful for risks stratification between patients with and without risk factors.

Conclusion: CTPA is the gold standard examen to diagnose PE and is also very reliable to evaluate right cardiac cavities repercussions. With the Qanadli Vasular Obstruction Score and index, one can also provide an evaluation of the clot burden and residual arterial pulmonary vasculature. This educational poster helps undersand how to calculate the Qanadli Score and Index and discuss use in risk stratification in patients with and without risk factors.

AssessNet-19: An Artificial Intelligence Multi-class Segmentation Model for Assessing Acute COVID-19 Pneumonia: Comparison to Existing State-of-the-art COVID-19 Pneumonia AI Segmentation Models.

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Purpose: To compare the performance of the AssessNet-19 segmentation model with two published artificial intelligence (AI) COVID-19 pneumonia segmentation models: Model 1, a 3D single lesion model based on a full-resolution 3D U-Net trained with the COVID-19 2020 grand challenge dataset (Roth et al., Version 1. Res Sq. Preprint. 2021.), and Model 2, the Scancovia AI segmentation model (Lassau et al., Nat Commun. 2021).

Methods and Materials: AssessNet-19 was trained on a 2D U-Net neural network with 118 CTs of the lungs with COVID-19 pneumonia, each with 10 manually segmented axial slices (ground truth, GT). Multi-class lesion segmentation was used, consisting of consolidation (CON), ground-glass opacity (GGO), pleural effusion (PLE) and band-like lesion (BAN). Model 1 uses single-class lesion segmentation, whereas Model 2 is a multi-class lesion segmentation model consisting of CON, GGO and crazy-paving. For comparison, Model 1 and 2 were reconstructed as a single-class lesion segmentation model by combining all lesion classes, for Model 2 crazy-paving was added to GGO, as our model did not contain crazy-paving. The metrics used to compare between the ground truth and AI-generated segmentations were dice similarity coefficient (DSC) and Hausdorff distance (HD).

Results: Test performance of AssessNet-19 compared with GT yielded a mean DCS/HD of 0.77/49 for single lesion, 0.70/52 for GGO, 0.68/62 for CON, 0.65/54 for PLE, and 0.30/121 for BAN. In comparison, test performance of Model 1 yielded a mean DCS/HD of 0.65/74 for single lesion, and test performance of Model 2 yielded a mean DSC/HD of 0.48/95 for single lesion, 0.46/89 for GGO, and 0.18/105 for CON.

Conclusion: AssessNet-19 is significantly better at segmenting COVID-19 pneumonia compared to available state-of-theart COVID-19 pneumonia AI segmentation models based on our ground truth. A limitation of the performance comparison is not considering the other two models' ground truth and segmentation protocol.

A-347

The first 1000 functional and structural lung MRI in children. Lessons learned.

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Learning objectives:
To describe the MR protocol and potentials of functional matrix-pencil decomposition and structural lung MRI (MP-MRI and sMRI) in children. We summarize the main findings of the first published studies.

Background: Since 2016 at total of 997 thoracic MRI studies have been assigned to the department of radiology by the department of paediatric respiratory medicine, including participants with cystic fibrosis (CF), primary ciliary dyskinesia (PCD), congenital lung malformation, adolescents with bronchopulmonary dysplasia (BPD) in infancy or fetal growth restriction, congenital diaphragmatic hernia as well as healthy controls.

The MP-MRI was used to assess the relative lung volume with impaired fractional ventilation and perfusion (ventilation and perfusion defect percentage: VDP and QDP) during free tidal breathing, without the need for sedation or contrast-agents. The results from MP-MRI were then compared to standard methods of lung function testing as well as the lung clearance index from multiple breath washout. Morphological images in patients with CF and PCD were scored with the Eichinger Score, BPD-children with the adapted Aukland Score.

Imaging findings or procedure details: Lung MRI was feasible from the age of 5 years. In children with CF, MP-MRI reliably assessed defects in pulmonary VDP and QDP with a very good short-term reproducibility. These findings from MP-MRI showed a strong correlation in patients with CF and PCD to lung function tests. In children who underwent resection for congenital lung malformation, MP-MRI revealed functional impairment that was not captured by sMRI. Most useful structural sequences for scoring purposes were axial T2w Haste, coronal T2w Blade and ultrashort TE (UTE) sequences to describe morphological lung changes in children.

Conclusion: Functional and structural lung MRI in children, especially in patients with CF and PCD, are a promising new method for disease monitoring and assessment of response to therapy.

A-169

Avoiding the Intercostal Arteries in Percutaneous Thoracic Interventions

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Purpose: Determine the distance between intercostal arteries and ribs along the course of all ribs to determine save intercostal puncture spots. These arteries are not well hidden beneath the ribs in the paravertebral course.

Methods and Materials: Retrospective inclusion of 250 patients with a chest CT in the normal arterial phase. Four radiologists performed the image analysis in the coronal plane (angulated to the thoracic spine) and in the MPR mode using maximum intensity projection (MIP) with a slice thickness of 12mm and an iteration of 1mm.
Definitions: D = Danger intercostal space (ICS), the intercostal artery runs closer to the lower than the upper rib (not suitable for intervention). E = Expert ICS, the intercostal artery is constantly closer to the upper than lower rib (suitable for intervention by experts). S = Save ICS, intercostal artery is touching the upper rib (save location for puncture).
Determine the age dependent D, E, S ICS in cm from the spinous process for each intercostal space (ICS) on both sides. The 97.5 percentiles of D, E, S ICS were defined as possible intervention points.

Results: The median female danger and expert intercostal space (ICS) measured 2.9 cm (range: 1.0 to 9.3cm) and 6.4 cm (range: 1.9 to 12.1cm) from the spinous process to the lateral periphery. For men the danger and expert intercostal space (ICS) measured 3.3cm (range: 1.0 to 9.7) and 6.9cm range (range 1.2 to 14.0cm).
Using the 97.5 percentile as cut-off level for possible interventions, a needle puncture of the ICS in men/women could be done 5.1/6.5cm away from the spinous process for expert radiologists and a puncture would be safe 10.0/10.4cm lateral to the spinous process.

Conclusion: Overall, an ICS puncture > 7cm lateral to the spinous process incurs moderate risk and > 10cm lateral incurs the lowest risk of puncturing the intercostal arteries and would be safe for general radiologists and general practitioners.

A-145

Liver morphological changes beyond alcoholic and viral cirrhosis: etiologies and patterns

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Learning objectives:
- To become familiar with the spectrum of diseases responsible for liver morphological changes
- To identify key imaging features which help to determine the etiologies of liver dysmorphia

Background: Cirrhosis is the most common cause of hepatic dysmorphia seen on routine abdominal imaging, and leads to typical morphological changes of liver. However, this is not the only condition responsible for the loss of normal liver morphology. This poster illustrates the different patterns of liver dysmorphia by identifying the key imaging features of each pathology, as well as highlighting the necessary adaptations in acquisition protocols to improve diagnostic confidence.

Imaging findings or procedure details: The etiologies of liver dysmorphia can be divided into tumoral, vascular, toxic, and chronic inflammatory pathologies. Tumoral pathologies include liver primary cancer and metastatic hepatic involvement. Vascular origins encompass portal or hepatic vein thrombosis as well as hepatic artery occlusion. In the etiologies of toxic liver dysmorphia, systemic chemotherapy and SIRT can be encountered. Finally, the most frequent inflammatory conditions include primary biliary cirrhosis and primary sclerosing cholangitis. Morphological alterations include different patterns of global or lobar atrophy, segmental volume redistribution, notching and liver surface retraction. Diagnostic tips are provided for each condition.

Conclusion: This poster reviews different patterns of liver dysmorphia beyond alcoholic and viral cirrhosis. Identifying and understanding key imaging manifestations is essential and helpful to narrow the differential diagnosis of liver dysmorphia.

A-172

Esophageal cancer: Spectrum of MR Imaging findings

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Learning objectives:
- To highlight the new role of Magnetic Resonance Imaging (MRI) in initial staging and restaging after neoadjuvant treatment.
- To describe the acquisition protocol of an MRI of the esophagus including cine-sequences.
- To describe the main MR imaging characteristics of esophageal tumors, including gastroesophageal junction cancers.

Background: Initial staging of esophageal cancer is based on the TNM classification and currently consists of complementary multi-modality imaging approach, including positron emission tomography (PET/CT), endoscopic ultrasound (EUS) and computed tomography (CT). MRI of the esophagus is not yet used as a routine examination because of its limited availability and cost. Thanks to technological developments, MRI presents interesting perspectives for tumor staging, radiotherapy planning and post-neoadjuvant treatment evaluation.

Imaging findings or procedure details: MRI is a non-irradiating, non-invasive modality that provides good soft tissue contrast. Compared to CT, MRI improves detection of small tumors (T1/T2), allows better assessment of circumferential resection margin and involvement of adjacent structures such as peri-esophageal fat, pleura, aorta and diaphragmatic pillars.

Adding Cine sequences to static MRI increases sensitivity and improves interreader agreement on T staging, notably for higher stages. Diffusion weighted imaging (DWI) is useful in depicting lymph nodes and liver metastases and for assessing the extent of disease into the stomach for gastroesophageal junction cancer.

Change in apparent diffusion coefficient (ADC) can be used as a predictor of treatment response.

Conclusion: MRI is a promising alternative to EUS and CT for both for the initial assessment of esophageal cancer as well as for the evaluation of response to treatment.

A-203

Normal imaging findings and early complications occurring after cephalic pancreaticoduodenectomy

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Learning objectives: To review the imaging findings during the normal post-operative course and in case of complications after cephalic pancreatico-duodenectomy.

Background: Cephalic pancreatico-duodenectomy is a common surgical procedure for tumors of the right-sided pancreas, ampulla, common bile duct, and duodenum. The pancreatic head and uncinate process, duodenum, extrahepatic bile duct, and gall bladder are removed en bloc, requiring three anastomoses. Additional venous resection with venoplasty has enabled a higher percentage of margin-negative resections, thus expanding the indications for surgery.

Although post-operative mortality has decreased in the past decades, morbidity remains high and results from complications occurring early after surgery. Imaging findings are divided into normal postoperative findings depending on the time course and surgical technique, and real complications mostly involving the anastomoses.

Triple-phase intravenously contrast-enhanced CT is the imaging method of choice in the early post-operative course, due to its rapidity, high sensitivity, and excellent spatial resolution.

Imaging findings or procedure details: Normal early post-operative findings include transient edema of the biliary or pancreatic anastomoses with moderate upstream ductal dilatation, free fluid, fat stranding in the surgical bed, and lymphadenopathy.

Complications include intestinal leakage, pancreatic fistula, hemorrhage, pseudo-aneurysms, pancreatitis, abscesses, liver ischemia, delayed gastric emptying, and pancreatic or biliary anastomotic strictures.

After venous resection and reconstruction, stenosis or thrombosis of the portomesenteric venoplasty requires prompt intervention to prevent portal hypertension.

Conclusion: The radiologist plays a key role in detecting potentially life-threatening complications occurring early after cephalic pancreatico-duodenectomy. Familiarity with the normal post-operative findings as well as early anastomotic and vascular complications allows for accurate and timely diagnosis.

A-210

Additional Findings in Prostate MRI: Benefits of an extended protocol

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Purpose: To describe the benefits of an extended prostate MRI protocol, indexed by the number and the clinical importance of additional findings and their potential impact on the change in patient management.

Methods and Materials: We retrospectively included 901 consecutive patients undergoing a mp-MRI of the prostate at our institution between 01.10.2018 and 31.03.2021. Additional findings were defined as any pathology not located in the prostate or the seminal vesicles. These were further classified as related or unrelated to prostate cancer. Findings unrelated to prostate cancer were divided into 3 subgroups as having low, moderate, or high clinical significance (1, 2, 3). A finding was judged to be significant (moderate and high) if further diagnostic investigations, follow-up or treatment was necessary. The degree of urgency of the latter determined moderate and high significance. In case of a highly significant finding, a management change was defined as further work-up (imaging, biopsy, treatment). In addition, these findings were stratified by organ systems.

Results: A total number of 3648 additional findings were recorded in 864/901 patients (96%). 70 extra-prostatic prostate cancer related additional findings (lymph node metastasis and bone metastasis) were found. Discopathy (n=661, 18% of all findings) was the most common finding unrelated to prostate cancer belonging to group 2. 1737, 1315 and 107 lesions were assigned respectively to group 1, 2 and 3. Most frequent additional findings of group 3 were aneurysms (n=28, 26.1%), suspicious renal lesions (n=26, 24.2%) and fractures (n=10, 9.3%). A management shift was identified in 21 patients having a highly significant additional finding. Further diagnostic investigation included biopsy, colonoscopy, dedicated MRI, CT, ultrasound. 7 (0.77%) patients underwent a surgical treatment or other treatment.

Conclusion: Extended MRI protocol for prostate cancer evaluation shows a considerable prevalence of additional findings with a potential change in management.

The Role of Imaging in the "Lego Player's Foot"

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Learning objectives: The clinical assessment together with the history of present illness (especially playing behavior) generally lead to the correct diagnosis. Imaging studies or biopsy are usually not necessary and can be misleading. The goal of this poster is to highlight the clinical picture of the Lego player's foot and to demonstrate a few important differential diagnoses of soft tissue lesions of the foot.

Background: The Lego player's foot is the description of a callosity esp. in children on the anterolateral aspect of the ankle caused by the sitting position on the dorsum of one or both feet (talar callosity). In the history of present illness caregivers state the patient often plays sitting on the floor on their feet with lego or other toys. The clinical picture of the Lego player's foot was rarely encountered in pediatric radiology and is also unknown to many referring clinicians. Although entirely benign, it can cause major concern in parents and physicians and can lead to imaging studies as ultrasound and MRI.

Imaging findings or procedure details: The sonographic sign of talar callosity are non specific and show a thickening of the dermis and subcutanous tissue with a diffuse decrease in echogenicity. Underlying calcaneus, talus or tarsal bones are usually normal. Ultrasound, radiographs or even MRI can be helpful in ruling out the most common differential diagnoses, such as vascular lesions, ganglia, neurofibroma, pilomatrixoma or other soft tissue masses. If the diagnosis of «Lego Player's foot» is not known to the radiologist or referring physician, imaging may be misleading and unnecessary MRI or biopsies are recommended.

Conclusion: Familiarity with the clinical picture of the "Lego player's foot" prevents unnecessary imaging examinations.

On the other hand, it is necessary to be able to make the diagnosis also with imaging modalities and to know the most frequent differential diagnoses of cutaneous changes of the foot in children.

Hamartomas from head to toe in paediatric patients and young adults – Overview of clinicoradiological features

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Learning objectives: To illustrate and familiarize radiologists with the clinical and imaging features of hamartomas occurring throughout various organ systems in paediatric patients and young adults, highlighting important syndromic associations.

Background: Hamartomas are benign tumour-like malformations comprising of architecturally disorganized mesenchymal components (e.g cartilage, fat, connective tissue, and smooth muscle) that are typically found in the organ of origin, virtually in any organ system. These lesions can occur either sporadically or in conjunction with underlying syndromic conditions, some with a known hereditary basis. Hamartomas are usually discovered incidentally and can give rise to symptoms due to obstruction, compression, infection, infarction, haemorrhage and pathological bony fractures. Rarely, some hamartomas can also undergo sarcomatous transformation, such as transformation of osteochondroma into chondrosarcomas. Although the imaging appearances of hamartomas can mimic malignancy and also vary depending on the organ from which they originate, the findings are usually distinctive and a diagnosis can often be made with certainty.

Imaging findings or procedure details: The imaging features of a wide variety of hamartomas will be illustrated in various organ systems, including:
- Nervous system – Hypothalamic, hamartomas associated with neurofibromatosis-1 and tuberous sclerosis, fibrolipomatous hamartoma of the median nerve
- Breast
- Lung
- Gastro-intestinal tract – liver, spleen, biliary and bowel eg polyp or associated with Peutz-Jeghers syndrome
- Musculoskeletal – eg chest wall mesenchymal hamartoma, osteopoikilosis, osteochondroma, enchondroma, non-ossifying fibroma, fibrous dysplasia bone haemangioma and others. Associated underlying syndromes and neoplasms that may arise will be highlighted.

Conclusion: Knowledge of the wide imaging spectrum of hamartomas and their syndromic associations is essential in avoiding unnecessary and invasive interventions as well as in directing further work-up for syndromic associations.

Imaging evaluation of acute and chronic bleeding complications in paediatric haemophilia

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Learning objectives: To familiarize readers with the imaging features of acute and chronic bleeding complications in haemophilia patients, highlighting unusual locations in the body where these can occur, using multimodality imaging.

Background: Haemophilia is an inherited bleeding disorder with a male preponderance. Bleeding in these patients may present acutely in different and unusual locations throughout the body, occurring spontaneously or secondary to prior insult or trauma with disproportionate bleeding which may result in life-threatening consequences. For example, bleeding may occur in the brain and spine causing acute stroke with subsequent seizures and neurological deficits. Bleeding into the abdominal cavities and intramural bleeding into the genitourinary or gastrointestinal walls may also rarely occur. Repeated bleeding episodes may cause chronic manifestations with often severe morbidity.

The most common manifestation of the disease is acute haemorrhage into joints causing hemarthrosis. This usually affects large joints such as the knee, elbow, ankle, hip and shoulder. Repeated episodes can lead to pannus formation with destruction of the synovium, cartilage and subchondral bone resulting in haemophilic arthropathy, which can result in debilitating chronic pain and contractures in the long term.

Imaging findings or procedure details: Imaging features of acute and chronic bleeds in the setting of haemophilia will be illustrated on plain radiographs, ultrasound, CT and MRI. The unusual sites of bleeding in the body shown on imaging study will serve as important review areas for radiologists when reading the study.

Conclusion: Knowledge and recognition of haemophillic bleeding complications is essential for timely diagnosis and management.

Avascular Necrosis in the pediatric population: Do not forget the small bones!

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Learning objectives: Recognise avascular necrosis within the small bones within the hands and feet in the pediatric populationr, know and recognise the common radiological features of the entity and proceed to MRI investigation when the symptoms persist despite negative X-Ray findings.

Background: The most common presentations and sites for avascular necrosis in children are the femoral head, knee, and within the foot the navicular bone and the metatarsal heads. Avascular necrosis (AVN) of the smaller bones within the hand and foot often results in unexplained pain, and the diagnosis of osteonecrosis gets overlooked as the initial X-ray findings are often normal. Depending on the stage of Osteonecrosis, symptoms can range from asymptomatic to highly debilitating, with severe pain, limited range of joint motion up to joint destruction. MRI is the gold-standard diagnostic tool to identify early stage ON, when direct radiography is still negative.

Imaging findings or procedure details: We would like to present the imaging findings within two rare cases of Osteonecrosis within young children: Renander's disease (osteonecrosis of the medial sesamoid bone within the foot) within an 11-year-old female patient, and osteonecrosis within the pisiform bone in the hand in an 11-year- old boy. No reports of avascular necrosis in these locations within such young patients have been found within the literature. The common findings that are usually seen within the larger bones in avascular necrosis, will be described and demonstrated; as well as the similar findings that can be found within the smaller bones as in our 2 cases.

Conclusion: Radiologists should always be aware that even the smallest bones within the hand and foot can present with avascular necrosis within the pediatric population, and should actively search for this in children who presents with unexplained pain with negative Xray findings. In the case of sesamoid bone osteonecrosis, the existence of a bipartite, tripartite or even a multipartite sesamoidbone should even further raise the diagnosis.

Imaging of non tumoral pancreatic abnormalities in children

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Learning objectives: Upon completion of this educational exhibit, the reader will be able to:
- Know the normal appearance of the pancreas in children on US, CT and MRI.
- Know the main non-tumoral pancreatic lesions in childhood and their imaging characteristics.

Background: Pancreatic lesions in children vary from those in adults, both in their cause and in their clinical presentation.

To be aware of these differences is necessary to avoid confusion and reduce delay in management.

In children, the pancreas is more visible and easier to evaluate on ultrasound that in adults patients, due to the smaller abdominal diameter and greater echogenicity. However, complementary CT and MRI are usually required to improve diagnosis

Imaging findings or procedure details:
1. Normal imaging findings of the normal pancreas for each imaging modality.
2. Imaging findings of representative cases of the major causes of pediatric non -tumoral pancreatic abnormalities, including congenital malformations, traumatic lesions and complications, pancreatitis, cystic fibrosis and/or genetic diseases, among others.

Conclusion: Pancreatic non-tumoral anomalies are rare in the pediatric population and may be difficult to identify. It is important to recognize the main causes of pancreatic pathology in this collective. The clinical history and the choice of the most appropriate imaging modality for each pathology are essential for a correct radiological diagnosis.

Diagnostic imaging in children with acute abdominal pain

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Learning objectives:
- To be familiar with the most common pediatric entities with abdominal pain
- To be aware of pitfalls and rare clinical problems in acute abdomen
- To know the appropriateness of the best diagnostic modality in different clinical situations.

Background: Children with non-traumatic acute abdominal pain are the most common requests for abdominal imaging from the emergency department. For many radiology residents, children with belly pain remain a diagnostic challenge especially on duty. Functional pain and viral gastroenteritis are the main reason for self-limiting abdominal pain while conditions such as appendicitis or intussusception require surgical assessment. Since abdominal pain is not specific, imaging can help to identify rare conditions.

Imaging findings or procedure details: Abdominal radiographs are mainly performed to demonstrate free gas, stones or calcifications, bowel gas distributions, gas-fluid levels or to rule out foreign body ingestions.

US is the preferred modality for detecting free fluid, bowel wall thickening and specific signs such as the "donut" sign in intussusceptions. In addition, gallbladder stones and pancreatitis are easily imaged. In stable patients IV contrast media increases sensitivity for parenchymal laceration or infections (abscess, focal nephritis).

Fluoroscopy with oral or rectal contrast media still adds diagnostic value in children with bilious vomiting, bowel obstruction or Hirschsprung's disease.

CT use is discouraged in children due to radiation exposure. Low dose CT is recommended for urolithiasis.

Also, imaging acute trauma or postoperative complications.

MRI is highly sensitive and specific for the diagnosis of the whole range of abdominal and pelvic abnormalities. We recommend a short MR protocol for appendicitis, when ultrasound is inconclusive.

Conclusion: Acute abdominal pain is a common complaint among children. Therefore, selection of appropriate imaging modality and correct interpretation of findings is a key for quick and effective management.

Focal hepatic lesions of the neonate and infant: a diagnostic approach.

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Learning objectives: To provide, through examples, imaging clues for the diagnostic approach of hepatic lesions in neonates and infants.

Background: Focal lesions of the liver are rare in the first year of life. They are detected by antenatal or postnatal ultrasound, incidentally, or secondary to clinical signs (hepatomegaly, liver and heart failure, or tumor rupture).

Neonatal liver masses are most often benign, solid with vascularization (vascular malformations) or cystic (mesenchymatous hamartoma, ciliated cysts, simple cyst), but can also be malignant (hepatoblastoma, neuroblastoma metastases). In the neonate at the intensive care, the differential diagnosis includes nontumoral lesions of the liver, iatrogenic (birth-injury trauma, umbilical catheter complications) or infectious (abscess, candidiasis).

Imaging findings or procedure details: We illustrate the most common tumoral and non-tumoral liver lesions and provide key imaging features (US/Doppler, MRI, CT), clinical and laboratory findings to assist in their work-up.

US/Doppler is the first-line imaging to analyse the lesion (appearance, number, vascularisation, localisation), the liver itself (size, hepatic vessels, biliary tract, elastography) and extra-hepatic findings (spleen, ascites, abdominal vessels, retroperitoneum, etc).

MRI is performed without general anaesthesia for infants < 2 months old: axial and coronal T2 (respiratory gating), axial diffusion (DWI), axial T1 VIBE. If contrast is necessary, the protocol is completed by dynamic T1 and 3D fat-saturated sequences.

CT with angiography is restricted to selected patients to plan surgical or endovascular management.

Conclusion: Although liver lesions in the neonates and infants are rare, they have radiological and clinical features that radiologists should be aware of. Imaging has an important role in establishing the diagnosis and in orientating the physicians towards the most appropriate management, surgical, endovascular or medical.

A systematic review of T2 relaxation time of the immature knee cartilage

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Purpose: To systematically review the methodology of T2 mapping of the growing knee cartilage and to compare the T2 relaxation times between healthy young subjects and patients at risk of cartilage damage.

Methods and Materials: The study protocol was registered in PROSPERO.

We included all studies using T2 relaxation of the knee cartilage in participants younger than 20 years, including healthy controls and patients prone to cartilage damage from any pathology affecting the knee.

We searched Medline, Embase, Cochrane, Web of Science, Google Scholar and arXiv from 2000 to September 2022.

Data extracted comprised characteristics of participants, scanning parameters, post-processing methodology, and T2 relaxation times. We used the AXIS tool to evaluate quality of reporting. Pool effect sizes were calculated for each articular compartment.

Results: Seventeen articles met eligibility criteria, including 879 participants. At risk participants had either patellafemoral instability, juvenile idiopathic arthritis, osteochondritis, discoid meniscus, hemophilia, or obesity. The most commonly segmented knee compartment was the weight-bearing femur. There was considerable variability between studies in terms of acquisition techniques and T2 relaxation time values. The overall assessment of methodological quality was good.

Conclusion: The existing literature on T2 mapping of cartilage of the immature knee is heterogenous. Research agenda should focus on standardization of imaging and post-processing techniques. Importantly, the clinical relevance of T2 relaxation of cartilage has yet to be evaluated in children and adolescents.

Pediatric polytrauma in a tertiary center

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Purpose: Traumatic injuries are responsible of 45% of deaths in children. Whole-body CT is increasingly used for severe pediatric trauma.
For the radiologist, it is important to learn how to recognize different traumatic injuries in parallel with their prevalence distribution throughout the body. Traditionally, the skull is the most frequent location followed by the thoraco-abdominal region.
Therefore, we aimed to analyze the incidence of different soft tissue traumatic injuries in children, with a special focus in intra-abdominal lesions.
Methods and Materials: This is a retrospective analysis of all CT examinations named "CT POLYTRAUMATISE" in our PACS system, concerning children aged <18 years between 01/01/2010 and 30/09/2022.
The inclusion criteria were imaging of at least the skull, thorax and abdomen. The exclusion criteria were absence of trauma.
The lesions were categorized as intracranial, liver, spleen, kidney, pancreas and lung according to the CT reports.
The clinical information was found in patient files.
Results: The total number of examinations was 352 with 313 respecting our inclusion/exclusion criteria. The number of whole-body CTs/year was stable, averaging 24.
The yearly distribution of each lesion type is shown on graph 1.
The most frequent injured organs were the lung (n=86), followed by intracranial (n=63), liver (n=15), spleen (n=14), kidney (n=5) and pancreas (n=1).
The degree of liver, splenic and kidney injury was graded according the international AAST-classification and is shown in graph 2.
From a total of 34 abdominal lesions, 24 patients were clinically surveilled, 4 treated with embolization, one underwent splenectomy and 5 deceased. The deaths resulted from cerebral damage and were not directly related to abdominal injuries.
Conclusion: The number of whole-body CT in the pediatric population remained stable over >10 years and lung was the most affected organ. Abdominal lesions were mostly treated conservatively or with embolization.

Artificial intelligence-based image reconstruction of abdominal MRI in children

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Purpose: To investigate image quality of abdominal magnetic resonance imaging (MRI) with artificial intelligencebased image reconstruction.
Methods and Materials: In 23 children (mean age 5 years, range from 1 year 7 months to 20 years 1 month) undergoing abdominal MRI employing radial k-space filling (PROPELLER), the axial T2-weighted and T1-weighted images were evaluated for image quality. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the liver and spleen were compared between images obtained by conventional and deep learning (DL) reconstruction methods. Subjective image quality was assessed by three observers.
Results: Both T2-weighted and T1-weighted images provided significantly higher SNR and CNR (Wilcoxon signedrank test, $p < 0.001$). The images with DL reconstruction showed less noise, reduced blurring of organ borders and sharper delineation of small structures such as intrahepatic vessels.
Conclusion: AI-based image reconstruction improves image quality of abdominal MRI with the potential to obtain higher spatial resolution and shorten imaging time.

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An open access AI-based pattern recognition tool for application in MSK imaging – suitability and limitations of resources today

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Purpose: Research on artificial intelligence for the use in medical application is slowed down by the reluctance of medical practitioners to get involved with computer programming, as well as the intricate utilization of available resources. We test in this study open access resources for the building and providing of an open access MSK tool for a typical 4-class labeling task.

Methods and Materials: We chose Google-Chrome as browser, Google-Drive as online cloud, Google-Colab as the running environment. We implemented the code using Google-TensorFlow in Python. We ran the code on a relatively small and unbalanced dataset consisting of shoulder implant Xray images from 4 different manufacturers.

For classification, we finetuned the ResNet-50 model pretrained on ImageNet dataset and performed a 5-fold cross validation. To reduce overfitting, we enlarged the dataset by online data augmentation and introduced significant dropout during training for achieving regularization.

Results: The chosen open access resources are sufficient for the intended task. Proper training of the network is achievable. Enlargement of the image dataset by data augmentation reduces overfitting and increases labeling accuracy between the shoulder implant manufacturers.

Conclusion: The artificial intelligence tool will be made available for download on github. Its potential use lies also outside MSK. Main concern and limitations when using online cloud services today is their lack of data safety and data privacy. Providing graphical user interfaces will potentially increase the uptake of artificial intelligence into medical application further.

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Diagnostic performance of the Darth Vader sign for the diagnosis of lumbar spondylolysis in routinely acquired examinations of the abdomen

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Purpose: To assess the inter-reader agreement and diagnostic performance of a novel image sign defined by a helmet shaped anterior edge of the vertebral body and flat-shaped, irregular osseous interruptions in the interarticular pars ("Darth Vader sign") for the detection of spondylolysis in axial CT images of the abdomen including the lumbar spine.

Methods and Materials: We performed a retrospective search in our institutional image report archives through keyword strings for lumbar spondylolysis and spondylolisthesis. Abdominal CT imaging data from 53 spondylolysis cases (41% female) as well as from controls (n=6) without spine abnormalities was identified. Of those, a total of 139 normal and pathologic single-slice axial images covering the lumbar spine (86 normal images, 40 with spondylolysis, 13 with degenerative spondylolisthesis without spondylolysis) were exported. Two radiology esidents rated all images for presence or absence of the "Darth Vader sign". Diagnostic accuracy for both readers as well as inter-reader agreement was calculated.

Results: The "Darth Vader sign" showed an inter-reader agreement of 0.770 among resident radiologists. Using the "Darth Vader sign", spondylolysis was detected with a sensitivity and specificity of 65.0-88.2% and 96.2-99.0%, respectively.

Conclusion: The "Darth Vader sign" shows excellent diagnostic performance at substantial inter-reader agreement for the detection of spondylolysis and thus should be implemented in radiology training curriculums. Using the "Darth Vader sign" in CT reading routine may be an easy yet effective tool to improve the detection rate of spondylolysis in non-musculoskeletal cases and hence improve patient care.

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Fully automated anatomical quantification of the scapula for the management of shoulder disorders

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Purpose: Assessing bone morphometry by imaging is important for the diagnosis and management of several bone and joint disorders, including in the shoulder. However, manual quantification of morphological parameters is time-consuming and tedious in increasingly busy clinical workflows, and its reliability depends on the experience of human observers. Therefore, we developed a deep-learning-based image analysis approach to automatically quantify scapular morphological markers from clinical CT scans.

Methods and Materials: First, the scapula and humerus were segmented from shoulder CT scans using nnU-Net, trained with 60 healthy and 56 osteoarthritic shoulders. As a second step, six landmarks allowing the quantification of scapular morphology were positioned on the scapula by four trained human observers. An algorithm was developed to automatically position these landmarks based on a U-Net architecture. Finally, these landmarks were combined with the segmented glenoid cavity to automatically calculate morphological markers of the scapula, such as glenoid inclination and version and the critical shoulder angle. Validation was performed using 5-fold cross-validation over the whole dataset.

Results: Validation showed excellent segmentation accuracy (Dice ≥0.97), and automatic landmark detection achieved equal or better accuracy than trained human observers, with an average prediction error of <2.5mm. Morphological markers quantified by clinical experts and those predicted automatically also agreed well: regression between manual and automatic measurements yielded slopes around 0.85 and R2 >0.85.

Conclusion: Our results demonstrate the feasibility of accurate morphometric quantification of the scapula based on clinical CT scans using deep learning. Future work will focus on applying this fully automated method to a large cohort of patients and CT scans with glenohumeral osteoarthritis to evaluate the predictive power of these markers on clinical outcomes.

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Imaging of the postoperative meniscus: differentiating the normal from the abnormal

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Learning objectives: To provide an overview of the normal appearance of the postoperative meniscus, focusing on:
1) A short review of the normal meniscal anatomy and main types of meniscal tears;
2) The main surgical treatment options for meniscal tear;
3) Limitations of MR imaging;
4) Strengths and limitations of MR arthrography and CT arthrography;
5) Expected findings of the postoperative meniscus on imaging.

Background: Meniscal surgery is a common procedure. Patients who have had surgery may return with clinical symptoms such as pain or internal derangement of the knee. Postoperative imaging often proves difficult to interpret due to the altered shape and signal intensity of the operated meniscus. Therefore, it is fundamental to be familiar with the most common surgical techniques to avoid many pitfalls in the postoperative setting.

Imaging findings or procedure details: After a short review of the normal anatomy of the meniscus, we will briefly go over the main surgical treatment options of meniscal tears in relation to different tear types. We will then describe strengths and limitations of the different imaging techniques, notably MRI, MR arthrography, and CT arthrography. We will focus on the expected, normal features of the postoperative meniscus, and how to differentiate them from pathological ones. Finally, we will illustrate pearls and pitfalls which can be encountered in daily practice.

Conclusion: Through a set of representative cases, this presentation will provide a pictorial review of the imaging of the postoperative meniscus, with the aim to help differentiate normal and abnormal findings.

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Turn it off! Saving Energy in Radiology Departments by Implementing Live Dashboards showing Idle Imaging Modalities, PCs and PACS Workstations not powered down during off-hours.

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Purpose: To develop and implement live dashboards monitoring the network status of all imaging modalities, PCs and PACS workstations in a radiology department in order to reduce energy consumption.

Methods and Materials: Our tertiary care radiology department operates around 40 medical imaging systems and 200 PC workstations. In order to identify devices running in idle mode rather than being switched-off when not in use, a self-developed Python-based script querying the network status ("Online" vs. "Offline") of all imaging modalities and PC workstations was implemented on an Ubuntu server. The status of all network clients is tracked automatically in 15-minute intervals by a ping signal to the respective IP addresses or DNS aliases.
Client names, network status and timestamps are recorded in an SQL database. Data can be queried from the database and visualized with open source or commercially available business intelligence software solutions (e.g. Redash or Tableau).

Results: Current network status as well as trends over the last 24 hours are visualized in workspace-specific live dashboards (e.g. information on MRI scanners and side panels for technologists or information on PACS workstations in the different imaging divisions for radiologists). Using the provided dashboard overviews, each team of technologists or radiologists may now identify unused imaging modalities or PC workstations running in idle mode in their environment (e.g. during off-hours) and can contribute to reducing the department's energy consumption by switching-off currently unneeded consumers of energy.

Conclusion: Live dashboards can provide insights on the current status of imaging modalities and PC workstations at a glance. Radiology department staff members may now easily contribute to reducing the department's energy consumption by identifying and switching-off unused machines, especially during off-hours. The script's source code will be published open-source.

Blunt Cerebrovascular Injury and pitfalls: a pictorial essay

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Learning objectives:

- To give an overview of the different lesion types encountered in blunt cerebrovascular injury (BCVI)
- To enable radiologists to become familiar with the CT and MR features of BCVI and to describe potential pitfalls

Background: BCVI is a serious spectrum of pathologies encountered in patients who suffer from high-energy blunt force trauma or direct cervical and/or craniofacial injury.

The diagnosis of BCVI can be challenging, also because the damage of the vessel wall may not always be associated with cervical fractures and vice versa.

Cervical CT angiography has widely been accepted as the emergency technique of choice in these severely injured patients. However, in challenging cases, CT may yield equivocal results so that MRI is a useful noninvasive adjunct, namely thanks to 3D fat-saturated T1-weighted MR sequences centered on the supraaortic vessels.

Imaging findings or procedure details: The radiologist plays a key role in the diagnosis and management of BCVI. Indeed, both therapy and prognosis are based on the Biffl grade, a scale based on imaging findings.

According to our database, including almost 100 patients, the most encountered lesion is arterial dissection.

Interestingly, between patients who suffered from this lesion, about a half did not have an associated bone cervical fracture.

Considering the educational aim of this pictorial poster, we will also include examples of mimics and pitfalls, in order to provide a comprehensive overview.

Conclusion: Prompt diagnosis and radiological grading of BCVI are fundamental for proper patient management and reduction of complication risk, namely stroke and death. Therefore, radiologist, who has a central role in the prevention of such complications, must be familiar with the features of BCVI, including potential pitfalls.

Under-Reporting of Forensic Findings: Craniocervical Emergency Imaging in Cases of Survived Hanging

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Learning objectives:

- Majority of cases of nonfatal hangings will have no or minor injuries.
- Missed imaging findings are strongly associated with a bad prognostic situation, indicating that these missed imaging findings are clinically irrelevant at the emergency setting.
- Combination of generally few findings in all cases of nonfatal hanging and increasing evidence for clinical under-reporting of forensic findings indicates the need for a forensic review of radiologic images.

Background: Forensic and clinical radiology have fundamentally different goals: Clinical radiology is a diagnostic tool that ensures the anatomical basis for therapy and the detection and staging of pathology. Forensic radiology is motivated by causality; reviewing exclusively the past as it determines the most likely causal of trauma.

Imaging findings or procedure details: Retrospective, single-center study: all patients admitted for attempted suicide with near-hanging or fatal-hanging between January 2008 and December 2020 who received CT or MR imaging of head and neck were reviewed, and missed findings in the original report were documented. A binary regression with disagreement as dependent variable was fit for imaging modality, fatality, age, and sex.

Conclusion: This study revealed statistically significant under-reporting of forensic findings during emergency craniocervical CT and/or MRI in victims of strangulation. This under-reporting is associated to fatality of the attempted hanging, which indicates that less severe findings are likely not considered important or clinical relevant in the emergency setting.

The combination of generally few findings and increasing evidence for clinical under-reporting of forensic findings indicates a need for a forensic review of radiologic images; in any case, they are to serve as evidence in forensic pathology.

Imaging of post-operative anatomy and complications of bariatric surgeries, moreover in Roux-en-Y By-Pass (RYGBP)

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Learning objectives:

- To show examples and illustrations of bariatric post-surgical anatomy, moreover in RYGBP surgery, and related complications to get familiarized with the typical and atypical imaging aspects.
- To review and emphasize the important signs in Computed Tomography (CT) for a better detection of these complications.
- To learn the correct protocol of image acquisition.lly different goals: Clinical radiology is a diagnostic tool that ensures the anatomical basis for therapy and the detection and staging of pathology. Forensic radiology is motivated by causality; reviewing exclusively the past as it determines the most likely causal of trauma.

Imaging findings or procedure details: To be familiar with the normal post-operative anatomy after RYGBP and sleeve gastrectomy is the key prerequisite for the detection of any complication.

Different protocols should be used depending on the suspected complication.

In RYGPB, oral administration of iodinated contrast allows a better visualization of the gastric pouch and the alimentary limb.

Acquisition without and with ingestion of contrast allows detection of anastomotic leaks.

When bleeding is suspected, oral contrast should be avoided.

An intravenously iodinated contrast-enhanced CT is mandatory in all circonstances (unless absolute contraindication).

Videofluoroscopic procedure is use for dynamic complications like anastomotic stricture or CSS.

Conclusion: The radiologist must be familiar with the principal techniques of bariatric surgeries, since their knowledge is of crucial importance for the detection of early or late complications.

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Imaging of the pancreas transplantation: normal anatomy and postoperative complications

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Learning objectives:
- To understand the normal anatomy of the pancreatic transplantation
- To present the value and limitations of imaging techniques used in the follow-up of pancreatic transplantation
- To recognize the imaging findings of post-operative complications.

Background: Pancreatic transplantation has shown its effectiveness in restoring normal blood sugar levels in diabetic patients for whom medical treatment is insufficient. The surgical techniques are complex. The arterial inflow comes from the donor superior mesenteric artery (SMA), supplying the head of the pancreas and from the donor splenic artery, supplying the body and tail. The donor common, internal, and external iliac arteries are attached to the donor SMA and splenic artery, forming a Y graft; this graft is anastomosed to the receiver common or external iliac artery. The venous drainage is performed between the graft portal vein and the receiver superior mesenteric vein or the receiver iliac vein; the exocrine pancreatic drainage is achieved via an enteric anastomosis.

Imaging findings or procedure details: Imaging plays an essential role in the follow-up of the transplanted pancreas and in the diagnosis of the complications. Sonography is performed in the first 24 hours and is traditionally used for the follow-up of pancreas transplantation. The B-mode assesses the pancreatic morphology and the peri-pancreatic environment, and the duplex-Doppler the perfusion and the vascular anatomy. CT is usually performed for suspected complications or when sonography fails to depict the pancreatic graft. The most frequently diagnosed complications are graft pancreatitis, vascular complications (arterial or venous thrombosis), intraabdominal collections, intraabdominal hemorrhage and bowel-related complications (anastomotic leak, obstruction).

Conclusion: This presentation aims to make the radiologist familiar with the imaging of pancreas transplantation, based on the experience of a large university center.

Gadolinium uptake by blood cells post contrast enhanced MRI examinations

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Purpose: Since the introduction of Gadolinium based contrast agents (GBCA) for enhanced MRI examinations in the late 1980s, millions of doses have been used worldwide and well tolerated by patients. Recently, it became known that frequent and/or high dose application of contrast agents (CA), in patients with severe renal insufficiency, could lead to development of life-threatening nephrogenic systemic fibrosis (NSF). Additionally, Gadolinium (Gd) deposits have been discovered in patient organs but with unknown clinical characteristics of a particular disease. However, little is known about the drug's interaction with cells even though the first interaction of the drug occurs with blood cells. Hence, the aim of this study was to see whether GBCA is taken up by blood cells.

Methods and Materials: Briefly, human blood was exposed to either gadoterate meglumine (Gd-DOTA) or Eu-DOTA ex vivo, or was collected from patients who underwent contrast-enhanced MRI with Gd-DOTA. The uptake of CA into blood cells was quantified by measuring Gd using single cell ICP-MS (SC-ICP-MS) or by measuring Eu by time resolved fluorescence (TRF) spectroscopy.

Results: Uptake of Gd-DOTA or Eu-DOTA into white blood cells (WBCs) was detectable by SC-ICP-MS and TRF respectively. Analysis of Gd uptake by SC-ICP-MS in patients' WBC was positive for all samples and provided a median value of approximately 50 atto (10^{-18}) gram per cell corresponding to concentrations in the low micromolar range intracellularly. However, no uptake of CA into erythrocytes was detected in *ex vivo* experiments, with either method, and therefore measurements of Gd in red blood cells were not performed in patients.

Conclusion: In summary, the findings clearly show GBCA uptake by patient WBCs not only ex vivo, but more importantly, under clinical conditions. In conclusion, further studies with different contrast agents should be conducted. In addition, the mechanism of contrast agent uptake needs to be explored.

Guide for radiologists and nuclear medicine physicians for a standardized radiomics analysis.

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Learning objectives: To sensitize radiologists and nuclear medicine physicians about radiomics analysis in the field of oncology to provide the basic skills to be able to start their own radiomics analysis.

Background: In recent years, radiomics has become an essential tool in oncology research, allowing the extraction of quantitative data from radiologic images to improve the assessment of tumor diagnosis and prognosis, as well as prediction of side effects.

Currently, in the literature, several papers have shown promising results of applying radiomics to different cancers, but a large methodological heterogeneity was revealed across studies which limits reproducibility between centers and so the external validation.

Thus, given the growing need to understand and apply these tools in oncology research practice, we present a summary of the radiomics workflow, as well as examples, and discuss the factors influencing the radiomics features and current limitations of this approach.

Imaging findings or procedure details: First, the radiomic study is planned after considering several fundamental questions regarding: the impact sought, the sufficient number of observations, the quality of data and their distribution (proportion and homogeneity) across the population.

Second, the workflow starts with image preprocessing and then proceed with segmentation of the region of interest with dedicated software. The stability of the contouring method can be evaluated using methods such as a specific reliability measure named Intraclass Correlation Coefficient (ICC). Then, the quantitative tumor features are extracted. The last steps is to find a model that would have a significant clinical impact and would be reproducible. For this, it is necessary to maintain methodological homogeneity of the studies by using guidelines and radiomic quality scores, that we will mention.

Conclusion: This poster aims to present a simplified approach to radiomics analysis with a summary of the basic concepts and the typical radiomics workflow, and with a discussion about his limitations.

Yet another pitfall on FDG-PET/CT: intraosseous hibernoma (IOH)

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Learning objectives:
- IOH mimics osseous metastasis, a rare pitfall not very well known in nuclear medicine
- imaging features in FDG-PET, CT, bone scan and MRT
- differential diagnosis
- literature overview

Background: 18F-FDG is fare from being tumor specific, but many pitfalls in FDG-PET/CT can often be distinguished from metastasis by their location, CT morphology or distribution. We present a rare pitfall in FDG-PET/CT that is not very well known and is uttermost difficult to distinguish from metastasis.

Imaging findings or procedure details: A 73-year old woman was assigned for FDG-PET/CT examination after an incidental finding of a suspicious pulmonary nodule. FDG-PET/CT revealed a small slightly FDG-avid pulmonary nodule suspect for malignancy and a small sligthly sclerotic lesion with mild FDG-Uptake in the upper pupic bone.

Histopathology revealed an interosseous hibernoma a rare benign soft tissue tumor arising from brown fat.In the few literature available intraosseous hibernomas may or may not be positive on bone scans. Like in our case most are slightly sclerotic on CT but also lytic lesions have been described. In MRI they are T1 hypointense to fat and hyperintense to muscle; they are usually T2 hyperintense and may show peripheral contrast enhancement. In the few available literature IOH are mostly incidental findings with solitary lesions in spine, pelvis, ribs or very rarely in extremities with low to moderately increased glucosemetabolism. IOH present as painless tumors in general, few painful cases could be successfully treated with RFA or surgery.

Differential diagnoses include metastasis, lymphoma, fibrous dysplasia, non ossifying fibroma, fractures and more.

Conclusion: Intraosseous hibernoma is a rare benign tumor which can mimic metastasis in FDG-PET, CT, bone scan and MRI. IOH might be indistinguishable from metastasis or malignant lesions wich makes biopsy or follow-up mandatory in clinically relevant cases. Given the benign nature of IOH, radiofrequency ablation or surgery is only an option in rare symptomatic cases.

Head and neck cancer metastases in percutaneous endoscopic gastrostomy sites: A clinically important FDG-PET/CT finding

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Learning objectives:
- To identify unusual metastases sites in head and neck cancers.
- To correlate head and neck cancer staging with the incidence of percutaneous endoscopic gastrostomy (PEG) site metastases.
- To discuss possible spread mechanisms to the PEG site.
- To understand the association of PEG placement method and incidence of PEG site metasases.
- To be aware of the clinical relevance of this unusual finding in daily practice.

Background: FDG-PET/CT is regularly used for the initial staging and therapy response evaluation in patients with head and neck cancers. In these patients, a percutaneous endoscopic gastrostomy is often required to maintain nutrition. However, the most frequently used Gauderer-Ponsky "pull" technique for endoscopic PEG placement can lead to direct or indirect spread of tumor cells with consecutive implantation at the PEG site.

Imaging findings or procedure details: Finding of a metabolically active soft tissue mass in the anterior abdominal wall at the location of prior percutaneous endoscopic gastrostomy site. To be found in the response evaluation with FDG-PET/CT after treatment of head and neck cancer and differentiation from commonly inflammatory changes is crucial. This clinical situation is typically found without clinical symptoms.

Conclusion: Metastases in percutaneous endoscopic gastrostomy sites in head and neck cancers are rare findings with high clinical importance regarding the prognosis and outcome. These unusual and often asymptomatic findings need to be recognized during therapy response evaluation of these patients.

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Analysis of model specific uptake distribution around joint prosthesis in quantitative SPECT data using voxel based morphometry

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Purpose: To evaluate hip joint prostheses with regard to prosthetic loosening based on distribution patterns of quantitative 99mTc-DPD/SPECT images with integrated CT information.

Methods and Materials: This retrospective analysis is an extension of a prospective study on patients with suspicion of aseptic loosening of hip joint arthroplasties (03/15-04/18). The prospective study was approved by the regional ethics committee and informed consent was obtained by all subjects. The standard for comparison was surgical evaluation or follow-up imaging.

So far, 5 patients (mean age: 81.4 years (74-91)) with 8 hip prostheses were included (3 loosened/ 5 nonloosened prostheses).

A Symbia Intevo SPECT/CT scanner (Siemens Healthineers, Erlangen) with a LEHR collimator was used.

SPECT acquisition followed 3h after cubital intravenous injection of 686±25.4 MBq 99mTc-DPD (30s/step).

CT scan parameters:130kV,130-160mAs.

Before analyzing voxel distributions for differences between stable and loosened prostheses, the SPECT images were registered to the CT images that were used for automatic mask creation (periprosthetic area of 20px) using non-rigid transformations. Presence and location of maximum uptake were also assessed through visual evaluation. This was a feasibility study, therefore only preliminary descriptive values were calculated.

Results: The images were successfully registered so that regional image correspondence could be achieved. There were radiomic features such as cluster characteristics that showed promising differences (see Table). Structural Similarity index of the masked 3D data did not show differences so far.

		Loosened	Non Loosened	Loosened/ Non Loosened
A. Radiomic Texture Features	Cluster Prominence Median [min,max]	220.6·10^7 [198.7, 529.8· 10^7]	67.2· 10^7 [46.4, 260.7· 10^7]	3.28
	Cluster Shade Median [min,max]	43.4· 10^5 [39.4, 87.7· 10^5]	19.0· 10^5 [14.4, 48.8· 10^5]	2.28
	Cluster Tendency Median [min, max]	16.2· 10^3 [14.9, 37.9· 10^3]	12.1· 10^3 [11.5, 19.1· 10^3]	1.34
	Joint Enery Median [min, max]	0.85· 10^-3 [0.743, 5.993· 10^-3]	1.457· 10^-3 [0.623, 4.322· 10^-3]	0.58
	Structural Similarity Index	Between L:0.975	Between NL: 0.989	Between L & NL:0.978
B. Visual Evaluation	Zones of maximum uptake (Hirschmann et al.2017)	Zone SP, 3, 1	Zone 1 & 8, Zone IA	
	SUV-max Median [min,max]	28.3 [17.1, 29.9]	14.7 [9.7 16.1]	1.93

A. Summary texture features from the patients with loosened and non-loosened prostheses (row 1–5). B. Overview of visual evaluation.

Conclusion: Comparing voxel distributions between SPECT images was shown to be feasible and could potentially have an additional diagnostic value over the use of the maximum uptake of the radionuclide.

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Association between SUVs parameters and immunohistochemical features in neuroendocrine patients undergoing ^{68}Ga-DOTATOC PET/CT on new generation SiPM PET/CT scanners

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Purpose: Neuroendocrine tumours (NET) are a heterogeneous group of tumours with Ki-67 playing a major role in tumour grade definition and prognosis. ^{68}Ga-labeled somatostatin analogues PET tracers (SSTR2-PET/CT) are used in the follow-up of NET but their metabolic phenotype remains heterogeneous. The advent of newgeneration SiPM PET/CT could help with a better understanding of NET biology. We aimed to compare SUV parameters of primary tumour (PT) and secondary lesions extracted from new-generation SiPM SSTR2-PET/CT and immunohistochemical features.

Methods and Materials: Patients were recruited from March 2019 to June 2022 in this retrospective single-centre study. PET/CT were acquired on a new generation SiPM PET/CT 90 minutes after administration of 2 MBq/kg of ^{68}Ga-DOTATOC. SUV_{max}, metabolic tumour volume (MTV) and total lesion activity (TLA) were measured on PT and 2 target lesions per organ, including lymph nodes (LN). Spearman correlation was used to assess the association between SUV parameters and Ki-67 expression and Mann-Whitney test according to tumour grade.

Results: We included 112 patients and assessed 96 PT, 88 LN and 172 metastasis. Per lesion analysis of Ki-67 expression showed a significant inverse correlation with PT SUV_{max} (49.7±41.5 SD; rho=−0.32, p<0.01) and LN SUV_{max} (34.6±25.7 SD; rho=−−0.29, p=0.04). Per lesion analysis according to tumour grade showed only significant association with SUV_{max} in LN and metastasis (p≤0.01).

Conclusion: Our study showed a significant inverse correlation between Ki-67 expression and PT SUV parameters, whereas no correlation was found for tumour grade suggesting that SUV parameters might better reflect PT heterogeneity. By contrast, main differences in SUV parameters for LN and metastasis were associated to tumor grade which could be explained by the indirect comparison of SUV parameters in LN and metastasis to a Ki-67 expression measured on the PT and not in LN or metastasis.

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Current perspectives of personalized dosimetry in the SIRT treatment of hepatocellular carcinoma

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Background: Hepatocellular carcinoma is the seventh leading cause of cancer worldwide. It is a relatively aggressive malignant disease with poor prognosis and the second most common cause of cancer-related mortality in the world. Lately many new treatment options have been developed, in particular local, liver-directed, intraarterial therapy options as for example the so called selective intra-arterial radiotherapy (SIRT). This treatment, using Yttrium-90 resin or glass spheres, is now well established in this indication and delivers high radiation doses to tumor lesions while sparing normal liver tissue. While first dose recommendations were based on body surface calculations, most modern dosimetric applications use voxel-based personalized calculations using pretreatment planning procedures. These newer calculations are supported by recent publications reporting a survival benefit in patient's using personalized dosimetry.

Imaging findings or procedure details: Several recent studies have demonstrated promising results of the use of personalized dosimetry on the pretreatment workflow of SIRT, for example: the trial DOSISPHERE-01 by Garin et.al. Despite these encouraging results, personalized calculations remain challenging in some patients and there is a learning curve on how-to-best-perform personalized dosimetry. In this educational poster we summarize the latest developments in personalized dosimetry, explain the principle of personalized dosimetry and potential pitfalls, as well as showing a few examples.

Conclusion: Personalized dosimetry is becoming an essential tool for optimal planning of SIRT treatment in HCC patients. In this educational poster we present our personal experience as high-throughput center at CHUV for SIRT therapies in HCC.

Iodine-131 Norcholesterol Scintigraphy

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Learning objectives: The aim of this work is to review the main indications to perform an I-131 norcholesterol scintigraphy, to provide an updated protocol, and discuss how to interpret the results according to the clinical situation.

Special attention is given to patient preparation, including: required premedication, medication interferences leading to medication discontinuation and dexamethasone suppression if required.

Background: Morphologic imaging like CT and MRI is the first line approach in the work-up of adrenal biochemical dysfunction, but it is also the leading cause of adrenal incidentalomas nowadays. In some cases, added value can be obtained by functional imaging like adrenal scintigraphy, that has evolved from classic planar imaging to quantitative SPECT/CT.

I-131 norcholesterol is incorporated like cholesterol by the three layers of adrenocortical cells, so it can be useful in cases of Cushing syndrome, primary aldosteronism and hyperandrogenism.

Imaging findings or procedure details: Based on a recent series of cases from our nuclear medicine department, a selection of the best planar scintigraphy and SPECT/CT images are presented. These illustrative cases show the added value of functional information to avoid inappropriate noncurative surgery and to improve patient outcomes.

The advantage of SPECT/CT that avoids overlapping of physiologic activity as compared to planar imaging, integrates morphologic and functional information, as well as the possibility of absolute quantification in MBq/mL or in SUV, are highlighted.

Conclusion: I-131 norcholesterol scintigraphy helps to lateralize hypersecretion disease and to guide the therapeutic strategy both in unilateral and bilateral lesions.

Study design and rationale: Visualization and quantification of myocardial infiltration with CXCR4-expressing immune cells using [^{68}Ga]Pentixafor-PET/CT in three clinical settings of acute myocardial inflammation

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Purpose: Acute myocardial inflammation is a heterogeneous clinical syndrome with common histopathologic features:

tissue infiltration of inflammatory immune cells, myocardial edema, necrosis and fibrotic scars leading to severe cardiac complications in advanced stages.

Current diagnostic modalities [endomyocardial biopsy (EMB), CMR or [^{18}F]FDG-PET/CT], although of undisputed clinical relevance, show limitations regarding sensitivity/specificity. [^{68}Ga]PentixaFor, a highaffinity CXCR4 tracer targeting proinflammatory immune cells, has shown excellent results in clinical PET/CT imaging of cardiovascular inflammatory conditions, such as atherosclerosis and myocardial infarction. We aim to assess its diagnostic performance compared to respective standard-of-care in three clinical settings: immune checkpoint-inhibitor-induced myocarditis (ICIM), cardiac sarcoidosis (CS), and acute cellular allograft rejection (ACR).

Methods and Materials: We aim to enroll sixty patients (20/group) in this prospective monocentric pilot study (NCT05499637).

Primary endpoints are sensitivity+specificity of [^{68}Ga]Ga-PentixaFor-PET/CT in ACR, CS and ICIM diagnosis compared to the currently established diagnostic flowchart, including EMB histological analysis (HA) in ACR; combination of CMR +[^{18}F]FDG-PET/CT±EMB HA in CS; and CMR±EMB HA in the ICIM group. After 3/6-months, a follow-up visit will be performed in the ICIM/CS groups, including CMR and [^{18}F]FDG-PET/CT in the CS group. In the ACR group, EMB immune landscaping analyses (including multiplex protein imaging, tissue gene expression profiling, mass spectrometry) will be performed to assess the cellular basis of the [^{68}Ga]PentixaFor-PET/CT signal on a proteomic and transcriptomic level.

Results: Not applicable

Conclusion: We strongly believe that [^{68}Ga]PentixaFor-PET/CT imaging and quantification of pro-inflammatory immune cells infiltrating inflamed myocardium is an important step forward for early and high-specificity diagnosis of the aforementioned pathologies.

Theranostics in Soft-Tissue Sarcoma using a Vascular Disruption Approach

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Purpose: Besides its expression in prostate cancer cells, PSMA is overexpressed in the neoendothelium of many solid tumors, where activated tumor endothelium suppresses local immune response by various processes as PDL1 or TIM-3 expression, or secretion of local soluble immunosuppressive factors as TGFβ or IL-10. In this study we aim to analyze if Lutetium-177 PSMA-1 (PRRT) enhance neoendothelium disruption and local immune infiltration leading to an enhance immunogenicity.

Methods and Materials: This theranostic open label, non-randomized, exploratory trial will prospectively include metastatic soft-tissue sarcoma patients progressing under clinically indicated immunotherapy. Potential participants will be screened using PSMA PET/ceCT, and enrolled to receive PRRT if more than 50% of the tumor lesions exhibit higher than background uptake (3cm liver sphere) and there is at least one PSMA-positive measurable lesion according to RECIST 1.1. The primary objective is reduction in SUV$_{max}$ uptake in follow-up PSMA PET/CT compared to baseline. Secondary objectives are toxicity, dosimetry, induction of inflammatory cell phenotypes and cytokine response as ctDNA to provide changes on tumor burden.

Results: We are currently opening this study and aim to show first results.

Conclusion: This trial is the first to analyze Lutetium-177-PSMA treatment in combination with clinically indicated immunotherapy outside prostate cancer. By combining the effect of low-dose irradiation and endothelial disruption, we might enhance immunogenicity, arguing for a combination approach with immunotherapy for sarcoma patients.

Focal myocardial FDG uptake other than cardiac inflammation: 3 reported cases of confirmed ischemia on [^{82}Rb] PET/CT

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Purpose: Increased myocardial FDG is a well-established hallmark of cardiac inflammation/infection. However, by focal myocardial uptake, alternative diagnosis should be discussed.

Methods and Materials: We report three cases of patients with suspicion of myocarditis/endocarditis, who underwent an FDG PET/CT after 36 to 72 hours of high-fat-low-carbohydrate (HFLC) diet to suppress for the physiological myocardial FDG uptake. All patients received IV heparine 50 IU/kg ± a HFLC beverage before PET/CT. In a second step, all patients underwent [^{82}Rb] PET/CT at a median of 6.7 days [2-11], due to their cardiovascular history. [82Rb] PET/CT was performed according to our standard stress/rest protocol.

Results: All cases achieved excellent myocardial suppression. Visual analysis showed intense focal myocardial FDG uptake in a selective coronary territory, raising suspicion of ischemia because of its distribution and the patient cardiovascular history. [^{82}Rb] PET/CT showed superimposed reversible hypoperfusion in the same territory with increased FDG uptake, confirming the ischemic nature. Regional quantitative parameters of myocardial perfusion were also altered in the same territory..

Conclusion: Chronic ischemic myocardium undergoes a metabolic shift to favor glucose utilization. Therefore, by focal myocardial FDG uptake after HFLC diet, ischemia must be suspected and investigated by complementary imaging modalities such as [^{82}Rb] PET/CT or coronarography.