tested interobserver agreement for several joints¹. The knee and the wrist were the most reliable sites for assessing CPPD.

Objectives: To assess whether the high level of inter-observer agreement of US for the detection of Calcium Pyrophosphate Deposition Disease (CPPD) in the triangular fibrocartilage complex (TFCC) of the wrist found by the experienced rheumatologists of the OMERACT group² could be reproduced in real life

Methods: The OMERACT US criteria for identification of CPPD were utilised for this exercise on pre-recorded static images using a dichotomous score among several radiologists (n=2) and rheumatologists (n=5) with varying level of experience in musculoskeletal ultrasonography (range: 2–10 years). Firstly, the same 15 US images of the wrist that had been evaluated by the OMERACT panel were sent for evaluation to the local participants in order to calculate the inter-observer agreement. Secondly, 22 additional wrist US images extracted from locally performed examinations, in patients with a high suspicion of CPPD arthritis were evaluated. These local US examinations were performed in real life conditions, by different operators, on different machines and without prior standardisation of the procedure. For comparison, interobserver of wrist radiographs was also evaluated for all local patients

Results: The mean overall agreement and kappa values on the OMERACT panel US images were 0.89 and 0.78 respectively. These values are similar to those obtained previously by the OMERACT panel during the web exercise with the same images (0.80 and 0.68 respectively). The interobserver agreement was lower with the local US images (0.70 and 0.49 respectively), probably due primarily to the absence of strict standardisation of US procedure and inferior image quality. For comparison, the performance on the local radiographs was similar (0.70 and 0.47 respectively).

Conclusions: Our results confirm that the new OMERACT US definitions for assessing wrist CPPD are reliable when applied to pre-recorded static images. Scanning technique and standardisation of the procedure appear to be an important aspect with regards to the assessment of CPP deposition at the wrist.

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SAT0640

WHOLE BODY-MRI IN AXIAL SPONDYLOARTHRITIS (AXSPA): DIFFUSION WEIGHTED IMAGING (DWI) OUTPERFORMS THE STIR SEQUENCE

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Background: None

Objectives: To compare the diagnostic value of DWI and STIR sequences as part of WB-MRI studies in AxSpA patients.

Methods: 20 consecutive patients (P) with confirmed diagnosis of active AxSpA and 20 controls (C) referred for metastatic cancer screening were investigated with identical WB-MRI protocols including DWI and STIR images. Two independent observers recorded the presence of "lesions" (high signal intensity foci on STIR and high b-value DWI images) in 17 anatomic areas; making a 17-point "area score" and a calculated 40-point "lesion score". Both were tested for correlation with clinical and biological parameters.

Results: In P, the "lesion score" was significantly higher with DWI than with STIR (p<0.025). The most experienced observer had higher DWI lesion scores, suggesting a learning effect. The lesion score and some anatomic areas could discriminate P from C. For this purpose, DWI had a higher AUC than STIR (AUC=99.9, CI: 99.5–1.00 vs AUC=95.8, CI: 90.9–1.00). For a trained MRI observer using DWI, a lesion score threshold of >4 had 100% sensitivity and 95% specificity. With STIR, a threshold of >3 had 85% sensitivity and 90% specificity. The area score AUC was significantly lower with STIR than with DWI (p=0.0233), but no satisfactory area score threshold was identified. The most frequently involved areas were the spine and hip entheses in C, the spine and SIJ in P. Manubrio- and chondro-sternal joint involvement was specific for AxSpA. The lesion score was positively correlated with ASDAS-CRP and (log) CRP.

Conclusions: DWI is a promising alternative to STIR in WB-MRI studies for the detection of active lesions in AxSpA. Training may be necessary. The involvement of specific anatomic areas could distinguish P from C.

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SAT0641

PERFORMANCE AND AGREEMENT OF DIFFERENT OPERATORS AND HISTOLOGICAL TECHNIQUES FOR THE ASSESSMENT OF GERMINAL CENTRES IN MINOR SALIVARY GLANDS IN PRIMARY SJÖGREN'S SYNDROME

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Background: A standardisation of minor salivary gland (MSG) histopathology in primary Sjögren's syndrome (pSS) has been recently proposed by the EULAR study group on Sjögren's syndrome. Although there is strong agreement that germinal centres (GCs) should be routinely identified, due to their prognostic value, a consensus regarding the best protocol is still lacking.

Objectives: Aim of this study was to compare the performance of different histological techniques and operators with variable experience in MSG histopathology to identify GCs in pSS MSGs.

Methods: MSG biopsies from 50 pSS patients were studied. Three blinded operators (expert rheumatologist, expert pathologist and rheumatologist with scarce experience on MSG histopathology) scored one slide stained with haematoxylin and eosin (H and E). Consecutive slides were processed by immunofluorescence and immunohistochemistry to assess CD3/CD20, CD21 and Bcl-6 expression.

Results: Overall, the prevalence of GC in MSG specimens (namely the presence of at least one focus positive for at least one operator or histological technique) ranged between 26% and 52%. By separate assessment of 225 foci, the best agreement was between H and E-stained sections evaluated by the expert rheumatologist and CD3/CD20 segregation (Cohen's kappa=0.72). In the foci with CD21 positivity, the agreement with the expert rheumatologist further increased (Cohen's kappa=0.75). Among the 3 methods employed, the best agreement was observed between B/T-cell segregation and the positivity for CD21 staining (0.84). The absence of Bcl-6 in a focus does not necessarily rule out the presence of the GC detected with other stainings.

Conclusions: GC assessment on H and E-stained sections should be performed with caution, as it is dependent on the background and expertise of the operator. The combination of H and E with CD3/CD20 and CD21 staining should be recommended as it is reliable, feasible, able to overcome the bias of operator experience and easily transferrable into routine practice.

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SAT0642

A CAD SYSTEM IN HEP-2 IIF READING: A MULTICENTRE STUDY

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Background: The indirect immunofluorescence (IIF) on HEP-2 cells is the recommended technique for anti-nuclear antibodies (ANA) detection. Automation of IIF image reading can provide a reliable basis for cost-effective serological diagnostics. Computer-aided diagnosis (CAD) tools based on digital imaging reading can help us to overcome the reader subjectivity. In a recent work¹ we assessed the inter-observer variability using digital images showing the 74.1% of agreement. It improved using "ground truth" as gold standard.

Objectives: To compare classification accuracy between readings provided by expert readers belonging to three different laboratories and those automatically returned by CAD.

Methods: We acquired 1771 images from 583 consecutive sample with an acquisition unit using HEp-2 cells (MBL) at 1:80 screening dilution. Each image was blindly classified as positive, negative, or weak positive by two experienced physicians, with more than ten years of experience in IIF, for each of the three laboratories. We obtained gold standard on the basis of annotations provided by expert physicians. We described a CAD system for HEp-2 classification that relies upon features provided by a deep neural network architecture, namely an Invariant Scattering Convolutional Network (Scatnet). We therefore compared human readings with automatic classification provided by a CAD.

Results: The dataset contains 215 positive samples, 136 weak positive, 219 negative. The CAD-system classification and experts showed a sensitivity of 93% vs 92.9%, 79.4% vs 74.5%, and 92.2% vs. 92.8% on positive, negative and weak positive, respectively (Fig 1). The CAD-system obtained an accuracy of 89.5%, slightly better than average experts' classification (88.5%) and, interestingly, it better recognised the weak positive samples.

Fig1

Sensitivity	CAD	Experts
Positive	0.930	0.929
Weak positive	0.794	0.745
Negative	0.922	0.928
Positive Predictive Value		
Positive	0.939	0.933
Weak positive	0.777	0.779
Negative	0.927	0.913

Conclusions: Solid gold standard is essential for use CAD systems in routine work lab. The CAD-system classification and the 3 experts have provided comparable results. Laboratories' agreement improves using digital images and comparing each single human evaluation to a potential reference data and for this reason nowadays the CAD system should be considered a reliable tool of standardisation reducing the inter-laboratory variability.

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SAT0643

ULTRASOUND ABNORMALITIES IN WRIST, MCP2 AND MTP5 ARE MOST DISCRIMINATIVE IN PREDICTING ARTHRITIS DEVELOPMENT IN SEROPOSITIVE ARTHRALGIA PATIENTS

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Background: Seropositive arthralgia patients are at risk of developing rheumatoid arthritis (RA). Ultrasound (US) might be used to further predict which seropositive individuals will progress to RA. However, the value of US in the prediction of RA is still a point of debate, mainly due to the use of different scoring systems and compositions of joints in US protocols in literature.

Objectives: To investigate which joints are most discriminative in predicting arthritis development in seropositive arthralgia patients.

Methods: We included 174 seropositive patients with arthralgia, but without clinical arthritis. US was performed at baseline in 16 joints: bilateral metacarpal phalangeal (MCP) 2 and 3, proximal interphalangeal (PIP) 2 and 3, wrist and metatarsal phalangeal (MTP) joints 2, 3 and 5. Images were scored for grey-scale (GS) synovitis and Power Doppler (PD) on a scale of 0–3. Grades ≥ 2 for GS synovitis and grades ≥ 1 for PD were regarded as abnormal. Clinical arthritis development was assessed in any of 44 joints during yearly follow-up or during an

unscheduled visit in case of progression of symptoms. Patients were followed until clinical arthritis development or for a maximum of 5 years.

Results: In a total of 2784 joints that were imaged, 112 showed GS synovitis and 14 PD. The majority of GS synovitis was present in MTP2 and MTP3 joints (56 (50%) and 32 (29%), respectively), followed by wrists (15 (13%)), MCP3 (4 (4%)), MTP5 (3 (3%)), MCP2 (2 (2%)) and none in PIPs. Out of 14 joints with PD, 7 were wrists, 3 MTP5, 2 MCP2 and 2 PIP3. Fifty-one (29%) of the patients developed clinical arthritis in at least one joint after a median follow-up of 12 (interquartile range 6–23) months. For GS synovitis, the wrist, MCP2 and MTP5 were most discriminative in predicting clinical arthritis development (12/15 (80%) of patients with GS synovitis in wrist developed clinical arthritis, 3/3 (100%) in MTP5 and 2/2 (100%) in MCP2). MTP2 and 3 were least discriminative (<27%). No substantial differences were found between left and right joints. No clear association with clinical arthritis development was found in the limited number of joints that had positive PD.

Conclusions: Wrist, MCP2 and MTP5 joints (although numbers were small) showed the highest predictive value for development of clinical arthritis in any of 44 joints. Although most GS synovitis was observed in MTP2 and 3, predictive value of MTP2 and 3 joints for development of clinical arthritis was low. These results indicate that the choice of joints in the US protocol may influence the predictive value of ultrasound in predicting clinical arthritis development in seropositive arthralgia patients.

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SAT0644

T1RHO MAPPING IN THE ASSESSMENT OF ARTICULAR CARTILAGE INTEGRITY OF THE KNEE IN CHILDREN WITH JUVENILE IDIOPATHIC ARTHRITIS

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Background: Early detection of microstructural damage to cartilage of patients with juvenile idiopathic arthritis (JIA) might prevent irreversible cartilage damage by timely treatment and follow-up of cartilage microstructure. New, quantitative MRI sequences such as T1 ρ are possibly able to detect pre-erosive cartilage damage by quantifying proteoglycan (PG) loss of cartilage.¹⁻⁴

Objectives: To study feasibility of T1 ρ mapping for assessment of articular cartilage integrity in children with JIA and study correlation between T1 ρ relaxation time and the Juvenile Arthritis MRI score (JAMRIS)⁵ for disease activity.

Methods: After IRB approval and informed consent, the knee of patients with JIA or suspected JIA was imaged at 3T MRI using T2, pre and post contrast T1 and a sagittal T1 ρ sequence with 400 Hz and spin lock time of 5, 10, 20, 40 and 50 ms. A region of interest (ROI) was drawn in articular cartilage of the knee on the T1 ρ images, resulting in a mean T1 ρ value of articular cartilage per patient. Using regular T2W and T1W pre and post contrast scans, JAMRIS was assigned to discriminate inflamed knees (JAMRIS ≥ 1) from non-inflamed knees (JAMRIS 0). In SPSS, Mann-Whitney U test and Spearman correlation coefficient were used to compare the mean T1 ρ value between patients with and without arthritis on MRI and to correlate T1 ρ values with JAMRIS score. ROI drawing was performed twice in 5 subjects. Intraclass correlation coefficient (ICC) was used to study intra-reader reliability.

Results: Of all 13 patients (median age 13.7 years), 7 patients had inflammation in the knee. No cartilage lesions were observed on standard MRI sequences. Acquisition of the T1 ρ was successful and without artefacts in 100% of the children. Patients with inflammation in the knee showed a significantly longer T1 ρ value than patients without inflammation in the knee: 36.3 ms (IQR 29.0–40.4) versus 27.7 ms (IQR 25.8–30.2), $p=0.02$. Correlation between T1 ρ value and JAMRIS score was 0.76 ($p=0.003$). Repeatability of ROI drawing was characterised by ICCs >0.99 , $p<0.05$.