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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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 , $p<0.05$.