Conclusions: McGonagle et al. advocated the concept of synovio-entheseal complex and suggested that the inflammation occurs primarily at the enthesis and spreads to adjacent synovial tissues such as bursae in SpA patients. Our cross-sectional data indirectly indicated that RCB precedes or accompanies AT enthesitis in a narrow definition in the early phase of the RA, suggesting that the inflammation around the enthesis of RA patients occurs primarily at the synovial tissues and spreads to the enthesis in an opposite way. In addition, the isolated AT enthesitis without RCB in the established and/or treated RA patients may suggest several possibilities as follow: 1. Enthesitis is more refractory to RA treatment than bursitis; 2. Enthesitis is partially due to the degenerative changes related to damages and deformities caused by RA synovitis; 3. US-detected enthesitis in RA basically represents repair process rather than ongoing inflammation.

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FRI0595 THE BEACH TOOL: A QUANTITATIVE MRI-BASED METHOD FOR MEASURING OEDEMA AND FAT METAPLASIA IN SPONDYLOARTHRITIS

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Background: Magnetic resonance imaging (MRI) is an important part of diagnostic pathways in spondyloarthritis (SpA), and can be used to stratify patients and assess severity. However, measurements of the burden of inflammation currently rely on qualitative assessment, which is subjective and time-consuming thus impractical for clinical practice. There is a need for a more objective, faster method for measuring inflammation and damage with potential for automation, and quantitative MRI is a candidate tool.

Objectives: We aimed to provide proof-of-principle for the BEACH (Bone Oedema and Adiposity quantification with Apparent diffusion coefficient and Chemical shift imaging with histograms) tool, which quantifies bone marrow oedema and fat metaplasia – features of active and chronic inflammation – in the SIJs.

Methods: Fifty-three patients aged 12–24 years with either SpA or mechanical back pain were recruited prospectively, and underwent quantitative MRI consisting of diffusion weighted imaging (DWI) and fat fraction (FF) mapping,^{2,3} and conventional MRI scans. Apparent diffusion coefficient (ADC) and FF maps were assessed using the BEACH tool, which automatically propagates ROIs on sub-chondral bone after the observer defines the SIJ. Pixel values were analysed to derive the histographic parameters for ADC and FF: median, 10th, 25th, 75th and 90th percentiles (denoted ADC₁₀, ADC₂₅, FF₁₀, FF₂₅, etc), and P_{high} and plough (the proportion of high and low value pixels respectively).

Conventional MRI scans were assessed using visual scoring.⁴ Patients were deemed to have active inflammation if their inflammation score was ≥2, and to have fat metaplasia if this score was ≥3. Quantitative measurements were compared between inflamed and non-inflamed SIJs.

Results: Use of the BEACH tool is demonstrated in figure 1(a)-(f). Example ADC histograms are shown in (g),(h).

ADC₇₅, ADC₉₀, and P_{high}(ADC) were significantly increased in inflamed SIJs ($P=0.041$, 0.006 and 0.003 respectively), although median ADC values did not differ significantly between inflamed and uninflamed joints ($P=0.31$). Diagnostic performance was superior for histographic parameters (AUC=0.59, 0.67 and 0.69) than for the median (AUC=0.54): Median FF, FF₇₅, FF₉₀ and P_{high}(FF) were all significantly increased in SIJs with fat metaplasia compared to those without (all $p<0.0001$). Diagnostic performance was superior for histographic parameters FF₇₅, FF₉₀ and P_{high}(FF) (AUC=0.89, 0.92 and 0.92) than for the median (AUC=0.87).

Conclusions: ADC and FF measurements can differentiate between inflamed and non-inflamed SIJs, and between joints with and without fat metaplasia. Compared to simple averages such as the median, histographic parameters can increase diagnostic performance for detecting inflammation and fat metaplasia. There is minimal subjectivity associated with ROI placement using the BEACH tool, which can potentially make inflammation scores more reproducible.

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FRI0596 FEASIBILITY OF JOINT STRUCTURAL ANALYSIS IN HEMOCHROMATOSIS HAND ARTHROPATHY USING HIGH-RESOLUTION PERIPHERAL QUANTITATIVE COMPUTED TOMOGRAPHY – FIRST RESULTS AND CLINICAL CORRELATIONS

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Background: Hereditary Hemochromatosis (HH) is a common inherited disorder and characterised by an excess iron accumulation in several organs with consecutive organ dysfunction.¹ Apart from the liver, the joints are a major site of excess iron deposition. Joint pain counts among the most frequent (>50%), earliest, and most debilitating symptoms of HH.² To date, joint health status in HH patients is routinely assessed on hand radiographs.³ However, plain radiography is a low-resolution, 2D-technique with limited sensitivity to detect early joint changes or to monitor subtle progression of joint damage.⁴ With the advent of high-resolution peripheral quantitative computed tomography (HR-pQCT), a promising imaging tool has emerged allowing for *in vivo* 3D characterisation of human joint microstructure at a spatial resolution of 130 µm.⁵ Due to its high sensitivity to detect and monitor subtle, short-term joint changes, HR-pQCT has been successfully applied to patients with RA.⁶ However, to date, HR-pQCT has not been used to characterise joint and bone changes seen in HH arthropathy.

Objectives: Here, we aimed to investigate in a cohort of HH patients 1) if the usage of HR-pQCT is feasible on HH patients; 2) to quantify joint microstructure of metacarpophalangeal joints (MCP2–4) in this specific patient group; and 3) investigate the relationship between HR-pQCT-derived joint microstructural parameters and clinical outcomes.

Methods: 25 HH patients were enrolled and their HH history and treatment were recorded. MCP joints of all patients were imaged at a clinical HR-pQCT system (XtremeCT, Scanco Medical AG). 330 images were acquired covering MCP 2, 3 and 4. The joint space (JS) morphology of each MCP was quantified from the HR-pQCT images semi-automatically⁴ and volume (JSV), joint space width mean (JSW), JSW variance (JSW.SD), and JSW asymmetry (JSW.AS) were calculated.

Results: Out of the 75 MCP joints available for analysis, 79% were successfully segmentable, and 19% required semi-manual intervention to separate the individual bones. 3 joints were excluded due to motion artefacts, and 1 joint was unsegmentable. HH patients were 32–72 years old, in 64% male, and had been diagnosed with HH 2 months to 40 years ago. 15% were pain free at the study