A NOVEL METHOD FOR QUANTIFYING INFLAMMATION OF SACROILIITIS IN JUVENILE ARTHRITIS

Kanimozhi Vendhan[1], David Atkinson[2], Debajit Sen[3], Corinne Fisher[3], Yiannis Ioannou[4], Paul Bassett[5], and Margaret Hall-Craggs[6]

[1]UCLH, London, London, United Kingdom, [2]UCL, London, United Kingdom, [3]UCLH, London, United Kingdom, [4]Arthritis Research UK Centre for Adolescent Rheumatology, UCL, London, United Kingdom, [5]Statsconsultancy Ltd, London, United Kingdom, [6]Imaging Department, UCLH, London, United Kingdom

Target audience: Clinicians, physicians and technologists working in the arena of body DWI and musculoskeletal MRI.

Purpose: To quantify inflammation of the sacroiliac joints in patients with juvenile arthritis (subtype enthesitis-related arthritis), by using ADC maps.

Method: We performed a retrospective case control study and reviewed MRI sacroiliac joints scans of 20 patients (10 cases with enthesitis-related arthritis [age range 13.2yrs – 22.4yrs] and 10 controls with mechanical back pain [age range 9.6yrs – 17.6 yrs]). All attended the adolescent rheumatology clinic at our institution over 18 months to July 2013 and scans were performed at initial presentation.
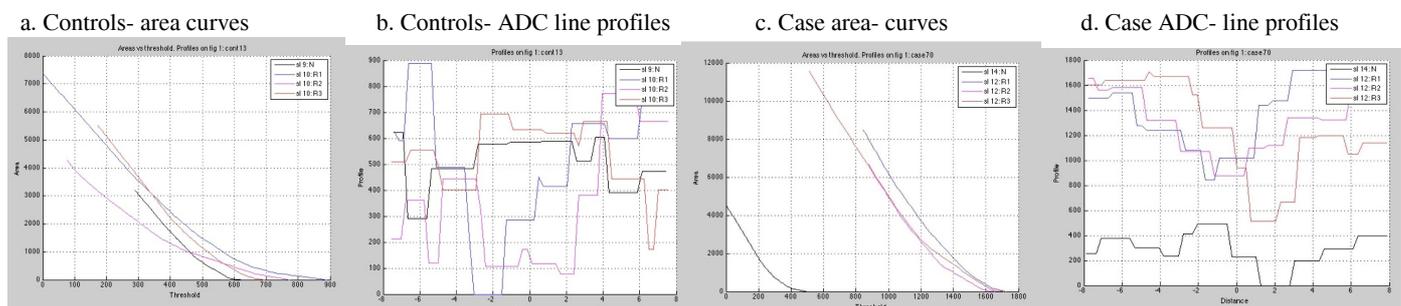
All patients had routine MRI of the sacroiliac joints (SIJs) together with diffusion-weighted imaging (multiple b values 0, 50,100, 600 and 1000; TR 3500, TE 87, averages 6, sl. thickness 8mm, phase oversampling 50) on a 1.5 Tesla system (Avanto; Siemens, Germany). ADC maps were calculated using standard software.

All images were anonymised, assigned random patient numbers and imported to Matlab for analysis. A Matlab program was written to create a profile of ADC values across the SIJs and a reference sample in normal bone. This was done by manually drawing a linear region of interest, measuring 14mm, centered on the SIJ so as to include subcortical bone on the sacral and iliac sides. In each patient 6 consecutive axial images of the SIJs were evaluated by obtaining 2-3 ADC profiles through the synovial portion of each of the right and left joints. The total number of samples across the SIJs obtained for each patient varied between 24 and 36 (depending on the size of the joint). The normalized area under the curve of the ADC profile was calculated for each of the line profiles. An average ADC area score was calculated for each patient and this was correlated to the 'inflammation score' obtained from STIR images using an established visual scoring method [1]. An unpaired t-test was used to compare ADC area values between the two groups.

Results: There was a significant difference ($p < 0.001$) between mean normalized ADC area value for controls (2320 mm^2) and cases (8162 mm^2). Similarly the difference in ADC values between the areas of worst inflammation in cases compared to the average ADC value in controls was significant ($p < 0.001$). In the ERA cases, the ADC area score largely correlated with the STIR score. However in the controls there was a marked variation between the STIR score and average ADC area score.

Discussion: Assessment of pain is particularly difficult in adolescents as pain assessment tools are inappropriate for adolescents and self-reporting of pain is unreliable. This preliminary data shows a clear separation between normal (and immature) subcortical bone and areas of inflammation using ADC scores. The discordance between the STIR scores and ADC area scores observed, particularly in the controls, is possibly due to subchondral immature bone producing high signal on the ADC maps. These findings need further validation in a larger clinical cohort.

Conclusion: This novel technique for scoring and quantifying SIJ inflammation shows promise and could potentially be used to monitor disease over time and to assess response to therapy.

a. Controls- area curves b. Controls- ADC line profiles c. Case area- curves d. Case ADC- line profiles

References:

1. Maksymowych WP, Inman RD, Salonen D, Dhillon SS, Williams M, Stone M, Conner-Spady B, Palsat J, Lambert RGW.Spondyloarthritis research Consortium of Canada magnetic resonance imaging index for assessment of sacroiliac joint inflammation in ankylosing spondylitis. Arthritis Rheum. 2005 Oct 15 ;53(5):703–9.