

Quantification of Inflammation using Diffusion-weighted Imaging: Biological Validation in Enthesitis-related Arthritis

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Introduction

Early treatment in enthesitis-related arthritis (ERA) may have a disease-modifying effect with consequently good outcomes, but if treatment is inadequate then outcomes are poor. Although clinical evaluation is helpful in used to assess disease activity, clinical assessment of sacroiliitis is somewhat unreliable and blood inflammatory markers may be normal in active disease. The aim of this study was to *biologically validate* a quantitative magnetic resonance imaging tool for measuring inflammation, which could be used to guide biologic therapy in the clinic and enable more effective treatment stratification.

Materials and Methods

22 adolescents with ERA underwent routine MRI and DWI before and after biologic therapy. Sacroiliac joint normalized ADC (nADC) was measured on each scan. Therapeutic clinical response was defined as an improvement of $\geq 30\%$ physician global assessment and radiological response defined as ≥ 2.5 -point drop in Spondyloarthritis Research Consortium of Canada (SPARCC) score. We compared nADC changes in responders and non-responders using the Mann-Whitney-Wilcoxon test.

Results

For both radiological and clinical definitions of response, reductions in nADC after treatment were greater in responders than in non-responders (for radiological response: $p=0.055$; for clinical response: $p=0.089$). nADC could predict radiological response with a high level of sensitivity and specificity, and was a moderately sensitive and specific predictor of clinical response (the area under the receiver operating characteristic curves were 0.82 for radiological response and 0.78 for clinical response).

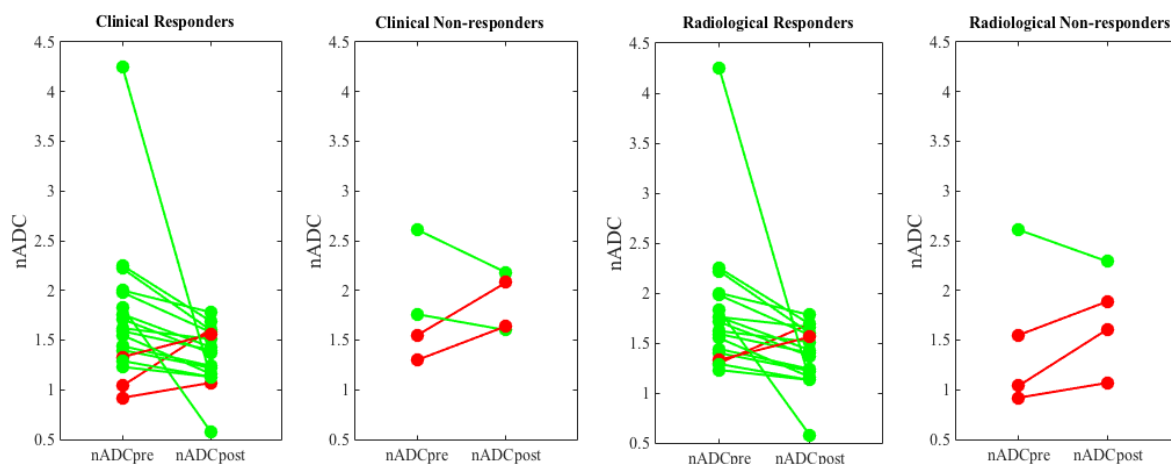


Figure 1 – Response plots showing the change in nADC after treatment, classified by clinical response and radiological response. Patients whose nADC/ADC reduced between after treatment are shown in green, whilst patients whose nADC/ADC increased are shown in red. ADC values have units $\text{mm}^2/\text{s} \times 10^{-6}$.

Discussion

DWI measurements reflect response to TNFi treatment in ERA patients with sacroiliitis, as defined using both clinical and radiological criteria. DWI measurements are derived from pixel values in the image itself, and are therefore intrinsically more objective than visual scoring. nADC could be used as a biomarker for sacroiliitis in the clinic and in clinical trials.

Conclusions

DWI measurements reflect response to TNFi treatment in ERA patients with sacroiliitis, as defined using both clinical and radiological criteria.

References

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