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Assessing Inflammatory Change in Early RA

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Early rheumatoid arthritis (ERA) is defined as symptom duration of less than 24 months. This represents the best time to diagnose and treat rheumatoid arthritis as RA is most responsive to change during the first 2-3 years. There are two key aspects to any inflammatory arthropathy – inflammation and structural change. For clinical decision-making, knowing the degree of inflammation present is much more clinically relevant than knowing the degree of structural change.
Inflammation in ERA can be assessed clinically (simple disease activity score, disease activity score 28), serologically (ESR, CRP) or with imaging (ultrasound or MRI). Typically, ERA patients have considerable inflammatory change (synovitis, tenosynovitis, osteitis) with relatively little structural change (erosions, joint space narrowing, joint deformity). Two aspects of synovitis are assessed, namely synovial volume and synovial perfusion.

On MRI, inflammation can be either graded qualitatively (minimal, mild, moderate, severe) as is done is everyday practice or measured (semiquantitatively or quantitatively) as in research studies. Semiquantitative assessment provides an estimate measure of the inflammatory parameter being assessed, with measures typically incorporated into an MR scoring system (RAMRIS or ERAMRS). Quantitative assessment provides an absolute measure of the inflammatory parameter being assessed and is presented as absolute volume, relative signal intensity or arbitrary perfusion parameter (Emax, Eslope). Quantitative assessment correlates better with clinical/ serological parameters than semiquantitative assessment. The correlation between MRI inflammatory parameters and clinical /serological parameters is highest when change over time is considered rather than one-to one correlation at baseline or following treatment. Even so, the correlation between MRI parameters of inflammation and clinical/serological parameters is still, at best, only modest. This modest correlation is not unexpected since MRI evaluates inflammation in a localized body area (such as the wrist) whilst pain, functionality, and systemic inflammation reflect more diverse complex processes.
Reduction in pain during treatment correlates best with reduction in tenosynovial volume while improvement in function and lowering of disease activity during treatment correlates best with reduction in synovial volume. Improvement in early morning stiffness during treatment correlates best with reduction in synovial perfusion.
In summary, inflammation is the key parameter in ERA and this can be evaluated very accurately with dynamic contrast-enhanced MRI. The key features of inflammation are synovitis (synovial volume and perfusion), tenosynovitis (tenosynovial volume and perfusion), and osteitis. These key features of inflammation on MRI correlate with different clinical symptoms. Quantitative assessment of inflammation on MRI correlates better with clinical / serological parameters than semiquantitative assessment. This quantitative MRI – clinical/serological correlation is highest when changes over time are tracked rather than snapshot correlations at either baseline or following treatment.

Keywords: Early rheumatoid arthritis, synovitis, tenosynovitis, osteitis, inflammation, MRI, quantification.