

# Magnetic resonance imaging versus ultrasonography for the diagnosis of synovitis in rheumatoid arthritis

*Comparing MRI and US for synovitis diagnosis*

**This Editorial refers to Diagnostic test accuracy of ultrasound for synovitis in rheumatoid arthritis: systematic review and meta-analysis by Kaoru Takase-Minegishi et al., doi:10.1093/rheumatology/kex036**

Inflammatory synovitis is considered to be the active lesion of RA that promotes bone resorption and osteolysis, resulting in osseous erosions, bone marrow oedema and ultimately joint destruction. Synovitis is reversible with appropriate pharmacological therapy, for which accurate diagnosis is required. While synovitis can be diagnosed accurately by physical examination, factors such as underlying joint degeneration may interfere with the accuracy of the examination, and asymptomatic and residual synovitis during therapy or remission may be difficult to diagnose clinically. While both MRI and US can diagnose synovitis [1, 2], it is important to consider how both imaging tests compare in their abilities to diagnose synovitis. In an attempt to do so, Dr Takase-Minegishi and colleagues [3] performed the study 'Diagnostic test accuracy of US for synovitis in rheumatoid arthritis: systematic review and meta-analysis'. The authors identified 17 cohorts in 14 eligible reports who met their inclusion criteria for comparing US and MRI for the diagnosis of synovitis in RA of the wrist, MCP, PIP and knee joints. Patients with osseous erosions or synovitis caused by diseases other than RA were not included. The studies that were included originated from Japan, Denmark, Belgium, China, Germany and the UK and were conducted in university hospitals, community hospitals and arthritis clinics.

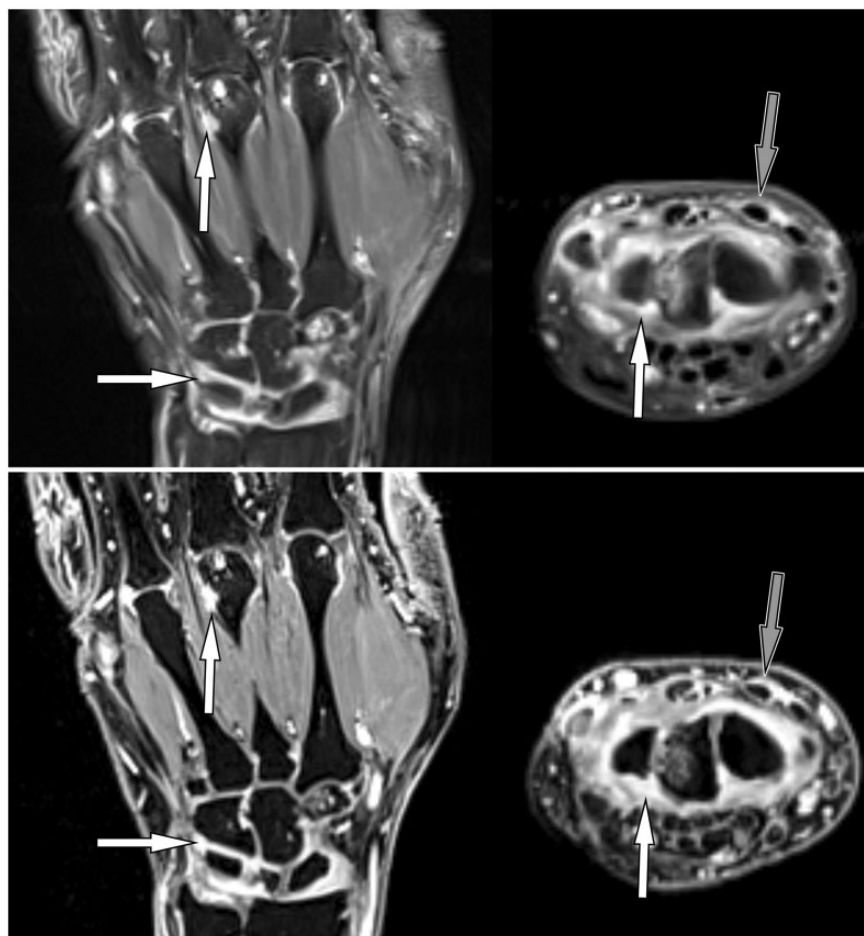
The imaging findings of synovitis can be divided into morphological and functional abnormalities. Morphologically, synovitis is often accompanied by an increased amount of joint fluid, as well as thickening, pannus formation and frond-like proliferations of the synovium, whereas functionally, hyperaemia and oedema are imaging markers of synovitis. Increased synovial blood flow is reflected by abnormally increased Colour and Power Doppler signals on US and increased synovial T2 signal and contrast enhancement on MRI. Both imaging modalities can use intravenous contrast agents for diagnosing synovitis. On MRI, synovitis results in abnormal synovial enhancement after the i.v. administration of a gadolinium-based contrast agent. Although the underlying mechanisms (including hyperaemia and increased capillary permeability) are complex, gadolinium-based synovial contrast enhancement is a well-established and accepted technique for the detection

of synovitis, and may be considered the imaging standard of reference [4]. I.v. contrast agents may also be used with US; however, the value is less well established [5] and the diagnosis usually relies on Doppler signal abnormalities.

The included studies used MRI as the standard of reference for the diagnosis of synovitis, and US was compared with the MRI. An important consideration, however, is that the true standard of reference of synovitis is histopathological analysis, and both US and MRI findings would need to be compared against this to obtain diagnostic performance parameters and test accuracies. Of course, this standard of reference is difficult to obtain; without such a standard of reference, non-inferiority evaluations are often the most appropriate study designs. In view of this, the results of this meta-analysis of US for the diagnosis of synovitis should be considered relative, rather than absolute.

There is considerable heterogeneity in the US and MRI techniques that were used to diagnose synovitis by the authors of the various studies that were included in the systematic review and meta-analysis. US techniques included non-contrast-enhanced power Doppler mode, grey-scale-only mode, contrast-enhanced power Doppler mode, and combined grey-scale and power Doppler mode. The spectrum of MRI techniques was even more diverse and included non-contrast-enhanced MRI, delayed contrast-enhanced MRI and dynamic contrast-enhanced MRI; these were obtained with different magnet designs (including extremity, open and closed-bore MRI systems) and different field strengths (ranging from 0.2 to 3 Tesla). Both Doppler US and contrast-enhanced MRI at high field strength may be more accurate than grey-scale US and non-contrast-enhanced MRI at low field strength, respectively. To account for these heterogeneities, the authors introduced weighting categories that qualified the MRI techniques. As the included studies spanned a long period of time ranging from 2001 to 2014, different generations of US and MRI scanner technology and techniques were used. An illustrative example of the progress of MRI into faster techniques with more image detail is the advancement from two-dimensional thick-slice contrast-enhanced MRI to three-dimensional isotropic high-resolution MRI of the wrist, which is now routinely available on state-of-the-art 3 T MRI systems (Fig. 1). Finally, it was not possible for Dr Takase-Minegishi and colleagues to apply standardized evaluation criteria to the diagnosis of synovitis on US and MRI studies; they

**Fig. 1** A 64-year-old woman with RA



A 3 Tesla MRI of the wrist comparing two-dimensional contrast-enhanced fat-suppressed T1-weighted coronal and axial MR images (upper row) and three-dimensional contrast-enhanced fat-suppressed coronal and axial MR images (lower row). The three-dimensional MR images were acquired twice as fast and demonstrate higher spatial resolution visualization of the enhancing carpal and MCP synovitis (white arrows) and extensor tenosynovitis (grey arrows).

had to rely on the reported results of the individual author groups.

Allowing for the inherent limitations, Dr Takase-Minegishi and colleagues are to be commended for investigating this important topic and for the skilful and rigorous methods used in conducting this study. The results of their systematic review and meta-analysis suggest good agreement of US and MRI techniques for detecting synovitis in the MCP and PIP joints, lower agreement for the wrist and low agreement for the knee joint. The results suggest that Doppler US techniques may be used to diagnose synovitis in the wrist and finger joints; however, more studies with appropriate study designs are needed to confirm this.

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