

Volume 3, Number 5 – March 30, 2009

Rheumatoid Arthritis: MRI's Role in Diagnosis and Management (Part II)

Development of sensitive biomarkers for disease surveillance is crucial in clinical trial studies. MRI affords just such a window into the disease activity of rheumatoid arthritis (RA). It allows the disease to be monitored when RA is below the threshold for patient symptomatic complaint, but still at a level that can cause joint destruction. MRI therefore provides a barometer of drug response, one that holds utility in establishing a pharmaceutical trial's ability to make quiescent the destructive inflammatory cascade of RA. This issue of *The WCC Note* continues our examination of MRI's place in the diagnosis and management of RA.

**APPEARANCE
&
SYMPTOMS**

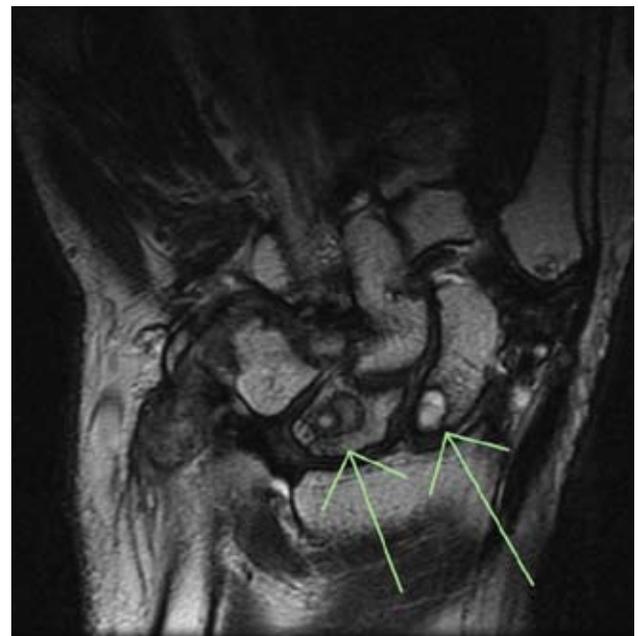
1. What is the MRI appearance of rheumatoid arthritis?

a. Early RA often first affects the wrist, MCP, and MTP joints. (1) Abnormalities include:

1. *Synovitis*. Thickening of the synovial membrane, appearing as quick enhancement after gadolinium on T1-weighted, fat-suppressed images
2. *Tenosynovitis*. Any tendon may be involved, but flexor digitorum, extensor digitorum, and extensor carpi ulnaris are frequent.
3. *Bone erosions*. Sharply margined trabecular bone loss with cortical defects and often with synovitis. More frequently in the capitate, triquetrum, lunate, radial aspect of the second and third MCPs, and lateral fifth metatarsal.
4. *Bone-marrow edema*, usually at the synovial membrane insertion where a small gap between it and the cartilage leaves a "bare area."
5. *Bursitis*. Between or beneath metatarsal heads.

b. Additional joints of involvement may include these:

1. *Knees*: (2) Synovitis; effusion; subsequent erosions.



MR image showing multiple erosions. Those at the arrows involve the scaphoid and lunate. Synovitis is evident.

2. *Shoulders*: RA incidence and prevalence increase to about age 85. RA onset in the elderly has been described as having striking large-joint involvement, particularly of the shoulders (3), hips, and wrists (with sparing of the hands mimicking polymyalgia rheumatica). (4)
 3. *Hips*: When RA is advanced, it may result in acetabular protusion from axial migration.
 4. *Elbows* (5)
 - a. More than half of RA patients.
 - b. RA is the most common rheumatological cause of elbow instability.
 - c. Isolated elbow involvement is present in only 5% of cases.
 - d. Synovitis; joint capsule distention causes patients to hold the elbow flexed, leading to risk of flexion deformity
 - e. Laxity of annular ligament with radial head instability.
 - f. Laxity of anterior medial ligament, leading to valgus instability.
 - g. Trochlear erosion can lead to proximal ulnar subluxation.
 5. *Hand*: Radial and ulnar aspects of the bases of the hand, proximal phalanxes, and PIP joints, typically sparing the DIPs. (4)
 6. *Additional wrist*: Marginal erosion of the styloid tip.
 7. *Cervical spine*.
 - a. Laxity of transverse ligament with subluxation of atlantoaxial joint, most commonly anterior type.
 - b. Vertical subluxation with odontoid superiorly migrating.
 - c. Erosions of odontoid process and apophyseal joints.
 - d. Subluxation of lower cervical spine, most commonly at C3-4.
 - e. Thoracic and lumbar involvement proves rare.
 8. *Clavicle*: Distal clavicular, pencil-like erosions.
- c. Technique: Yao, *et al.*, report contrast-enhanced, T1-weighted images depict more periarticular bone findings in RA than fat-suppressed, T2-weighted images. (6)

ASYMPTOMATIC CHANGES

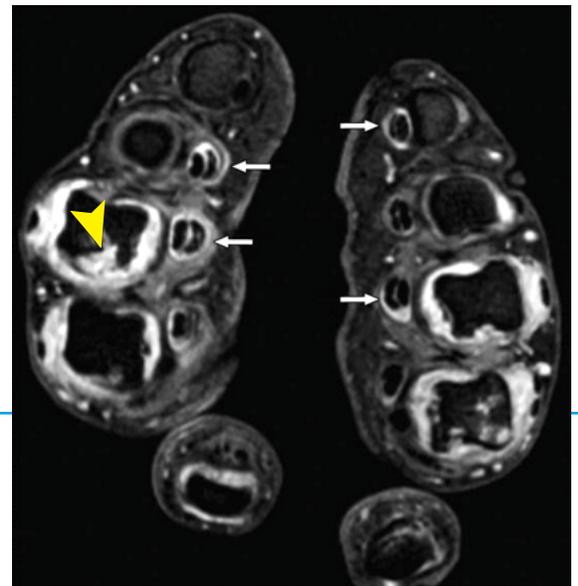
2. Do the MRI or immunologic changes of RA occur before a patient has symptoms?

Yes. RA immunological changes with anti-CRP and RF occur years before clinically apparent disease, which may then be triggered by the proper genetic milieu in combination with environmental factors – such as heavy smoking. Ultrasound and MRI may show synovitis when the clinical findings are still nonexistent. (7)

POSITIVE MRI FINDINGS

3. What do positive RA MRI findings mean, even when a person has no symptoms?

- a. A direct relationship exists between subclinical synovitis in asymptomatic patients and joint structural damage, with MRI and ultrasound imaging evidence predicting subsequent progression in such patients. As



A 38-year-old woman with early rheumatoid arthritis and bone erosions. This transverse fat-suppressed, gadolinium-enhanced 3D gradient-echo

written in a 2009 article in *Nature Clinical Practice Rheumatology*, studies have shown synovial inflammation can persist even in clinical remission. The report profiled a recent study of 102 patients with RA who were receiving DMARDs and were thought to be in remission clinically, but 19% of whom demonstrated significant radiologic disease progression at one year. Imaging-detected baseline synovitis presaged the likelihood of progression. The authors state that conventional criteria for remission prove insensitive to low-level disease; therefore, the assessment should be made by imaging. (8,9)

MR image shows bone erosion on radial aspect of third metacarpal bone (arrowhead). Note also the presence of significant bilateral synovitis in second and third metacarpophalangeal joints and flexor digitorum tenosynovitis (arrows).

- b. MRI findings prove common in early RA (20), and bone-marrow edema independently predicts radiographic damage. (10,11)

INTERVENTION

4. What is the optimal time to intervene in RA?

Noting that bone damage occurs early, the argument for early disease-modifying agent (DMA) therapy has received attention. (7)

Conclusion: Immunological features occur in rheumatoid arthritis years before clinically apparent disease. MRI may afford early RA diagnosis even when serology proves negative, which is important because early disease-modification therapy better protects long-term joint function. MRI can document active RA disease and continued joint destruction — even in asymptomatic patients thought to be in clinical remission.

SOURCES

1. Bouty N, Morel M, Flipo R-M, *et al.* "Early rheumatoid arthritis: A review of MRI and sonographic findings." *AJR* 2007; 189:1502-1509.
2. Frick MA, Wenger DE, Adkins M. "MR imaging of synovial disorders of the knee: An update." *Rad Clin N Amer* 2007; 45:1017-1031.
3. Tutuncu Z, Kavanaugh A. "Rheumatic disease in the elderly: Rheumatoid arthritis." *Rheum Dis Clin N Am* 2007; 33:57-70.
4. Cheong HW, Peh WCG, Guglielmi G. "Imaging of Diseases of the Axial and Peripheral Skeleton." *Radiologic Clinics of North America* 2008; 46:703-733.
5. Worthing AB, Cupps TR. "The rheumatic causes of elbow instability." *Hand Clinics* 2008; 24:79-90.
6. Yao L, Magalnick M, Wilson M, *et al.* "Periarticular bone findings in rheumatoid arthritis: T2-weighted versus contrast-enhanced T1-weighted MRI." *AJR* 2006; 187:358-363.
7. Quinn MA, Cox S. "The evidence for early intervention." *Rheum Dis Clin N Am* 2005; 31:575-589.
8. "RA joint deterioration despite clinical remission is predicted by imaging of synovitis." Research Highlights. *Nature Clinical Practice Rheumatology* 2009; 5:2.
9. Brown AK, *et al.* "An explanation for the apparent dissociation between clinical remission and continued structural deterioration in rheumatoid arthritis." *Arthritis Rheum* 2008; 58:2958-2967.
10. Haavardsholm EA, Boyesen P, Ostergaard M, *et al.* "Magnetic resonance imaging findings in 84 patients with early rheumatoid arthritis: Bone oedema predicts erosive progression." *Ann Rheum Dis* 2008; 67:794-800.
11. Hetland ML, Ejbjerg BJ, Horslev-Petersen K, *et al.* "MRI bone oedema is the strongest predictor of subsequent radiographic progression in early rheumatoid arthritis: Results from a 2-year randomized controlled trial." *Ann Rheum Dis* 2009; 68:384-90 (published online April 3, 2008).

THE WCC NOTE™: Volume 3, Number 5 – March 30, 2009

- *Contributing Editors:* Margaret D. Phillips, M.D. (newsletter@wcclinical.com) and Stephen J. Pomeranz, M.D. (newsletter@wcclinical.com)
- *Managing Editor:* Rod Willis
- *Graphic Designer:* Tom Anneken
- *Distribution Manager:* Shannon Roeper