

Magnetic Resonance Imaging in Rheumatologic Practice: Low Field or Standard



At the last American College of Rheumatology meeting a debate was presented between an enthusiast for immediate incorporation of magnetic resonance imaging (MRI) in routine practice and a “go slow — let’s improve the use of traditional imaging” protagonist. Both debaters made valid points. The MRI bug emphasized that more erosions are seen by MRI than by conventional radiography and that MRI detects synovitis¹⁻⁸. The traditionalist pointed out that we fail to exploit all the information available in plain film radiography. I was impressed that neither speaker commented on the critical question: Which modality provides the clinician essential information needed to make important diagnostic and therapeutic decisions in the most efficient and economic manner?

Does finding larger numbers of erosions really matter? Erosive disease is erosive disease whether there are 5 or 10 erosions. Does finding erosions earlier matter? Yes, in some situations: for example, the clinician with a new patient whose symptoms are less than 6 months in duration whose findings are non-diagnostic, namely a patient with undifferentiated arthritis. Detection of erosions by MRI when none are present by plain radiography^{5,6}, or finding synovitis or bone edema or both using MRI, makes a powerful argument for beginning a disease modifying antirheumatic drug. Even though limited healing of erosions has been demonstrated in controlled studies, receiving early treatment before erosions are extensive is important in sustaining normal function; prevention is better than cure⁹. Erosions are frequently associated with soft tissue damage such as tendon rupture and disruption of capsular structures. One erosion in a finger, wrist, or toe bone has little to do with a specific function but even one erosion may predict a progressive course with functional impairment. Thus finding erosions early after onset of the disease provides the rationale for the recent renewed emphasis on early treatment⁶.

Early and accurate diagnosis is the key to optimal treatment. The patient with symptoms of a few months who has

a few swollen joints and elevated erythrocyte sedimentation rate or C-reactive protein does not necessarily have rheumatoid arthritis¹⁰. The presence of rheumatoid factor or anti-cyclic citrullinated peptide antibodies makes RA more likely but does not prove the diagnosis. The emphasis on early treatment is pushing us to make earlier diagnoses, but in the majority of early cases diagnosis remains uncertain for weeks or months, and the majority of patients do not develop progressive (rheumatoid) arthritis. Drugs provide symptom relief and prevent structural damage; however, waiting to see how the disease evolves means a period of uncertainty: not an attractive option. But the high cost and potential side effects of unnecessary treatment are also unattractive. Will MRI help in this situation? Do MRI erosions have the same prognostic significance as those seen using conventional radiography? Presumably they do^{8,10}. Even more helpful, finding synovitis and/or bone edema before erosions develop is an accurate predictor of a progressive course⁵.

Monitoring response to therapy, in particular the continued presence of synovitis or bone edema, and detecting new erosions will help the practicing clinician answer the same questions posed by the patient with early disease. The poor response seen in many patients and the long lag before MTX takes effect argue for early use of combination of MTX and tumor necrosis factor- α (TNF- α) inhibitor, which is superior to monotherapy with either agent^{11,12}. “Inducing” remission using combination therapy and then prescribing MTX “maintenance” monotherapy means the physician also needs to ascertain whether the patient is in a true remission to rule out subclinical synovitis. Neither normalized ESR or CRP, nor absence of tender or swollen joints, is sufficient to prove that remission is present. If plain radiography shows no progression, further confirmation with MRI and longterm followup are necessary to confirm remission.

The therapeutic trial is another situation in which finding

See MRI is more sensitive than radiographs in detecting change in size of erosions in RA, page 1957

more erosions and finding them earlier is a significant benefit. In order to develop treatment programs with new agents, or different ways of using currently available agents to induce remission in 100% of patients, more trials are essential. The cost of conducting trials is huge and to a large extent cost is driven by the number of patients needed and the length of the trial. If finding more erosions earlier translates into finding a greater difference between treatment groups in a shorter time span, then definitive results might be obtained with MRI when plain radiography fails. Perhaps equally important, because today's treatments are more effective than ever before in slowing progression of disease in a majority of patients and in inducing remission, the subject pool for conducting trials on new agents is smaller and has different baseline characteristics than even a few years ago. Finding new erosions earlier can make the difference between success and failure.

The recent development of "low field" 0.2 Tessa (T) MRI, also known as "extremity" MRI, offers advantages over standard 1.5 T MRI: the low cost of the machine, much less expensive installation, no need for extensive shielding, and ability to obtain images — often with an arm extended — without needing to confine the patient inside a tubular structure. For the patient with some degree of claustrophobia or a painful shoulder, MRI in a standard machine is an unpleasant or impossible experience. On the downside, 0.2 T machines cannot provide images of the same quality as "standard" MRI. Nevertheless, erosions are found more frequently by low field MRI than by plain radiography and, in one study, the number was similar to that found with a 1.5 T machine¹³⁻¹⁵. The question then becomes: Do the images obtained by the 0.2 T extremity instruments provide information that is sufficiently useful in clinical decision making to justify their regular use? Despite the loss of image quality does the 0.2 T provide the information essential to decision making in the situations discussed above? Undoubtedly we would all prefer to have 1.5 Tessa (or higher) images from well established radiology units with immediate consultation with experienced radiologists if this were as convenient and comfortable for the patient, if cost was in the same range, and the images were immediately accessible to the attending physician. Unfortunately this is not the case in many practice settings. So can we make an informed judgment about the tradeoffs?

In this issue of *The Journal* Chen and his associates report finding more new and enlarged old erosions during followup by MRI employing a 0.2 T unit than by plain radiography, a finding consistent with earlier observations of more erosions at a single time point found by low field MRI. Chen, *et al* argue that a difference in the method of collecting the MR image compensates for some of the disadvantages of poor imaging of the low field unit¹⁶.

This editorial will not attempt to critically assess the differences in imaging technique, but the illustrations present-

ed (Figures 1 and 2) demonstrate the poor quality of images obtained by the 0.2 T unit. Whether this low quality image hampers interpretation of the results is unclear. The authors have used a conservative criterion for judging change in size of erosions that was designed to compensate for this and other problems. Perhaps this argument is irrelevant to the question of value of MRI. If we assume that image quality has not impaired accuracy of interpretation of new erosions and increased erosion size, then data in this article provide more evidence that MRI evaluation of erosions, even images obtained in a low field unit, is a useful method of assessing progression of structural damage in rheumatoid arthritis. The Chen study does not deal with sensitivity of the 0.2 T unit for detecting synovitis, an issue that requires future investigation.

The merits of low-field, extremity MRI cannot be discussed without considering economic factors. By comparison the cost of the 0.2 T "office" unit is well within the range of many instruments used in ambulatory care in single practitioner or small group practices. This has led to speculation that some of the attraction of the low field machine is its potential to increase income. Doctors are always vulnerable to this accusation, and the issue of imaging has now caught the attention of US federal agencies and the US Congress¹⁷. In order to effectively refute such suspicions, it must be established that information obtained is useful and reliable and provided at the same cost as other methods. In addition a certification process must be adopted to guarantee that those reading the MRI images have had the training and experience to reliably interpret the images. Rheumatologists do not want the general public to become suspicious that MRI is "just another cash cow for the doctors." Real and important information needed for providing the best possible care for RA patients is provided by appropriate use of MRI. Realization of the benefit MRI provides for optimal patient care must not be jeopardized by hasty adoption of inadequate equipment.

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