Early identification and early treatment with disease modifying antirheumatic drugs (DMARDs) has become the standard of care for patients with rheumatoid arthritis. The goals are to alleviate symptoms, maintain and improve function, and prevent structural damage. Progression of structural damage has been associated with loss of function. Imaging plays a significant role in the diagnosis of rheumatoid arthritis, the determination of remission, and follow-up to monitor for progressive joint damage.

RADIOGRAPHS

Despite the advent of ultrasound and magnetic resonance imaging (MRI), conventional radiographs of hands and feet remain the most commonly used method to assess joint damage and monitor disease progression in rheumatoid arthritis.
assess joint damage and monitor disease progression in rheumatoid arthritis. Radiographs are readily available, cost-effective, and have good reproducibility. Radiographic signs of rheumatoid arthritis include soft tissue swelling, joint effusions, juxta-articular osteopenia, uniform joint space narrowing, cysts, bone erosions, joint subluxations, and malalignment. Changes in the second to fifth metatarsophalangeal joints of the feet often appear before changes are noted in the hands. The metacarpophalangeal (MCP) and proximal interphalangeal joints are most commonly affected in the hands, whereas the ulnar styloid joint is the most common site for erosions in the wrist.

Scoring systems have developed to standardize the assessment of radiographic damage in evaluating rheumatoid arthritis. Most systems focus on the hands and feet because damage in the hands and feet is highly correlated with overall joint damage. The most widely used scoring systems are the Sharp/van der Heijde (SvdH) method, the Larsen method, and the Sharp/Genant method. The SvdH method assesses erosions and joint space narrowing separately, and it can be used for both hand and foot films. The Genant/Sharp method focuses on 14 sites for erosions and 13 sites for joint space narrowing for a maximum score of 100. The Larsen system uses reference films to assess the joint and grades joint involvement largely based on erosions.

SVDH SCORING METHOD

With the SvdH method, erosions are assessed in 16 joints for each hand and wrist, and 6 joints for each foot. Erosions are graded as follows: 0, no erosions; 1, discrete; 2, larger; 3, extending to the imaginary middle of the bone; 4+, erosions extending over the imaginary middle of the bone; and 5, extensive. Joint space narrowing is assessed in 15 areas for each hand and wrist and 6 areas for each foot. Joint space narrowing is scored as follows: 0, normal; 1, focal; 2, generalized (>50% of the original joint space left); 3, generalized (<50% of the original joint space is left or there is subluxation); 4, bony ankylosis or complete subluxation. The erosion score ranges from 0 to 160 for the hands and wrists and 0 to 120 for the feet. The joint space narrowing score ranges from 0 to 120 for the hands and wrists and 0 to 48 for the feet. Therefore, the total SvdH score ranges from 0 to 448.

THE SIMPLIFIED EROSION NARROWING SCORE

The Sharp method and the SvdH method both require trained and experienced readers to ensure reliable scores. As a result, Dias and colleagues proposed a simplified method, the Simplified Erosion Narrowing Score (SENS), which could feasibly be used to assess structural damage in clinical practice and compared it with the SvdH method. The SENS method assesses erosions and joint space narrowing (JSN) in the same joints as the SvdH method, but instead of grading severity it only scores the presence or absence of erosions or JSN. The study concluded that results of the SENS method correlated with those of the SvdH method and that the SENS method could potentially be validated for use in clinical practice.

ROLE OF IMAGING AS AN OUTCOME MEASURE IN CLINICAL TRIALS

Radiographs show cumulative damage and, therefore, can be used to evaluate the effectiveness of treatment. The Sharp score and SvdH score have been used as outcome measures in multiple large clinical trials, as outlined in Table 1.
INTERPRETING RADIOGRAPHIC PROGRESSION

As noted in Table 1, clinical trials use different primary end points to assess treatment efficacy. In 2002, Bruynesteyn and colleagues worked to define the relationship between the smallest detectable difference (SDD) noted on radiographs using the SvdH score and the minimal clinically important difference (MCID). The SDD is the smallest change in a scoring method that can reliably be differentiated from measurement error; however, a statistical difference may not be clinically relevant. Five expert rheumatologists reviewed 46 pairs of hand and foot films for progression of joint damage.

Fig. 1. (A, B) With the SvdH method, erosions are assessed in 16 joints for each hand and wrist, and 6 joints for each foot. RA, Rheumatoid arthritis. (Adapted from Hulsmans HM, Jacobs JW, van der Heijde DM, et al. The course of radiologic damage during the first six years of rheumatoid arthritis. Arthritis Rheum 2000;43(9):1929; with permission.)
damage and determined whether the progression in joint damage warranted change in treatment. The SDD for the SvdH score was 5, which correlated in this study with the radiographic change that causes an expert rheumatologist to change treatment (ie, the MCID). Another way to report the data is to calculate the percentage of patients with progression of joint damage beyond a cutoff. An international consensus group suggested a percentage of patients with progression greater than 0.5 for 2 observers or greater than 0 for 1 observer; or percentage of patients with progression greater than SDD. Other groups have proposed the use of probability plots as outcome measures because only a small percentage of patients show radiographic progression and, therefore, the results are not normally distributed. Probability plots show data in
a continuous manner so readers can visualize the coherence of the data.\textsuperscript{23} The SDD can be added to the plot, or readers can apply other cutoff points.\textsuperscript{23}

Landewe and van der Heijde\textsuperscript{25} used data from the Combinatietherapie Bij Reumatoid Arthritis (COBRA) trial to show the usefulness of probability plots. The COBRA was a randomized, double-blind, placebo-controlled trial of 155 patients with rheumatoid arthritis for less than 2 years.\textsuperscript{13} The trial compared treatment with sulfasalazine monotherapy and treatment with combination therapy (prednisone, methotrexate, and sulfasalazine).\textsuperscript{13} Their graphs, shown in Fig. 2, show the progression scores for all the patients in the trial. It is easy to visualize the number of patients with no change in SvdH score as well as the number of patients with high scores who may shift the mean and standard deviation for the group.\textsuperscript{25} It is easy to visualize the median, 25th, and 75th percentiles (see Fig. 2).\textsuperscript{25}

Landewe and van der Heijde\textsuperscript{25} also used probability plots to visually compare the results in the two treatment arms of the COBRA trial (Fig. 3). In Fig. 3, the radiographic progression of the treatment groups are compared (monotherapy shown in circles and combination therapy shown with triangles). The plots also show the importance of choice of cutoff level.\textsuperscript{25} If the cutoff level is 0 and everyone with a score greater than 0 is considered to have progressed, the treatments would not be considered different (contrast of 7%).\textsuperscript{25} If a progression of 5 Sharp units is considered the cutoff, the treatment contrast is 27%.\textsuperscript{25}

**WHEN DOES RADIOGRAPHIC DAMAGE CAUSE A CHANGE IN FUNCTION?**

The Health Assessment Questionnaire (HAQ) is a patient measure of functional status that is used to assess disability in rheumatoid arthritis. A review by Scott and colleagues\textsuperscript{26} found that, in patients with early rheumatoid arthritis, average HAQ scores are about 25\% of the maximum, a score largely driven by pain and synovitis, not joint damage. The effect of pain and synovitis on functional status seems to decline as damage increases. Scott and colleagues\textsuperscript{26} noted a linear relationship of disability and damage when radiologic scores exceed 33\% of maximal damage. Smolen and colleagues\textsuperscript{27} used clinical trial data to estimate the level of disability related to 1 Sharp score unit. Because radiographic progression is not always linear, this estimation applies on the group level. They estimated that the HAQ increases by one-tenth of a unit for every 10-unit increase in Sharp score.\textsuperscript{27} In a systematic review of the literature, Bombardier and colleagues\textsuperscript{1} found that evidence joint damage measured by Sharp or Larsen score correlated with physical disability as measured by HAQ, Arthritis Impact Measurement Scale, grip strength, Short Form 36 (SF-36), work disability, and quality of life. An increase in joint damage was associated with an increase in future disability over time.\textsuperscript{1}

**ARE CLINICAL MEASURES OF LOW DISEASE ACTIVITY OR REMISSION CORRELATED WITH RADIOGRAPHIC PROGRESSION?**

The Swedish Pharmacotherapy (SWEFOT) trial studied the 2-year clinical and radiological outcomes of patients with early rheumatoid arthritis who achieved low Disease Activity Score 28 (DAS28; $\leq 3.2$) with methotrexate monotherapy.\textsuperscript{28} Most of the patients remained on methotrexate (target dose 20 mg/wk) for the duration of the 2-year trial. At baseline, 48.1\% of the 147 patients had no radiographic damage (SvdH score of 0), at 1 year this proportion had decreased to 26.9\%, and at 2 years to 20.2\%.\textsuperscript{28} The mean progression after 2 years in patients who had follow-up radiographs ($n = 101$) was 3.9 (standard deviation = 6.84) ($P = .0003$).\textsuperscript{28} There was no
<table>
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<tr>
<th>Year</th>
<th>Subjects</th>
<th>Design</th>
<th>Treatment Groups</th>
<th>Outcome Measures</th>
<th>Sharp or SvdH Score</th>
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</table>
| 1997 | N = 155 RA<2 y | Randomized double-blind, placebo-controlled 28-wk trial with step-down therapy through week 56 and observation through week 80 | 1. SSA  
2. SSA + prednisone + methotrexate  
Taper: prednisone tapered first, then methotrexate | Primary outcome  
1. Pool index of measures  
2. Change in SvdH score | Median change (range) at 28 wk:  
Combined group  
Erosions 0 (0–24)  
Narrowing 0 (0–11)  
Total 1 (0–28)  
SSZ group  
Erosions 4 (0–26)  
Narrowing 1 (0–20)  
Total 4 (0–28)  
Statistically significant change that persisted to week 80 |
| 2002 | N = 632 RA ≤ 3 y MTX naive +RF ≥ 3 erosions on radiograph | Randomized double-blind, placebo-controlled 1-y trial with 1-y open-label extension | 1. Enbrel 10 mg BIW  
2. Enbrel 25 mg BIW  
3. MTX 7.5 mg Qwk increased to 20 mg Qwk as needed | Primary outcome  
1. ACR 20, ACR50, ACR70  
2. Change in Sharp score | Sharp score  
1. At 2 y, mean change in total score from baseline: 25 mg Enbrel 1.3 units vs 3.2 units in the MTX group ($P = .001$)  
2. Mean change in erosion score: 0.7 and 1.9 in 25 mg Enbrel and MTX group respectively ($P = .001$)  
3. 63% of 25 mg Enbrel patients had no increase in total Sharp score vs 51% patients on MTX ($P = .017$)  
4. 70% of 25 mg patients on Enbrel vs 58% of patients on MTX had no increase in erosions ($P = .012$) |
<table>
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<tr>
<th>Study</th>
<th>Year</th>
<th>N =</th>
<th>Criteria</th>
<th>Study Design</th>
<th>Primary Outcome</th>
<th>Secondary Outcome</th>
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<tr>
<td>TICORA&lt;sup&gt;15&lt;/sup&gt;</td>
<td>2004</td>
<td>111</td>
<td>RA &lt; 5 y and DAS28 &gt; 2.4</td>
<td>18-mo single-blind randomized-controlled trial</td>
<td>1. Intensive management 2. Usual care</td>
<td>1. Mean decrease in DAS 2. Percentage of patients with good response Secondary outcome SvdH score</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Both groups used sequential DMARDs</td>
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<tr>
<td>ASPIRE&lt;sup&gt;16&lt;/sup&gt;</td>
<td>2004</td>
<td>1049</td>
<td>RA ≥ 3 mo and ≤ 3 y, ≥ 10 swollen and ≥ 12 tender joints, + RF, erosions, or CRP ≥ 2.0, MTX and anti-TNF naïve</td>
<td>54-wk randomized, double-blind, placebo-controlled trial</td>
<td>3 groups in a 4:5:5 ratio 1. MTX-placebo 2. MTX + 3 mg/kg infliximab 3. MTX + 6 mg/kg infliximab</td>
<td>1. ACR N 2. Change in SvdH score at 54 wk 3. Change from baseline in HAQ scores averaged over weeks 30–54 SvdH score</td>
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<td></td>
<td></td>
<td></td>
<td>1. Mean change in total score from baseline to week 54 in MTX vs 3 mg/kg infliximab vs 6 mg/kg infliximab 2. Mean change in erosion score 3.0 ± 7.8, 0.6 ± 4.9, 0.1 ± 4.2; P &lt; .001</td>
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<tr>
<th>Year</th>
<th>Subjects</th>
<th>Design</th>
<th>Treatment Groups</th>
<th>Outcome Measures</th>
<th>Sharp or SvdH Score</th>
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</table>
| 2005 | N = 508  | 2-y multicenter, randomized, single-blind trial | 1. Sequential DMARD monotherapy  
2. Step-up combination therapy  
3. Initial combination DMARD therapy with tapered high-dose prednisone  
4. Initial combination DMARD therapy with infliximab | Primary outcomes  
1. Functional ability by D-HAQ  
2. Change in SvdH score  
Secondary outcomes  
1. ACR20, ACR50, and ACR70  
2. Clinical remission DAS44<1.6 | SvdH score  
Patients treated with initial combination therapy including prednisone (group 3) or infliximab (group 4) had significantly less progression of radiographic joint damage than did patients with sequential monotherapy (group 1) or step-up combination therapy (group 2). Median increases in total SvdH score were 2.0, 2.5, 1.0, and 0.5 in groups 1–4 respectively  
Number of patients without progression of total SvdH score (greater than the SDD) was higher in groups 3 and 4 than in groups 1 and 2: 76/114, 82/112, 104/120, 113/121 in groups 1–4 respectively |

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<table>
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<tr>
<th>Study</th>
<th>Year</th>
<th>N</th>
<th>Selection Criteria</th>
<th>Design</th>
<th>Treatment Groups</th>
<th>End Points</th>
<th>Radiographic Outcomes</th>
<th>( \text{SvdH score} )</th>
<th>( \text{Mean change} )</th>
<th>( P ) Value</th>
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<tr>
<td>PREMIER</td>
<td>2006</td>
<td>799</td>
<td>RA &lt; 3 y</td>
<td>2-y multicenter, double-blind, active comparator-controlled phase III trial</td>
<td>1. Adalimumab + MTX 2. Adalimumab 3. Oral MTX</td>
<td>Primary end points 1. Percentage of patients with ACR50 at 1 y 2. Mean change from baseline in total SvdH score</td>
<td>1.3 units vs adalimumab monotherapy 3.0 units (( P = .002 )) vs MTX monotherapy 5.7 units (( P &lt; .001 ))</td>
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<td>COMET</td>
<td>2008</td>
<td>542</td>
<td>MTX naive, RA 3–24 mo</td>
<td>24-mo double-blind, randomized, parallel-group, multicenter trial</td>
<td>1. MTX alone 2. MTX + etanercept</td>
<td>Primary end points 1. Remission by DAS28 2. Change in total SvdH score</td>
<td>No change in SvdH score 125/230 (54%) in MTX and 184/246 (75%) in etanercept ( P &lt; .001 )</td>
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<tr>
<td>RAPID 1</td>
<td>2008</td>
<td>982</td>
<td>52-wk randomized, double-blind, parallel-treatment trial</td>
<td>1. MTX alone 2. Certolizumab 400 mg Q2 wk 3. Certolizumab 200 mg Q2 wk</td>
<td>Primary end points 1. ACR20 at week 24 2. Mean change in baseline SvdH score at week 52</td>
<td>SvdH score Mean radiographic progression in 200-mg certolizumab group (0.4 Sharp units), 400-mg certolizumab (0.2 Sharp units), MTX alone (2.8 units) (( P &lt; .001 ) by rank analysis)</td>
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* Tender joint count, physician global, grip strength, ESR, McMaster Toronto Arthritis Questionnaire.
statistically significant difference in progression between patients in DAS28 remission (DAS28<2.6) versus those not in remission ($P = .73$).\textsuperscript{28}

Comparing radiographic outcomes with clinical outcomes can be problematic because patients in a clinical trial often show no radiographic progression during the trial and the few patients who show significant progression skew the results.\textsuperscript{23}

Fig. 2. Cumulative probability plot of the individual progression scores of 135 rheumatoid arthritis patients who participated in the COBRA trial. (Data from Landewe R, van der Heijde D. Radiographic progression depicted by probability plots: presenting data with optimal use of individual values. Arthritis Rheum 2004;50(3):701.)

Fig. 3. Cumulative probability plots of individual 1-year radiographic progression scores in 135 rheumatoid arthritis patients who participated in the COBRA trial (67 patients in the monotherapy group [circles] and 68 patients in the combination therapy group [triangles]). Cumulative probability was calculated per group. (Data from Landewe R, van der Heijde D. Radiographic progression depicted by probability plots: presenting data with optimal use of individual values. Arthritis Rheum 2004;50(3):704.)
Missing data also make it difficult to compare clinical and radiographic outcomes. Landewe and colleagues showed that radiographic progression is often driven by a small number of patients who do not respond to treatment.

**CAN RADIOGRAPHIC PROGRESSION HELP TO REDEFINE REMISSION?**

Pain control, maintenance of physical function, and prevention of joint damage are important goals for treatment. The DAS28 is a clinical tool that uses tender and swollen joint counts, ESR, and patient global assessment to define disease activity and remission in patients with rheumatoid arthritis. Investigators have questioned the DAS28 definition of remission because a significant number of patients in remission continue to have persistent joint swelling. Aletaha and colleagues analyzed data from the methotrexate monotherapy arms of the Active-Controlled Study of Patients Receiving Infliximab for the Treatment of Rheumatoid Arthritis of Early Onset (ASPIRE), Trial of Adalimumab versus Methotrexate versus Combination of Adalimumab and Methotrexate in early rheumatoid arthritis (PREMIER), Early Rheumatoid Arthritis trial of etanercept versus methotrexate, Trial of Etanercept and Methotrexate with Radiographic Patient Outcomes (TEMPO), and trials of leflunomide compared with sulfasalazine or methotrexate and showed that patients on methotrexate monotherapy in DAS28 remission without joint swelling had lower rates of radiographic progression that those on methotrexate monotherapy who had persistent joint swelling. Gandjbakhch and colleagues evaluated 294 patients with rheumatoid arthritis who were in clinical remission or low disease activity state and found MRI evidence of subclinical inflammation (synovitis or bone edema) in many of the patients in clinical remission or with low disease activity states, which could explain radiographic progression in patients who are clinically doing well.

Other studies by Landewe and colleagues and Smolen and colleagues have suggested a disconnect between clinically active disease and radiographic progression by documenting patients treated with methotrexate and anti–tumor necrosis factors who have persistent synovitis without radiographic progression. This phenomenon has also been seen with the COBRA strategy of step-down prednisolone and with tocilizumab. The disconnect may arise because clinical and radiographic findings are more likely caused by radiographic insensitivity and suggest that ultrasound and newer MRI techniques are more sensitive and better predictors of disease state. These results show the importance of evaluating both clinical and radiographic outcomes for patients who are treated with biologics.

**IS RADIOGRAPHIC EVIDENCE OF DISEASE PROGRESSION REVERSIBLE?**

Remission is now the goal of treatment in rheumatoid arthritis. Lillegraven and colleagues found that adding sustainability or time in clinical remission as a variable for rheumatoid arthritis remission criteria helped identify patients with a good future outcome (ie, no radiographic progression).

Is repair of joint damage possible? Improvement in SvdH scores has also been seen in clinical trials and case reports suggest that healing of erosions occasionally occurs. However, changes can be subtle and healing of erosions can be difficult to differentiate from artifact or changes in positioning.

**ULTRASOUND AND MRI**

Although radiographs are readily available and reproducible, they do not provide the earliest assessments of joint damage and cannot document bone edema or...
Early cartilage changes are not readily evident on radiographs because detection depends on indirect evidence shown as JSN. As a result, radiographs cannot reliably guide treatment decisions for patients with very early rheumatoid arthritis to the same degree as direct cartilage assessment, which is possible with cartilage-sensitive protocols on MRI or ultrasound. However, because of a lack of equipment and user standardization, uniform protocols for monitoring early rheumatoid arthritis or imaging changes after treatment are not yet established. Baillet and colleagues reported that ultrasound was comparable with MRI and more effective than radiographs for diagnosing erosions. The Outcomes Measures in Rheumatoid Arthritis Clinical Trials (OMERACT) group defined ultrasound criteria for joint synovitis and erosions. The European League Against Rheumatism (EULAR) and OMERACT are in the process of developing a global sonography scoring system specific for small-joint evaluation using gray-scale and power Doppler scores.

**Ultrasound**

Ultrasound is a low-cost imaging modality that does not use ionizing radiation. Ultrasonography allows assessment of synovitis, tenosynovitis, enthesitis, and erosions. Transducers generate ultrasound pulses and receive returning echoes that are processed to form an anatomic image. The limitation of ultrasound in the musculoskeletal setting is that scans and technique are operator dependent and it does not easily assess cartilage. Portable devices are available but the degree of sensitivity for the detection of subtle changes varies with different ultrasound units and transducers. Normal hyaline cartilage is identified as anechoic (black, without echoes), hypoechoic (dark, few echoes), and a sharp interface with the subchondral bone. When cartilage is not normal, the image is hyperechoic (bright with many echoes) along with a loss of the sharp interface with the subchondral bone. High-end units with increased diagnostic accuracy and sensitivity will better enable detection of early rheumatoid disorders. Power Doppler ultrasound records vascularity. Active synovitis detected by power Doppler has been correlated with disease activity measured by DAS28 and radiographic progression.

**MRI**

MRI uses a powerful magnetic field, applied in pulses, to detect water protons present in body tissue. Limitations of MRI include cost, accessibility, contraindications such as patients with pacemakers and cochlear implants, and, for some patients, claustrophobia. The magnetic pulses affect the electron spin, which produces signal variations that are displayed as an image. MRI has the potential to directly visualize articular hyaline cartilage and can evaluate volume, thickness, morphology, and structural integrity. MRI is sensitive and can show active inflammation in bone, soft tissues, and within the joint. Inflamed tissues, such as synovium and tenosynovium, contain inflammatory cells and increased vascularity with a higher water content (and therefore more H\(^+\) ions) than normal tissue. Bone damage can also be imaged with MRI. Erosions appear as breaks in cortical bone, whereas bone marrow edema is characterized by increased signal on fat-suppressed T2-weighted images. Cartilage morphology (eg, area of thinning) can also be visualized with MRI. Newer magnetic resonance (MR) techniques for assessing cartilage matrix can quantify cartilage integrity and may be a method to predict preclinical disease and progression. The ability to assess changes in water content and proteoglycan density along with specific cartilage pulse sequence protocols are helping to achieve a new understanding of cartilage biology.
Evaluation of small joints requires high-resolution surface coils and newer gradient platforms. The OMERACT group has defined and validated an MRI scoring system for rheumatoid arthritis disease activity of the wrist and MCP joints called the Rheumatoid Arthritis Magnetic Resonance Imaging Score (RAMRIS). RAMRIS consists of a score for erosions, bone marrow edema, and synovitis as well as a composite score. A limitation of RAMRIS is that scoring the study is time consuming and requires training for reproducible results. Acquisition of MR images differs at various facilities. Use of contrast, magnet strength, and field of view (coned down, entire hand, both hands) all affect the sensitivity of the resultant image. Efforts have been made to simplify the scoring of RAMRIS and to decrease invasiveness and the cost of MRI by eliminating the intravenous gadolinium. Ostergaard and colleagues found that RAMRIS scores of bone erosions and bone edema did not change in studies without intravenous gadolinium, but synovitis scores were less reliable.

CAN MRI HELP PREDICT WHICH PATIENTS WITH UNDIFFERENTIATED INFLAMMATORY ARTHRITIS WILL DEVELOP RHEUMATOID ARTHRITIS?

An estimation of the risk of disease progression, joint damage, and loss of function are crucial to treatment decisions for patients who present with undifferentiated inflammatory arthritis. MRI evidence of bone edema and a combination of a distinct synovitis and erosion pattern are correlated with an increased risk of development of rheumatoid arthritis as defined by the 1987 American College of Radiology (ACR) criteria. In patients with undifferentiated arthritis, bone edema on MRI predicts progression to rheumatoid arthritis both independently and when combined with positive rheumatoid factor or anti–cyclic citrullinated peptide antibodies. MRI detection of synovitis and bone edema are also independent predictors of radiographic progression in patients with early rheumatoid arthritis. McQueen and colleagues showed that baseline bone edema predicted both JSN and the erosion component of the score, suggesting a influence on subchondral bone and cartilage. Biopsies of patients with late rheumatoid arthritis have shown that what is called bone edema on MRI represents inflammatory and vascular lymphoplasmacytic infiltrate of the bone marrow.

Figs. 4 and 5 show how MRI and ultrasound can be used to diagnose early rheumatoid arthritis in patients with normal radiographs of the hands.

HOW OFTEN SHOULD PATIENTS HAVE IMAGING DONE AND WHICH IMAGING MODALITIES SHOULD BE USED?

Treat to Target

With advances in treatment and improved outcomes for many patients with rheumatoid arthritis, treat-to-target strategies have recently been developed for rheumatoid arthritis to improve patient care. Treatment should be adjusted if the desired target is not rapidly reached, and the desired target should be sustained over time. An international task force recommended in 2010 that the desired target should be based on validated clinical measures of remission or low disease activity, but that structural changes and functional impairment should be considered when making treatment decisions. They recommended that radiographs be obtained annually and potential progression be estimated (not scored). They noted the lag time of radiograph changes and the existence of other validated imaging modalities (ultrasound and MRI) but thought that scoring systems required further standardization and validation. In 2011, the Canadian Rheumatology Association developed guidelines for the pharmacologic management of rheumatoid arthritis with traditional
and biologic disease-modifying antirheumatic agents.\textsuperscript{71} They recommended radiographs of the hands and feet as frequently as every 6 to 12 months in patients with recent-onset disease.\textsuperscript{71} Radiographs could be performed at longer intervals for patients with established disease.\textsuperscript{71} In addition, they recommended that change in
Fig. 5. A 33-year-old man with 4 months of bilateral MCP and proximal interphalangeal pain and swelling. He has minimal clinical synovitis, negative serologies, and a DAS of 2.61. Fat-suppressed and fast-spin echo MR show no evidence of synovitis affecting the wrist joints. MR angiography reveals no evidence of neovascularity. Coronal T1 fat-suppressed MR following injection of contrast also shows no abnormal areas of synovial enhancement in this normal study. (From Vasanth LC, Foo LF, Potter HG, et al. Using magnetic resonance angiography to measure abnormal synovial blood vessels in early inflammatory arthritis: a new imaging biomarker? J Rheumatol 2010;37(6):1133; with permission.)

Fig. 4. (A) A 23-year-old woman with 6 months of symmetric polyarthritis with morning stiffness. She had clinical synovitis, positive serologies, and a DAS of 5.32. Power Doppler ultrasound of the same patient shows the volar aspect of the wrist along the radioscaphoid joint. A region of interest encompasses hypoechoic soft tissue with increased vascularity. The graph plots the mean power Doppler signal intensity (dB/mm²) versus time. The pulsatility reflects the arterial component of the visualized vascularity. (B) Fat-suppressed coronal MRI shows a reactive bone marrow edema pattern affecting all joint compartments of the wrist. Axial and sagittal fast-spin echo MR images show synovial debris within the distended distal radioulnar (yellow arrow) and radiocarpal (red arrow) joints. Note also the presence of tenosynovitis of the flexor carpi radialis (green arrow). MR angiography shows the presence of new vessels (blue arrow) at the level of the midcarpal joint. (From Vasanth LC, Foo LF, Potter HG, et al. Using magnetic resonance angiography to measure abnormal synovial blood vessels in early inflammatory arthritis: a new imaging biomarker? J Rheumatol 2010;37(6):1133; with permission.)
therapy be considered in patients with radiographic progression even if they met criteria for low disease activity clinically.71

SUMMARY

Increased awareness of the need for early diagnosis of rheumatoid arthritis and advances in the ability to effectively treat rheumatoid arthritis have made disease remission and maintenance of function a reality for many patients. However, identification of patients with early inflammatory arthritis who are at risk for erosive disease remains a challenge. As more is learnt about risk factors for disease severity and the role of imaging techniques such as ultrasound and MRI is defined as a criterion for the diagnosis of early rheumatoid arthritis and treatment response, the ability to prevent disease progression in the form of joint damage and its attendant deformity and functional limitation will further improve.

REFERENCES


28. Rezaei H, Saevarsdottir S, Forslind K, et al. In early rheumatoid arthritis, patients with a good initial response to methotrexate have excellent 2-year clinical outcomes, but radiological progression is not fully prevented: data from the


