MR imaging adds weight to sacroiliitis diagnosis

November 05, 2004
By Anne Grethe Jurik, MD [1]

Early diagnosis of rheumatoid arthritis and monitoring of the disease during therapy have attracted considerable interest over the past decade. Imaging studies of seronegative spondyloarthropathies, however, are few and far between, even though these disorders occur as frequently as rheumatoid arthritis. Now the potential promise of biological therapy to treat ankylosing spondylitis, one of the most disabling seronegative spondyloarthropathies, is focusing attention on techniques capable of detecting the disease early and tracking its progress through treatment.

The European Spondyloarthropathy Study Group (ESSG) described the full set of disorders in 1991. They can be classified as ankylosing spondylitis, psoriatic arthritis, reactive arthritis, arthritis associated with inflammatory bowel diseases (enteropathic arthropathy), and unclassified spondyloarthropathy. The ESSG based its classification on clinical findings and radiographic evidence of sacroiliitis. Radiography has a high specificity (97.8%) but a low sensitivity (54.4%) for spondyloarthropathy. This low sensitivity can delay the diagnosis for several years. Because the condition mainly affects young patients, an early diagnosis would greatly aid therapy, prognosis, and evaluation of the ability to work, particularly in cases of ankylosing spondylitis. Because most spondyloarthropathies involve the sacroiliac joint and sacroiliitis is often the first manifestation of the disorder, diagnosis of sacroiliitis on imaging is extremely important for early detection. Several studies have emphasized the value of CT and MR in diagnosing sacroiliitis; both can visualize joint erosions earlier than radiography. MR imaging can also detect inflammatory changes.

Cross-sectional imaging plays an important role in identifying, localizing, and characterizing sacroiliac joint abnormalities in early stages of spondyloarthropathies, due to its higher sensitivity compared with radiography. MR is especially valuable for early diagnoses. It is diagnostically comparable to CT for erosions and sclerosis, and it can also visualize fat accumulation in the bone marrow, a sign of chronic disease. MR's greatest advantage, however, is its ability to detect signs of disease activity such as edema and/or contrast enhancement, enabling detection of sacroiliitis before changes are visible on CT. MR imaging can also be performed without known risk.

EXAMINATION SUGGESTIONS
A widely accepted method for evaluating the degree and type of MR abnormalities would be extremely valuable. It would allow inclusion of MR findings in any future elaboration of diagnostic criteria for various forms of spondyloarthropathy. Quantification of sacroiliac joint abnormalities, using a method more sensitive than conventional radiography, would also aid evaluation of therapy. It could help, for example, in assessing the efficacy of novel biological agents targeting tumor necrosis factor-α (TNF-α).

The lack of an accepted method for MR classification and grading/quantification of sacroiliac joint abnormalities may be due in part to difficulties in interpreting the special anatomic features. Practitioners may also still be seeking the optimal MR technique. Disadvantages related to MR in general, including long examination times, relatively high cost of scans, need for skilled staff, and specific contraindications such as pacemakers, may also play a part.

MR imaging of the sacroiliac joints and interpretation of the findings demand knowledge of the area's complex anatomy. The sacroiliac joints transmit all forces from the body to the lower extremities and are stabilized by an oblique orientation of irregular joint facets, surrounding joint ligaments, and strong external ligaments and muscles. Each joint is composed of two compartments: a C-shaped cartilaginous part that lies inferiorly/anteriorly, and a ligamentous part lying...
superiorly/posteriorly. The cartilaginous portion of the joint is without synovia (a symphysis) proximally, whereas a small synovial recess is seen on the iliac side at the joint's distal part. The anatomy of the middle part exhibits a number of normal variations. Knowledge of normal anatomy and awareness of possible pitfalls on MR imaging are important in establishing a diagnosis. Most analyses of sacroiliac joints have been based on semicoronal MR slices. An MR study with histological comparison, however, has shown that semiaxial slices are important for visualizing both the cartilaginous and ligamentous portions of the joint. The semiaxial slice orientation reveals fatty tissue in the ligamentous portion but not in the cartilaginous portion and thus differentiates between the two. Coronal slices provide a better overview of joint erosion, however, so both slice orientations should ideally be performed.

Standard slice orientations at Aarhus University Hospital include semicoronal slices obtained parallel to a line joining the upper dorsal aspect of S1 and S3 and semiaxial slices perpendicular to the semicoronal plane (Figure 1). Sacroiliitis screening requires a semiaxial STIR sequence (or T2-weighted imaging with fat suppression) to display inflammation. Semicoronal T1-weighted MR displays chronic changes such as fatty bone marrow changes and erosion. Sacroiliitis is excluded if imaging results are normal. An additional semicoronal STIR sequence may provide more information relating to inflammatory changes if results are equivocal. Vascularized abnormalities can be further characterized after administration of gadolinium contrast on semicoronal and semiaxial T1-weighted fat-suppressed MR imaging. Contrast-enhanced imaging should always be performed when infectious sacroiliitis is suspected.

**INTERPRETING MRI**

MR is being used increasingly as a basis for clinical decision making in many rheumatology departments. Abnormalities seen on MR have yet to be included in internationally accepted diagnostic criteria for differing forms of spondyloarthropathies, however. Investigations of specific MR signs to justify its inclusion in classification criteria demand several years of follow-up. Preliminary assessment of five years of MR follow-up at Aarhus University indicates that it may be possible to predict the development of progressing ankylosing spondylitis based on bilateral abnormalities and iliac and sacral changes consisting of erosion and/or fatty marrow degeneration (Figure 2). Sacral involvement is rare in reactive arthritis, unclassifiable in spondyloarthropathy, and rare in psoriatic and enteropathic arthritis unless the condition progresses to ankylosing spondylitis-like involvements.

Inflammatory involvement of the sacroiliac joint in ankylosing spondylitis may be comparable to intervertebral disk space involvement, predominantly affecting the symphyseal and ligamentous parts. Reactive arthritis and slight psoriatic changes predominantly involve the distal synovial part of the joint. Enteropathic changes related to Crohn's disease and ulcerative colitis are characterized by more dominant involvement of the joint's ligamentous part than is seen in other forms of spondyloarthropathy.

**GRADING SACROILIAC JOINT INVOLVEMENT**

A system for grading sacroiliac joint changes in ankylosing spondylitis according to radiography findings has gained international acceptance, but radiography can detect only definite joint and/or osseous alterations, and both inter- and intraobserver variation is considerable for slight changes. Similar widely accepted grading systems based on MR and CT are not available, despite their potential role in quantifying slight osseous changes and inflammatory changes (MR alone). Rheumatologists use these quantitative measurements of disease severity as indicators for aggressive therapy and for monitoring disease changes during therapy. Sacroiliitis can produce acute and chronic changes separately or simultaneously in different joint areas. Erosions, sclerosis, changes of joint width, and fat deposition in the bone marrow are all regarded as signs of chronic disease, and can be graded/quantified by MR. The same applies to active inflammatory changes in the form of edema and contrast enhancement caused by increased vascularization. Few proposals exist for grading/quantification of MR abnormalities. The first such proposal, published in 1990, divided MR findings into two types based mainly on signal changes from T1- and T2-weighted imaging and from phase-contrast sequences. The authors characterized type I lesions as having low signal intensity on T1-weighted MRI and high signal intensity on both phase-contrast and T2-weighted MRI, compatible with active inflammation. They described type II lesions as having low signal intensity on all sequences, corresponding to chronic changes. But this division does not account for the frequent occurrence of fatty marrow changes in chronic disease.

An alternative grading system for disease activity, published in 2000, proposed quantitative evaluation of contrast enhancement from dynamic MRI. Findings were divided into three stages of disease activity and were further supplemented by the New York criteria for joint destruction.
Despite the advantages of quantitative assessment, this method requires subjective placement of regions of interest (ROI). Because misplacement of an ROI to a blood vessel could cause false-positive results, and because dynamic MRI is not yet used routinely in many radiological departments, the grading system has not gained widespread acceptance. Only one grading/quantification proposal has been evaluated with regard to intra- and interobserver variation. This semiquantitative grading system is based on STIR, T1-weighted, and T1-weighted fat-suppressed MR, performed before and after intravenous gadolinium administration, using both semicoronal and semiaxial slice orientation. Grading includes assessment of osseous lesions at four anatomic sites of the sacroiliac joint (sacral and iliac sides of the cartilaginous and ligamentous portions), in addition to alteration of both the cartilaginous and ligamentous joint space. Semiquantitative grading of inflammatory activity is based on bone marrow edema/reparative processes (high signal intensity on STIR) and on gadolinium contrast enhancement in the bone marrow, cartilaginous and ligamentous joint spaces, and at entheses outside the joints (Table 1).

Assessment of joint destruction/chronic changes is based on erosions, osseous sclerosis (low signal intensity on T1-weighted MR and/or T1-weighted fat-suppressed MR), fat accumulation in the bone marrow (high signal intensity on T1-weighted MR), joint space alteration, and new bone formation at entheses. All parameters were semiquantitatively scored in the range of zero to three, where zero is normal, one is minimal, two is moderate, and three is severe.

Analysis of 41 patients, including comparison with CT and conventional radiography, confirmed that parameters indicating disease activity can be monitored with good intraobserver agreement and relatively good interobserver agreement. It proved more difficult to reach agreement on the grading of chronic changes in the form of joint destruction, especially joint space narrowing but also osseous sclerosis (Table 2).

MR, using the described semiquantitative grading system, fared equally well against CT in detecting joint erosion and sclerosis, although evaluation of sclerosis with MR may still be difficult.6 MR appeared inferior to CT for assessing the rare occurrence of new bone formation at entheses and for evaluating joint space alteration.6 Nonetheless, the grading/quantification system6 was found to be valuable in a one-year follow-up study of 34 patients. It was possible to detect decreasing disease activity but increasing chronic changes without concomitant clinical signs.16,17

The semiquantitative MR grading system was based partly on contrast-enhanced sequences. Results revealed a significant correlation between osseous edema on STIR images and contrast enhancement in the bone marrow, suggesting that contrast may not be necessary.6 A similar association appears to exist between increased signal intensity on STIR and contrast enhancement corresponding to the joint space. This is a personal evaluation, and it has not been evaluated in a blinded way. Poor interobserver agreement for joint space alteration, coupled with the lack of blinded evaluation of edema in the joint space, means that the grading system must be reevaluated. Blinded evaluation of a modified method should include analysis of the justification for using contrast.

**VALUE OF MR**

MR is valuable in the detection and classification of sacroiliitis. The modality can visualize active inflammatory changes and detect joint erosion and sclerosis with the same sensitivity as CT. MR can also detect fatty marrow degeneration, a sign of chronic changes. CT appears superior to MR only in evaluating chronic changes in the form of joint space alteration and new bone formation at entheses. MR imaging can distinguish between acute and chronic changes and estimate and quantify the degree of disease activity. This capability would be of benefit in classifying different forms of spondyloarthopathy and monitoring disease progression before, during, and after any drug treatment. MR should therefore be used whenever possible to evaluate sacroiliitis.

A proposal has been published for a semiquantitative grading of sacroiliac joint abnormalities on MR. It has the potential to differentiate between various forms of spondyloarthopathy and can be used to quantify abnormalities, but it needs to be modified and then reevaluated.

**References**

MR imaging adds weight to sacroiliitis diagnosis
Published on Diagnostic Imaging (http://www.diagnosticimaging.com)


Disclosures:

Source URL:
http://www.diagnosticimaging.com/articles/mr-imaging-adds-weight-sacroiliitis-diagnosis

Links: