

Imaging of the Seronegative Spondyloarthropathies

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KEYWORDS

- Seronegative spondyloarthropathy • Sacroiliitis • Magnetic resonance imaging
- Inflammatory arthritis • Ankylosing spondylitis

KEY POINTS

- The seronegative spondyloarthropathies can be categorized based on imaging findings in association with clinical features and laboratory testing.
- Multiple modalities (radiography, computed tomography [CT] and magnetic resonance [MR] imaging) can be used to assess the axial and appendicular skeleton in patients suspected of seronegative spondyloarthropathies.
- MR imaging is the optimal modality for imaging the seronegative spondyloarthropathies, with improved sensitivity compared with radiography and CT.
- Contrast-enhanced MR imaging can distinguish between active and inactive disease and also assess response to treatment.

INTRODUCTION

Spondyloarthritis refers to a diverse group of diseases involving inflammation of the axial skeleton and peripheral joints.^{1–3} The individual entities are distinguished by specific clinical and laboratory features with disease presentation often on a spectrum that is dynamic and progressive rather than static and unchanging. These diseases can be grouped based on common clinical and imaging features such as inflammatory back pain, sacroiliitis, spondylitis, and enthesitis. Laboratory studies, with the exception of the strong association with the genetically determined human leukocyte antigen B27 (HLA-B27), are generally nonspecific, with elevated inflammatory markers such as C-reactive protein and erythrocyte sedimentation rate sometimes present. Clinical features may allow some differentiation (such as urethritis in Reiter syndrome or reactive spondyloarthropathy), but there remains significant overlap.^{1,3}

The original concept of a group of interrelated but distinctive disorders was developed by Moll

and colleagues⁴ in 1974 to describe a group of inflammatory diseases affecting the spine and sacroiliac joints. The term seronegative spondyloarthropathies was coined to indicate that rheumatoid factor was not present in these patients, with the individual forms of the disease including ankylosing spondylitis, psoriatic arthritis, reactive arthritis (formerly known as Reiter syndrome), arthritis related to inflammatory bowel disease, and a form of juvenile idiopathic arthritis distinguished only by the age of the patient.⁵ Undifferentiated spondyloarthropathy and late-onset spondyloarthropathy are also sometimes included in this grouping.^{6,7} In addition to the distinction by the absence of rheumatoid factor, the seronegative spondyloarthropathies uniquely affect entheses. The definition and subcategorization of the spondyloarthropathies has evolved over time, and multiple groups have attempted to characterize the symptoms and natural history of the spondyloarthropathies, including the New York criteria⁸ for sacroiliitis and similar criteria for ankylosing spondylitis, in the 1960s and 1970s.^{1,3} In the 1990s there was a move to reclassify the entire

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disease spectrum; this grouped all patients with inflammatory arthritis involving the axial skeletal as seronegative spondyloarthritis, despite a wide variety of clinical symptoms.⁹ The Amor criteria addressed the difficulty in diagnosing these disorders through the creation of a scoring system.⁹ A newer (2009) classification was proposed by the Assessment of Spondyloarthritis International Society (ASAS) after a large cross-sectional study.¹⁰ Rather than focusing on specific subtypes such as ankylosing spondylitis, this classification depends on 2 important clinical features: axial symptoms and peripheral involvement. The investigators proposed the term “axial spondyloarthritis” for the entire spectrum of diseases whereby axial involvement predominates. This type can then be broken down into the more traditional subtypes based on clinical features, HLA-B27 positivity, and the presence or absence of sacroiliac involvement based on the detection of active inflammation by advanced imaging techniques such as magnetic resonance (MR) imaging. The ASAS criteria for axial spondyloarthritis consists of active sacroiliitis on imaging plus 1 or more features of spondyloarthritis or HLA-B27 positivity with 2 or more features of spondyloarthritis. In comparison, the criteria for peripheral spondyloarthritis are more complex and include such options as Crohn disease or ulcerative colitis, prior infection (as in Reiter syndrome), inflammatory back pain, or positive family history.⁹ The diagnosis of a peripheral spondyloarthritis also can depend on the presence of sacroiliitis on imaging (ie, arthritis with sacroiliitis alone meets these criteria).⁹ Although classification remains of interest for these complex disorders, the main challenge at the current time is the development of strategies for early diagnosis and treatment aimed at limiting disability and disease progression over time. The newer classifications all depend on advanced imaging techniques such as MR imaging, supplanting the prior use of radiography (and radiographic atlases) in assisting clinical decision making.

IMAGING TECHNIQUES

Although the spondyloarthropathies can involve the entire axial and appendicular skeleton, including central and peripheral entheses and joints, the hallmark for all types of spondyloarthritis remains sacroiliitis.^{1–3} Inflammation of one or both sacroiliac joints is the most characteristic and consistent feature of these disorders. Involvement of the remainder of the axial skeleton is rare in the absence of sacroiliitis, as is peripheral involvement even when those symptoms, such

as enthesitis at the heel, dominate the clinical picture. Inflammatory back pain is commonly associated with sacroiliitis, but is a nonspecific symptom and may be seen in other disorders unrelated to spondyloarthropathy. HLA-B27 positivity on its own is not an indication of spondyloarthritis in the absence of symptoms or positive imaging findings.^{10,11} The unifying diagnostic tool for the seronegative spondyloarthropathies is imaging of the sacroiliac joints.

Conventional radiography remains the most common initial imaging study for patients suspected of having inflammatory arthritis of all kinds (Fig. 1).³ Plain radiography of the pelvis for assessment of the sacroiliac joints has significant limitations, including the need for ionizing radiation in young patients as well as low sensitivity for detection of early disease.^{2,3} Experience and knowledge of the clinical context may improve detection, but it is common for radiologists to miss advanced cases of sacroiliitis on radiography.¹² Five stages of radiographic changes in the sacroiliac joints have been described, ranging from 0 (normal) through 4.⁵ The most difficult stages are 1 (unclear) and 2 (small erosions, sclerosis), with more advanced disease (3, definite erosions and 4, ankylosis) less problematic to detect, testifying to the poor specificity and moderate sensitivity of radiography in detecting sacroiliitis. The relatively low utility of radiography for sacroiliitis is exacerbated by poor interobserver and intraobserver reliability for subtle changes in early disease.^{13–15} The detection of the structural changes of sacroiliitis is challenging enough, but the physiologic parameter of disease activity is beyond the capabilities of radiography, which precludes using radiography to monitor response to therapy.

The complexity of the sacroiliac joints themselves and the difficulty in seeing the entire joint in a 2-dimensional projection is part of the challenge, but studies comparing more specialized views such as the angled anteroposterior oblique Ferguson view have not shown significant improvement in accuracy.^{1,3,16} Conventional views of the pelvis may actually have some added value over dedicated imaging of the sacroiliac joints, in that the hips are usually included in such images.¹⁷ Despite these limitations, conventional radiographs are important, especially in distinguishing ankylosing spondylitis from other types of spondyloarthritis. Radiographic imaging of the entire spine and symptomatic individual peripheral joints can help to classify the various types of spondyloarthropathy and to visualize complications such as discovertebral fractures in ankylosing spondylitis, although with lower sensitivity than with computed tomography (CT).

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