UPDATE ON MR IMAGING OF SPONDYLOARTHITIS.  
PART TWO: SPINE MR IMAGING

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Introduction

MRI of the sacro-iliac joints has become a key-imaging technique for the detection of early non-radiographic axial SpA and has been shown to contribute to optimized clinical decision-making (1, 2, 3). The current paper aims at summarizing the contribution of Spine MRI in patients with SpA, the optimized MRI protocols and findings at imaging. Pitfalls and differential diagnosis for spine changes will be addressed. Vertebral fractures and dural ectasia occasionally observed in long-standing SpA patients will be mentioned.

Contributions of spine MR imaging in patients with SpA

The role of MRI of the spine in patients with known SpA is controversial because there is little evidence, if any, that a definite diagnosis of the disease can be accepted in patients with normal sacro-iliac joints. Despite this limitation, evidence of anterior or posterior spondylitis in three or more vertebral corners or evidence of fatty deposition in several vertebral corners is highly suggestive of SpA (4). Because of the possible confusion with degenerative disc disease, spine MRI alone should not be prescribed to answer the question of the presence or absence of SpA.

Nowadays, the radiologists should be aware of the spectrum of changes that can be observed on MR images of the spine of patients with SpA for several reasons. First, Spine MRI can be the first imaging test obtained in a patient with unrecognized SpA and it may contribute to the recognition of the disease. Second, in case of changes of unknown significance at the SI joints, spine MRI can demonstrate additional features that increase the likelihood of SpA. Third, involvement of the small joints of the thoracic spine is highly suggestive of SpA because of the rare involvement of these joints in degenerative joint disease (5). Finally, MRI plays a crucial role in the accurate diagnosis of complications of long-standing SpA such as fracture in ankylosed spine and dural ectasia.

Spine MR imaging protocol in patients with SpA

Spine MRI protocol includes at least one T1-weighted and one fat-suppressed fluid-sensitive sequence (Table I). The sagittal plane is the imaging plane of reference and it should cover the most lateral aspects of the spine because of the high frequency of involvement of the zygoapophyseal joints. The costo-vertebral joints of the thoracic spine can also be imaged on the sagittal images. A large field-of-view coronal STIR sequence of the lumbar spine and SI joints yields important information in the setting of SpA as it is sensitive for bone marrow edema and covers a large body segment that contains numerous possible target areas. It can be optimized by including the thoracic spine, which is frequently involved in SpA (mainly the zygoapophyseal and costo-vertebral joints). The cervical spine is not an easy area to screen for lesions, and will be imaged only if clinically indicated.

Whole-body MRI is a research area in which extended anatomic coverage in combination with the use of sensitive sequences may contribute to better detection of disseminated inflammatory lesions (6, 7). A drawback of this technique is the limitation in the precise definition of the involved structures due to reduced spatial resolution and the high frequency of degenerative involvement of small joints of the body (8). Further research is needed before this technique can be implemented in routine clinical practice.

Diagnosis of inflammatory involvement of the spine

Table I. — Mandatory MRI sequences for spine imaging in SpA patients

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<td>• T1-weighted sagittal sequence</td>
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<td>• Fat-suppressed intermediate-weighted SE or STIR sagittal sequence</td>
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<td>• Fat-suppressed intermediate-weighted SE or STIR coronal sequence</td>
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Fig. 1. — Discitis and enthesitis in a 64-yo woman with SpA. Fat-saturated intermediate-weighted sagittal image. Discitis is demonstrated by the presence of increased signal intensity in the disc space (large arrow) with extensive marrow edema-like changes in adjacent bone. Enthesitis appears as increased signal intensity in marrow at the insertion site of the anterior longitudinal ligament or on the spinous process (arrowheads). Disc ankylosis (thin arrow) is barely visible as its signal can be similar to that of adjacent marrow.
Inflammatory lesions of the spine

- Axial SpA frequently demonstrates a patchy distribution along the axial skeleton with multiple foci of inflammation in different anatomic regions. Active inflammatory lesions of the spine include spondylitis, spondylodiscitis, arthritis of synovial joints and enthesitis.

- Spondylitis is often a triangular shaped area of marrow edema localized in the corners of vertebral bodies. It parallels the areas of ligament insertion and can be located at the anterior and posterior aspect of the vertebral bodies, near the insertion of the anterior or posterior longitudinal ligaments (Fig. 1) (9).

- Spondylodiscitis is usually a semi-circular area of marrow edema localized at the cortical end-plate adjacent to intervertebral disc (Fig. 2). They are associated with end-plate erosions. En-miroir lesion is not systematic. The disc is usually preserved. Spondylodiscitis has low specificity since degenerative disc lesions can have a similar appearance. (10).

- Arthritis of synovial joints presents as bone marrow edema in articular surfaces and adjacent soft tissue edema, best seen on fat-suppressed coronal images (Fig. 3).

- Enthesitis of supraspinous, interspinous (Fig. 1) ligaments and ligament flavum presents as edema in corresponding areas associated with marrow edema of adjacent bones. Moderate changes in adjacent muscles can also be seen. Fat-suppressed fluid sensitive sequence obtained in the coronal plane best depicts these changes.

Structural lesions of the spine

- Structural lesions of the spine include syndesmophytes, ankylosis and fatty deposition.

- Syndesmophytes are linear ossifications that develop in spine ligaments (Fig. 4).

- Joint ankylosis can involve the intervertebral and the synovial joints of the spine (Fig. 1, 4). At the discs, ankylosis is associated with disc ossification on radiograph/CT images and with variable signal patterns on MR images including fatty-like, edema-like, and fibrous-like changes.

- Erosion near the entheses appears as disappearance of the normal prominent aspect of the vertebral end-plate and is usually associated with adjacent bone sclerosis (Fig. 5).

- Fatty deposition can be seen on MRI in any areas in which edema is observed (see above).

Types and amount of lesions required for diagnosis

- Evidence of anterior/posterior spondylitis in 3 or more sites is highly suggestive of axial SpA. Each lesion must be seen on 2 or more consecutive sections.

- The vast majority of spinal inflammatory lesions in SpA are seen in the bone (osteitis) in association with other lesions.
with enthesitis or fibrous disc insertions. It is unclear whether synovitis (zygopophyseal, costo-vertebral and costo-transverse joints) does occur alone without concomitant osteitis.

**Differential diagnosis**

Artefacts due to partial saturation of fat signal must be recognized to avoid false positive results (Fig. 6).

Corner-based vertebral lesions on MRI are frequently observed in the normal asymptomatic population.
In all these situations in which spine involvement is ambiguous, dedicated MR images of the SI joints may be obtained because SpA involvement of the spine rarely occurs without SI joint changes.

Axial complications observed in patients with long-standing SpA

Vertebral fracture

Spontaneous vertebral fracture is the most feared complication in patients with advanced SpA or DISH (11). Compression vertebral fracture may be similar to those observed in elderly osteoporotic patients. However, some of these fractures can be transverse and develop in the ankylosed disc or the adjacent bone (Fig. 9). They involve the anterior or posterior elements of the spine and are unstable. In the absence of early diagnosis, they may lead to neuro-arthropathic like joint disorders or to spinal cord compres-

and in patients with spine symptoms. In this condition, they are usually more extensive along the vertebral end-plate than the vertebral wall, they predominate in anterior corners, and they are preferentially located at the apex of the lumbar curvature (9). Their frequency increases with age. Extensive marrow involvement in the posterior vertebral corner is rare in the normal population.

Vertebral end-plate based lesions are extremely frequent in the adult population without inflammatory changes. Marrow changes in association with degenerative disc disease are extremely common (Fig. 7). Intravertebral disc herniation may also be extremely difficult to differentiate from inflammatory discitis.

Septic arthritis of small synovial joints of the spine can occur in unusual conditions including in immuno-compromised patients, in non-pyogenic infections including brucellosis or mycosis (Fig. 8).

Fig. 7. — Degenerative L4-L5 changes in a 43 yo woman. The sagittal CT reformat(A) demonstrates disc space narrowing, subtle subchondral bone plate sclerosis and small osteophytes. On the corresponding T2-weighted SE image (B), well-delimited edema-like changes involve the marrow adjacent to the vertebral end-plates. The adjacent soft tissues are preserved and the disk signal intensity is not very high.

Intravertebral disc herniation may also be extremely difficult to differentiate from inflammatory discitis.

Septic arthritis of small synovial joints of the spine can occur in unusual conditions including in immuno-compromised patients, in non-pyogenic infections including brucellosis or mycosis (Fig. 8).

Fig. 8. — Septic arthritis of the costo-vertebral joint. Bone marrow edema (arrowhead), adjacent soft tissue infiltration and costo-vertebral joint destruction are visible on the (A) T1-, (B) T2- and C) enhanced T1-weighted SE images. The CT image (D) better demonstrates joint destruction (arrow).
sion. They should not be confused with inflammatory disc changes.

Conclusion

MR imaging of the sacro-iliac joints has been validated by international experts associations as a major diagnostic tool for the early detection, classification and monitoring of SpA patients. The role of spine MRI remains to be clearly defined in patients with uncomplicated SpA. However, the radiologist must be aware of the wide spectrum of changes that can be observed in the spine of SpA patients. The dissemination of foci of active and quiescent lesions along the axial skeleton is a key-distinctive feature. Overdiagnosis of SpA at spine MR should be avoided.

References