HOW SENSITIVE AND SPECIFIC ARE MRI FEATURES OF SACROILIITIS FOR DIAGNOSIS OF SPONDYLOARTHRITIS IN PATIENTS WITH INFLAMMATORY BACK PAIN?

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Objective: To determine the sensitivity and specificity of MRI features of sacroiliitis in spondyloarthritis (SpA).

Materials and methods: A retrospective study reviewed MRI of the sacroiliac (SI) joints in 517 patients with inflammatory back pain. Sensitivity, specificity, positive and negative likelihood ratios of active and structural lesions of sacroiliitis with final clinical diagnosis as golden standard was calculated.

Results: MRI showed active inflammation in 42% of patients (bone marrow oedema (BMO) (41.5%), capsulitis (3.3%), enthesitis (98.4%), ankylosis (74.3%), sclerosis (75.5%) and fat infiltration (84.0%) were less specific. BMO concomitant with enthesitis, capsulitis or erosions increased the specificity. Concomitant presence of BMO and sclerosis or fat infiltration decreased the specificity.

Conclusion: BMO is moderately sensitive and specific for diagnosis of SpA in patients with inflammatory back pain. BMO concomitant with enthesitis, capsulitis, ankylosis or erosion increases the specificity. Concomitant fat infiltration or sclerosis decreases the specificity for diagnosis of SpA. Of all lesions, erosion had by far the highest positive likelihood ratio for diagnosis of SpA.

Keywords: Spine, MR – Arthritis.

Spondyloarthritis (SpA) is a group of inflammatory joint conditions sharing common clinical, radiological, genetic and even therapeutic characteristics and are often associated with the presence of human leukocyte antigen (HLA)-B27.

Early diagnosis of SpA has gained significance for rheumatologists as new medical treatment options have become available (6). MRI of the SI joints shows active inflammatory and structural lesions of sacroiliitis long before radiographic changes become evident (7,8).

Active sacroiliitis on MRI is an important classification criterion. MRI is regarded ‘positive’ for sacroiliitis if bone marrow oedema (BMO) is clearly present (8). Other MRI features representing active inflammation of the SI joint such as enthesitis or capsulitis alone are not sufficient for a ‘positive’ MRI for sacroiliitis. Structural lesions in sacroiliitis are sclerosis, fat infiltration, erosion and finally ankylosis (8).

These active and structural changes of the SI joints, in particular the presence of BMO, may also be present in patients presenting with non-rheumatological entities that clinically mimic sacroiliitis such as degenerative disease, lumbosacral transitional anomaly, spondyloysis, fracture, infection and tumor (9,10).

The aim of this study is to determine the sensitivity and specificity of MRI features of sacroiliitis in SpA. Also, we sought to find if BMO concomitant with other MRI features of sacroiliitis may increase the sensitivity and specificity for diagnosis of SpA.

Materials and methods

The retrospective study was approved by the institutional ethics committee.

Study group

All participants, aged 16-45 years old, were recruited from the hospital rheumatology outpatient clinics in a tertiary care center and were referred for MRI of the SI joints with clinical suspicion of sacroiliitis. Clinical criteria for ‘inflammatory type’ back pain included a. age at onset < 40 years, b. insidious onset, c. improvement with exercise, d. no improvement with rest, e. pain at night (8). Patients who underwent back surgery were excluded from the study.

From March 2005 to February 2013, 517 patients were included in the study (185 (35.8%) men, 332 (64.2%) women), with a median age of 33.3 years (range 16.1-44.9).

We recorded from the clinical files if patients fulfilled the ASAS (Assessment of SpondyloArthritis international Society) classification criteria for axial or peripheral SpA (8). 210 patients (114 women, 96 men), with a median age of 30.8 years (range 16.1-44.9) were classified to have SpA (89.5% axial SpA, 10.5% peripheral SpA). The ASAS classification of these patients was considered the gold standard (8).

307 patients were not diagnosed with SpA (89 (29%) men, 218 (71%) women), with a median age of 34.7 years (range 16.2-44.9). In this group, MRI findings were normal in 211 patients. In 96 patients non rheumatological findings were present: LS-S1 degenerative changes in 57 patients (60.6%), lumbar disc degeneration in 25 patients (4.8%), hip joint disease in 10 patients (1.9%), osteitis condensans ilii in 12 patients (2.3%), DISH in 3 patients (0.6%), tumor in 5 patients (1%), fracture in 4 patients (0.8%) and infection in 1 patient (0.2%).

Magnetic resonance imaging

MRI was performed on a 1.5T MRI unit (Avanto/Symphony, Siemens Medical, Erlangen, Germany). The SI joints were imaged in a body flexed array coil (Siemens Medical, Erlangen, Germany). Sequence protocol included: semicoronal (along long
MRI features of sacroiliitis for diagnosis of spondyloarthritis — JANS et al

Specificity of 74.6%. Presence of enthesitis and capsulitis had a low sensitivity, but a very high specificity for diagnosis of SpA.

Diagnostic utility of active and structural lesions of sacroiliitis for diagnosis of SpA were determined by calculating sensitivity, specificity, positive and negative likelihood ratio for consensus reader data with final clinical diagnosis as golden standard.

Results

Active MRI lesions in sacroiliitis

MRI showed active lesions in 42% of patients (bone marrow oedema (BMO) (41.5%), capsulitis (3.3%), enthesitis (2.5%). BMO was the MRI feature with the highest sensitivity (65.2%) for diagnosis of SpA, with a specificity of 74.6%.
Structural MRI lesions in sacroiliitis

MRI showed structural lesions in 48.8%. Erosion had a moderate sensitivity but high specificity. Ankylosis had a low sensitivity but very high specificity for diagnosis of SpA. Sclerosis and fat infiltration had moderate sensitivity but lower specificity compared to ankylosis and erosion. Of all lesions, the presence of erosion had the highest LR+ (10.4) for diagnosis of SpA (Table I).

Diagnostic utility of lesions in sacroiliitis

Capsulitis (99%), enthesitis (98.4%), ankylosis (97.4%) and erosion (94.8%) had a high specificity for diagnosis of SpA. Fat infiltration (84.0%), sclerosis (75.6%) and BMO (74.6%) were less specific. BMO concomitant with enthesitis, capsulitis or erosions increased the specificity. Concomitant presence of sclerosis or fat infiltration decreased the specificity.

BMO concomitant with ankylosis, erosion and fat infiltration had a moderate higher positive likelihood ratio (LR+) for diagnosis of SpA, compared to the LR+ of concomitant presence of enthesitis and sclerosis (Table II).

Table I. — The sensitivity, specificity, positive and negative likelihood ratios of MRI features of sacroiliitis for the diagnosis of SpA.

<table>
<thead>
<tr>
<th>N</th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMO</td>
<td>215</td>
<td>65.2</td>
<td>74.6</td>
<td>2.56</td>
</tr>
<tr>
<td>Enthesitis</td>
<td>13</td>
<td>3.8</td>
<td>98.4</td>
<td>2.38</td>
</tr>
<tr>
<td>Capsulitis</td>
<td>17</td>
<td>6.7</td>
<td>99.0</td>
<td>6.7</td>
</tr>
<tr>
<td>STRUCTURAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sclerosis</td>
<td>167</td>
<td>43.3</td>
<td>75.6</td>
<td>1.77</td>
</tr>
<tr>
<td>Fat infiltration</td>
<td>164</td>
<td>54.8</td>
<td>84.0</td>
<td>3.42</td>
</tr>
<tr>
<td>Erosion</td>
<td>130</td>
<td>54.3</td>
<td>94.8</td>
<td>10.4</td>
</tr>
<tr>
<td>Ankylosis</td>
<td>39</td>
<td>14.8</td>
<td>97.4</td>
<td>5.7</td>
</tr>
</tbody>
</table>

(N = number of patients; LR+ = positive likelihood ratio; LR- = negative likelihood ratio; BMO = bone marrow oedema).

Table II. — The sensitivity, specificity, positive and negative likelihood ratios of BMO concomitant with other MRI features of sacroiliitis for the diagnosis of SpA.

<table>
<thead>
<tr>
<th>N</th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMO</td>
<td>215</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Enthesitis</td>
<td>10</td>
<td>5.1</td>
<td>96.1</td>
<td>1.31</td>
</tr>
<tr>
<td>+ Capsulitis</td>
<td>17</td>
<td>10.2</td>
<td>96.1</td>
<td>2.67</td>
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<tr>
<td>+ Sclerosis</td>
<td>109</td>
<td>57.0</td>
<td>60.3</td>
<td>1.43</td>
</tr>
<tr>
<td>+ Fat infiltration</td>
<td>112</td>
<td>67.9</td>
<td>75.6</td>
<td>2.78</td>
</tr>
<tr>
<td>+ Erosion</td>
<td>120</td>
<td>76.6</td>
<td>80.8</td>
<td>3.99</td>
</tr>
<tr>
<td>+ Ankylosis</td>
<td>26</td>
<td>16.8</td>
<td>96.1</td>
<td>4.31</td>
</tr>
</tbody>
</table>

(N = number of patients; BMO = bone marrow oedema; LR+ = positive likelihood ratio; LR- = negative likelihood ratio).

Discussion

Early assessment of inflammation in the course of SpA gains importance in the light of new therapeutic strategies. The value of MRI of the SI joints is well established and resulted in a definition of a 'positive MRI' for sacroiliitis (8, 11, 12). In the current ASAS criteria of axial SpA MRI plays an important role: a 'positive MRI' is a key criterion for disease classification (8, 13, 14).

However, in daily radiology practice it remains challenging to decide if demonstrated BMO is sufficient to really represent active sacroiliitis as seen in SpA. In our study we found a moderate sensitivity (65%) and in this context more importantly only a moderate specificity (74%) of BMO of the SI joints for diagnosis of SpA. These figures are similar to the figures published in the paper by Weber et al., who also reported on the limitations of using BMO as a single criterion in the current ASAS definition of a ‘positive MRI’ (16). We confirmed their findings, and also showed that concomitant fat infiltration and sclerosis decrease the diagnostic value of MRI. This is not surprising, since these features are commonly seen in degeneration,
with mechanical back pain mimicking inflammation in these patients (11-13). MRI provided the diagnosis in these cases.

Our study showed that the concomitant presence of other features of active sacroiliitis such as enthesitis or capsulitis, indicating an ongoing true inflammatory process, increased the specificity. The presence of structural lesions also contributes substantially to the diagnostic utility of MRI for diagnosis of SpA. The concomitant presence of erosions and ankylosis—both hallmarks of the disease—also increased the specificity (8). On the other hand, the concomitant presence of fat infiltration and sclerosis decreased the specificity for diagnosis of SpA, which may be explained by the presence of the same MRI features in degenerative processes (15).

Weber et al stressed the importance of erosions as an MRI feature of SpA (16-17). In our study we found that of all lesions of the SI joints, the presence of erosion had the highest LR+ (10.4) for diagnosis of SpA. This finding confirms that erosion could play a role as a new or additional criterion in future classification systems, especially as it improves the specificity of MRI of the SI joints for diagnosis of SpA.

In our study we also found a very high specificity of enthesitis (98%) and capsulitis (99%) for diagnosis of SpA. However, as these lesions were not commonly seen (in 4% and 6% respectively), they might not be as useful as classification criteria. Still, the presence of enthesitis or capsulitis may be particularly helpful in equivocal cases or may indicate that active inflammation is present at a certain stage in the disease process.

There are some limitations to our study. Firstly, MRI was the only imaging technique, without correlation with radiography or CT. Secondly, the patient population represented referrals from a single tertiary center; referral patterns for sacroiliitis may vary elsewhere. This will particularly affect the reported likelihood ratios. Thirdly, as MRI is included as a criterion in the current ASAS classification, there is a risk of circular reasoning. Finally, we only studied patients with inflammatory back pain clinically suspected of SpA, no control group of age and sex-matched individuals was studied for comparison.

In conclusion, we found that BMO MRI is an important MRI feature of sacroiliitis with a moderate sensitivity and specificity for diagnosis of SpA in patients with inflammatory back pain. The specificity increases if concomitant enthesitis, capsulitis, erosions or ankylosis is present, but decreases if concomitant fat infiltration and sclerosis is demonstrated. Of all lesions, erosion has by far the highest positive likelihood ratio for diagnosis of SpA.

References