A multi-method study of sacroiliac joints in patients with Behcet disease and AAU (acute anterior uveitis) evaluated by X-ray, CT and MRI in comparison

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Authors: L. Testaverde, A. Stagnitti, L. Caporali, A. Ermini, L. Lo Mele, M. Marini; Rome/IT
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Purpose

It's controversial if Behcet Disease (BD) must be included in the group of seronegative spondyloarthropathy (SpA). In favour of this hypothesis are some case reports and small case series in which has been identified an overlap between BD and several SpA, particularly ankylosing spondylitis\textsuperscript{1-3}. Other studies, evaluating larger number of patients, showed discordant results for the prevalence of sacroiliitis (SI) in patients with BD, perhaps in relation with different ethnic groups involved. Moreover high observer variation in interpreting radiographs of sacroiliac joint has been suggested as the main cause of these differing results\textsuperscript{4-8}. Computed Tomography (CT) and Magnetic Resonance (MR) are known as more sensitive techniques than plain radiograph in early detection and definition of changes occurring during SI. Our aim was to establish the prevalence of sacroiliitis in patients with Behcet disease using X-Ray, CT and MRI in comparison with patients with Acute Anterior Uveitis (AAU), that is known to belong to the subgroups of SpA.
Methods and Materials

We considered, in the period from 04/2006 to 04/2009, 21 consecutive patients with BD, positive for HLA B51 and 28 consecutive patients with AAU, positive for HLA B27. These patients were previously selected by our Rheumatological Sciences Department.

Altogether we evaluated 98 sacro-iliac joints (SIJ); each side of any patient was graded separately.

Patients underwent X-ray of the pelvis, CT and MR of SIJ. For the evaluation of sacroiliitis by X-ray and CT were used the modified New York Criteria\textsuperscript{9}. For MR, in the absence of criteria univocally accepted on an international level, has been adopted a similar evaluation system, built ad hoc (table 1).

X-Ray study of the pelvis comprehended traditional anteroposterior view and oblique projection for each SIJ

CT scans (Siemens Somatom Sensation 64-slice, Germany) were done in axial plane and then reformatted in coronal plane, with osseous algorithm (Kernel B70 very sharp)

MR scans (Siemens Magnetom Avanto 1,5T, Germany) were done in axial and coronal plane obtaining T1- and T2-weighted images and fat-suppressed STIR images.

All images were transferred to a PACS system in order to be evaluated by the two radiologists L.T. and A.S.; each one was blinded for the diagnosis of the patient (BD vs AAU) and for the radiological evaluation of the colleague.

The inter-observer concordance was estimated by statistical test of Cohen's kappa with linear weighting.

We considered 4 grade of pathology for sacroiliitis: grade 1 (within normal limits) and grade 2 (dubious/minimal abnormalities) were judged negative for SI whereas grade 3 was mild positive (osseous abnormalities) and grade 4 clearly positive (advanced SI).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>X-Ray and CT</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Within normal limits</td>
<td>Nothing to notice</td>
<td>Nothing to notice</td>
</tr>
<tr>
<td>2</td>
<td>Dubious abnormalities</td>
<td>Minimal irregularity of the articular surfaces</td>
<td>Like CT and fatty accumulation</td>
</tr>
<tr>
<td></td>
<td>Mild positive, osseous abnormalities</td>
<td>Bony erosions or sclerosis of the articular surfaces</td>
<td>Like CT and subchondral edema</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
<td>----------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clearly positive, advanced SI</td>
<td>Bony erosions or sclerosis and narrowing or widening of articular spaces</td>
<td>Like CT and subchondral edema</td>
</tr>
</tbody>
</table>

Table 1 - Grading system
Results

AAU

X-ray of the pelvis showed advanced SI (grade 4) in 14% of the cases (bilateral); overall positives (both grades 3 and 4) were 28 and 35% of the cases (respectively right side and left side) in patients with AAU; in BD group only 7% of the patients showed advanced SI (bilateral) and this was the total percentage of positives.

CT showed advanced SI in 14% and 38% of total positives (bilateral) within AAU patients versus 6-12% of advanced SI and 23-29% (right to left) of total positives within BD patients.

MR showed 14% of advanced SI (bilateral) and 46-39% (right to left) of total positives within AAU patients versus 6-11% of advanced SI and 17-22% (right to left) in BD patients.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Total positive (%)</th>
<th>AAU</th>
<th>Advanced SI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Right SIJ</td>
</tr>
<tr>
<td>RX</td>
<td>28</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>TC</td>
<td>38</td>
<td>38</td>
<td>14</td>
</tr>
<tr>
<td>RM</td>
<td>46</td>
<td>39</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2 - Prevalence of advanced SI in AAU patients

<table>
<thead>
<tr>
<th>Technique</th>
<th>Total positive (%)</th>
<th>BD</th>
<th>Advanced SI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Right SIJ</td>
</tr>
<tr>
<td>RX</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>TC</td>
<td>23</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>RM</td>
<td>17</td>
<td>22</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 3 - Prevalence of advanced SI in BD patients
Interobserver agreement was very good for XR ($K = 0.8$), good for MR ($K > 0.7$) and only moderate good for CT ($K > 0.6$).
Fig. 0: MR, AXIAL STIR, Patient with grade 3 at right SIJ, grade 4 at left SIJ. Note bony sclerosis (hypointense signal on both iliac and sacral sides of the left SIJ) and bone subchondral edema (hyperintense signal in the left emisacrum)

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Fig. 0: MR, AXIAL, T1 Same patient as figure 1. Note bony sclerosis in the left SIJ and fatty accumulation (hyperintense signal) in right emisacrum

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Fig. 0: CT, AXIAL. Patient with grade 3 at right SIJ, grade 4 at left SIJ. CT depicts clearly massive sclerosis in left SIJ and erosions of the articular surfaces of both SIJ

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Fig. 0: CT, CORONAL. Same patient as figure 3. Coronal plane better demonstrates bony erosions of the articular surfaces on both sides

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Fig. 0: MR, AXIAL, STIR. Patient with grade 1 (negative) at right SIJ, grade 2 (dubious) at left SIJ.

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**Fig. 0**: CT, AXIAL. Patient with grade 1 (negative) at right SIJ, grade 2 (dubious) at left SIJ.

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Conclusion

This study supports the trend to not consider BD within the SpA, being the prevalence of SI in BD patients not very different from normal population\textsuperscript{8} and anyway lower than that observed in patients with AAU.

On the other side the prevalence of SI in AAU patients is higher than in BD patients and very similar to the one observed in patients with seronegative arthritis\textsuperscript{10}, and anyway high enough to consider joint involvement as an important feature of the disease.

A limitation of this study is that we did not study a control population but this it's explained by the fact that, for the Italian law, it's not ethically acceptable submit an healthy person to XR/CT study with unjustified exposure to ionizing radiation (art.99 D. Lgs 230/1995).

Another limitation of this and previous studies is the high observer variation in interpreting radiological examinations of SIJ. In fact, in spite of the use of an evaluation system carefully stated, agreement of our readers was very good only for X-ray, decreasing as the technique becomes more complex and radiographic details to be evaluated become more numerous.

Further studies with higher population are needed in order to reach a better knowledge of the prevalence of SI in BD.

MR is superior to X-Ray and CT in depicting osseous abnormalities linked with SI because can demonstrate fatty accumulation and subchondral edema.
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Personal Information

L. Testaverde, A. Stagnitti, L. Caporali, A. Ermini, L. Lo Mele, M. Marini; Dipartimento Scienze Radiologiche, Policlinico Umberto I, Università degli studi di Roma - Sapienza.

Address: V.le del Policlinico 155, 00161, Rome - Italy

Mail to: doctor.lot@gmail.com

Fax: +39064456695