Magnetic resonance imaging of sacroiliitis in early seronegative spondylarthropathy. Abnormalities correlated to clinical and laboratory findings

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Objective: To compare a new MRI scoring system of the sacroiliac joints (SIJs) in early spondylarthropathy (SpA) with clinical and laboratory parameters.

Methods: Forty-one patients (24 males, 17 females) with a median age of 26 yr and a median duration of inflammatory low back pain of 19 months were included. They all fulfilled the ESSG-criteria for SpA. The patients were examined by MRI of the SIJs using a new scoring system. Clinical examinations, biochemical tests, functional score (BASFI), and pain score (BASDAI) were also performed.

Results: 95% of the patients had inflammation and/or destructive bone changes of the SIJs at MRI. No correlation was found between MRI pathology and clinical findings. MRI demonstrated significantly greater severity of both inflammation and destruction of the SIJs in HLA B27 positive patients than in the HLA B27 negative patients.

Conclusions: In patients with early SpA, MRI was able to detect inflammatory and destructive changes of the SIJs, but the changes were not associated to clinical findings. Our results suggest a role of MRI in the detection of early-stage sacroiliitis.

Seronegative spondylarthropathies (SpA) are closely related inflammatory diseases that affect the axial skeleton, in particular the sacroiliac joints (SIJs). The patients are more often HLA-B27-positive than the healthy population [1]. Criteria for SpA were defined by the European Spondylarthropathy Study Group (ESSG) in 1991 [2]. The SpA can be divided into ankylosing spondylitis, psoriatic arthritis, reactive arthritis, arthritis associated with inflammatory bowel diseases, and unclassified SpA. The ESSG classification is based on clinical and radiological findings. Although radiographic evidence of sacroiliitis is included in the definition, it is not necessary for the diagnosis of SpA. Using the ESSG criteria and the New York criteria, including X-ray findings [3], the delay in diagnosis may be up to 9yr [4-6]. MRI aids diagnosis by making it possible to detect both inflammatory and destructive changes [7-10]. Clinical and/or laboratory data are reported in some studies in order to characterize SpA patient groups [8, 11-13], but only four reports have analysed the association of such data with MRI findings, and there have been divergent conclusions [14-17].

There is no established way of evaluating pathological MRI findings regarding the SIJs. We have therefore recently published a new scoring system [18]. The purpose of the present study was to compare this new MRI scoring system for the SIJs in early SpA with clinical and laboratory parameters [Schober test, finger-to-floor distance, physician’s global assessment score, functional score (Bath Ankylosing Spondylitis Disease Functional Index; BASFI), pain score (Bath Ankylosing Spondylitis Disease Activity Index; BASDAI), C-reactive protein (CRP) concentration and HLA-B27 type].

Patients and methods

The study was cross-sectional and took place at two centres: Aarhus University Hospital (centre A) and the Rheumatological Hospital, Graasten (centre B). Patients who were referred from the primary ward and fulfilled the ESSG criteria for inflammatory low back pain (ILBP) [2] had their X-ray examination of the SIJs evaluated according to the New York criteria for sacroiliitis [3]. Patients with radiographic changes of grades 0–3 were included in the study consecutively.

Forty-one patients (24 males, 17 females) with a median age of 26yr (quartiles, 24, 35) and a median duration of ILBP of 19 months (quartiles 8, 36) were included (25 at centre A, 16 at centre B). The patients provided informed consent. The study was carried out according to the Declaration of Helsinki and was approved by the local ethics committees.

MRI included the following sequences: semicoronal STIR (short tau inversion recovery), T1, T1 with fat saturation (FS), semiaxial T2 high resolution and, after administration of intravenous gadolinium (Gd) (Omniscan®), semicoronal and semiaxial T1 with FS. Semicoronal slices were placed parallel to a line joining the upper dorsal aspect of S1 and S3, and the semiaxial slices were perpendicular to this plane. The images were obtained with either a 1.0 T unit (18 patients) or a 1.5 T unit (23 patients).

The MRI examinations were assessed independently by two senior radiologists (A.G.J., N.E.) who were blinded to the clinical and laboratory findings. The inter- and intra-observer agreements were good [18]. The MRI abnormalities recorded were erosions,
The findings are compared with the pathological MRI findings. The medians of the MRI activity score and MRI destruction score were 10.3 and 6.5 respectively.

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The association between the overall joint destruction score and the duration of ILBP only approached significance ($P=0.06$). Although there was a negative association with joint space width ($\rho = -0.39$, $P = 0.01$), the duration of ILBP was not significantly associated with the scores for erosions and sclerosis.

There was no significant association between the MRI scores for single abnormalities, the overall scores for joint destruction or activity and abnormal FFD, the Schober test, BASFI, BASDAI and physician's global assessment (Table 1).

Eight patients (20%) with elevated CRP all had signs of activity by MRI and had significantly higher mean scores for both inflammatory activity ($P < 0.001$) and joint destruction ($P < 0.001$) compared with patients with normal CRP, 29 of whom had MRI signs of activity.

Twenty-six patients (63%) were HLA-B27-positive and did not differ significantly from the HLA-B27-negative patients with regard to clinical observations. HLA-B27-positive patients had significantly higher joint destruction scores ($7.8 \text{ vs } 4.3$, $P < 0.05$) and activity scores ($13.4 \text{ vs } 5.0$, $P < 0.01$) compared with HLA-B27-negative patients. A negative association between the overall MRI activity score and duration of ILBP was found only in HLA-B27-positive patients; this was also the case for scores for bone marrow oedema and enhancement in bone and joint space. Seven of the eight patients with elevated CRP were HLA-B27-positive.

Discussion

Different radiological methods have been used to examine the SIJs in early SpA. As MRI becomes more available, it is increasingly preferred for conventional radiography and CT because of its ability to detect inflammatory changes (Fig. 1). Because of the potential value of MRI in the diagnosis of early sacroiliitis, there is a need to evaluate it in relation to clinical findings [7–10].

MRI has high sensitivity for inflammation, but the diagnosis of such changes demands knowledge of the normal anatomy of the SIJs in order to prevent misinterpretation. In an MRI study of the SIJs of healthy volunteers, no signs resembling pathology in early SpA were found [21].

There is no well-established method for evaluating pathological MRI findings of the SIJs. Proposals have been made [14–17], but no studies have assessed MRI findings according to grade and specific localizations. We have therefore introduced a new scoring system to describe the MRI findings in sacroiliitis [18]. This system embraces both joint destruction, which represents signs of chronicity, and inflammation, which represents acute attacks. MRI is the only method that can give information about both aspects at the same time. In addition, MRI has the advantage of preventing radiation exposure [4, 8].

Table 1. Clinical and laboratory findings of 41 patients with early SpA

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<tr>
<th>MRI</th>
<th>Activity score</th>
<th>Destruction score</th>
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<tr>
<td></td>
<td>$P$</td>
<td>$P$</td>
</tr>
<tr>
<td>Duration of ILBP (months): median</td>
<td>19</td>
<td>8, 36</td>
</tr>
<tr>
<td>Finger-to-floor distance (cm): median</td>
<td>3.0</td>
<td>0, 23.0</td>
</tr>
<tr>
<td>Schober test (cm): median</td>
<td>4.0</td>
<td>3.0, 5.0</td>
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<td>BASFI: median</td>
<td>2.4</td>
<td>1.4, 4.7</td>
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<tr>
<td>BASDAI: median</td>
<td>3.9</td>
<td>2.3, 6.0</td>
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<tr>
<td>Physician’s global assessment score: median</td>
<td>2.0</td>
<td>1.0, 3.0</td>
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<td>Elevated CRP (%)</td>
<td>20</td>
<td>63</td>
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<td>HLA-B27-positive (%)</td>
<td>63</td>
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The patients answered two questionnaires: BASDAI and BASFI [19, 20]. Two experienced rheumatologists (B.S.-C. at centre A and G.V.O.H. at centre B) performed a clinical examination which included the Schober test, finger-to-floor distance (FFD) and physician’s global assessment (scale 0–10). Laboratory tests included HLA-B27 typing and CRP concentration.

Statistics

SPSS software (version 10.0; SPSS, Chicago, IL, USA) was used for: Spearman’s correlation coefficient ($\rho$) to determine rank order associations, the non-parametric independent-samples $t$ test to compare means, and cross-tabulation with $\chi^2$/Fisher’s test to determine the association between two variables. A $P$ value of $\leq 0.05$ was considered significant.

Results

MRI examination showed that 35 patients had both joint destruction and inflammatory activity. Two patients had only signs of joint destruction, two had only inflammatory activity, and two had signs of neither joint destruction nor activity. The mean overall joint destruction score was 6.5 (quartiles 2.5, 9.5), and the activity score was 10.3 (quartiles 3.5, 15.5).

There was a significant negative association between the overall activity score and the duration of ILBP ($\rho = -0.39$, $P = 0.01$). This significant association was also seen for the single parameters in the score: bone marrow oedema ($\rho = -0.41$, $P = 0.008$), Gd contrast enhancement in bone ($\rho = -0.39$, $P = 0.01$) and enhancement in joint space ($\rho = -0.37$, $P = 0.02$).
Using this scoring system, the present analysis demonstrated that MRI can detect pathological SIJ changes in patients with few or no clinical findings. Four previous studies have described associations between clinical findings and the MRI features of sacroiliitis [14–17]. Corresponding to our findings, Ahlström et al. [14] and Oostveen et al. [16] showed no association. Lee et al. [17] found that bone marrow oedema and synovitis on MRI may predict disease activity, and according to Braun et al. [15] the findings of dynamic MRI in acute sacroiliitis seem to correlate with symptoms and signs of disease activity.

The clinical examinations and tests chosen for the present study correspond to the proposals of the Assessments in Ankylosing Spondylitis Working Group of Omeract (Outcome Measures in Arthritis Clinical Trials) IV [22]. None of these clinical tools was developed to evaluate the SIJ only; rather they reflect changes in more pronounced disease. This may explain the lack of association between MRI and clinical findings.

Elevated CRP may indicate the possibility of active inflammation at the SIJs detectable by MRI, which is consistent with other studies [23, 24]. However, it has been stated that CRP does not have advantages in the assessment of SpA [25]. Our finding of normal CRP values in 29 of the patients who had MRI signs of SIJ inflammation supports the previous observations.

The natural history of SpA consists of acute attacks of enthesal and osseous inflammation associated with pain. In the course of time these processes result in chronic bone changes. The inflammation thus predicts future radiographic changes [16]. Our finding that short disease duration is mainly associated with MRI inflammatory changes is in agreement with these observations. This association occurred only in HLA-B27-positive patients, who had a significantly higher degree of both acute and chronic MRI changes compared with HLA-B27-negative patients. This may imply that inflammatory attacks in HLA-B27-positive patients occur mainly at the beginning of the disease process. HLA-B27 has been found to be important in disease manifestations in other studies also. The probability of SpA was increased in HLA-B27-positive patients with ILBP and MRI-proven sacroiliitis [26], and an association between HLA-B27 and bone marrow oedema in plantar fasciitis in SpA has also been described [27].

The relatively small size of the present study group and the division of the patients into subgroups limits our ability to draw extensive conclusions. However, the results are comparable with other studies of the same size, which included 25–40 patients with SpA [14–17].

The natural history of SpA makes it difficult to compare groups of patients between different studies, as some patients can be in an inactive disease stage while others are examined during acute attacks. Furthermore, there are individual differences in the patients’ threshold for consulting the health-care system.

Our results suggest an additional role of MRI in the detection of early-stage sacroiliitis. Future studies should focus on the ability of MRI to characterize inflammation in early SpA, the ability to predict destructive changes, and the value of monitoring treatment effects.

Conclusions

In patients with early ILBP fulfilling the ESSG criteria for SpA, MRI was able to detect inflammatory and destructive changes in the SIJs. There was no association between MRI and clinical findings. HLA-B27-positive patients had significantly more severe MRI changes than HLA-B27-negative patients. Our results support an additional role of MRI in the detection of early-stage sacroiliitis.

Acknowledgements

We acknowledge the Danish Rheumatism Association and A. P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til almene Formaal for financial support. We thank Nycomed Danmark A/S for providing the contrast agent.

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<th>Rheumatology</th>
<th>Key message</th>
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<td>MRI can detect sacroiliitis defined as destructive or inflammatory changes in patients suspected of spondylarthropathy in spite of a normal clinical examination.</td>
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References


