

# MRI Findings of the Sacroiliac Joints in Patients with Low Back Pain: Alternative Diagnosis to Inflammatory Sacroiliitis

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**ABSTRACT:** **Background:** Magnetic resonance imaging (MRI) is the most sensitive imaging modality for the detection of sacroiliitis. Diagnosing sacroiliitis on MRI is not always straightforward and can be challenging in some cases.

**Objectives:** To evaluate the prevalence of alternative diagnoses suggested by MRI and characterize the MR appearance of the most common ones.

**Methods:** Consecutive MRI examinations of the sacroiliac joints (SIJ) performed between 2005 and 2012 were retrospectively evaluated for the presence of structural and active sacroiliitis findings according to the Assessment of SpondyloArthritis International Society guidelines. Alternative diagnoses, including degenerative changes, diffuse idiopathic skeletal hyperostosis (DISH), osteitis condensans ilii (OCI), septic sacroiliitis/discitis, stress reaction and anatomic variants, were registered.

**Results:** We evaluated 281 MRI examinations, 116 males, 165 females, average age  $44 \pm 15$  years. Sacroiliitis was found in 71 examinations (25%) and alternative diagnoses were suggested in 87 (31%) (OCI 8.9%, anatomic variants 5.3%, septic sacroiliitis/discitis 5.3%, degenerative findings 4.3%, DISH 1.5%, stress reaction 0.7%, tumor 0.3%). A normal examination was found in the remaining 123 examinations. Patients with alternative diagnoses were older than those with sacroiliitis (62 vs. 47 years of age, respectively,  $P > 0.05$ ). Alternative diagnoses in the SIJ were significantly more common in females (66) than in males (21),  $P < 0.05$ .

**Conclusions:** A substantial proportion of patients with suspected sacroiliitis had normal SIJ while the rest were more commonly diagnosed with pathologies other than inflammatory sacroiliitis. A referral by an experienced rheumatologist may improve the sensitivity and specificity of this important examination.

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**KEY WORDS:** sacroiliac joints, sacroiliitis, MRI, alternative diagnosis, spondyloarthritis

Spondyloarthritis (SpA) is a group of inflammatory diseases of which ankylosing spondylitis is the prototype. These diseases are negative for rheumatoid factor and are often associated with the carriage of human leukocyte antigen B27 (HLA-B27) [1]. Inflammation of the sacroiliac joints (SIJ), or sacroiliitis, is a hallmark of SpA, typically presenting with inflammatory low back pain [2]. It is the most common early clinical finding and the presumed first manifestation of the disease in the majority of SpA patients [1]. Bony changes of sacroiliitis such as erosions, sclerosis, and ankylosis can be diagnosed by conventional radiographs and computed tomography (CT) in an advanced, already established disease. However, a more sensitive diagnostic tool, such as magnetic resonance imaging (MRI) is necessary for diagnosing and evaluating inflammation in patients with early disease [3].

The main acute inflammatory findings of sacroiliitis, observed on MRI, include periarticular SIJ bone marrow edema (BME) [Figure 1] and contrast enhancement [4], which may be seen years before late structural findings are evident [5]. The beneficial effect of biological drugs such as the tumor necrosis factor- $\alpha$  receptor blocker group has further emphasized the need for early diagnosis of sacroiliitis in SpA patients and has accelerated the use of MRI as an effective tool for early detection of sacroiliitis [3,6]. As a result, an increasing number of SIJ MRIs are performed each year on patients with suspected sacroiliitis [7]. However, one should bear in mind that non-inflammatory diseases such as spinal degenerative changes, tumors, or infections may present as inflammatory-type back pain that clinically mimics sacroiliitis [8]. To this end, in this article, we aimed to evaluate and characterize the non-inflammatory conditions detected on SIJ MRIs in patients with suspected inflammatory sacroiliitis.

## PATIENTS AND METHODS

All consecutive MRI examinations of the SIJ performed in our institution, a tertiary medical center, for suspected inflammatory sacroiliitis between 2005 and 2012 were retrospectively evaluated.

This work was presented at a radiology–rheumatology meeting focusing on the contribution of imaging to the understanding of the pathogenesis and treatment decisions in musculoskeletal rheumatic diseases that took place in December 2016 at the Sheba Medical Center, Tel Hashomer, Israel

**Figure 1.** Semicoronal T2-w with fat saturation sequence of the sacroiliac joints of a 30 year old male with left sided sacroiliitis. Bone marrow edema and some mild cortical erosions are demonstrated both on the iliac and sacral sides of the left joint (arrows)



Institutional review board approval for the retrospective review of the MRI images was obtained. Informed consent was waived due to the retrospective nature of the study.

Included in the study were examinations of patients 18 years of age and older who were referred due to suspected inflammatory sacroiliitis. Exclusions included examinations of patients younger than 18 years of age and examinations that were technically inadequate.

**MRI EXAMINATIONS**

All MRI examinations were conducted on a 1.5T unit (Signa HDX, GE healthcare, Milwaukee, MN, USA) with a phased-array 8-element coil. The examination was performed in the semi-coronal orientation (along the long axis of the sacrum and perpendicular to the S2 vertebral body) in T1-W (TR = 534, TE = 8.9), T2-W with fat saturation (TR = 6079, TE = 80) and T1-W with fat saturation before and after gadolinium (Gadoterate meglumine, Dotarem; Guerbet, Roissy, France) intravenous administration (TR = 130, TE = 2.9) sequences. Sagittal images of the lumbar spine in T1-W and T2-W sequences were also obtained.

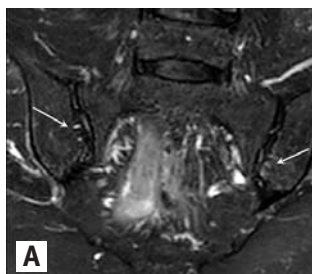
**MRI EVALUATION**

The MRI examinations were reviewed by an experienced musculoskeletal radiologist. Images were assessed for the presence of structural and active sacroiliitis findings befitting the Assessment of SpondyloArthritis International Society (ASAS) definition [6,9].

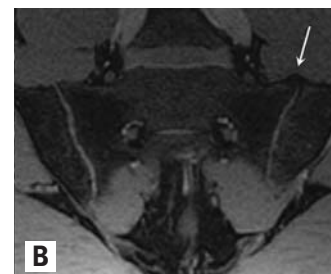
Alternative diagnoses were registered when a constellation of other SIJ pathologies were noted according to the following definitions:

- *SIJ degenerative changes:* Joint space narrowing, subchondral sclerosis, subchondral cysts, osteophytes and minute sub-

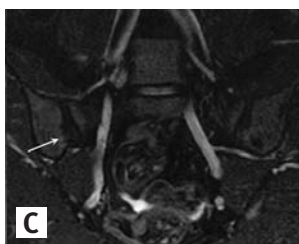
**Figure 2.** Semicoronal T2-w with fat saturation sequences of the sacroiliac joints



**[A]** a 65 year old female with degenerative changes of the sacroiliac joints, some mild iliac sided bone marrow edema with small subchondral cysts are evident on the iliac sides of both sacroiliac joints (arrows)



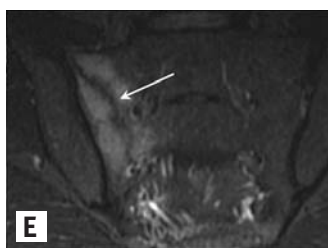
**[B]** a 45 year old male with an anterior bony bridge connecting the iliac and the sacral side of the left sacroiliac joint is seen (arrow) compatible with diffuse idiopathic skeletal hyperostosis



**[C]** a 36 year old female with right sided pain. Mild iliac sided subchondral sclerosis and cortical irregularity are evident on the anterior part of the right sacroiliac joint (arrow), compatible with osteitis condensans ilii



**[D]** an 18 year old male with septic sacroiliitis. Iliac and sacral left sided bone marrow edema is evident (arrows) as well as soft tissue edema anterior and posterior to the joint and a fluid collection (arrowheads) compatible with an iliac muscle abscess



**[E]** a 34 year old male, marathon runner. Sacral sided bone marrow edema is evident with a fracture line in its center (arrow), compatible with a stress fracture. The sacroiliac joint itself is intact with no erosions or cortical irregularity

- chondral fat deposition with or without minor subchondral BME [Figure 2A]
- *Diffuse idiopathic skeletal hyperostosis (DISH):* Overt, coarse bony/ossified bridges over the anterior SIJ articular margins [Figure 2B]
- *Osteitis condensans ilii (OCI):* Localized subchondral sclerosis of the anterior part of the joint, mainly on the iliac side. Some bony irregularity and minor BME may be present in the same location [Figure 2C]
- *Septic sacroiliitis:* Unilateral SIJ BME with or without erosions, joint fluid with capsular distention, pronounced

periarticular soft tissue, and muscle edema with or without periarticular collections [Figure 2D]

- *Stress reaction*: Unilateral sacral sided BME usually without involvement of the subchondral bone with an apparent vertical fracture line within the edematous sacrum [Figure 2E]
- *Degenerative disc disease*: Loss of signal and intervertebral disc space narrowing with significant disc herniation with or without adjacent BME
- *Septic discitis/osteomyelitis*: Loss of intervertebral disc space with enhancement, pronounced BME, paravertebral soft tissue, and muscle edema with or without periarticular collections

Additional registered diagnoses included:

- Anatomic variants of the SIJ potentially causing the patient's symptomatology, including degenerative changes in accessory facets of the SIJ or pseudo-arthritis of L5 vertebra hemi-sacralization
- Space-occupying lesions

#### STATISTICAL ANALYSIS

Categorical variables were analyzed by chi-square test and continuous variables by Student's *t*-test test, as appropriate.  $P < 0.05$  was considered significant. Statistical analysis was performed using SPSS software version 11 (SPSS Inc., Chicago, IL, USA).

#### RESULTS

A total of 283 MRI examinations of the SIJ were performed during the defined period. Two examinations of reduced quality (one due to metal artefacts and the other due to multiple motion artefacts) were excluded, leaving a total of 281 examinations for evaluation, 116 males and 165 females. The average age was  $44 \pm 15$  years.

Inflammatory sacroiliitis was found in 71 of 281 examinations (25%), 44 males and 27 females. The average age was 47 years. Alternative diagnoses were suggested in 87 additional examinations (31%), 21 males and 66 females. The average age was 62 years. A normal examination with no registered pathology was found in the remaining 123 examinations (44%), 51 males and 72 females. The average age was 35 years. Alternative non-inflammatory diagnoses demonstrated on SIJ MRI and their prevalence are summarized in Table 1.

Patients with alternative diagnoses were older than ones with sacroiliitis (62 vs. 47 years of age, respectively); however, this difference was not statistically different. Alternative pathologies in the SIJ were significantly more common in females than in males (66 vs. 21, respectively,  $P < 0.05$ ).

#### DISCUSSION

In the current study we assessed the prevalence of various pathologies in the SIJ in patients suffering from inflamma-

**Table 1.** Sacroiliac joints and lumbar spine alternative diagnoses to inflammatory sacroiliitis demonstrated on the MRIs of sacroiliac joints (out of a total cohort of 281 patients)

Disease	N	%
<b>Sacroiliac joints:</b>		
Osteitis condensans ilii	25	8.9
Anatomic variants	15	5.3
Septic sacroiliitis	15	5.3
Degenerative	12	4.3
DISH	4	1.5
Stress reaction	2	0.7
Space occupying lesion	1	0.3
<b>Spine:</b>		
Degenerative	11	4
Discitis	2	0.7
Total	87	31

MRI = magnetic resonance imaging, DISH = diffuse idiopathic skeletal hyperostosis

tory back pain. We showed that only a quarter of patients referred for MRI due to a clinical suspicion of inflammatory sacroiliitis indeed harbor this pathology. A third of the patients with inflammatory back pain were found to present with non-inflammatory conditions, while almost half were found to have normal SIJ on MRI.

A similar study performed by Jans and colleagues [8] reported a slightly lower percentage of alternative diseases (23%) and a higher prevalence of sacroiliitis (36%) with remarkable similarity in the prevalence of normal exams (41%). The distribution of the alternative pathologies in the SIJ in Jans' cohort was, however, quite different. While they reported spinal degenerative changes in 44.1% of the exams, we found degenerative changes in a mere 4%. Conversely, osteitis condensans ilii was the most frequent pathology described in our patients (8.9%) whereas it was described in only 2.5% of the European cohort. One potential explanation of the different results may be the different inclusion criteria. In our study the cohort represented all those suspected sacroiliitis who were referred by either rheumatologists, orthopedic surgeons, or family physicians. Jans' cohort included only patients with inflammatory back pain beginning before the age of 40 who were referred by a rheumatologist. While these different inclusion criteria may explain the higher percentage of patients with sacroiliitis in Jans' cohort, one would have expected a much higher percentage of sacroiliitis in such a targeted cohort. The lesson learned is therefore that inflammatory back pain in itself is not a specific enough condition, even when diagnosed by an experienced rheumatologist. This conclusion concurs with Rudwaleit's data [10] showing that the likelihood ratio of a person with inflammatory back pain with a diagnosis of axial SpA is no more than 3.7. Diagnostic confirmation can be assured only when additional clinical criteria are taken into account, such as a good response to nonsteroidal anti-inflammatory drugs, a positive family history, anterior uveitis, dactylitis, peripheral arthritis,

enthesitis, elevated acute phase reactants, and HLA-B27 positivity. Hence, the relatively low percentage of sacroiliitis in patients who are referred to MRI only due to inflammatory back pain, regardless of age of onset, underscores that additional clinical criteria suggestive of spondyloarthropathy is warranted to conclude the diagnosis of axial SpA in this patient population. Moreover, due to the lack of specificity of MRI examinations of the SIJ, some degree of inflammatory changes in and around the SIJ may be present in non-inflammatory conditions. These inconclusive inflammatory changes in concert with inflammatory type back pain may lead to an erroneous diagnosis of axial SpA and the institution of inappropriate therapy.

The non-specific nature of back pain is due in part to the complex neural innervation of the pelvis. Hence, pelvic and hip pain may originate from pathology in neighboring structures, such as the lumbar spine and hip [11]. This may explain the relatively high percentage of alternative diagnoses encountered both in the current study and in Jans' study, highlighting the need to focus the anamnesis and physical examination on additional SpA-related features and to encourage referral by rheumatologists rather than orthopedic doctors and general practitioners.

The rate of degenerative changes in the spine and SIJ reported in Jans' study (44.1%) was tenfold higher than that found in our patients. This discrepancy is explained by the fact that we defined only substantial disc herniation as a degenerative change while they included any degenerative change in this category.

Finally, we found a high rate of OCI (8.9%) among our cohort suggesting that this condition may be associated with inflammatory type back pain, as has been eluded to in several previous studies [12,13], as well as that the index of suspicion of SpA among female patients with inflammatory back pain has increased. Indeed, non-radiographic axial SpA, diagnosed in the presence of sacroiliitis on MRI in the face of normal pelvic radiographs, affects males and females equally, whereas ankylosing spondylitis, which is diagnosed based on chronic changes of the SIJ, is more predominant in males. Thus, the referral of more female patients with inflammatory back pain to MRI of the SIJ reflects the paradigm shift in recent years which has enabled more and more patients to be diagnosed in their pre-radiographic stage, before chronic changes ensue.

The study's main limitation is its retrospective nature and absence of clinical information substantiating the radiographic diagnosis.

## CONCLUSIONS

In conclusion, we have taken an MRI snapshot of the SIJ of all those presenting with suspected sacroiliitis. We have shown that a substantial proportion of patients turn out to have nor-

mal SIJ while the rest are more commonly diagnosed with pathologies other than inflammatory sacroiliitis despite it being the original clinical suspicion. It stands to reason that referral by an experienced rheumatologist, which may supplement the anamnesis of inflammatory type back pain with SpA targeted questions, improves the sensitivity and specificity of this important examination.

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**“Nothing in life just happens. It is not enough to believe in something; you have to have the stamina to meet obstacles and overcome them, to struggle”**

Golda Meir, (1898–1978), Israeli teacher, kibbutznic, stateswoman, politician and the fourth Prime Minister of Israel