ORIGINAL ARTICLE

Incidental Findings Observed on Magnetic Resonance Imaging of Sacroiliac Joints

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ABSTRACT

Objectives: To investigate the frequency and nature of various incidental findings and their relationship with presence or absence of sacroiliitis, observed on magnetic resonance imaging (MRI) of sacroiliac joints (SIJ).

Study Design: Observational study.

Place and Duration of Study: Fauji Foundation Hospital, Rawalpindi, from January 2018 to March 2021.

Materials and Methods: All patients undergoing MRI of SIJ were included except those who could not lie down supine in MR gantry. Data regarding age, gender, MRI findings related to SIJ and other incidental findings were recorded. Frequencies of findings in various groups were compared using chi-square test considering p value of <0.05 as significant.

Results: Out of 302 patients, 126 (41.7%) showed incidental findings. Among 201 females, 87 (43.3%), while among 101 males, 39 (38.6%) showed incidental findings (p=0.437, not significant). Sacroiliitis (SI) was seen in 58.7% and 45.5% of females and males respectively (p=0.030, significant). One hundred and sixty-four (54.3%) of 302 patients were grouped as having SI on the basis of MRI while 138 (45.7%) had normal SIJ. In the former group 64 (20.5%) showed at least one incidental finding. Among the latter group, 62 (20.5%) had incidental findings (p= 0.300, not significant). Most common incidental finding was lower lumbar disc degenerative disease (LLDDD), seen in 65 (21.5%) patients.

Conclusion: Incidental findings are commonly observed on MRI of SIJ. They were seen overall, in two-fifth of our patients. Incidental findings must be reported, as these can have important clinical implications. There was no significant difference between patients with and without SI with respect to prevalence of incidental findings.

Key Words: *Ankylosing Spondylitis, Bone Marrow Oedema, Lumbar Disc Degenerative Disease, Sacroiliac Joint, Sacroiliitis.*

Introduction

Inflammation of sacroiliac joints (SIJ) is usually a diagnosis of exclusion.[1] Magnetic resonance imaging (MRI) has emerged as an important technique for diagnosis and follow-up of patients with sacroiliitis (SI).[2] It can detect acute inflammatory changes across the joints even when plain radiographs are normal. Initial changes of sub-chondral oedema are picked up easily.[3] There are multiple pathologies that can clinically mimic this disease, for example genitourinary, hip, muscle, and lower back pathologies and elicit request for MRI of SIJ due to clinical suspicion of SI.[4] Some of them can have important clinical significance in patients' management.

The aim of this study was to identify the nature and analyze the frequencies of various incidental findings that were observed during the MRI of SIJ in both the genders, and to compare their frequencies in different groups.

Materials and Methods

This observational study was carried out at Radiology department of a tertiary care hospital in Rawalpindi, Pakistan, from January 2018 to March 2021, after approval from hospital's ethics review committee. All patients undergoing MRI of SIJ were included, regardless of age or gender, employing consecutive, non-probability sampling technique. Those patients were excluded who could not lie down supine in MR gantry to complete the examination. Data regarding age, gender, MRI findings related to SIJ and other tissues were recorded.

SI on plain MRI was defined as sub-articular bone marrow oedema in at least two consecutive images, or more than one lesion in a single slice.[5,6] Incidental findings were defined as all abnormal findings that

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were seen other than or in addition to SI, including clinically significant normal anatomical variants.

Scans were performed on 1.5 Tesla MRI unit (Toshiba Vintage Titan), using body flexed array coil in supine position. The sequences included coronal STIR (short-tau inversion recovery) along long axis of sacrum and perpendicular to second sacral vertebral body, axial T2-weighted (fat saturated), coronal obliques (T1 and T2-weighted) and sagittal T2 weighted. MRI scans of patients were studied for presence or absence of SI by radiologist having more than five years' experience of reporting.

Demographic data of all the patients was recorded. In addition to documenting presence or absence of SI, data was also collected regarding the presence of any incidental finding. This included scrutiny of visualized lumbo-sacral spine, genitourinary organs, hip joints, muscles, and soft tissues.

Patients were arbitrarily divided, decade-wise into seven age groups, viz. group 1 (11-20 years), group 2 (21-30 years), group 3 (31-40 years), group 4 (41-50 years), group 5 (51-60 years), group 6 (61-70 years), and group 7 (71-80 years). The frequency of incidental findings was recorded for each age group. The data was entered into statistical package for social sciences version (version 21.0) for analysis. Mean and standard deviation were calculated for quantitative variables. Frequency and percentage were calculated for qualitative variables. Frequencies of SI and incidental findings were compared in males and females using chi-square test considering *p*-value $\leq$ 0.05 as significant. Patients were also divided into those with, and those without SI. Frequencies of incidental findings were compared in both groups employing chi-square test, considering *p*-value $\leq$ 0.05 as significant.

Results

A total of 302 subjects were included in the study. Patients' age ranged from 12 to 80 years with mean and median ages as 33.6 (SD$\pm$10.7) and 33 years respectively. Most of the patients, i.e. 114 (37.7%) out of 302, were in 4th decade of life. Age distribution of patients and frequency of patients showing incidental finding on MRI of SIJs in different age groups are shown in the Fig 1, and Table I.

Female to male ratio was 1.9. Mean ages for female and male were 35.3 (SD$\pm$ 10.52) and 30.2 (SD$\pm$ 10.51) respectively. SI was seen in 118 (58.4%) of 202 females as compared 46 (45.5%) of 101 males. Difference was significant with p-value 0.030 (Table II). Among the females, 87 (43.3%) of 202, and among the males 39 (38.6%) of 101 showed incidental findings. Difference was not significant with p-value 0.437 (Table II).

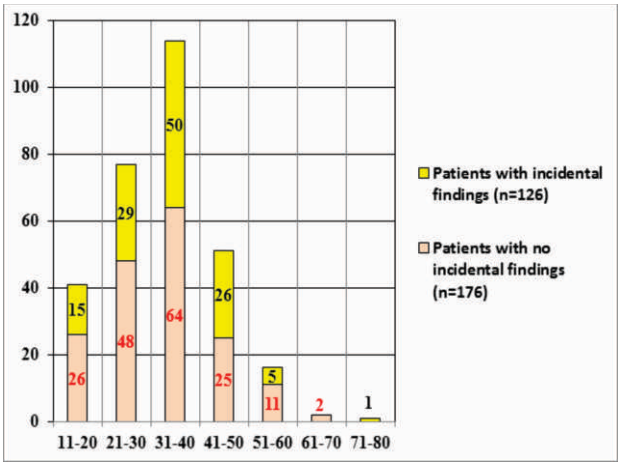

Fig 1: Distribution of The Frequency Distribution of Patients (Shown Along Y-Axis), Subjected to Magnetic Resonance Imaging of Sacroiliac Joints, According to Decade-Wise Age Groups (Shown Along X-Axis).

Table I: Frequency of Patients Showing Incidental Finding on Magnetic Resonance Imaging of Sacroiliac Joints in Different Age Groups (N=302)

Age Groups in Years	Frequency and Percentage of Patients	Patients with no Incidental Findings	Patients with Incidental Findings
11-20	41(13.6%)	26 (8.6%)	15 (4.9%)
21-30	77 (25.5%)	48 (15.9%)	29 (9.6%)
31-40	114 (37.7%)	64 (21.2%)	50 (16.5%)
41-50	51 (16.8%)	25 (8.3%)	26 (8.6%)
51-60	16 (5.3%)	11 (3.6%)	5 (1.6%)
61-70	2(0.6%)	2(0.6%)	0 (%)
71-80	1 (0.3%)	0 (0%)	1 (0.3%)
TOTAL	302	176 (58.3%)	126 (41.7%)

Table II: Distribution of Sacroiliitis and Incidental Findings in Male and Female Patients

	Female (n=202)	Male (n=101)	p-value. Significant if < 0.05
Sacroiliitis	118 (58.4%)	46 (45.5%)	chi square statistics 4.693, p-value 0.030 (significant)
Incidental findings	87 (43.3%)	39 (38.6%)	chi square statistic 0.603, p-value 0.437 (not significant)

Out of 302 patients, 164 (54.3%) were diagnosed as having SI, according to MRI criteria. In this group of patients, 64 (21.2%) showed at least one incidental finding. The second group of 138 (45.7%) patients revealed no MRI evidence of SI. Among the latter group, 62 (20.5%) had incidental findings. No significant difference (*p*-value 0.300) was observed between the patients in two groups with respect to prevalence of incidental findings (Table III).

Table III: Frequency of Incidental Findings in Patients with and without Sacroiliitis (SI) on Magnetic Resonance Imaging (MRI) of Sacroiliac Joint (N=302)

	Incidental Findings Detected on MRI	No Incidental Findings on MRI	Total
MRI showing SI	64 (21.2%)	100 (33.1%)	164 (54.3%)
No SI on MRI	62 (20.5%)	76 (25.2%)	138 (45.7%)
Total	126 (41.7%)	176 (58.3%)	Grand Total= 302
The chi square statistic is 1.074 and the p-value is 0.300, not significant.			

Most common incidental finding was lower lumbar disc degenerative disease (LLDDD) that was present in 66 (21.5%) of 302 patients. It was seen in 37 (21.2%) patients with SI and 29 (9.6%) patients without SI (p=0.746, not significant). Distribution of various incidental findings on MRI, in groups of patients with and without evidence of SI is shown in Table IV.

Table IV: Distribution of Various Incidental Findings on Magnetic Resonance Imaging (MRI), In Groups of Patients With and without Evidence of Sacroiliitis (SI). Total Number of Patients=302

Incidental Findings with Frequency and Percentage	Frequency and % of Patients with SI on MRI	Frequency and % of Patients with No SI on MRI
Lumbar disc degenerative disease n= 66 (21.8%)	37 (12.2%)	29 (9.6%)
Genitourinary pathologies n=25 (8.3%)	10 (3.3%)	15 (5.0%)
Hip joint abnormalities n=10 (3.3%)	5 (1.65%)	5 (1.65%)
Soft tissue lesions, n=9 (2.9%)	3 (0.9%)	6 (1.9%)
Transitional vertebra , n=7 (2.3%)	5 (1.6%)	2 (0.7%)
Sacral pathologies,n=4 (1.3%)	1 (0.3%)	3 (0.9%)
Other abnormal osseous findings n=4 (1.3%)	3 (0.9%)	1 (0.3%)
Ascites, n=1 (0.3%)	0 (0%)	1 (0.3%)
No incidental findings, n=176 (58.3%)	100 (33.1%)	76 (25.2%)

Discussion

SIJ can be imaged using plain radiographs, fluoroscopy, computerized tomography, nuclear imaging, positron emission tomography, sonography and MRI. MRI has revolutionized the diagnosis of SI.[7] It is superior to the rest of imaging modalities due to excellent depiction of bone marrow and soft tissue contrast; hence it enables detailed evaluation of tissues in addition to SIJ. Moreover, it is radiation-free and can be safely used in younger patients and those of reproductive age. Earliest changes of sub-chondral marrow oedema are well identified on MRI. However, the imaging time is relatively longer than the rest of the modalities, rendering it difficult for the patients with severe pain to lie supine for the examination. On the other hand, radiographic manifestations of SI occur much later in the course of the disease and the procedure is attended with risk of irradiating pelvic organs.[2]

SI can be due to multiple causes, e.g., infection, inflammation, neoplasia, or trauma.[8] Early diagnosis of this entity is crucial in the management to prevent complications like chronic backache, hip pain and muscle wasting. Due to complex pelvic anatomy, there is significant overlap of symptoms of bones, joints, soft tissues, genitourinary and gastrointestinal system diseases. A good clinical history and examination remains the mainstay of management and must be obtained by the radiologist.[9]

Differential diagnoses of sacroiliitis include ankylosing spondylitis, fractures around hip joint, tendinitis, piriformis syndrome, pyogenic infections, tuberculosis, and trochanteric bursitis.[4] The joints can show inflammatory changes in pregnancy and other hyper- and hypomobile states. Obesity is also a risk factor. Malignant causes e.g. multiple myeloma and non-malignant etiologies such as osteitis-condensens-ilii can also be a cause of painful SIJ. We diagnosed one patient with latter condition during

this study. Functional causes like scoliosis and leg-length discrepancy can cause inflammatory changes at SIJ. Hip degenerative and inflammatory arthritis should also be looked for while interpreting SIJ.[10]

Acute SI manifests as bone marrow edema in sub-chondral location; this is the most important criterion for defining active disease on MRI.[11] Acute disease can show as joint fluid, sub-chondral or soft tissue edema. Edema is manifested as hypo-intense signal on T1-weighted imaging and high signal intensity on T2 and STIR sequences. Earliest signs of cartilage and bone destruction can be picked up by MRI.[12] Active or acute SI is best seen on fluid-sensitive sequences like STIR sequence; post contrast imaging is not essential.[13] Features of chronic disease include structural changes such as new bone formation or sclerosis, fat deposition, erosions, joint space narrowing and ultimately, ankylosis.[14] Erosions and ankylosis are best seen on T1-weighted images. A newer technique, MRI-based synthetic computed tomography (sCT) is reported to depict better details of erosions, sclerosis and ankylosis in comparison to T1 weighted MR imaging.[15]

A multi-centric study was carried out in Belgium, Canada and Poland to determine common incidental findings on MRI of SIJ in children.[16] Out of 540 children, 106 (20%) had SI and 228 (42%) patients showed one or more incidental finding on MRI. Our study, though not limited to children only, shows a similar frequency (41.7%; n=302) of incidental findings. Commonest incidental finding in both the studies was lumbar disc degenerative changes.

A study was conducted in Turkey, which included only the female subjects, mainly to see the frequency of pelvic congestion syndrome in patients who underwent MRI of SIJ for clinically suspected SI.[17] The study revealed that 285 (37%) of 774 patients had incidental findings which included pelvic congestion, various other genitourinary system disorders, and musculoskeletal system disorders. The percentage of patients showing incidental findings is not much different from the percentage of such patients seen in our study. This Turkish study showed that in the group of patients without SI, incidental findings were seen in 182 (24%) patients. On the other hand, in the group of patients with SI, the incidental findings were less common and were seen in 103 (13%) patients. These findings are also concordant with the findings of our study. Moreover, in both the studies the frequency of incidentally discovered musculoskeletal diseases was more in the group with SI than the other group.

During literature search, we found a case-report of Paget's disease with sacroiliitis.[18] Our study did not find this entity in any of our patients. Jans et al showed in their six-year retrospective analysis that non-inflammatory disease entities were more common than SI on MRI in patients with inflammatory type back pain.[19] They found that out of 691 subjects, 249 (36%)showed SI on MRI, whereas more than half (54.3%) of our patients were diagnosed as suffering from SI.

A UK-based study investigated the incidence of transitional vertebrae and numerical variants of the spine using MRI. They found transitional vertebrae in 14 (3.3%) of 418 subjects.[20] We came across lumbo-sacral transitional vertebrae in 7 (2.3%) of 302 patients.

The limitation of our study is that the size of the sample is relatively small. Secondly, it has been carried out in a single centre; therefore the results cannot be generalized. Thirdly, we did not receive any patient less than 10 years of age, with a request for MRI of SIJ. More research is needed to diagnose incidental findings in this age group. In case of children it is important to keep a low threshold for selection with regards to imaging, for detecting pelvic and skeletal pathologies. This is because the underlying conditions can have long-term implications if not diagnosed early.

Conclusion

Incidental features on MRI of SIJ are common and were seen in approximately two-fifth of our patients. These must be reported, as these can have important clinical implications. Commonest incidental finding in our study was lumbar degenerative disc disease. No significant difference was observed between the patients with SI as compared to those without SI with respect to prevalence of incidental findings. In suspected cases of sacroiliitis with negative MRI findings, some other possible cause of symptoms should be looked for. These incidental findings may help in explaining the cause of symptoms and aid in management.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.