

## MRI AND CT IN THE DIAGNOSIS OF EARLY SACROILIITIS IN BENGALI POPULATION

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### ABSTRACT

MR and CT scan had equal sensitivity and specificity in the diagnosis and determination of staging of sacroiliitis in all stages of involvements of bones and joints. There was no significant mentionable difference between CT scan and MR study in the determination of bone changes like erosion, sclerosis or inflammation.

### BACKGROUND

To compare the value and usefulness of CT scan and MR imaging studies in the diagnosis of sacroiliitis<sup>1</sup> in all stages of the disease in ethnic Bengalis among West Bengal population.

### METHODS

Total of 45 patients attending in the outpatient department and admitted in the indoor ward of a teaching medical college in West Bengal (KPC Medical College and Hospital, Jadavpur, West Bengal) with clinical diagnosis of sacroiliitis of any stage were selected. Detail histories of the condition of the patients were taken and thorough physical examination was done. All pathological investigations<sup>2</sup> reports were collected. In some patients, there was no previous investigation report. In those cases, fresh tests were done. Then, all reports were assessed separately for each patient. In next step, the patients were imaged and evaluated by MRI using T1, T2, STIR, two-dimensional T2\* FLASH and after intravenous contrast, T1 fat saturated sequence on a GE 3.0 Tesla system.

Then, CT scan evaluation of the sacroiliac joints of the same patient were done using GE 16-slice multidetector system in the supine position with a 20° cranial gantry tilt to obtain sections through both the cartilaginous and ligamentous portions of the joints.

Findings of both the methods were charted in a tabulated form and compared with each other for the same patient. Then, statistical evaluation was done and p values were considered.

### RESULTS

In total, 26 patients were diagnosed to have sacroiliitis by CT scan and 31 patients were diagnosed to have sacroiliitis by MRI study.

MR and CT had equal sensitivity and specificity in the diagnosis of sacroiliitis. There was no significant difference between CT and MR in the determination of erosion or sclerosis.

However, active inflammation<sup>3</sup> in the bone and joint space change including acute arthritis can only be diagnosed by MRI study. Contrast-enhanced MRI is also an added advantage because postcontrast MRI study did give many extra information, which were not available with CT alone.

### CONCLUSION

Both MRI and CT are equally useful in the diagnosis of sacroiliitis. Bone marrow oedema and enhancement that cannot be shown by CT can only be visualised by MRI (plain or contrast enhanced). Absence of ionising radiation is another advantage in MRI. However, easy availability and cost of investigation are also important factor to consider.

### KEYWORDS

Sacroiliitis, Inflammatory Ieitis, Erosion of Sacroiliac Joint, Seropositive Arthritis with Sacroiliitis.

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**INTRODUCTION:** If only x-ray is used in all or any suggested view, diagnosis of sacroiliitis may be unduly delayed in early stage. Because bony changes in x-ray take

months to manifest even though physical complaints suggestive of the disease are already present.

As sacroiliitis occurs mainly in young patients, an early diagnosis would be valuable to reduce the suffering of this physically active age group patients. For treatment and prognosis also, early detection is very important.

CT scan is superior to x-ray in establishing osseous changes in sacroiliitis. In spite of this, it is insufficient in the detection of early inflammatory changes or in the differentiation between active and inactive sacroiliitis.<sup>4</sup> Ionising radiation associated with CT scan is a limiting factor for using CT scan in younger age group patients.

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MRI has been used effectively as a primary tool in the evaluation of cartilages of the peripheral joints. It seems to be superior to other imaging modalities in the diagnosis of sacroiliitis due to the evaluation of bone marrow oedema and contrast enhancement.

Early active inflammatory changes of the sacroiliac joint can only be diagnosed with MRI scan.

The main objectives of our study are to compare the reliability of CT and MRI in the diagnosis of sacroiliitis and especially in the determination of early stage sacroiliitis by revealing early inflammatory changes and the subjects are selected from resident population.

**AIM AND OBJECTIVES:** The aim and objective of this study are to compare the value of CT and MR scan in the diagnosis of sacroiliitis in different stages in ethnic Bengal population.

**MATERIALS AND METHODS:** Out of thousand patients attending KPC Medical College and Hospital, Jadavpur, West Bengal, in the OPD and IPD, 45 patients with clinical diagnosis of sacroiliitis were selected. These were evaluated by MRI using T1, T2, STIR, two-dimensional T2\* FLASH and after IV contrast T1 fat saturated sequence on a GE 3 Tesla system.

Then, CT scan of the sacroiliac joints of the same patient were also done with multidetector 16-slice GE system and compared with the MRI finding.

All patients were clinically examined before doing CT and MRI examination.

All patients fulfilled the European Spondyloarthropathy Study Group (ESSG) criteria for SIJs having Inflammatory Low Back Pain (ILBP) with at least four of the following manifestations:

- 1) Onset before the age of 45 years.
- 2) Insidious onset.
- 3) Improvement with exercise.
- 4) Associated morning stiffness.
- 5) At least three months of duration.

Patients having other diseases like any metabolic disease, malignancy or a positive rheumatoid factor were excluded from the study. The patients had a mean age of 26 years with 26 women and 19 men. The median duration of ILBP was 7 months. The patients gave written consent to participate in the prospective clinical and radiological investigations of sacroiliitis.

CT scans of the SI joints in all patients were performed in the supine position with a 20° cranial gantry tilt to obtain coronal images through both the cartilaginous and ligamentous portions of the SI joints using GE 16-slice CT scanner. MR images were obtained in 3 Tesla GE machine.

Scans were done with a body array coil with the following sequences: spin echo T1 (TR/TE 500/15 ms), fast spin-echo T2 with fat saturation (TR/TE 3000/45 ms), 2D T2\* FLASH (TR/TE/FA 660/18 ms, 30°), STIR (TR/TE/TI 5000/90/125 ms) and after IV gadolinium, 1 mmol/kg, T1 with fat saturation (TR/TE 500/15 ms).

The slice thickness was 3 mm at all sequences with 1 mm spacing. The matrix was determined as 192x256 and FOV as 260-mm for all sequences. Sequences were acquired

in a coronal plane tilted parallel to the long axis of the sacroiliac joint and 12 slices acquired.

**Assessment of Images:** CT image are reviewed for, 1) Erosion of the joint margin; 2) Sclerosis; 3) Joint space change.

Sacroiliitis is graded into 5 types, 1) Normal; 2) Suspicious change; 3) Minimal erosion or sclerosis without joint space change;<sup>5</sup> 4) Moderate erosions, sclerosis without or with partial ankylosis; 5) Complete ankylosis.

MRI images are reviewed for, 1) Sclerosis (low signal in all sequences, no enhancement); 2) Erosion; 3) Fatty marrow; 4) Joint space change; 5) Bone marrow oedema; 6) Contrast enhancement.

Then, the findings were evaluated statistically. Values of p<0.01 were considered to be significant.

**RESULTS:** Findings of sacroiliitis in CT and MR imaging of 45 patients with strong clinical suspicion of sacroiliitis is shown in Table 1. Sacroiliitis is found in 26 patients with CT and 31 patients in MRI.

No. of Patients with Sacroiliitis			
	Sacroiliitis	Unilateral	Bilateral
CT	32	14	18
MRI	41	19	22

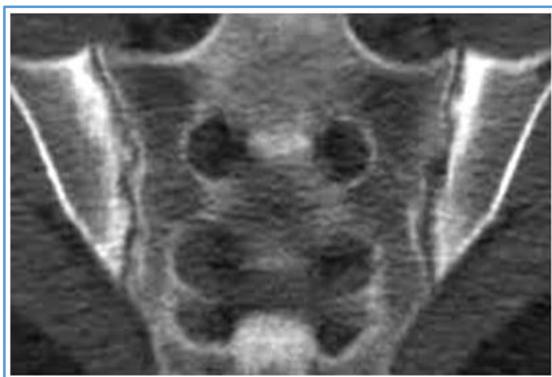
**Table 1: Comparison of MR with CT Images for Detecting Sacroiliitis**

	CT and MRI positive	MRI positive CT negative	MRI negative CT positive	p-value
Sacroiliitis	40	9	4	0.38 (p>.01)
Erosion	33	4	6	0.37 (p>0.01)
Sclerosis	26	2	5	0.10 (p>0.01)

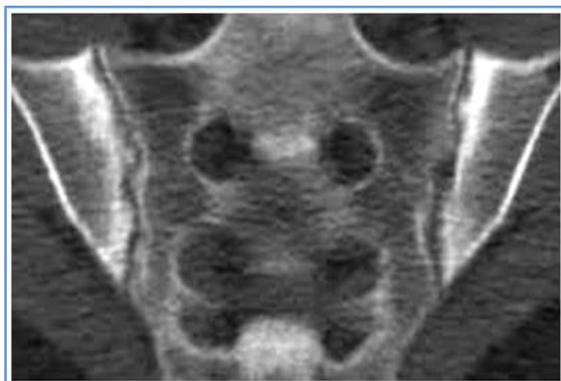
**Table 2: Comparison of MR with CT in the Detection of Sacroiliitis, Erosion and Sclerosis**



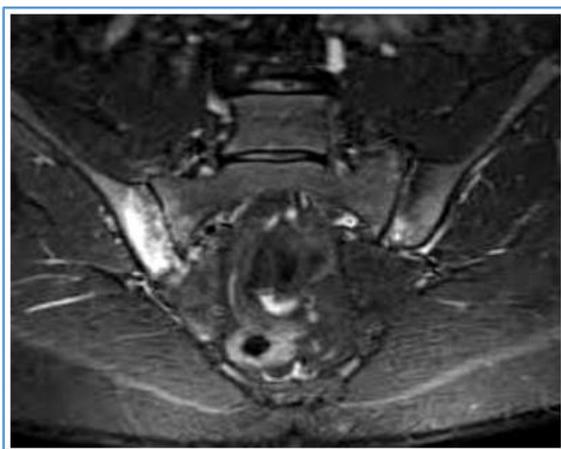
**Fig. 1: CT Scan Early Sacroiliitis**



**Fig. 2: CT Scan Moderate Sacroiliitis**



**Fig. 3: MRI Coronal STIR Moderate Bilateral Sacroiliitis**



**Fig. 4: MRI Coronal STIR Moderate Right Sacroiliitis**

**DISCUSSION:** Joints formed between the sacrum and the iliac bones of the pelvis are the sacroiliac joints, which are connected by strong band of ligaments. The sacrum supports the spine and is supported in turn by an iliac bone on each side. The joint is a strong, weight transferral synovial plane joint with irregular elevations and depressions that produce interlocking of the two bones. The human body has two sacroiliac joints, one on the left and one on the right side that often match each other, but are highly variable from person to person.

**Structure:** Sacroiliac joints are C or L shaper joints. Only about 2 to 18 degrees range of movement is allowed in the SIJ. Different type of articulating cartilages are covering the articular surfaces of the participating bones. The sacral surface is covered by hyaline cartilage. But, iliac surface of

the joint is covered by some form of fibrocartilage. Stability of this joint is offered by bony structure and also by several ligaments of high tensile strength. With normal ageing, sacroiliac joints also undergo adoptive changes to cope with the changing demand of the body. In infants, joint surfaces are plane or flat. But, when the infant start walking, the articular surface undergoes definite changes in orientation. These become angular in alignment. Moreover, iliac surface develop elevated ridge like linear projections and sacral surface produce corresponding matching depressions. These elevation and depression and group of strong ligaments give the joint a great strength and stability. Therefore, dislocation of this joint is extremely rare except with fracture. Surface topography of the SIJ corresponds to "dimple of venus" or fossae lumbales laterales over the body.

**Ligaments:**<sup>6</sup> Five ligaments in relation to SIJ are anterior sacroiliac ligament, interosseous sacroiliac ligament, posterior sacroiliac ligament, sacrotuberous ligament and sacrospinous ligament.

Anterior sacroiliac ligament is actually a localised thickening of anterior joint capsule. It is very thin and ill-defined unlike the posterior sacroiliac ligament. Only in some individuals like athletes and manual workers it is particularly well developed and seen well.

Posterior sacroiliac ligament is anatomically divided into two parts. The intrinsic (short) and extrinsic (long) components, both offer stability to the joints.

Dorsal interosseous ligaments are very strong ligaments, even stronger than the bones itself, so much so that bones may undergo fracture, but the ligaments remain intact.

Dorsal sacroiliac ligaments extend in a vertical and oblique orientation. But, the short component of the interosseous ligament runs vertically from posterior articular surfaces of the sacrum to the iliac bone and acts to keep the sacroiliac joint from being separated from one another.

Sacrotuberous and sacrospinous ligament are also known as extrinsic sacroiliac joint ligaments. These ligaments control the degree of ante flexion of sacrum.

During pregnancy, hormone relaxin acts on the pelvic joints causing their relaxation to help in childbirth. During puerperal period gradual withdrawal of hormonal effect, SIJ go back to their original state of stability and rigidity.

Interosseous ligaments:- these are very short in length. These extend from the surface of the ilium to that of sacrum in a vertical direction. Their main function of this ligament is to keep the articular surfaces together from separating away.

In thin built subjects, these ligaments maybe palpated and compared with both sides. However, this comparison is not a reliable test of assessment.

**Function: Shock Absorption:** Thrust received in the lower extremity is mostly absorbed by the sacroiliac joint and only part of it is transmitted up into the spine. Torque conversion is another component of shock absorption permitting the transverse rotations that occurs in the lower limbs. This in turn is affected over the spine.

During the forward thrust phase of normal walking, sacroiliac joint offer an automatic locking mechanism when the joint takes up the most congruent posture. This joint gets locked on one side when weight is transmitted from one extremity to the other and via the pelvic bone. The body weight is transmitted from the sacrum to the hip bone. This is unique in all lower extremity joints.

**Movements at the Sacroiliac Joint:** Anterior tilt of both hip bones on the sacrum: Both left and right joints move together.

Posterior tilt of both hip bones on the sacrum where the left and right move together as a unit.

Anterior inclining of one pelvic bone while the opposite pelvic bone inclines posteriorly on the sacrum. This is called antagonistic movement, which occurs during gait.

**Sacral Flexion:** Motions of the sacrum occur simultaneously with motion of the ilium.

Sacral extension takes place in position like swimming.

Like all spinal joints, sacroiliac joints are bicondylar joints. Therefore, movement of one side matches with the correlative movement of that of opposite side.

SI Joint Dysfunction (SIJD) is the most common complaint of the sacroiliac joint. It usually presents with pain in the sacroiliac joint felt by abnormal motion in the sacroiliac joint - either too much or too little movement. It typically results in inflammation of the SI joint or sacroiliitis.

Early and actual diagnosis is required for expecting good result from the treatment of the disease and in planning follow up protocol for sacroiliitis.

Chronic destruction bone<sup>7</sup> can be easily seen in CT, but MR is more helpful for active inflammation.

MRI having excellent soft tissue contrast resolution, enables a clear distinction between the ligamentous and cartilaginous portion.

Superiority of MRI over CT is that it visualises early active inflammation as bone marrow oedema and contrast enhancement. Therefore, diagnosis of sacroiliitis by MR can be done before definite joint destruction is detectable by CT scan.

In this study, different sequences and scan protocol were used and postcontrast MR images were obtained in five studies. When looking at the results, MR has been reported as equally good or even better than CT at detecting overall changes.

In publication, there are only few comparative studies that claim that MR is equal to CT in the evaluation of sacroiliitis.

Probably, the difference in opinion could be due to fact that the studies were done with high resolution CT (slice thickness of 2 mm) and MRI performed with a body coil and that too with T1 and T2 weighted sequences only.

In this study, MRI detected sacroiliitis by showing early inflammation in the form of marrow oedema and contrast

enhancement in nine cases where CT was negative. No significant difference between MRI and CT in the detection of erosions was found.

Furthermore, T1 and T2\* were the most successful MR sequences in the detection of erosion.

In the majority of the joints, oedema was associated with erosion. STIR was the best sequence to detect bone marrow oedema. Bone oedema was also present in more than half of the joints in which enhancement in the joint space was seen. All the areas of enhancement of bone marrow or joint space produced high signal intensity on the STIR sequence.

Therefore, the administration of contrast did not provide any additional information for the diagnosis of sacroiliitis and the evaluation of features of active inflammation.

**CONCLUSION:** Bone changes can be seen with both CT and MRI.<sup>8</sup> But, MRI alone can show only inflammatory changes like bone marrow oedema and contrast enhancement. This is not identifiable with CT.

MRI can differentiate active with chronic sacroiliitis.

MRI has no ionising radiation. Therefore, MRI would be first modality of choice in the diagnosis of early sacroiliitis.

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