VOLUME - 14, ISSUE - 07, JULY - 2025 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Radio-Diagnosis

COMPARATIVE ANALYSIS OF RADIOGRAPHY AND MAGNETIC RESONANCE IMAGING IN DIAGNOSING SACROILIITIS: INSIGHTS FROM A CROSS-SECTIONAL STUDY.

Dr. Aishwarya Gosavi.	Junior Resident, Dr. Vithalrao Vikhe Patil Medical College & Hospital, Ahilyanagar.
Dr. Saurabh Patil	Senior Resident, Dr. Vithalrao Vikhe Patil Medical College & Hospital, Ahilyanagar
Dr. Suhas Ghule	Professor & Head Of The Department, Dr. Vithalrao Vikhe Patil Medical College & Hospital, Ahilyanagar
Dr. Saad Shaikh	Assistant Professor, Dr. Vithalrao Vikhe Patil Medical College & Hospital, Ahilyanagar
Dr. Dhanashree Gaikwad	Assistant Professor, Dr. Vithalrao Vikhe Patil Medical College & Hospital, Ahilyanagar

ABSTRACT Sacroiliitis, a hallmark of spondyloarthropathies (SpA), is often missed early on radiography due to its inability to detect acute changes. In this 18-month study of 40 suspected cases, MRI proved significantly superior, diagnosing 70% of cases (sensitivity 93.5%, specificity 100%) compared to radiography's 30% (sensitivity 29%, specificity 66.7%). MRI clearly identified early bone marrow edema, erosions, and extracapsular abnormalities, with distinct patterns seen in inflammatory and infectious forms. The results support MRI as the preferred tool for early and accurate sacroiliitis diagnosis, guiding timely and effective treatment.

KEYWORDS : Sacroiliitis, Spondyloarthropathy, Radiography, MRI, Bone Marrow Edema, Inflammatory Back Pain

INTRODUCTION

The global prevalence of low back pain is 10% and causes major social and economic consequences [1]. Sacroiliitis, an inflammation of one or both sacroiliac joints (SIJs), is a hallmark of spondyloarthropathies (SpA), a group of chronic inflammatory diseases that include ankylosing spondylitis (AS), psoriatic arthritis, reactive arthritis, IBD-related arthritis, and undifferentiated SpA [2]. Sacroiliitis causes inflammatory back pain (IBP) with morning stiffness lasting over 30 minutes, relief with activity but not rest, and NSAID response [3]. Clinical characteristics, imaging, and test results, including HLA-B27 positivity and rheumatoid factor absence, are essential for identifying SpA, formerly seronegative spondyloarthropathies[4]. Early sacroiliitis diagnosis is difficult. Conventional radiography, the standard SIJ assessment method, uses the modified New York (modNY) criteria to grade sacroiliitis from 0 (normal) to 4 (full ankylosis) [5]. Radiographic abnormalities such as sclerosis, erosions, and ankylosis may appear after 5–8 years of clinical illness, delaying diagnosis and therapy [6]. This restriction led the Assessment of SpondyloArthritis International Society (ASAS) to establish revised categorisation criteria in 2009, including MRI and radiography for early diagnosis [7]. MRI can detect early inflammatory alterations, such as bone marrow oedema (BME), before radiograph-visible structural damage, allowing earlier intervention to slow disease progression and improve patient outcomes [8]. Despite MRI's benefits, radiography's affordability and availability make it popular. However, its low sensitivity for early sacroiliitis and poor interobserver reliability require MRI comparison to determine effective diagnostic methods [9]. Differentiating between inflammatory and infectious sacroiliitis is important since SpA treatment is anti-inflammatory, whereas infections require medications or surgery [10]. MRI patterns, such as iliac-dominant BME in SpA and extracapsular abnormalities in infections, may help differentiate, although rigorous investigations are needed [11].

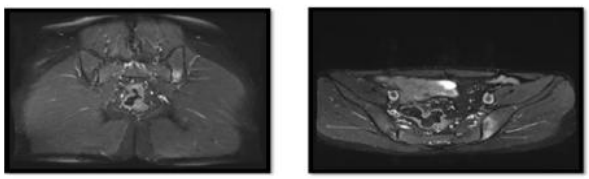
MATERIALS AND METHODS

Study Design And Population:

Radiographs of the sacroiliac joints were taken using specific patient positioning and tube angulation—AP views with 10–25° cephalad tilt and oblique views with 15–25° pelvic rotation. Images were graded 0–4 using ModNY criteria. MRI was performed on a 1.5T scanner with T1, T2, STIR, and contrast-enhanced sequences, focusing on BME, erosions, and soft tissue changes. Data were collected using a standard proforma, reviewed by two blinded radiologists, and confirmed by rheumatologists. Statistical analysis included t-test, Pearson's correlation, and diagnostic accuracy measures ($p<0.05$). Sample size was calculated as 40 with 97% confidence

Case No.

Image 4- 35 Yrs old patient with low back pain showing Normal Radiograph of sacroiliac joints .



Same patient on MRI (Coronal and axial T2 STIR sequence) showing subchondal Hyperintense signal at iliac aspect of left sacroiliac joint and both iliac and sacral aspect of right sacroiliac joint (left > right) s/o Bone Marrow Edema diagnosed as inflammatory sacroiliitis on MRI . The final clinical diagnosis was inflammatory

RESULTS

Demographic And Clinical Characteristics

40-patient were included: 22 males (55%), 18 females (45%), with a mean age of 35.75 ± 5.55 years (range 21-44). 62.5% of patients (n=25) were 31–40 years old, followed by 41–45 (25%, n=10) and 21–30 (12.5%, n=5). 100% patients experienced low back pain, 57.5% (n=23) had morning stiffness >30 minutes, 87.5% (n=35) reacted to NSAIDs, and 15% (n=6) had fever. (Table 1)

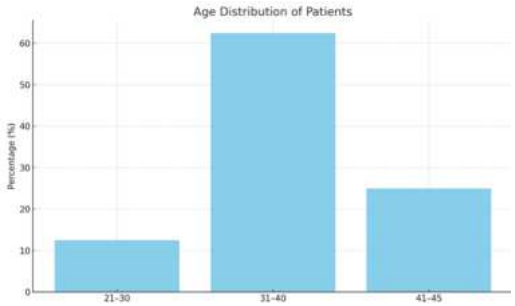


Figure 1: Age Distribution of Patients

(Bar graph showing 12.5% in 21–30 years, 62.5% in 31–40 years, 25% in 41–45 years)

Table 1: Distribution Of Chief Complaints

Complaint	No. (n=40)	%
Low back pain	40	100
Morning stiffness >30 min	23	57.5
Improvement with exercise	22	55.0
Improvement with rest	18	45.0
Response to NSAIDs	35	87.5
Fever	6	15.0

Radiographic Findings

Radiography detected sacroiliitis in 30% (n=12) of cases, while 70% (n=28) appeared normal. Key findings included sclerosis (12.5%), erosions (15%), joint space narrowing (7.5%), widening (5%), and ankylosis (2.5%). Diagnosis was based on modNY criteria, requiring bilateral grade ≥2 or unilateral grade ≥3 changes.

MRI Findings

MRI detected sacroiliitis in 70% (n=28) of patients, with 30% (n=12) showing normal SIJs. BME was present in all positive cases, with 42.5% iliac-dominant and 27.5% sacral-iliac patterns. Other findings included erosions (25%), sclerosis (12.5%), joint space narrowing (12.5%), widening (10%), enthesitis and capsulitis (25% each), extracapsular fluid (12.5%), and muscle edema (20%).(Table 2).

Table 2: Comparison Of Radiographic And MRI Findings

Finding	Radiography (n=40)	%	MRI (n=40)	%	p-value
Sclerosis	5	12.5	5	12.5	1.00
Erosions	6	15.0	10	25.0	0.74
Joint Space					0.49
Narrowing	3	7.5	5	12.5	
Widening	2	5.0	4	10.0	
Normal	35	87.5	31	77.5	
Ankylosis	1	2.5	1	2.5	1.00
BME	-	-	28	70.0	-
Iliac-dominant	-	-	17	42.5	-
Even distribution	-	-	11	27.5	-
Enthesitis	-	-	10	25.0	-
Capsulitis	-	-	10	25.0	-
Thin (<5mm)	-	-	6	15.0	-
Thick (>5mm)	-	-	4	10.0	-
Extracapsular Fluid	-	-	5	12.5	-
Periarticular Edema	-	-	8	20.0	-

Diagnostic Performance

Radiography showed low sensitivity (29%) and moderate specificity (66.7%) compared to the clinical diagnosis, with a PPV of 75% and NPV of 21.4%. In contrast, MRI demonstrated high diagnostic accuracy with 93.5% sensitivity, 100% specificity, 100% PPV, and 81.8% NPV.. (Table 3).

Table 3: Diagnostic Performance Of Radiography Vs. MRI

Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Radiography	29.0 (13.1–45.0)	66.7 (35.9–97.5)	75.0 (50.5–99.5)	21.4 (6.2–36.6)
MRI	93.5 (84.9–102.2)	100.0 (100.0–100.0)	100.0 (100.0–100.0)	81.8 (59.0–104.6)

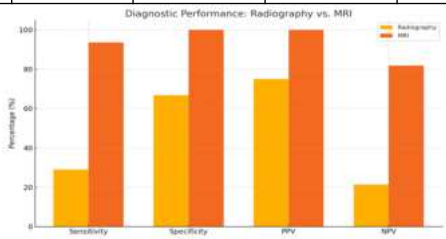


Figure 2: Diagnostic Performance of Radiography vs. MRI

Inflammatory Vs. Infectious Sacroiliitis

Of 25 sacroiliitis cases, 19 were inflammatory (76%) and 6 were infectious (24%). MRI distinguished etiologies based on distinct patterns (Figure S2):

- **Inflammatory Sacroiliitis (n=19):** Iliac-dominant BME was seen in 78.9% (n=15), even BME in 22.2% (n=4), with bilateral involvement. Erosions, joint space narrowing, enthesitis, and capsulitis were present in 21.1% (n=4), with minimal extracapsular findings. Diagnoses included AS (10 cases) and undifferentiated SpA (9 cases).
- **Infectious Sacroiliitis (n=6):** Infectious sacroiliitis showed evenly distributed BME in 80%, iliac-dominant in 20%, with 100% unilateral involvement and erosions. Joint space widening was seen in 66.6%, enthesitis in 50%, capsulitis, extracapsular fluid, and muscle edema in 83.3% each. Two cases were tubercular

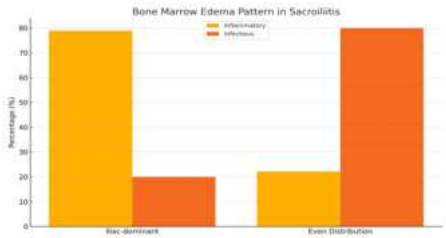


Figure 3: Bone Marrow Edema Distribution in Inflammatory vs. Infectious Sacroiliitis

(Bar graph comparing iliac-dominant vs. even BME: 78.9% vs. 22.2% in inflammatory, 20% vs. 80% in infectious sacroiliitis)

DISCUSSION

This study underscores MRI's superiority over radiography in diagnosing sacroiliitis, particularly in its early stages, and its utility in differentiating inflammatory from infectious etiologies. With a sensitivity of 93.5% and specificity of 100%, MRI significantly outperformed radiography (sensitivity 29%, specificity 66.7%), aligning with prior studies by Oostveen et al. (85% sensitivity) and Battafarano et al. (93% sensitivity, 100% specificity) [13,14]. Radiography's low sensitivity reflects its dependence on chronic structural changes, which typically appear 3–7 years after symptom onset, as noted by Braun et al. [15]. This delay hampers early intervention, critical for preventing irreversible joint damage in SpA [16].

Radiography Vs. MRI: Diagnostic Efficacy

Radiography evaluated by modNY criteria revealed sacroiliitis in 30% of patients, omitting 22 genuine positives (false negatives) due to its inability to recognize acute inflammatory alterations like BME [5]. Hollingsworth et al. [17] noted that interpretation problems and inadequate interobserver reliability caused 7.5% false positives, reducing its specificity (66.7%). MRI's high sensitivity and specificity come from its ability to identify BME on STIR and fat-

suppressed T1 sequences, a sign of early sacroiliitis [18]. BME was observed in 70% of patients, with 42.5% displaying iliac-dominant patterns, supporting Bowen et al.'s finding that SpA's fibrocartilaginous iliac cartilage predisposes to early edema [19 MRI detects erosions (25% vs. 15% on radiography), especially minor erosions (<10mm), enabling early diagnosis [20]. In agreement with Ranga et al.'s findings, MRI's greater anatomical resolution (12.5% narrowing, 10% widening) better detected joint space abnormalities than radiography (7.5% narrowing, 5% broadening) [21]. Both modalities were similarly sensitive (2.5%) for chronic alterations such ankylosis, which is an end-stage characteristic seen on radiographs [22].

Inflammatory Vs. Infectious Sacroiliitis:

For various therapy, inflammatory and infectious sacroiliitis must be separated [10]. Inflammatory patients showed iliac-dominant, bilateral BME (78.9%), while infected patients had unilateral, evenly distributed BME (80%) with frequent extracapsular findings (83.3%), corroborating Kang et al. [11]. As described [11,23], infected sacroiliitis exhibited 100% erosions and >10mm lesions. Infection expands joints, whereas inflammation contracts them [24]. Stürzenbecher et al. found that infection-specific extracapsular abnormalities such fluid and muscle oedema aid early detection. MRI is better for early sacroiliitis identification, especially in undifferentiated SpA with negative radiographs [21]. According to Weber et al., radiographic development can be stopped with TNF drugs after early diagnosis [23].The study highlights MRI's clear diagnostic advantage over radiography in detecting early sacroiliitis and distinguishing between inflammatory and infectious causes, owing to its superior sensitivity, specificity, and ability to visualise early bone marrow changes and extracapsular abnormalities.

Limitations of this study are the small sample size (n=40), which limits generalizability. Use of 1.5T MRI and disease variability may affect sensitivity. Larger studies with diffusion-weighted MRI are recommended.

CONCLUSION

Sacroiliitis is best diagnosed by MRI, which has 93.5% sensitivity and 100% specificity. Radiography only detects chronic alterations, although it can reveal early causes. Investigations should begin with MRI, with future research concentrating on cost and sophisticated methods.

REFERENCES

1. Rudwaleit M, et al. ASAS classification criteria for axial spondyloarthritis (part II): validation. Ann Rheum Dis. 2009;68:777-83.
2. Sieper J, et al. The ASAS handbook: a guide to assess spondyloarthritis. Ann Rheum Dis. 2009;68(2):1-44.
3. Braun J, Van Der Heijde D. Imaging and scoring in ankylosing spondylitis. Best Pract Res Clin Rheumatol. 2002;16:573-604.
4. McMichael A, Bowness P. HLA-B27: natural function and pathogenic role. Arthritis Res. 2002;4(Suppl 3):153-8.
5. van der Linden S, et al. Proposal for modified New York criteria. Arthritis Rheum. 1984;27(4):361-8.
6. Braun J, et al. Imaging of sacroiliitis. Clin Rheumatol. 2000;19(1):51-7.
7. Rudwaleit M, et al. Early diagnosis of axial spondyloarthritis. Ann Rheum Dis. 2004;63:535-43.
8. Weber U, et al. Diagnostic utility of MRI in spondyloarthritis: multicenter study. Arthritis Rheum. 2010;62:3048-58.
9. Hollingsworth PN, et al. Observer variation in grading SI radiographs. J Rheumatol. 1983;10(2):247-54.
10. Hodgson BF. Pyogenic SI joint infection. Clin Orthop Relat Res. 1989;246:146-9.
11. Kang KY, et al. Fat metaplasia and spinal progression in axial SpA. PLoS ONE. 2015;10(8):e0135207.
12. Krishna Kiran S, et al. MRI findings in SI joint in low back ache. Int J Contemp Med Surg Radiol. 2018;3(3):C105-7.
13. Oostveen J, et al. Early MRI detection of sacroiliitis. J Rheumatol. 1999;26:1953-8.
14. Battafarano DF, et al. MRI vs bone scan and CT in active sacroiliitis. Semin Arthritis Rheum. 1993;23:161-76.
15. Braun J, Sieper J. Ankylosing spondylitis overview. Lancet. 2007;369:1379-90.
16. Wanders A, et al. NSAIDs reduce radiographic progression in AS. Arthritis Rheum. 2005;52:1756-65.
17. Geijer M, et al. CT vs radiography in diagnosing sacroiliitis. J Rheumatol. 2007;34(7):1561.
18. Heuft-Dorenbosch L, et al. Combining MRI and radiographs in early back pain. Ann Rheum Dis. 2006;65:804-8.
19. Bowen V, Cassidy JD. Anatomy of the SI joint through life. Spine. 1981;6:620-8.
20. Murphey MD, et al. MR imaging findings in sacroiliitis. Radiology. 1991;180(1):239-44.
21. Ranga A, et al. Imaging comparison in sacroiliitis. Astrocyte. 2016;2:179-84.
22. Brophy S, et al. Natural history of AS by radiological progression. J Rheumatol. 2002;29(6):1236-43.
23. Braga MV, et al. MRI changes in psoriatic arthritis. Sci Rep. 2020;10(1):1157.
24. Puhakka KB, et al. MRI vs radiography/CT in early SpA. Acta Radiol. 2003;44(2):218-29.