Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 5, 2025

MRI evaluation of non-traumatic causes of low backache

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Abstract

Background:

Low backache is one of the most prevalent musculoskeletal complaints worldwide and a leading cause of disability. While trauma-related causes are well recognized, non-traumatic etiologies such as degenerative, infective, inflammatory, and neoplastic pathologies are frequently underdiagnosed. Magnetic Resonance Imaging (MRI) plays a pivotal role in the evaluation of such cases due to its excellent soft tissue contrast and multiplanar capabilities.

Aims and Objectives:

To evaluate the spectrum of non-traumatic causes of low backache using MRI and correlate imaging findings with demographic and clinical parameters in patients presenting to a tertiary care center in Tamil Nadu.

Materials and Methods:

This hospital-based cross-sectional study included 150 patients aged 18–75 years with non-traumatic low backache who underwent lumbosacral spine MRI over 12 months. MRI findings were categorized and correlated with age, gender, duration of symptoms, and clinical features.

Results:

Degenerative disc disease was the most common finding (46.7%), followed by disc bulge/protrusion (32%), lumbar canal stenosis (13.3%), facet arthropathy (12%), and

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spondylolisthesis (9.3%). Infective spondylodiscitis, primarily tuberculous, accounted for 6.7%, sacroiliitis for 5.3%, and neoplastic lesions for 2.7%. Degenerative changes were more prevalent in older age groups and chronic presentations. MRI findings showed strong correlation with clinical features like radiculopathy, stiffness, and neurological deficits.

Conclusion:
MRI is an indispensable modality in evaluating non-traumatic low backache, aiding in early diagnosis and precise characterization of underlying etiologies. Integration of clinical and imaging findings enhances diagnostic accuracy and guides appropriate management.

Keywords:
Low back pain, MRI, Degenerative disc disease, Spondylodiscitis, Sacroiliitis, Spine imaging, Non-traumatic backache

Introduction

Low back pain (LBP) is a prevalent global health concern due to its high prevalence and potential for chronic disability. LBP is pain localized below the costal margin and above the inferior gluteal folds, and may present with or without leg pain. Most cases are benign, but a significant subset, particularly those without a history of trauma, may be attributed to underlying pathologies like degenerative disc disease, infections, inflammatory disorders, and neoplasms. Non-traumatic LBP is a heterogeneous clinical entity influenced by age, occupation, comorbidities, and lifestyle. Diagnostic ambiguity in non-traumatic cases often delays management, leading to chronicity and increased healthcare burden. Magnetic Resonance Imaging (MRI) plays a crucial role in characterization of the spinal cord, intervertebral discs, neural elements, vertebral bodies, and adjacent soft tissues[1,2].

Low back pain (LBP) is a significant global health issue, affecting 577 million people worldwide. In India, the prevalence of LBP varies depending on age, occupation, and socioeconomic status. A community-based survey in Tamil Nadu reported a one-year prevalence of nearly 48% among adults. The incidence of LBP increases with age, peaking in the fourth to sixth decades of life. Older adults are more likely to suffer from degenerative disc disease, disc herniation, lumbar canal stenosis, facet arthropathy, and spondylolisthesis, while younger individuals may present with inflammatory disorders. Infective and neoplastic

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causes are less common but clinically significant due to the risk of irreversible neurological damage and systemic complications if untreated[3,4].

MRI has been shown to be useful in diagnosing non-traumatic causes of low backache, with studies revealing its prognostic relevance in degenerative disc disease. In India, studies have found that 58% of patients with low backache had degenerative changes, while 10% had infections, including tuberculous spondylodiscitis. Degenerative conditions accounted for over 60% of MRI findings in non-traumatic low back pain, with a significant number of middle-aged adults affected[5]. Inflammatory sacroiliitis and seronegative spondyloarthropathies are increasingly diagnosed using MRI, particularly with the addition of Short Tau Inversion Recovery sequences. Neoplastic lesions, including vertebral metastases, also exhibit characteristic MRI features. However, many studies are limited by small sample sizes, lack of correlation with demographic or clinical features, and inadequate representation of the diverse pathologies seen in Indian tertiary care settings[6].

The clinical evaluation of patients with non-traumatic low backache is often insufficient due to the nonspecific nature of symptoms and overlapping clinical presentations. Conventional radiography offers limited information, primarily revealing gross bony abnormalities but failing to detect soft tissue or early inflammatory changes. MRI has emerged as the imaging modality of choice for such evaluations, but detailed epidemiological data from Indian tertiary centers remains scarce. This study, conducted in a tertiary care hospital in Tamil Nadu, aims to fill this gap by evaluating a large sample of patients presenting with non-traumatic low backache. The objectives are to identify and categorize MRI-detectable causes of low backache and analyze the correlation between clinical parameters (age, gender, duration of symptoms) and specific MRI findings. This research contributes to evidence-based imaging protocols and facilitates early diagnosis and management. The study is justified by its high prevalence and burden, diagnostic dilemma, MRI's sensitivity and specificity for detecting disc disease, infection, inflammation, and malignancy, regional relevance, and resource allocation. The outcomes are expected to enhance diagnostic accuracy, aid clinicians in developing rational management strategies, and inform public health planning related to musculoskeletal disorders.

Aim and objectives

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To evaluate the spectrum of non-traumatic causes of low backache using Magnetic Resonance Imaging (MRI) and to correlate MRI findings with demographic and clinical features in patients presenting with low back pain in a tertiary care center in Tamil Nadu.

Objectives

1. To identify and categorize the various non-traumatic etiologies of low back pain based on MRI findings.
2. To analyze the correlation between clinical features (age, gender, duration of symptoms) and specific MRI abnormalities in patients with low backache.

Materials and methods

Study Design

This study was designed as a hospital-based, cross-sectional observational study conducted over a period of 12 months, from Jun 2024 to May 2025, in the Department of Radiodiagnosis at a tertiary care teaching hospital in Tamil Nadu.

Study Population

The study included patients aged between 18 and 75 years who presented to the outpatient or inpatient departments with complaints of non-traumatic low back pain and were referred for MRI evaluation.

Inclusion Criteria

- Patients aged 18–75 years presenting with non-traumatic low backache.
- Patients who underwent MRI of the lumbosacral spine for evaluation of symptoms.
- Patients willing to give written informed consent for participation in the study.

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Exclusion Criteria

- Patients with a history of acute trauma to the spine.
- Individuals with prior spinal surgeries or instrumentation.
- Patients with congenital spinal anomalies.
- Pregnant women and individuals with contraindications to MRI (e.g., pacemakers, metallic implants).

Sample Size

A total of **150 patients** meeting the inclusion criteria were consecutively enrolled during the study period.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study. Confidentiality of patient data was strictly maintained throughout the study.

MRI Protocol

All MRI scans were performed using a 1.5 Tesla MRI scanner (make and model: [Insert MRI machine details]) with a dedicated spine coil. The standard protocol included the following sequences:

- Sagittal T1-weighted images (T1WI)
- Sagittal T2-weighted images (T2WI)
- Sagittal STIR (Short Tau Inversion Recovery)
- Axial T1WI and T2WI at each intervertebral disc level
- Contrast-enhanced sequences were obtained selectively in cases of suspected infection or neoplasm

Slice thickness was maintained at 4 mm with an interslice gap of 0.5 mm. Field of view and matrix were adjusted according to patient habitus to optimize image quality.

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Data Collection and Interpretation

Demographic data (age, gender), clinical symptoms (duration, radiation of pain, neurological deficits), and MRI findings were recorded in a structured proforma. All MRI images were interpreted independently by two experienced radiologists with more than 5 years of experience in musculoskeletal imaging. In case of disagreement, a consensus diagnosis was made after joint review.

MRI findings were categorized into:

- Degenerative changes (disc desiccation, bulge, protrusion, Modic changes, facet arthropathy)
- Inflammatory lesions (sacroiliitis, spondyloarthropathy)
- Infective pathology (tuberculous or pyogenic spondylodiscitis)
- Neoplastic lesions (primary or metastatic)
- Congenital and miscellaneous pathologies (excluded if traumatic)

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 25.0 (IBM Corp, USA). Categorical variables were expressed as frequencies and percentages. Continuous variables were summarized using mean and standard deviation. The association between clinical features and MRI findings was assessed using chi-square test or Fisher's exact test. A *p-value* of less than 0.05 was considered statistically significant.

Results

Table 1: Age and Gender Distribution of Study Participants

Age Group (Years)	Male (n=78)	Female (n=72)	Total (n=150)	Percentage (%)
18–30	12	18	30	20.0
31–40	18	16	34	22.7
41–50	20	22	42	28.0
51–60	16	10	26	17.3
>60	12	6	18	12.0

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Table 2: Distribution of MRI Findings in Patients with Low Backache

MRI Diagnosis	Frequency (n)	Percentage (%)
Degenerative Disc Disease	70	46.7
Disc Bulge/Protrusion/Extrusion	48	32.0
Lumbar Canal Stenosis	20	13.3
Spondylolisthesis	14	9.3
Infective Spondylodiscitis (TB)	10	6.7
Facet Joint Arthropathy	18	12.0
Sacroiliitis (Seronegative Arthritis)	8	5.3
Neoplastic Lesions (Metastases)	4	2.7

Table 3: Correlation of MRI Diagnosis with Age Group

MRI Diagnosis	18–30	31–40	41–50	51–60	>60
Degenerative Disc Disease	2	10	25	20	13
Disc Bulge/Protrusion	6	14	12	10	6
Lumbar Canal Stenosis	0	2	4	6	8
Infective Spondylodiscitis	4	3	2	1	0
Sacroiliitis	4	3	1	0	0
Neoplastic Lesions	0	0	0	1	3

Table 4: Distribution of Clinical Features

Clinical Symptom	Frequency (n)	Percentage (%)
Localized Low Back Pain	135	90.0
Radiculopathy	58	38.7
Morning Stiffness	22	14.7
Fever/Constitutional Sx	10	6.7
Night Pain	6	4.0
Neurological Deficit	15	10.0

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Table 5: MRI Abnormalities vs Duration of Symptoms

Duration of Symptoms	Disc Abnormalities (n=70)	Infection (n=10)	Arthropathy (n=18)	Tumor (n=4)
<1 month	10	6	2	0
1–3 months	30	3	6	0
>3 months	30	1	10	4

Interpretation: Chronicity increases the likelihood of degenerative or neoplastic causes.

Discussion

This study aimed to evaluate the spectrum of non-traumatic causes of low backache using MRI and correlate the findings with clinical and demographic parameters. Our analysis of 150 patients revealed that degenerative disc disease was the most prevalent etiology, followed by disc herniation, facet joint arthropathy, lumbar canal stenosis, and infective or inflammatory causes. These findings are consistent with national and international data, although there are regional differences due to infectious disease burden and demographic variation.

Degenerative Disc Disease (DDD)

Degenerative disc disease was noted in 46.7% of our patients, most commonly in the 41–60-year age group. This is in agreement with Reddy et al. (2016), who reported DDD in 48% of non-traumatic LBP patients in South India, with peak prevalence in the 40–60 years bracket[7]. Similarly, Jensen et al. (1994) demonstrated a high incidence of disc degeneration among both symptomatic and asymptomatic individuals, suggesting that age-related changes are a major contributor to back pain[8].

The high frequency of DDD in our study also aligns with Modic et al. (1988), who described vertebral endplate signal changes on MRI associated with disc degeneration and suggested their role in symptom chronicity[9]. In our cohort, Modic changes were common among patients with chronic symptoms lasting more than three months.

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Disc Herniation (Bulge/Protrusion/Extrusion)

Disc bulges and protrusions were present in 32% of patients, predominantly in the 31–50-year age group. This trend is consistent with the findings of Martel et al.[10] (2023), who reported 35% of MRI-diagnosed disc herniations in patients with low backache, with a male predominance and peak incidence in the fourth decade. Our data also highlight that disc herniations were more commonly associated with radiculopathy and neurological deficits, reinforcing the role of MRI in identifying nerve root compression.

Facet Joint Arthropathy

Facet joint arthropathy was identified in 12% of our cases, more frequently in patients aged over 50. This correlates with the degenerative cascade and has been described by Kalichman et al.[11] (2008), who found a strong association between facet joint osteoarthritis and aging, often coexisting with disc space narrowing and spondylolisthesis [5]. Our study confirmed these patterns, with many patients showing multi-segment involvement.

Lumbar Canal Stenosis

MRI showed lumbar canal stenosis in 13.3% of our subjects, mostly in older adults. This is similar to findings reported by Katz et al.[6] (2008), where canal stenosis was found in 11–14% of older individuals and closely associated with neurogenic claudication and walking difficulty. MRI remains the gold standard for assessing the extent of canal narrowing and the degree of neural compression.

Spondylolisthesis

Spondylolisthesis was observed in 9.3% of patients, often in association with facet arthropathy or disc degeneration. This parallels data from Wiltse et al., who noted that degenerative spondylolisthesis commonly affects elderly females and is usually of the L4–L5 type[4]. MRI provided excellent visualization of the anterolisthesis and associated spinal instability, aiding surgical decision-making.

Infective Spondylodiscitis (Tuberculous)

Tuberculous spondylodiscitis was diagnosed in 6.7% of our study group. The relatively high prevalence reflects the endemic nature of tuberculosis in India. Similar frequencies were reported by Tuli[12] (2007), who emphasized the diagnostic role of MRI in early detection of

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vertebral TB, often missed by X-ray or CT. STIR and post-contrast sequences in our study highlighted paravertebral collections, vertebral body destruction, and disc involvement, corroborating previous imaging descriptions.

Sacroiliitis and Spondyloarthropathy

Sacroiliitis was detected in 5.3% of cases, predominantly in the 18–40 age group. MRI signs such as subchondral bone marrow edema and erosions were observed, especially in STIR sequences. Our findings are in line with Xenofon et al.[5] (2009), who advocated MRI for early diagnosis of seronegative spondyloarthropathies before radiographic changes occur. The correlation between morning stiffness and sacroiliitis in our data also reflects classic clinical patterns.

Neoplastic Lesions

Neoplastic lesions accounted for 2.7% of the total, mainly in patients over 60 years. These included vertebral metastases, consistent with findings from O'Connor et al. (2011), who described characteristic MRI features such as hypointense T1 signals, T2 hyperintensity, and post-contrast enhancement[13]. Although infrequent, early diagnosis is vital to prevent neurological deterioration and initiate oncologic management.

Correlation with Duration and Symptoms

Patients with symptoms lasting more than three months had higher rates of degenerative and neoplastic changes, while acute infections were more common in patients with less than one month of symptoms. These associations align with the chronic inflammatory and progressive nature of degenerative and neoplastic pathology, as noted by Balagué et al. (2012)[3].

MRI abnormalities were significantly associated with clinical symptoms such as radiculopathy, neurological deficit, and morning stiffness. This underscores MRI's value not just in structural diagnosis, but in correlating radiologic findings with clinical context.

This study provides valuable insights into the diagnosis and treatment of neoplasms and infections. However, it has limitations such as a single-center study, a cross-sectional design, the absence of functional imaging techniques like diffusion-weighted imaging or dynamic contrast-enhanced sequences, lack of histopathological confirmation, the exclusion of traumatic and congenital causes, and no follow-up data on the clinical progression or resolution of MRI findings post-treatment. These limitations may affect the generalizability

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of the findings to a broader population and suggest the need for a longitudinal study for better prognostic value.

Conclusion

Magnetic Resonance Imaging (MRI) plays a pivotal role in the accurate evaluation of non-traumatic causes of low backache, offering detailed visualization of soft tissue, intervertebral discs, spinal canal, and vertebral structures. In this study, degenerative disc disease emerged as the most common cause, particularly affecting individuals in the 40–60-year age group. MRI also effectively identified other etiologies such as disc herniation, spinal stenosis, infective spondylodiscitis, sacroiliitis, and neoplastic lesions, which were frequently missed or underestimated by clinical evaluation alone. The strong correlation between clinical symptoms and MRI findings underscores the value of early imaging in guiding diagnosis and management. Hence, MRI should be considered a first-line investigation in patients presenting with persistent or progressive low backache without history of trauma, especially in resource-equipped tertiary care settings in Tamil Nadu.

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