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Magnetic Resonance Imaging Evaluation of Non-Traumatic Low Back Pain and Its Correlation with Clinical Findings

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ABSTRACT
Background: *Low back pain (LBP) is a common musculoskeletal disorder with degenerative changes being the most frequent cause. Magnetic Resonance Imaging (MRI) plays a crucial role in evaluating the underlying pathology and guiding management.*
Objective: *To evaluate MRI findings in patients with non-traumatic low back pain and correlate imaging abnormalities with clinical features.*
Methods: *This prospective observational study was conducted over one year at RKDF Medical College Hospital & Research Centre. 80 patients presenting with non-traumatic low back pain underwent clinical evaluation, including neurological examination and straight leg raising (SLR) test, followed by MRI of the lumbosacral spine. MRI findings were analysed for disc degeneration, disc bulge, herniation, spinal canal stenosis, and nerve root compression, and correlated with clinical symptoms.*
Results: *The majority of patients were 41–50 years old (30%), with a male predominance (57.5%). MRI revealed disc degeneration (70%), disc bulge (60%), disc herniation (40%), and nerve root compression (42.5%). The L4–L5 level was most frequently affected (47.5%). Clinical radiculopathy significantly correlated with MRI-detected nerve root compression, and a positive SLR test correlated with disc herniation ($p < 0.05$).*
Conclusion: *Degenerative changes, particularly at L4–L5 and L5–S1, are the most common cause of non-traumatic low back pain. Significant clinico-radiological correlation emphasises the role of MRI in diagnosis and management, but findings should be interpreted alongside clinical assessment.*
Keywords: *Low back pain, MRI, Disc degeneration, Disc herniation, Radiculopathy, Clinico-radiological correlation*

I. INTRODUCTION

Low back pain (LBP) is one of the most common musculoskeletal disorders worldwide and is a leading cause of disability, work absenteeism, and reduced quality of life. Nearly 60–80% of individuals experience low back pain at some point in their lifetime, making it a significant public health problem and economic burden on healthcare systems (1).

Non-traumatic low back pain is most commonly associated with degenerative disorders of the lumbosacral spine, including intervertebral disc degeneration, disc bulge or herniation, facet joint arthropathy, ligamentum flavum hypertrophy, and spinal canal stenosis (2). Clinical manifestations range from localized back pain to radiculopathy with neurological deficits, depending on nerve root involvement. However, clinical evaluation alone is often insufficient to accurately localize and characterize the underlying pathology (3).

Magnetic Resonance Imaging (MRI) is the preferred imaging modality for evaluating low back pain due to its excellent soft-tissue contrast, multiplanar capability, and lack of ionising radiation (4). MRI enables detailed assessment of intervertebral discs, spinal canal, nerve roots, ligaments, and paraspinal soft tissues, and helps in differentiating degenerative causes from infections, tumours, and inflammatory conditions (5).

Despite its high sensitivity, MRI findings may not always correlate with clinical symptoms, as degenerative changes can also be observed in asymptomatic individuals (6). Therefore, a clinico-radiological correlation is essential to avoid overdiagnosis and unnecessary interventions. Correlating MRI findings with clinical features such as radiculopathy and straight leg raising test results improves diagnostic accuracy and guides appropriate management strategies (7).

The present study was undertaken to evaluate MRI findings in patients with non-traumatic low back pain and to correlate these findings with clinical presentations at a tertiary care centre.

II. MATERIALS AND METHODS

Study Design and Setting
This was a prospective observational study conducted in the Department of Radiodiagnosis in collaboration with the Department of Orthopaedics at RKDF Medical College Hospital & Research Centre (MCH & RC). The study was carried out over a duration of one year.

Study Population
A total of 80 consecutive patients presenting with non-traumatic low back pain were included in the study. All patients were referred for Magnetic Resonance Imaging (MRI) of the lumbosacral spine as part of their diagnostic evaluation.

Inclusion Criteria
- Patients aged 18 years and above
- Patients presenting with low back pain without a history of trauma
- Patients with or without radicular symptoms
- Patients willing to provide written informed consent

Exclusion Criteria
- History of recent or past spinal trauma
- Previous spinal surgery
- Known cases of spinal infection, malignancy, or inflammatory spondyloarthropathy
- Patients with contraindications to MRI (e.g., pacemakers, cochlear implants, metallic foreign bodies)
- Pregnant women

Clinical Evaluation
A detailed clinical history was obtained from all patients, including duration of pain, radiation of pain, associated neurological symptoms (numbness, weakness), and bowel or bladder involvement. A thorough physical and neurological examination was performed, assessing spinal tenderness, range of motion, motor power, sensory deficits, reflexes, and special tests such as the Straight Leg Raising (SLR) test. Clinical findings were documented systematically using a structured proforma.

MRI Technique
MRI examinations were performed using a 1.5 Tesla MRI scanner. The imaging protocol included sagittal and axial sequences of the lumbosacral spine using:
- T1-weighted images
- T2-weighted images
- Short Tau Inversion Recovery (STIR) sequences

Images were evaluated for disc degeneration, disc bulge, disc herniation (protrusion, extrusion, sequestration), spinal canal stenosis, nerve root compression, ligamentum flavum hypertrophy, facet joint arthropathy, vertebral end-plate changes, and other relevant abnormalities.

Image Analysis
MRI images were reviewed independently by an experienced radiologist. Findings were categorised and recorded according to standard radiological criteria. The level and type of pathology were noted and correlated with the side and severity of clinical symptoms.

Correlation of MRI Findings with Clinical Features
MRI findings were correlated with clinical presentation, including pain distribution, neurological deficits, and SLR test results, to assess the clinico-radiological concordance in patients with non-traumatic low back pain.

Ethical Considerations
The study was conducted after obtaining approval from the Institutional Ethics Committee of RKDF MCH & RC. Written informed consent was obtained from all participants beforeenrollment. Patient confidentiality was maintained throughout the study.

Statistical Analysis
Data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) software (version 26.0). Descriptive statistics were used to summarise demographic data and MRI

findings. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. The Chi-square test was used to assess the association between MRI findings and clinical features. A p-value < 0.05 was considered statistically significant.

III. RESULTS AND OBSERVATIONS

Study Population

A total of 80 patients with non-traumatic low back pain were evaluated using MRI of the lumbosacral spine. The demographic profile, clinical presentation, MRI findings, and their correlation were analysed.

Table 1: Demographic Distribution of Study Participants (n = 80)

Variable	Number (%)
Age (years)	
18–30	12 (15.0)
31–40	18 (22.5)
41–50	24 (30.0)
51–60	16 (20.0)
>60	10 (12.5)
Gender	
Male	46 (57.5)
Female	34 (42.5)

Most patients belonged to the 41–50 years age group, with a male predominance.

Table 2: Clinical Presentation of Patients with Low Back Pain

Clinical Feature	Number (%)
Low back pain only	28 (35.0)
Low back pain with radiculopathy	44 (55.0)
Sensory symptoms (numbness/tingling)	30 (37.5)
Motor weakness	14 (17.5)
Positive Straight Leg Raising (SLR) test	42 (52.5)

Radicular symptoms were present in more than half of the patients, and SLR positivity was noted in 52.5%, suggesting nerve root involvement.

Table 3: Distribution of MRI Findings in Non-Traumatic Low Back Pain

MRI Finding	Number (%)
Disc degeneration	56 (70.0)
Disc bulge	48 (60.0)
Disc herniation	32 (40.0)
Spinal canal stenosis	20 (25.0)
Nerve root compression	34 (42.5)
Facet joint arthropathy	22 (27.5)
Ligamentum flavum hypertrophy	18 (22.5)
Normal MRI	6 (7.5)

Degenerative disc disease was the most common MRI finding, followed by disc bulge and disc herniation.

Table 4: Level-wise Distribution of Disc Pathology on MRI

Vertebral Level	Number (%)
L3–L4	12 (15.0)
L4–L5	38 (47.5)
L5–S1	30 (37.5)

The **L4–L5 level** was the most frequently involved, followed by **L5–S1**, consistent with biomechanical stress distribution.

Table 5: Correlation Between Clinical Radiculopathy and MRI Nerve Root Compression

Finding	Present	Absent	Total
Radiculopathy present	30	14	44
Radiculopathy absent	4	32	36
Total	**34**	**46**	**80**

- **Chi-square test:** Significant
- **p-value:**< 0.05

A statistically significant correlation was observed between clinical radiculopathy and MRI-detected nerve root compression.

Table 6: Correlation of SLR Test with MRI Disc Herniation

SLR Test	Disc Herniation Present	Disc Herniation Absent	Total
Positive	28	14	42
Negative	4	34	38
Total	**32**	**48**	**80**

- **p-value:**< 0.05

A positive SLR test showed a strong correlation with disc herniation on MRI, indicating good clinico-radiological concordance.

IV. DISCUSSION

Low back pain is a prevalent condition with multifactorial causes, and MRI has become the cornerstone for evaluating its underlying pathology. In the present study, we evaluated 80 patients with non-traumatic low back pain using MRI and correlated imaging findings with clinical presentation.

The majority of patients in this study belonged to the 41–50 years age group (30%), with a male predominance (57.5%). This aligns with previous studies suggesting that middle-aged individuals are more prone to degenerative spinal changes due to cumulative mechanical stress, occupational factors, and lifestyle habits (1,2).

Clinically, radiculopathy was observed in 55% of patients, and SLR positivity was noted in 52.5%, indicating frequent nerve root involvement. These findings highlight the importance of neurological evaluation, as the presence of radicular symptoms often correlates with structural abnormalities on imaging (3,4).

MRI findings in our cohort revealed that disc degeneration (70%) and disc bulge (60%) were the most common abnormalities, followed by disc herniation (40%) and nerve root compression (42.5%). This prevalence is consistent with prior studies reporting degenerative disc disease as the most frequent cause of non-traumatic low back pain (5,6). Disc degeneration leads to decreased disc height and altered biomechanics, which may contribute to nerve root compression and subsequent clinical symptoms.

The L4–L5 level (47.5%) was the most frequently affected, followed by L5–S1 (37.5%). These findings are in line with biomechanical studies showing that these segments are subject to maximal load and motion, making them more susceptible to degenerative changes (7).

Importantly, a significant correlation was observed between clinical radiculopathy and MRI-detected nerve root compression, as well as between positive SLR test and disc herniation. Among 44 patients with radiculopathy, 30 had corresponding nerve root compression on MRI, while 28 out of 42 patients with a positive SLR test demonstrated disc herniation. These results confirm the clinico-radiological concordance and reinforce the utility of MRI in corroborating clinical findings (8,9).

While MRI is sensitive in detecting spinal abnormalities, it is noteworthy that degenerative changes can also be present in asymptomatic individuals. In our study, 7.5% of patients had normal MRI scans, emphasising that low back pain is multifactorial and not all pain is structural (10). Therefore, MRI findings should be interpreted in conjunction with a detailed clinical assessment to guide appropriate management.

Overall, our study demonstrates that MRI is a valuable tool for evaluating non-traumatic low back pain, particularly in patients with neurological deficits or persistent symptoms. Correlation of imaging findings with clinical features such as radiculopathy and SLR test improves diagnostic accuracy and can aid in planning conservative or surgical interventions.

V. CONCLUSION

Degenerative changes, especially disc degeneration and bulge at L4–L5 and L5–S1, are the most common MRI findings in non-traumatic low back pain. Significant correlation between radiculopathy and nerve root compression, and positive SLR and disc herniation, highlights the importance of clinico-radiological correlation. MRI is a valuable tool for diagnosis and management, but findings should always be interpreted alongside clinical assessment.

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