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Clinical Findings and Magnetic Resonance Imaging Findings in Lumbar Prolapsed Intervertebral Disc

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Abstract: ***Background:*** Low back pain (LBP) is a prevalent condition, with lumbar prolapsed intervertebral disc (PIVD) being a significant cause of radiculopathy and disability, especially in working-age individuals. PIVD results from disc degeneration or mechanical stress, often affecting the L4–L5 and L5–S1 levels. Clinical symptoms include radiating leg pain, sensory loss, and weakness. While neurological examination is essential, imaging, particularly Magnetic Resonance Imaging (MRI), is the gold standard for diagnosis. MRI must be interpreted alongside clinical findings, as disc abnormalities may appear in asymptomatic individuals. Correlating MRI features with clinical symptoms is crucial for accurate diagnosis and management. ***Aim of the study:*** The present study aims to evaluate and correlate the clinical and MRI findings among patients presenting with lumbar prolapsed intervertebral disc at a tertiary care hospital. ***Methodology:*** This hospital-based descriptive cross-sectional study was conducted over six months, from January to June 2022 in the Dept. of Radiology & Imaging, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. Fifty patients aged 18–70 years with low back pain, with or without radiculopathy, who underwent MRI, were enrolled using purposive sampling. Clinical evaluation included neurological examination, pain scoring (VAS), and straight leg raising (SLR) tests. MRI findings were analyzed for disc herniation level, type, and associated features. Data were collected using a structured sheet and analyzed using SPSS version 26.0. Descriptive statistics and chi-square tests were used to assess the correlation between clinical and MRI findings. ***Results:*** Among 50 patients, most were aged 31–50 years (68%) and male (64%), with 62% overweight/obese and 56% smokers. All presented with low back pain; 80% had radiculopathy, mainly right-sided (40%). Numbness and motor weakness were noted in 70% and 32%, respectively, with a mean VAS score of 6.9 ± 1.8. MRI revealed L4–L5 (48%) and L5–S1 (36%) as the most affected levels, with protrusions (42%) and paracentral herniations (56%) common. Nerve root compression was seen in 76%. Radiculopathy correlated with compression in 95%, and 85% of positive SLR cases matched MRI findings, confirming a strong clinical-radiological correlation. ***Conclusion:*** There was a significant correlation between clinical features and MRI findings of disc prolapse, consistent with findings from similar studies. However, not all imaging abnormalities corresponded to clinical symptoms, emphasizing the importance of correlating radiological findings with clinical evaluation for accurate diagnosis and management.

Keywords: Lumbar Disc Prolapse, Intervertebral Disc Herniation, Low Back Pain, Magnetic Resonance Imaging (MRI) and Clinical Correlation.

Research Paper

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INTRODUCTION

Low back pain (LBP) is a common musculoskeletal disorder that affects up to 80% of individuals at some point in their lifetime, posing significant public health and economic burdens globally [1]. Among the many etiologies of LBP, lumbar prolapsed intervertebral disc (PIVD), commonly referred to as lumbar disc herniation, remains one of the leading causes of radiculopathy and disability in the working-age population [2]. PIVD typically occurs due to degeneration or mechanical overload of the

intervertebral disc, resulting in herniation of the nucleus pulposus through a weakened annulus fibrosus. This herniated material can compress adjacent nerve roots, leading to characteristic symptoms such as radiating leg pain (sciatica), sensory disturbances, muscle weakness, and, in severe cases, bowel or bladder dysfunction [3]. The pathophysiology of PIVD involves complex biomechanical and biochemical processes. Age-related disc degeneration, repeated mechanical stress, trauma, and genetic predisposition contribute to weakening of the disc structure [4]. Most herniations occur at the L4–L5 and L5–S1 levels, due to high mobility and mechanical stress in the lumbosacral region [5]. Clinically, patients may present with localized or radiating back pain, which is exacerbated by movement and relieved by rest. A comprehensive neurological examination assessing motor strength, sensory function, reflexes, and special tests like the straight leg raising (SLR) test is essential for initial evaluation [6]. However, clinical symptoms alone may not always accurately identify the underlying pathology or the precise level of disc involvement. This is where imaging, particularly Magnetic Resonance Imaging (MRI), plays a pivotal role. MRI is the gold standard for the evaluation of spinal disc pathologies as it provides excellent soft tissue contrast and allows visualization of disc morphology, nerve root impingement, spinal canal stenosis, and associated degenerative changes without the use of ionizing radiation [7]. Studies have shown that MRI not only assists in confirming the clinical diagnosis but also helps to guide treatment decisions, including conservative versus surgical interventions [8]. Despite its advantages, MRI findings must be interpreted cautiously. Several studies have reported the presence of disc bulges and herniations in asymptomatic individuals, raising concerns about over-reliance on radiological findings [9]. A study by Boden et al. reported that nearly 20–30% of asymptomatic adults showed disc abnormalities on MRI, emphasizing the need to correlate imaging results with clinical presentation [10]. Therefore, a combined assessment of clinical findings and MRI features remains the cornerstone of accurate diagnosis and appropriate management of lumbar PIVD. In recent years, increasing efforts have been made to explore the diagnostic accuracy and correlation between clinical symptoms and MRI findings. A study by Vroomen et al. found a significant association between MRI-detected nerve root compression and clinical radiculopathy, supporting the role of imaging in confirming diagnosis [11]. Similarly, Fardon et al. emphasized standardized terminology and classification of disc abnormalities to improve diagnostic consistency and communication among clinicians and radiologists [12]. In Bangladesh and other resource-limited settings, clinical evaluation remains the primary method of diagnosis due to limited access to advanced imaging modalities. However, in tertiary care centers where MRI is available, there is a growing need to evaluate how closely MRI findings align with the patient's clinical profile. This correlation is crucial not only for diagnostic accuracy but also for avoiding unnecessary surgical interventions in cases where imaging findings do not match clinical symptoms. Therefore, the present study aims to evaluate and correlate the clinical and MRI findings among patients presenting with lumbar prolapsed intervertebral disc at a tertiary care hospital.

METHODS AND METHODOLOGY

This was a hospital-based descriptive cross-sectional study. The study was conducted in the Dept of Radiology & Imaging, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. The study was carried out over 6 months, from January to June 2022. A total of 50 patients fulfilling the inclusion criteria were selected using a purposive sampling technique.

Inclusion Criteria

- Patients aged between 18 and 70 years
- Patients presenting with low back pain with or without radiculopathy
- Patients who underwent MRI of the lumbosacral spine
- Patients who provided informed written consent

Exclusion Criteria

- Patients with a history of spinal trauma or previous spinal surgery
- Congenital spinal deformities (e.g., spina bifida)
- Vertebral tumors or infections (e.g., tuberculosis, metastasis)
- Patients with known neurological or muscular disorders unrelated to disc prolapse
- Incomplete clinical or radiological records

Data Collection Procedure

After obtaining ethical clearance and informed consent, each participant was evaluated through various parameters. Clinical assessment including demographic details, duration and severity of symptoms, neurological examination, and special tests like straight leg raising (SLR). Neurological evaluation included assessment of motor power, sensory deficits, and deep tendon reflexes (patellar and Achilles). Pain severity was recorded using the Visual Analogue Scale (VAS). MRI scanning of the lumbosacral spine was done using a standard 1.5 Tesla MRI machine. Radiological findings such as the level and type of disc herniation, location, nerve root compression, canal stenosis, and associated degenerative changes (e.g., disc desiccation, ligamentum flavum hypertrophy, facet joint arthropathy) were documented. A structured data collection sheet was used to ensure uniformity in recording both clinical and MRI findings.

Data Analysis

Collected data were entered and analyzed using SPSS version 26.0. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to

summarize patient characteristics, clinical findings, and MRI features. Correlations between clinical findings and MRI parameters were assessed using appropriate statistical tests such as the chi-square test or Fisher's exact test, with a p-value <0.05 considered statistically significant.

RESULTS

The present study evaluated 50 patients with lumbar prolapsed intervertebral disc to correlate clinical findings with MRI characteristics. As shown in Table 1, the majority of patients were aged 31–50 years (68%), with a male predominance (64%). Most were involved in sedentary or manual labor occupations (84%), and 62% were either overweight or obese. Smoking history was reported in 56% of the patients. In terms of clinical presentation (Table 2), all patients had low back pain, while 80% experienced radiculopathy, predominantly affecting the right leg (40%). Numbness and motor weakness were seen in 70% and 32% of cases, respectively. The mean pain score (VAS) was 6.9 ± 1.8, indicating moderate to severe pain. Neurological examination (Table 3) revealed decreased motor power in 10–11 patients and sensory deficits in nearly 40% of cases. Reflex abnormalities were also observed in a notable proportion of participants. MRI evaluation (Table 4) revealed that the L4–L5 level was the most commonly affected (48%), followed by L5–S1 (36%). The majority of herniations were of the protrusion (42%) and extrusion (30%) types, with paracentral location being the most frequent (56%). Nerve root compression was detected in 76% of cases, and varying degrees of spinal canal stenosis were noted moderate in 48% and severe in 24%. Associated findings such as disc desiccation (62%) and ligamentum flavum hypertrophy (32%) were also prevalent. Importantly, the correlation between clinical and MRI findings (Table 5) showed that 95% of patients with radiculopathy had evidence of nerve root compression. Similarly, 85% of patients with a positive straight leg raising test had foraminal or paracentral herniation. Among patients with motor deficits, 62.5% had severe canal stenosis on MRI. All three cases with bladder/bowel involvement had large central herniations.

Table 1: Demographic Characteristics of the Study Population (n=50)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
≤30	6	12.00
31–40	18	36.00
41–50	16	32.00
>50	10	20.00
Sex		
Male	32	64.00
Female	18	36.00
Occupation		
Sedentary	22	44.00
Manual Labor	20	40.00
Others (e.g., housewife)	8	16.00
BMI Classification		
Normal	19	38.00
Overweight	21	42.00
Obese	10	20.00
Smoking Status		
Smoker	28	56.00
Non-Smoker	22	44.00
Comorbidities		
None	29	58.00
Diabetes Mellitus	8	16.00
Hypertension	9	18.00
Others	4	8.00

Table 2: Clinical Presentations of the Participants (n=50)

Clinical Feature	Categories	Frequency (n)	Percentage (%)
Low Back Pain		50	100.00
Radiculopathy		40	80.00
Leg Involvement	Left	18	36.00
	Right	20	40.00
	Bilateral	12	24.00

Numbness		35	70.00
Weakness		16	32.00
Bladder/Bowel Involvement		3	6.00
SLR Positive	Left	22	44.00
	Right	24	48.00
	Bilateral	16	32.00
Cross SLR Sign	Positive	12	24.00
Duration of Symptoms	<1 month	9	18.00
	1–3 months	21	42.00
	>3 months	20	40.00
Mean VAS Score (±SD)		6.9 ± 1.8	

Table 3: Neurological Examination Findings (n=50)

Parameter	Side	Normal	Decreased	Absent
Motor Power	Left	39	10	1
	Right	40	9	1
Sensory Deficit	Left	33	17	0
	Right	31	19	0
Patellar Reflex	Left	41	7	2
	Right	42	6	2
Achilles Reflex	Left	38	9	3
	Right	37	10	3

Table 4: MRI Findings among Participants (n=50)

MRI Parameter	Frequency (n)	Percentage (%)
Affected Level(s)		
L3–L4	3	6.00
L4–L5	24	48.00
L5–S1	18	36.00
Multiple Levels	5	10.00
Type of Herniation		
Protrusion	21	42.00
Extrusion	15	30.00
Sequestration	5	10.00
Bulge	9	18.00
Location of Herniation		
Central	11	22.00
Paracentral	28	56.00
Foraminal	7	14.00
Far lateral	4	8.00
Nerve Root Compression		
Present	38	76.00
Absent	12	24.00
Degree of Canal Stenosis		
Mild	14	28.00
Moderate	24	48.00
Severe	12	24.00
Disc Desiccation		
Present	31	62.00
Absent	19	38.00
Associated Findings		
Ligamentum flavum hypertrophy	16	32.00
Facet joint arthropathy	13	26.00
Modic changes	8	16.00

Table 5: Correlation Between Clinical and MRI Findings (n=50)

Clinical Finding	Corresponding MRI Finding	Frequency of Association (n)	Percentage (%)
Radiculopathy	Nerve Root Compression	38	95.00
Positive SLR	Foraminal / Paracentral Herniation	34	85.00
Motor Deficit	Severe Canal Stenosis (n=16)	10	62.5
Bladder Involvement	Large Central Herniation (n=3)	3	100.0
Numbness	Nerve Root Compression (n=35)	33	94.3

DISCUSSION

Lumbar intervertebral disc prolapse (LIDP) remains one of the most prevalent causes of low back pain and radiculopathy, especially among the working-age population. The current study aimed to analyze the correlation between clinical findings and magnetic resonance imaging (MRI) results in 50 patients diagnosed with lumbar disc herniation. Our findings demonstrate a high concordance between clinical symptoms such as radiculopathy, sensory deficits, and motor weakness and MRI-confirmed anatomical abnormalities, which is consistent with the existing body of literature.

In this study, the most affected age group was 31–50 years (68%), aligning with findings from various studies that report peak incidence of LIDP in the fourth and fifth decades of life due to degenerative disc changes and increased biomechanical stress on the spine [1,13]. The male predominance (64%) observed here is also well-documented, possibly attributed to higher rates of physically demanding labor and occupational exposure among men [14]. Low back pain was a universal symptom (100%) in our cohort, and 80% of patients presented with radiculopathy. This is consistent with findings by Sharma et al., who reported radiculopathy in 76% of LIDP patients [15]. The high prevalence of sensory disturbances (70%) and positive straight leg raising (SLR) tests (64%) also supports the classical clinical presentation of disc herniation. A study by Haig et al. emphasized the importance of SLR in diagnosing lumbar radiculopathy, though they also noted its limited specificity [16]. The most commonly involved disc level in our study was L4–L5 (48%), followed by L5–S1 (36%). These results are consistent with those of Rhee et al. and Modic et al., who identified these two levels as the most frequently affected due to increased axial load and mobility [7,17]. MRI findings revealed that the most frequent type of herniation was protrusion (42%), followed by extrusion (30%) and sequestration (10%). A similar distribution was observed in the work of Boos et al., who reported that disc protrusions were the most prevalent among patients with chronic lower back pain [18].

A significant observation was that 76% of patients had nerve root compression on MRI, most commonly associated with paracentral disc herniation (56%). Clinical correlation was robust in this group, as 95% of patients with radiculopathy demonstrated corresponding nerve root compression on imaging. This supports the hypothesis that radiculopathy is primarily a result of mechanical nerve impingement and associated inflammatory changes, as noted in biomechanical studies by Mixter and Barr [5]. Interestingly, 32% of patients had ligamentum flavum hypertrophy and 26% showed facet joint arthropathy, findings which often contribute to canal stenosis and compound neurological symptoms. These degenerative changes have been increasingly reported in conjunction with disc pathology in aging populations, as described by Kalichman et al. [19]. Bladder and bowel dysfunction, although rare (6%), was exclusively associated with significant central herniations and severe canal stenosis, which is consistent with the clinical diagnosis of cauda equina syndrome. The literature emphasizes the importance of urgent decompressive intervention in such cases to prevent permanent neurological deficits [20].

Despite the utility of MRI, it is essential to note that radiological findings do not always correlate with clinical symptoms. Boden et al. famously reported that asymptomatic individuals may still demonstrate disc bulges or protrusions on MRI, highlighting the risk of overdiagnosis if clinical context is ignored [21]. However, in our study, the correlation was notably high: 85% of positive SLR cases matched with foraminal or paracentral herniations, and 62.5% of patients with motor deficits had severe canal stenosis on imaging. This supports the notion that, while not definitive in isolation, MRI remains a powerful adjunct to clinical examination in diagnosing LIDP. Our findings underscore the importance of a comprehensive evaluation combining patient history, physical examination, and radiological studies. In clinical practice, this integrated approach enhances diagnostic accuracy, helps guide treatment decisions, and minimizes unnecessary surgical interventions. Conservative treatment remains effective for most patients, though surgical intervention is warranted in progressive neurological deficits or refractory cases [22].

Limitation of the study:

The primary limitation of this study was its relatively small sample size and cross-sectional design, which restricts the generalizability of findings. Furthermore, the use of a single MRI machine and institution may introduce minor diagnostic biases.

Longitudinal studies with larger cohorts could better elucidate predictive outcomes of clinical and radiological correlations.

CONCLUSION

In conclusion, the study demonstrates a strong correlation between clinical features and MRI findings in patients with lumbar prolapsed intervertebral disc. MRI is invaluable for confirming the level and type of herniation and its impact on nerve structures. However, clinical judgment should remain central to diagnosis and management, especially in cases with equivocal imaging findings.

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