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Correlation of clinical manifestation of lumbar disc prolapse with magnetic resonance imaging findings among adult patients

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ABSTRACT

BACKGROUND & OBJECTIVE: The most common cause of low back pain is disc prolapse. Disc prolapse occurs in both gender, but females are more prone to disc degenerative changes. The aim of this study was to determine the correlation between clinical findings and magnetic resonance imaging (MRI) findings of lumbar disc prolapse patients.

METHODOLOGY: This study recruited 32 participants of either gender, between the ages of 19 to 65, from the Radiology department of Shalamar Hospital. This study was carried out in six months with follow-up. Only diagnosed patients with lumbar disc prolapse on MRI were recruited. Numeric pain rating scale (NPRS) was used to identify the intensity of pain. History and neurological examinations were done in all diagnosed patients. All the findings of MRI were correlated with the clinical findings at different levels of lumbar vertebrae using Pearson correlation.

RESULTS: There was a statistically significant positive correlation of MRI findings with clinical findings in the presence of nerve root compression at the L1-L2 level of lumbar vertebrae. All abnormal findings on MRI did not correlate with clinical findings. There was a significant positive (p-value >0.05) correlation between clinical features (sensations, power and reflexes) and MRI findings at L1, L2, right L3 myotomes and L2 dermatome only.

CONCLUSION: There was a no correlation between MRI findings and clinical findings of patients with lumbar disc prolapse except L2 and L3.

KEYWORDS: Prolapse, Magnetic resonance imaging, Lumbar, Sacrum.

INTRODUCTION

Low back pain (LBP) is a musculoskeletal disorder that affects human health and impairs daily living activities. It occurs in the lumbar region due to high-impact forces. It causes muscle strain due to mechanical stress. LBP also occurs due to psycho-social factors and abnormal biomechanics. Deterioration in the structure of the spine changes the natural environment of the cells of the disc and results in cell-mediated degeneration that causes low back pain [1,2].

About 80% of patients of disc prolapse among the adult population present with LBP [3]. A disc is also called an intervertebral disc because it is between two adjacent vertebrae in the vertebral column. It makes a fibro-cartilaginous joint with adjacent vertebrae. It permits lesser motion of the vertebrae, supports the vertebra as a ligament and performs a shock absorber function for the spine[4].

The Intervertebral disc is easily ruptured from different underlying pathologies such as degeneration and diskitis, but disc prolapse is the most common pathology of the disc [5]. Disc prolapse means the nucleus pulposus is forced out through layers of annulus fibrosus. Disc prolapse occurs

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when there is pressure or stress on the spine, especially on the disc, due to trauma, poor posture and chronic destruction [6,7]. Disc prolapse is more common at the lumbar level, especially L4/L5 and L5/S1.

Clinical symptoms of disc prolapse patients vary widely[4]. Daily living activities like repetitive twisting, bending, or heavy lifting triggers pain in the lower back region which may radiate to the buttock and posterior thigh below the knee level and along the dermatome [8].

Disc prolapse at multiple sites increases the chances of clinical symptoms that may cause functional limitations. Disc prolapse of the same size may be asymptomatic in one person or symptomatic in another person [9]. The signs and symptoms of patients can be clinically helpful in assessing the root cause of L4/L5 and L5/S1 disc prolapse. The clinical assessment includes a detailed history, physical examination (sensory and motor), pain distribution and reflexes (knee jerk and ankle jerk).

If the symptoms of patients with disc prolapse are very severe, then different imaging studies like magnetic resonance imaging (MRI) or computerized tomography (CT scan) can be used to find out the cause. The MRI is a highly sensitive and gold standard investigation for disc prolapse [9], but sometimes, it shows incidental findings in asymptomatic patients [10].

MRI is non-invasive and does not use ionizing radiation [11]. It detects soft tissues better than a CT scan. It is used for both diagnostic and prognostic purpose. Through MRI, pathoanatomical changes in lumbar disc prolapse can be visualized, but it is not a specific test [12].

1.5 Tesla MRI is most frequently used in most setups, including our study. The 1.5 Tesla MRI scan is used to determine the clinical and intraoperative findings in patients with lumbar disc herniation [13].

Evidence regarding the correlation between MRI findings and clinical symptoms of disc prolapse is not sufficient [14,15]. This study will help to establish that correlation and add knowledge to the currently available evidence.

The purpose of this study was to find out the correlation of MRI findings with clinical symptoms on examination in patients with disc prolapse and observe that the subjects with positive MRI findings were either symptomatic or asymptomatic. Many patients can be managed with physiotherapy. According to the literature review, there is insufficient data that correlates clinical and radiological findings simultaneously. Community significance is that every patient cannot afford MRI in our part of the world as it is an expensive investigation, so the patient can be managed on the basis of clinical findings.

METHODOLOGY

This observational, correlational study was carried out in the Radiology department of Shalamar Hospital Lahore. Non-probability convenient sampling was used in this research. We set our inclusion and exclusion criteria. After the approval of IRB (letter number/0247), we conducted the study. The study duration was 6 months. The patient having age between 19-65 years, both male and female, and diagnosed with lumbar disc prolapse on MRI were included in the study. In our exclusion criteria, we ruled out the spinal tumor and pregnancy and history of spinal trauma.

Thirty-Two patients of age 19-65years (both gender) who were diagnosed on MRI on the basis of inclusion criteria were includedin the study. Consent was taken from all patients. Patients with lumbar disc prolapse, which was diagnosed on MRI, were interviewed. Their detailed history and examination was conducted, and the responses were recorded in proforma.

MRI films and reports of L1/L2, L2/L3, L3/L4, L4/L5 and L5/S1 disc prolapse patients were reviewed. Clinical symptoms, including pain distribution, duration of pain and intensity of pain was assessed using the Numeric Pain Rating Scale, NPRS (0-10) [13], nerve root compression signs, and neurological signs were assessed at the dermatome level, and the response was recorded in proforma. After clinical assessment, the investigator checked the pinprick sensations using pins, needles or cotton at specific dermatomes (L1, L2, L3, L4, S1). Firstly, the investigator taped the particular dermatome with pins, needles or cotton and asked the patient whether he/she felt it or not and graded the response using the American Spinal Cord Injury Association Impairment (ASIA) scale[16]. Muscle tone and muscle power were checked at specific myotomes by using a power grading scale, and deep tendon reflexes (knee jerk reflex and ankle jerk reflex) were assessed by using a reflex hammer. Investigator taped the patellar tendon with the reflex hammer [14] for the contraction of quadriceps muscles [17] and then taped the Achilles tendon for gastrocnemius contraction, and the response was recorded.

Investigator co-related all these clinical features of disc prolapse with MRI findingst. All information was kept confidential, and there were no risks to the participants.

The data were entered and analysed using statistical package for social sciences (SPSS 23). Frequencies and percentages were calculated. Correlation between the variables was seen using Pearson correlation coefficient. Results were considered significant if p-value is ≤ 0.05.

RESULTS

The study included 32 participants (14 males and 18 females) between the age of 19 to 65 years. The results showed that above 50 years old patients (females more than males) were more prone to have disc prolapse with a percentage of 62.5%. About 17(53.1%) females were housewives, about 6(18.8%) people were a teacher, about 5(15.6%) people were workers, about 1(3.1%) people were a student, and about 3(9.4%) person were farmer.

The general demographic features of the study population, pain severity, duration and site of disc prolapse are presented in table-I. The results show that a high percentage of disc prolapse was found at the level of L4/L5.

Table-I: General demographic features and frequency of pain severity, duration and site.

Variables	Groups	n(%)
Age	20-30yr	2(6.3%)
	30-40yr	4(12.5%)
	40-50yr	6(18.8%)
	>50yr	20(62.5%)
Gender	Male	14(43.8%)
	Female	18(56.3)
Farmer	Housewife	17(53.1%)
	Teacher	6(18.8%)
	Worker	5(15.6%)
	Student	1(3.1%)
	Farmer	3(9.4%)
NPRS	Mild pain	7(21.9%)
	Moderate pain	23(71.9%)
	Severe pain	2(6.3%)
Pain duration	1-2 weeks	19(59.4%)
	2-6 weeks	8(25%)
	6-12 weeks	5(15.6%)
Disc Prolapse level	L1-L2	1(3.1%)
	L2-L3	1(3.1%)
	L3-L4	6(18.8%)
	L4-L5	10(31.3%)
	L5-S1	8(25%)
	All Levels	6(18.8%)

Table-II shows a negative correlation between pain intensity and MRI findings at L1-L2, L2-L3, L4-L5 and L5-S1 but at L3-L4, this shows a positive correlation between pain intensity and MRI findings but the results are insignificant.

Table-II: Correlation among pain intensity and MRI findings.

	Intensity of pain	
MRI findings of lumbar vertebral levels	**r**	**p-value**
L1-L2	-.277	0.125
L2-L3	-.022	0.905
L3-L4	.234	0.197
L4-L5	-.079	0.667
L5-S1	-.268	0.138

r: Pearson correlation coefficient;

Table-III shows the correlation among MRI findings and clinical features of lumbar disc prolapse at specific dermatomes and myotomes and deep tendon reflexes (knee and ankle) and pain intensity.

According to Pearson Correlation and 2-tailed test of significance, these results showed us that at the L1-L2 level of disc prolapse, there was a significant positive correlation of MRI findings with right and left L1 myotome, right and left L2 dermatome and myotome (hip flexors) but not well correlated with a knee jerk and ankle jerk reflexes. At the L2-L3 level, there was a significant positive correlation of MRI findings with right and left L2 dermatome and myotome, right L3 myotome and an insignificant correlation with other variables. At the L3-L4 level, there was a significant positive correlation at right L3 myotome only.

At L4-L5 and L5-S1 levels, there was an insignificant correlation of MRI findings with right and left L4, L5 and S1 dermatomes, myotomes, knee jerk reflex and ankle jerk reflex. These results also showed us a negative correlation of pain intensity and MRI findings at all levels of the lumbar spine except L4 according to Pearson Coefficient Correlation, but this correlation was insignificant.

Table-III: Correlation among MRI findings and clinical findings.

Vertebral level			Sensations of Dermatomes		Power of Myotomes		Knee Jerk Reflex		Ankle Jerk Reflex	
			r	p-value	r	p-value	r	p-value	r	p-value
MRI Findings at Lumbar Vertebrae	L1	Right	0.305	0.089	0.557	0.001*	0.302	0.093	0.209	0.252
		Left	0.236	0.193	0.374	0.035*	0.345	0.053	0.297	0.099
	L2	Right	0.561	0.001*	0.557	0.001*	0.302	0.093	0.209	0.252
		Left	0.561	0.003*	0.374	0.035*	0.345	0.053	0.297	0.099
	L3	Right	0.249	0.169	0.376	0.034*	0.191	0.294	0.209	0.252
		Left	-.063	0.732	0.147	0.423	0.229	0.208	0.297	0.099
	L4	Right	.149	0.415	-.029	0.873	-.251	0.166	-.023	0.901
		Left	.139	0.448	-.182	0.318	-.226	0.213	-.033	0.859
	L5	Right	.070	0.704	.118	0.519	0.300	0.096	0.051	0.784
		Left	-.062	0.738	.061	0.739	0.233	0.200	0.072	0.696
	L6	Right	.231	0.204	0.106	0.563	0.258	0.153	0.048	0.793
		Left	.094	0.610	0.139	0.448	0.321	0.073	0.185	0.312

L: Lumbar ; S: Sacral; r: Pearson correlation coefficient; p-value ≤ 0.05 is significnat

DISCUSSION

This observational, correlational study was conducted to determine the clinical significance of lumbar disc prolapse, and it's correlation with MRI findings among adult patients. In this study, 32 participants were recruited between the ages of 19 to 65 years. After obtaining consent from participants who fell in the inclusion criteria, the intensity of pain of

these participants using NPRS was noted. Then, clinically examine the symptoms of all participants at specific dermatomes and myotomes (L1, L2, L3, L4, L5 and S1). It was found that the incidence of disc prolapse was higher in females at L4-L5 level than in males and symptoms of these patients were not well correlated with abnormalities observed in MRI.

A research was conducted in order to see the association between physical findings, MRI findings and nerve conduction studies (NCS)[18] among patients with lumbosacral radiculopathy. The study showed that about 30% of patients had radiculopathy at L4-L5 and 7% had radiculopathy at L5-S1, and their abnormalities on MRI were strongly associated with the dermatome distribution of L5 and S1, but NCS tests were poorly correlated with these clinical symptoms [19]. However, in our study, it was concluded that 31.3% of patients had disc prolapse at L4-L5 with radicular symptoms, and 25.0% of patients had disc prolapse at L5-S1 with radicular symptoms. These radicular symptoms were not well correlated with MRI findings of disc prolapse at all levels, but at L1-L2, there was a good correlation of MRI findings with L2 dermatome and myotome.

Another research conducted on patients with low back pain to find out its correlation with MRI concluded that the intensity of pain and disability in lumbar disc prolapsed patients were negatively correlated with abnormalities in MRI at all levels of the lumbar spine [20]. However, in our study, results showed that pain intensity was negatively correlated with L1-L2, L2-L3, L4-L5 and L5-S1 levels except for L3-L4 levels, but this correlation was insignificant. This study is consistent with previous studies who reported that pain negatively correlated with MRI findings.

Another study conducted to determine the correlation between clinical symptoms and MRI findings. This study showed that patients with disc prolapse without compression of nerve roots did not produce symptoms, but patients who had disc prolapse with nerve root compression were producing symptoms, and these symptoms were positively correlated with MRI findings[11,20]. Similarly, another research conducted to find out the correlation of clinical manifestations with nerve root compression findings on MRI, showed that mild to moderate nerve root compression with disc bulging on MRI did not correlated with clinical features of disc bulge, but severe compression or bulge was strongly correlated with dermatomal pain patterns [21].

However, in our study, it was concluded that disc prolapse with mild, moderate, or severe compression of nerve roots at any level of the lumbar spine showed clinical symptoms that were not significantly correlated with abnormalities in MRI, but there was a significant positive (p-value >0.05) correlation between clinical features (sensations, power and reflexes) and MRI findings at L1, L2, right L3 myotomes and L2 dermatome. Similar studies on larger number of population and including multicenters with extended analysis can help in better understanding of this relation.

LIMITATIONS:

It was a single center study with limited sample size due to the presence of COVID-19.

CONCLUSION

On the basis of results, it was concluded that the clinical significance (sensations, power, reflexes) of L1/L2 and L2/L3 disc prolapse was significantly correlated with MRI findings, but clinical findings of, L3/L4, L4/L5, and L5/S1 disc prolapse were insignificantly correlated with findings of MRI among the adult population.

It was also concluded that most patients with disc prolapse observed on MRI were asymptomatic, but few were symptomatic. So, detailed clinical examination and MRI investigation are more important to identify the symptoms.

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Author's Contribution:

Hamna Nasir: Substantial contributions to the conception and design of the work.
Usman Sarwar: Acquisition, analysis, and interpretation of data for the work.
Sumair Nasim Qureshi: Drafting the work and revising it critically for important intellectual content.
Manqoosh-ur-Rehman: Performed the statistical analysis and participated in its design.
Amjad Maqsood: Data collection and manuscript writing.
Saba Saif: Interpretation of data for the work.

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