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CORREALTION BETWEEN THE CLINICAL FEATURES AND MRI FEATURES OF DISC PROTRUSION

Hafiza Shagufta Batool[*1], Saba Waheed[2], Sadia Shahid[3], Yusra Khursheed[4]

[*1,2,3,4]*Department of Radiography and Imaging Sciences, The University of Faisalabad (TUF)*

[*1]shaguftabatool.rad@tuf.edu.pk, [2]sabazunair5@gmail.com, [3]sadiaranaz589@gmail.com, [4]yousrakhursheed654@gmail.com

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Lumbar disc protrusion, MRI, low back pain, nerve root compression, clinical correlation.

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Hafiza Shagufta Batool

Abstract

Background: *Lumbar disc protrusion is a common cause of lower back pain and may lead to nerve root compression, spinal canal stenosis, and radiating pain. Magnetic resonance imaging (MRI) is an important diagnostic tool for identifying disc abnormalities and evaluating their relationship with clinical symptoms. However, MRI findings do not always correspond to the severity of patients' symptoms.*

Objective: *To assess the correlation between clinical features and MRI findings in patients with lumbar disc protrusion.*

Materials and Methods: *A cross-sectional analytical study was conducted at Madina Teaching Hospital, Faisalabad, over a period of four months. A total of 60 patients aged 17–70 years were included through convenient sampling. Both male and female patients were enrolled. Clinical information was collected through patient history, while MRI examinations were performed using a Siemens 1.5 Tesla scanner. Data were analyzed using SPSS version 26. Pearson correlation was applied to assess the relationship between clinical and MRI findings.*

Results: *Among 60 patients, 32 (53.33%) were male and 28 (46.67%) were female. The mean age was 41.08 ± 14.12 years. Pain was present in 53 (88.33%) patients, with lower back pain being the most common complaint (79.25%). The most frequently affected disc level was L5-S1 (46.67%), followed by L4-L5 (35%). Nerve root compression was observed in 65% of patients, while spinal canal stenosis was present in 30%. A weak positive correlation was found between clinical and MRI features ($r = 0.144$, $p = 0.271$), which was not statistically significant.*

Conclusion: *MRI is valuable for identifying lumbar disc protrusion and associated structural changes. However, MRI findings should be interpreted alongside clinical symptoms and examination findings.*

INTRODUCTION

Low back pain is one of the most common disorders worldwide, with a lifetime prevalence of 70–85% [1]. It is most frequent between the ages of 30 and 50, and men are affected about twice as often as women. Symptomatic lumbar disc herniation is less common, at roughly 1–3% in Finland and Italy depending on age and sex. In adults aged 25–55, about 95% of herniations occur at L4/5 and L5/S1, while herniation above

these levels is more typical after age 55 [2]. Globally, an estimated 266 million people (3.63%) are affected each year by degenerative spondylolisthesis or disc-related low back pain, with the highest incidence in Europe (5.7%) and the lowest in Africa (2.4%). Low- and middle-income countries carry about four times as many cases as high-income countries [3]. The burden on health systems is large. In the UK, about 4% of people take time off work because of low back pain, which accounts for around 90 million lost working days and 8–12 million general practitioner visits a year [4]. In Germany, point prevalence is about 30–40% [5].

Disc herniation is classified by shape. In a protrusion, the distance between the edges of the herniated material is smaller than the distance at its base. In an extrusion, it is larger, and the defect usually involves a tear in the annulus fibrosus, so the material is typically not contained [6]. The nerve roots and spinal cord run through the vertebral canal, and each cord segment supplies a dermatome, so a protrusion that narrows the canal or neural foramen can produce pain, sensory change or weakness in a predictable distribution [7,8].

The intervertebral disc depends on its extracellular matrix for its mechanical function. With age, the boundary between annulus and nucleus blurs, the nucleus becomes more fibrous and less gel-like, and the annular lamellae become irregular. Clefts form, cells proliferate and die, and nerves and blood vessels grow into the disc. Changes of this kind appear even in young people, which makes it hard to separate normal ageing from pathology [9]. The cause of herniation is also debated. Traditionally it is attributed to annular rupture with extrusion of the nucleus pulposus and irritation of nerve fibres, but Rajasekaran et al. suggested that failure at the endplate junction is a more common mechanism [11]. Inflammation adds a further complication. It is linked to pain, yet it also appears to drive the spontaneous regression of herniated discs [10].

MRI is the standard imaging method for disc disease. It uses no ionising radiation, produces multiplanar images with high soft-tissue contrast, and localises changes in individual discs precisely. T1-weighted, T2-weighted and proton density sequences emphasise different tissue properties, which allows variations in disc shape and hydration to be detected (Table 1) [13–15]. Lumbar MRI is clearly indicated when neoplastic or infectious disease is suspected or when neurological impairment is present. Its use in uncomplicated low back pain is more controversial. The technique detects bulging and herniated discs and distortion of the thecal sac or nerve roots very well, but the diagnostic accuracy of most anatomical findings for explaining back pain symptoms is low or unknown [13].

This limitation matters in practice. Herniated discs appear on imaging in 30–40% of people with no symptoms [12], so a positive scan does not by itself explain a patient's pain. For that reason MRI findings have to be read alongside the history and clinical examination. Whether the features seen on MRI, such as the level of the protrusion, its size and its effect on neighbouring structures, actually track with patients' symptoms remains uncertain, and local data are limited.

This study therefore examined the correlation between clinical features and MRI findings in patients with lumbar disc protrusion at Madina Teaching Hospital, Faisalabad.

Materials and Methods

We carried out a cross-sectional analytical study at Madina Teaching Hospital, Faisalabad, over four months. Sixty patients with lumbar spine pain were recruited by convenience sampling. Men and women were both eligible, as were patients with traumatic or non-traumatic lumbar spine pathology. We excluded patients who could not have an MRI, for example because of metallic implants, surgical clips or metallic rods, as well as those who were claustrophobic or uncooperative. The hospital ethical committee gave permission for the study. After a relevant history was taken

from each patient, a lumbar spine MRI was performed, and senior radiologists reported the scans. All data were recorded on a predesigned proforma.

All examinations used a Siemens 1.5 Tesla scanner with a slice thickness under 3 mm. The protocol comprised sagittal STIR, sagittal T1-weighted, sagittal T2-weighted, axial T1-weighted and axial T2-weighted sequences. Data were entered in Microsoft Excel 2010 and analysed in SPSS version 26. We used Pearson correlation to test the relationship between clinical and MRI feature

Results

This was a cross-sectional analytical study on 60 patients. In this study both the symptomatic and asymptomatic patients were taken. The mean age of patients was 41 years. Among these 60 patients 32 (53.33%) patients were male and 28 (46.67%) were females. 53 (88.33%) patients were presenting with pain and 7 (11.67%) were having no pain. All the patients were diagnosed with disc protrusion at different levels of their vertebrae.

Table 1: Demographic data and frequency of the patients based on the Clinical and MRI features

Variables			Count	Column %	N
Demographic Data	**Age**	17 to 30	15	25%	60
		31 to 40	16	26.67%	
		41 to 50	9	15%	
		51 to 60	14	23.33%	
		61 to 70	6	10%	
	Gender	Male	32	53.33%	60
		Female	28	46.67%	
Clinical Features	**Pain**	Present	53	88.33%	60
		Absent	7	11.67%	
	Location of pain	Upper back	5	9.43%	53
		Lower Back	42	79.25%	
		Pain in legs	6	11.32%	
	Radiation of pain	Radiating	40	75.47%	53
		Non-Radiating	13	24.53%	
MRI Features	**Location of protrusion**	L2-L3 vertebrae	2	3.33%	60
		L3-L4 vertebrae	2	3.33%	
		L4-L5 vertebrae	21	35%	
		L5-S1 vertebrae	28	46.67%	
	Size of Protrusion (mm)	1 to 2	33	55%	60
		2 to 3	27	45%	
	Relationship to adjacent organs	Spinal Canal Stenosis	18	30%	60
		Nerve Root Compression	39	65%	
		Compression on Thecal Sac	3	5%	

Table 1 represents demographic data and frequency of the patients based on the clinical and MRI features. It is clear from the above mentioned data that 15 (25%) patients were in age group (17

to 30), 16 (26.67%) patients in age group (31 to 40), 9 (15%) patients in age group (41 to 50), 14 (23.33%) patients in age group (51 to 60) and 6 (10%) in age group (61 to 70). Out of 60, 32 (53.33%) patients were males and 28 (46.67%) were females. Clinical features shows that pain is present in 53 (88.33%) patients and absent in only 7 (11.67%) patients. Out of these 53 patients who were presenting with pain, 5 (9.43%) patients were presenting pain in upper back, majority of patients 42 (79.25%) were having pain in lower back and 6 (11.32%) patients were having pain in legs. In bulk of the patients 40 (75.47%) pain was radiating and in only 13 (24.53%) patients pain was non-radiating. MRI features shows that most of the patients 28 (46.67%) were showing disc protrusion at the level of L5-S1 vertebrae, 21 (35%) were at level of L4-L5 vertebrae, 2 (3.33%) were at level of L3-L4 vertebrae and 2 (3.33%) at L2-L3 vertebrae. Size of protrusion shows 33 (55%) protrusions were in between 1mm to 2mm and 27 (45%) were in between in 2mm to 3mm. Spinal canal stenosis was present in 18 (30%) patients, nerve root compression in 39 (65%) patients and compression on thecal sac in 3 (5%) patients.

Figure 1 shows the pie chart representing the frequency of male and female patients in study.

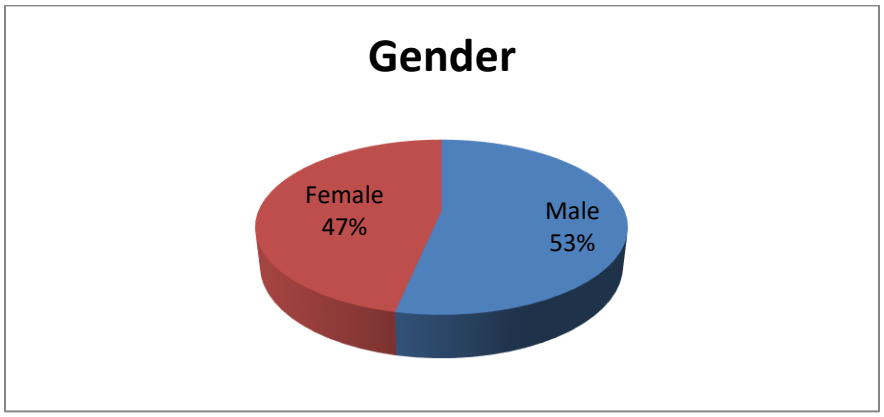


Figure 1: Frequency of patient gender representing by pie chart

Table 2: Descriptive analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Age of patient	60	17.00	70.00	41.0833	14.1244
Size of Protrusion (mm)	60	1.1	2.8	1.9367	0.4755
Valid N (listwise)	60				

The table 2 shows the descriptive statistics of 60 patients in which minimum age is 17 and maximum age is 70 with mean and standard deviation as 41.0833 and 14.1244 respectively. The size of the protrusion on MRI has standard deviation of 0.4755, mean of 1.9367, minimum size of 1.1 and maximum size of tumor as 2.8.

Figure 2 shows bar graph representing frequency of 60 patients in different age groups. 15 (25%) patients were in age group (17 to 30), 16 (26.67%) patients in age group (31 to 40), 9 (15%) patients in age group (41 to 50), 14 (23.33%) patients in age group (51 to 60) and 6 (10%) in age group (61 to 70). Out of 60, 32 (53.33%) patients were males and 28 (46.67%) were females.

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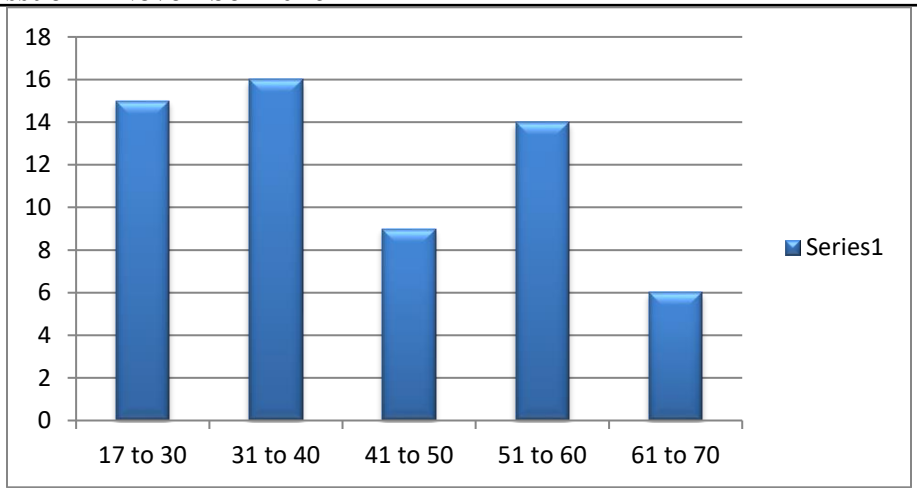


Figure 2: Frequency of patient age representing by bar graph

Figure 3 shows pie chart representing frequency of 53 patients with respect to location of pain. Out of these 53 patients who were presenting with pain, 5 (9.43%) patients were presenting pain in upper back, majority of patients 42 (79.25%) were having pain in lower back and 6 (11.32%) patients were having pain in legs.

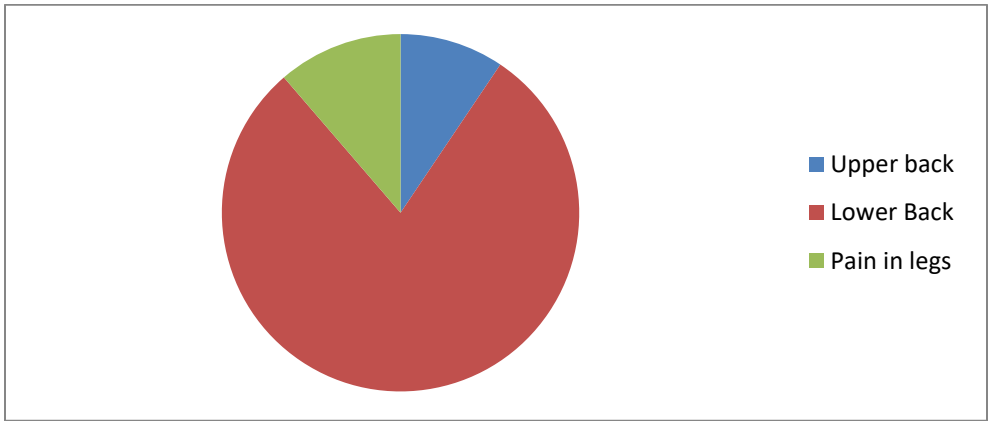


Figure 3: Frequency of location of Pain representing by pie chart

Table 3: Correlation between clinical features and MRI features

		Clinical Features	MRI Features
Clinical Features	Pearson Correlation	1	.144
	Sig. (2-tailed)		.271
	N	60	60
MRI Features	Pearson Correlation	.144	1
	Sig. (2-tailed)	.271	
	N	60	60

The correlation matrix shows positive correlation between the clinical features and MRI features. The results show that the protrusion which causing compressions on adjacent structures like nerve roots are more likely to cause clinical sign and symptoms and in our data, almost all the

protrusions were causing impressions on the adjacent structures.

Figure 4 shows bar graph representing multiple locations of disc protrusion on MRI in 60 patients.

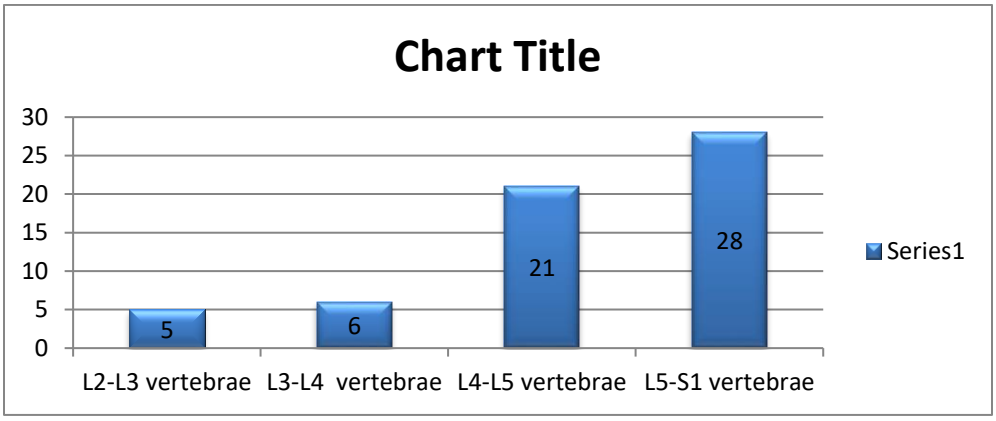
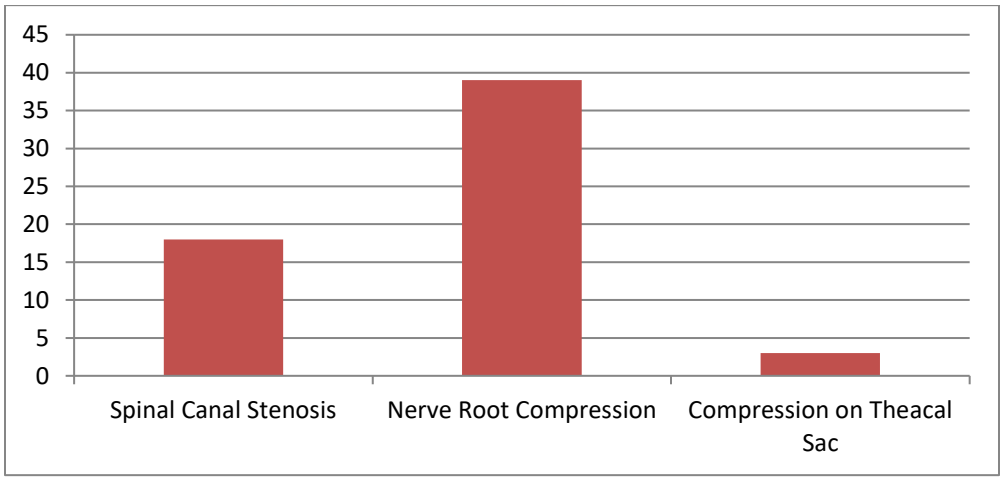


Figure 4: Frequency of location of disc Protrusion representing by bar graph

Figure 5 shows bar graph representing relationship of disc protrusion to adjacent structures of on MRI in 60 patients. Spinal canal stenosis was present in 18 (30%) patients, nerve root compression in 39 (65%) patients and compression on thecal sac in 3 (5%) patients.



Discussion

This was a cross-sectional analytical study on 60 patients. Both the symptomatic and asymptomatic patients were taken. The mean age of patients was 41 years. Among these 60 patients 32 (53.33%) patients were male and 28 (46.67%) were females. 53 (88.33%) patients were presenting with pain and 7 (11.67%) were having no pain. All the patients were diagnosed with disc protrusion at different levels of their vertebrae.

MRI features shows that most of the patients 28 (46.67%) were showing disc protrusion at the level of L5-S1 vertebrae, 21 (35%) were at level of L4-L5 vertebrae, 2 (3.33%) were at level of L3-L4 vertebrae and 2 (3.33%) at L2-L3 vertebrae. Spinal canal stenosis was present in 18 (30%) patients, nerve root compression in 39 (65%) patients and compression on thecal sac in 3 (5%) patients.

The correlation matrix shows positive correlation between the clinical features and MRI features. The results show that the protrusion which causing compressions on adjacent structures like nerve roots are more likely to cause clinical sign and symptoms and in our data, almost all the

protrusions were causing impressions on the adjacent structures. However, the nature of the impression caused by protrusion is different as spinal stenosis, nerve root compression and thecal sac compression.

The results of our study, matched with the results of Bajpai et al[1], who concluded that there is a significant correlation between clinical and MRI findings. Same results were shown by Alexander Baker[2] in a prospective study. There are more researches which coincides with our findings like Boos et al[3], Kerr et al[4], Masui et al[5] and Broetz et al[6].

Another study was found by Yousif et al[7], they found strong correlation between abnormal clinical findings and abnormal MRI finding as similar to our study. Moreover, in their study nerve room compression was found in 66% of patients which is almost equal to our findings as in our study there were 65% patients with nerve room compression.

Szypryt et al[8], found all the patients with abnormal MRI findings as disc protrusion. This also coincides with our study as all the patients in our study were diagnosed with disc protrusion on MRI. In addition the difference is both studies is the sample size, they included data from a large sample size and we used a smaller sample size of 60 patients.

Another study was proposed by Janardhana et al[9] who concluded that the centrolateral ectrusion or protrusion has significant correlation with the clinical findings but disc bulge and protrusion that are central do not correlate well with the sign and symptoms. In our study same phenomenon occurs as neural foramen compromise can cause sign and symptoms in patients. Moreover, disc protrusion level or location is also an important factor for production of clinical sign and symptoms.

Panezai et al[10] found in their study that almost half of the symptomatic patients having lumber spinal stenosis and they found that this is the main reason of problems in aged persons as in our study we also find most of our patients with symptoms, disc protrusion causing spinal stenosis. Thus, they have relationship with each other to some extent. However, there is a difference in patient age that this study included patients more than 50 years of age and their results are according to that and our study included younger patients also.

Conclusion

The present study concludes that there is a positive but statistically non-significant correlation between the clinical features and MRI findings of lumbar disc protrusion (Pearson correlation coefficient = 0.144, p = 0.271). The findings indicate that lumbar disc protrusion is commonly associated with clinical symptoms, particularly low back pain and radiating pain. The most frequently involved level was L5-S1 (46.67%), followed by L4-L5 (35%). Nerve root compression was the most common MRI finding, observed in 65% of patients, followed by spinal canal stenosis (30%) and thecal sac compression (5%). The majority of patients (88.33%) presented with pain, with lower back pain being the most frequently reported symptom (79.25%). These findings suggest that MRI plays an important role in identifying the location, size, and associated neural effects of disc protrusion. However, MRI findings should always be interpreted in conjunction with clinical history and physical examination to establish an accurate diagnosis and guide appropriate treatment.

Limitations of the Study

This study had several limitations. Firstly, the sample size was relatively small, consisting of only 60 patients, which may limit the generalizability of the findings to the wider population. Secondly, the study was conducted at a single hospital, Madina Teaching Hospital, Faisalabad, which may not represent patients from other healthcare settings. Thirdly, convenient sampling was used, which may have introduced selection bias. The study was conducted over a short duration of four months, limiting the ability to assess long-term clinical outcomes. Furthermore, the correlation analysis was limited by the available clinical and MRI variables, and detailed information regarding neurological examination, severity of pain, duration of symptoms, and functional disability was not included. The presence of disc protrusion in all participants also limited the comparison

between patients with and without disc protrusion. Therefore, the results should be interpreted with caution.

Recommendations

Based on the findings of this study, it is recommended that MRI of the lumbar spine should be considered an important diagnostic tool in patients with suspected lumbar disc protrusion, particularly those presenting with persistent low back pain, radiating pain, or neurological symptoms. MRI findings should be correlated with clinical history and physical examination rather than being considered independently, as disc abnormalities may also be present in asymptomatic individuals. Future studies should include a larger sample size, multiple healthcare centers, and random sampling techniques to improve the reliability and generalizability of results. Researchers should also investigate the relationship between specific MRI characteristics, such as the location, size, type, and severity of disc protrusion, nerve root compression, and clinical parameters, including pain intensity, neurological deficits, and functional disability. Longitudinal studies are also recommended to evaluate changes in MRI findings and their relationship with clinical improvement following conservative or surgical treatment.

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