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EVALUATING DIFFERENT LEVELS OF DISC BULGES OF THE LUMBAR SPINE WITH LOW BACK PAIN THROUGH MRI IN THE POPULATION OF DERA ISMAIL KHAN, PAKISTAN

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Abstract

Background: Low back pain (LBP) is one of the most common debilitating conditions and is frequently associated with lumbar disc bulges. Magnetic resonance imaging (MRI) plays a vital role in identifying disc bulges and determining their association with pain severity. Objective: To evaluate the frequency of lumbar disc bulges at various levels of the lumbar spine using MRI among the population of Dera Ismail Khan, Pakistan, and to assess their association with the severity of low back pain. Methods: A descriptive cross-sectional study was conducted among residents of Dera Ismail Khan, Pakistan. Data were collected through a questionnaire and lumbar spine MRI scan reports. Low back pain severity was assessed using the Modified Brief Pain Inventory (BPI). Participants were selected through a convenience sampling technique according to predefined inclusion and exclusion criteria. Data were analyzed using SPSS software, and Pearson's chi-square test was applied to determine associations. Results: A total of 384 patients were included, comprising 52.9% males and 47.1% females. The mean age of patients experiencing low back pain was 42 years. The most frequent levels of lumbar disc bulges were L5-S1 (24.7%), combined L4-L5 and L5-S1 (24.2%), and L4-L5 (18.8%). Severe low back pain was reported by 84.0% of patients across all disc bulge levels and was particularly common among patients with multiple-level disc bulges. Moderate pain was most frequently observed in patients with disc bulges at L4-L5 and L5-S1 levels. Among patients without lumbar disc bulges, 15.9% reported mild low back pain. Mild pain was reported by 21.7% of patients with combined L4-L5 and L5-S1 disc bulges and by 27.5% of patients with L5-S1 disc bulges. Severe low back pain was

more prevalent among females (57.4%) than males (42.6%), whereas mild low back pain was more common among males (71.0%) than females (29.0%). Conclusion: The findings indicate that lumbar disc bulges at multiple spinal levels are associated with greater pain severity compared to single-level disc bulges. The L5-S1 and combined L4-L5/L5-S1 levels were the most frequently affected sites among patients with low back pain.

INTRODUCTION

Low back pain (LBP) is one of the leading causes of disability worldwide and contributes significantly to disability-adjusted life years (Mohd Isa et al., 2023). The global prevalence of LBP has been reported as approximately 9.4%, with first-time episodes showing a 1-year incidence ranging from 6.3% to 15.4% (Fatoye et al., 2023). LBP represents a major public health concern because it affects daily activities, quality of life, and work productivity. Despite its global burden, limited information is available regarding the frequency and severity of lumbar disc bulges, particularly in developing regions such as rural Pakistan.

Magnetic resonance imaging (MRI) is considered the preferred imaging modality for evaluating lumbar disc pathology due to its non-invasive nature, absence of radiation exposure, multiplanar capability, superior soft tissue contrast, and accurate visualization of intervertebral disc changes (Suthar et al., 2015). MRI allows identification of structural abnormalities including disc bulges, herniation, degeneration, and other spinal changes. Understanding the relationship between lumbar disc bulges at different spinal levels and LBP severity is essential for early diagnosis, appropriate management, and preventive strategies.

The vertebral column consists of cervical, thoracic, lumbar, sacral, and coccygeal regions. It provides structural support, protects the spinal cord, maintains posture, enables movement, and transfers body weight from the trunk to the pelvis and lower limbs (Khumalo., 2018; Snell., 2012; Bogduk., 2016). The lumbar vertebrae are designated from L1 to L5 according to their anatomical position, with each segment contributing to spinal stability and mobility (bidin A., 2017). Degenerative changes in the lumbar spine can affect its normal biomechanics and may contribute to pain and functional limitations (Frost et al., 2019).

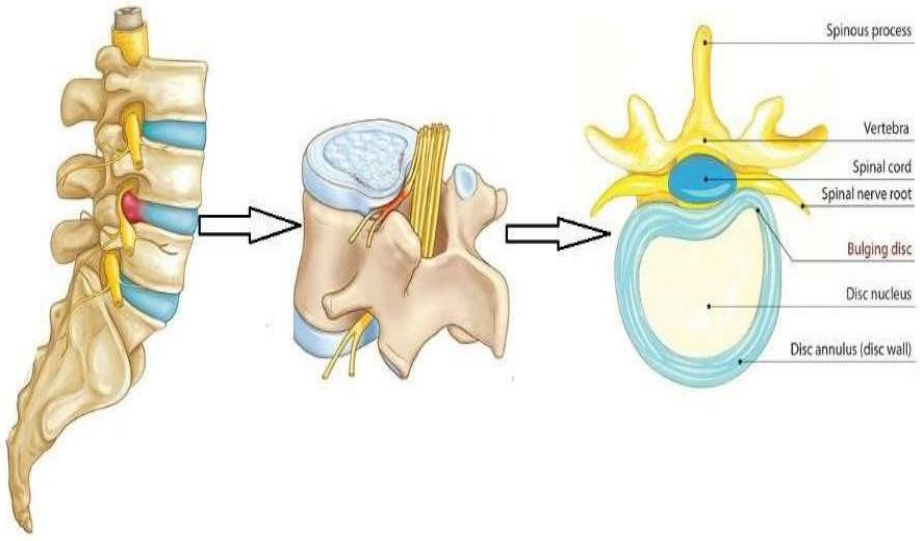

Figure: Spinal anatomy with a bulging disc (Abed & Suzani, 2024)

Intervertebral discs are fibrocartilaginous structures located between adjacent vertebrae that provide flexibility and absorb mechanical stress. Age-related degeneration of these discs is common, with degenerative changes observed in a large proportion of individuals above 50 years of age (Salam et al., 2023a). Lumbar disc herniation occurs when the nucleus pulposus protrudes through the annulus fibrosus, while disc bulging refers to extension of disc tissue beyond the normal disc margins (Mehmood et al., 2024). These changes may contribute to nerve compression, spinal stenosis, and varying degrees of low back pain.

Although many cases of LBP are non-specific and resolve without major intervention, a proportion of patients develop chronic symptoms lasting more than three months, resulting in significant personal and economic burden (Mir et al., 2021). Approximately 90% of LBP cases are considered non-specific, where no definite anatomical cause can be identified (Panagopoulos et al., 2017). However, lumbar disc abnormalities detected through imaging are frequently investigated due to their possible association with pain severity and disability.

Previous studies have reported that lumbar disc degeneration, disc bulges, and herniation are commonly observed findings among patients with LBP. MRI studies in asymptomatic individuals have also demonstrated disc abnormalities, including disc bulges and herniations, indicating that imaging findings should be interpreted alongside clinical symptoms (Kinkade, 2007). The relationship between structural abnormalities and pain severity remains complex because biological, psychological, and social factors may influence chronic low back pain outcomes (Ho et al., 2024).

Several factors contribute to the development and severity of LBP, including age, occupational activities, obesity, posture, lifestyle, and spinal degeneration. Obesity has been associated with increased LBP severity and disability, although body composition factors such as muscle and fat distribution may also influence musculoskeletal health (Hussain et al., 2017). Lumbar lordosis, sacral inclination, and lumbosacral angle are also considered important parameters related to spinal function and LBP development (Wagh., 2022).

Disc bulging is commonly observed at lower lumbar levels, particularly L4-L5 and L5-S1, due to increased mechanical loading in these regions. Previous studies have demonstrated that disc bulges at multiple lumbar levels may increase the likelihood of nerve compression and severe symptoms (Tonosu et al., 2017). However, disc bulges may also occur in individuals without symptoms, suggesting that the presence of structural abnormalities alone does not always explain pain severity (Ract et al., 2015a).

The increasing burden of LBP worldwide highlights the importance of identifying associated spinal abnormalities and their clinical significance. Pakistan has limited population-based evidence regarding lumbar disc bulges and their relationship with pain severity. Therefore, this study aims to evaluate the frequency of lumbar disc bulges at different spinal levels using MRI and determine their association with the severity of low back pain among patients in Dera Ismail Khan.

METHODOLOGY

This descriptive cross-sectional study was conducted to evaluate the association between different levels of lumbar disc bulges and the severity of low back pain among patients in Dera Ismail Khan, Pakistan. The study was carried out at District Headquarter (DHQ) Hospital and Shifa

Medical Center, which serve as major healthcare facilities providing diagnostic imaging services in the region. Patients presenting with low back pain and undergoing lumbar spine MRI examinations during the study period were considered for inclusion.

A convenience sampling technique was employed for participant recruitment. The sample size was calculated using the Raosoft sample size calculator with a 95% confidence level and a 5% margin of error, resulting in a minimum required sample size of 384 participants. Patients of either gender with low back pain who had undergone lumbar spine MRI were included in the study. Individuals without lumbar MRI findings, those with incomplete clinical or imaging records, and patients unwilling to participate were excluded. Data were collected through a structured questionnaire and lumbar spine MRI reports after obtaining informed consent from all participants. Demographic information, including age and gender, was recorded, along with clinical characteristics related to low back pain. The severity of low back pain was assessed using the Modified Brief Pain Inventory (BPI), a validated instrument commonly used to evaluate pain intensity and its impact on daily activities.

Lumbar spine MRI examinations covering levels L1 to S1 were performed using a 0.5-Tesla MRI scanner. Standard imaging protocols included T1-weighted and T2-weighted sequences in sagittal and axial planes. MRI reports were reviewed to identify the presence and anatomical location of lumbar disc bulges. Disc bulges were categorized according to the affected spinal level, including single-level and multilevel involvement. Ethical approval for the study was obtained from the Ethical Review Board of Times Institute, Multan, Pakistan. Administrative permission was also secured from DHQ Hospital and Shifa Medical Center, Dera Ismail Khan. All participants provided written informed consent before enrollment, and confidentiality of the collected information was strictly maintained throughout the study.

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 23. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic, clinical, and imaging characteristics. The association between lumbar disc bulge levels and low back pain severity was assessed using Pearson's chi-square test and Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

This study was conducted at the district headquarter hospital and Shifa medical center at the Radiology Department MRI Unit Dera Ismail Khan. This investigation contained a total of 384 patients with LBP who underwent lumber MRI scans. All eligible MRI reports and questionnaires were obtained from the participants and analyzed. The MRI unit of the radiology department at the district headquarter hospital and Shifa Medical Center is comprised of a 0.35T MRI machine. In our study we distributed the patients into gender wise, age wise, patients' height, weight wise and their marital status, educational level and occupation. The response rate was 100%. This chapter presents the findings, which include the percentages and frequencies of different demographic groups affected by LBP. The frequency of disc bulges at various levels of the lumbar spine, and the relationship between the levels of lumbar disc bulges with the severity of LBP.

Section I: Demographic values.

Gender wise distribution of patients

We examined a total of 384 individuals in our study. Reports and data were collected through a questionnaire from those patients who had low back pain (LBP). Out of these, 203 (52.86%) patients were males, and the remaining 181 (47.14%) patients were female, as shown in Figure.

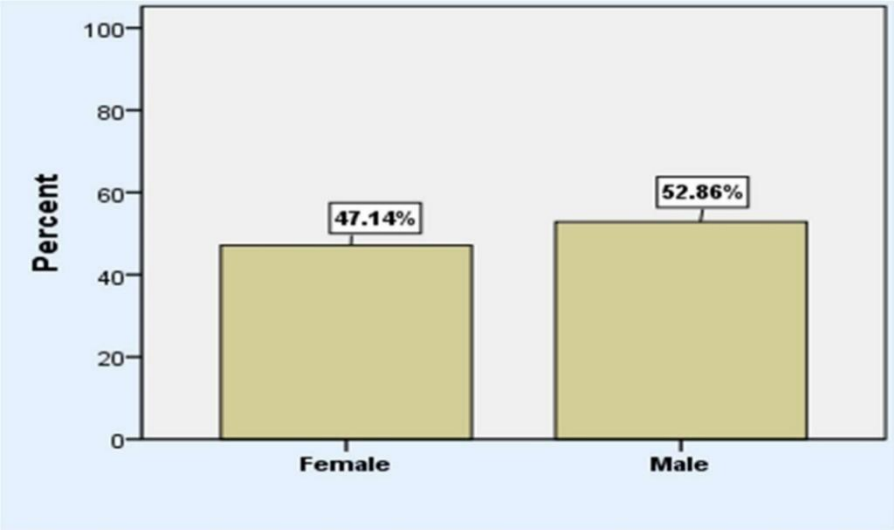

Figure: Gender wise distribution

Age wise distribution of patients

The age of participants ranges from under 20 to over 65 years and was categorized into five groups such as 1 = under 20 years, 2 = 20-35 years, 3 = 35-50 years, 4 = 50-65 years, over 65 years. Total number of participants in category 1 was 19, in category 2 were 100, in category 3 were 214, in category 4 were 37, and in category 5 were 14. The group most affected by LBP was 35-50, followed by 20-35. The least affected group by LBP was group 1, as shown in Figure.

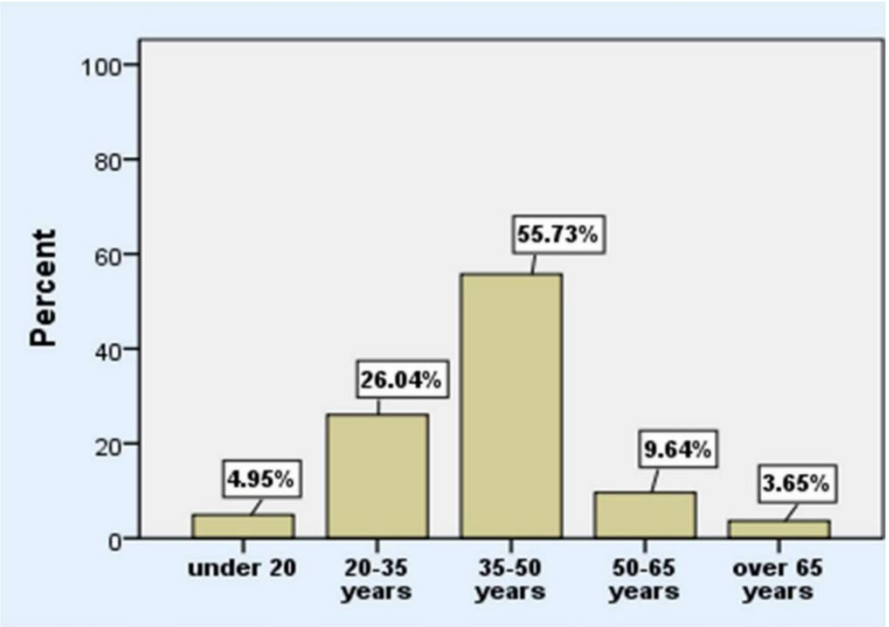

Figure: Patients age wise distribution

Weight wise distribution of patients

The participants' weight ranges from under 50 to over 95 kg were categorized into five groups such as 1=under 50 kg, 2=50-65 years, 3=65-80 years, 4 =80-95 kg, over 55 kg. Total participants in group 1 were 16, in group 2 were 103, in group 3 were 195, in group 4 were 67 and group 5 were 8. The most affected weight group by LBP in our study was 65-80 followed by 50-65, the least affected group by LBP was group 5 as shown in Figure.

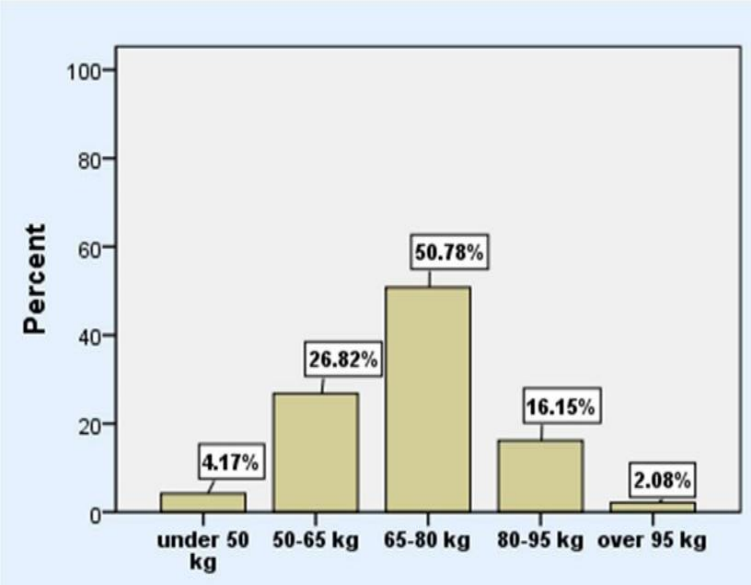

Figure: Weight wise distribution of patients

Height wise distribution of patients

The participants Height ranges from less than 4.5 feet to 5.9 feet were categorized into four groups. i.e., 1 = less than 4.5 feet, 2 = 4.5-5.0 feet, 3 = 5.0-5.5 feet, and 4 = 5.5-5.9 feet. Total participants in group 1 were 2, in group 2 were 3, in group 3 were 226, and in group 4 were 153. The most affected height group by LBP in our study was 5.0-5.5, followed by 5.5-5.9; the least affected group by LBP was group 1, as shown in Figure.

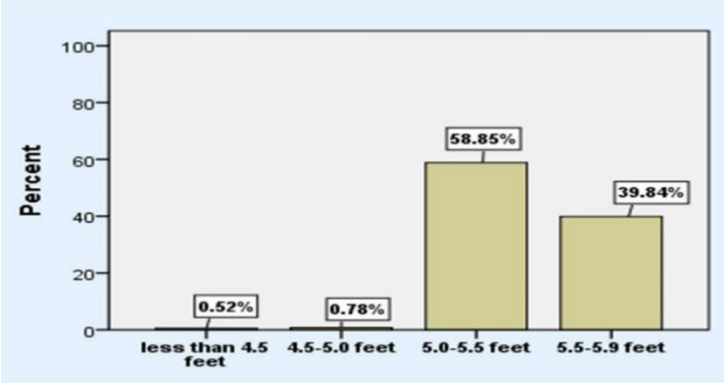

Figure: Height wise distribution of patients

Education wise distribution of patients

We were also distributing the participants according to educational level. Illiterate people kept in group 1 were 110; undergraduates in group 2 were 193; graduates in group 3 were 73; and in group 4 postgraduates were 8. The most affected group by LBP in our study was the undergraduate group, followed by the illiterate; the least affected

group by LBP was the postgraduate group, as shown in Figure.

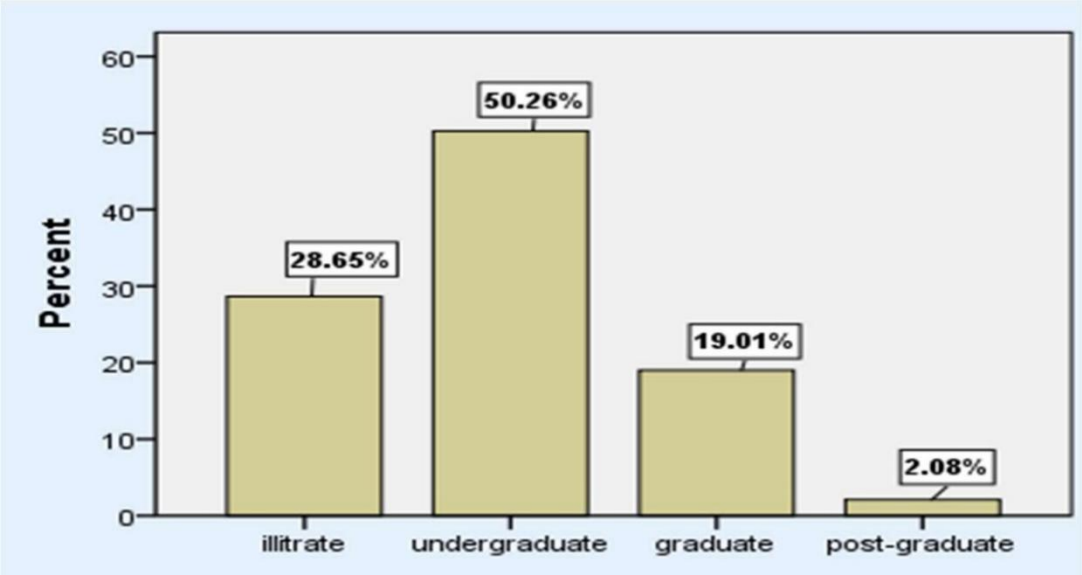

Figure: Education wise distribution of patients

Marital status wise distribution of patients

We also distributed the participants according to marital status. Group 1 represents 50 single/unmarried participants, and Group 2 represents 334 married participants. Group 2 is most affected by LBP followed by Group 1.

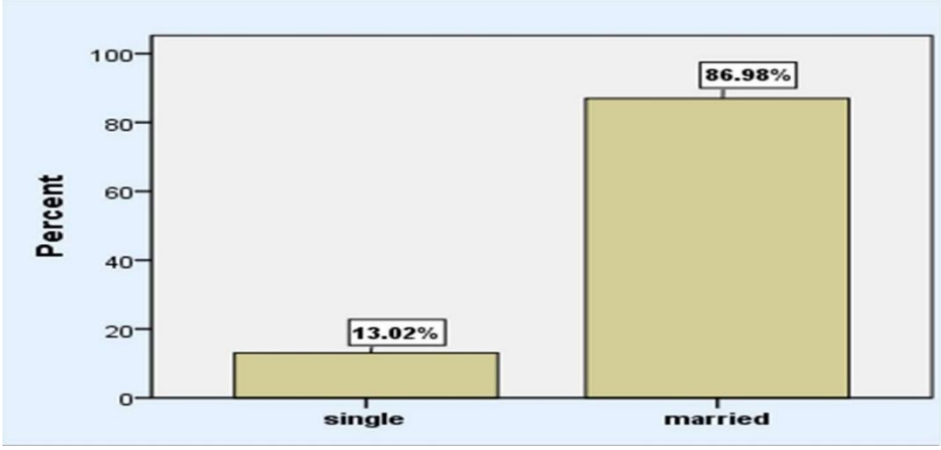

Figure: Marital status wise distribution of patients

Occupation wise distribution of patients

We arranged the occupations of the participants into 5 groups. I.e., 1 = labor, 2 = job holder, 3 = students, 4 = jobless, 5 = other business. Total participants in group 1 were 48, in group 2 were 142, in group 3 were 28, in group 4 were 108, and in group 5 were 58. The most affected group by LBP was group 2, followed by group 2, and the least affected group by LBP was group 3, as shown in Figure.

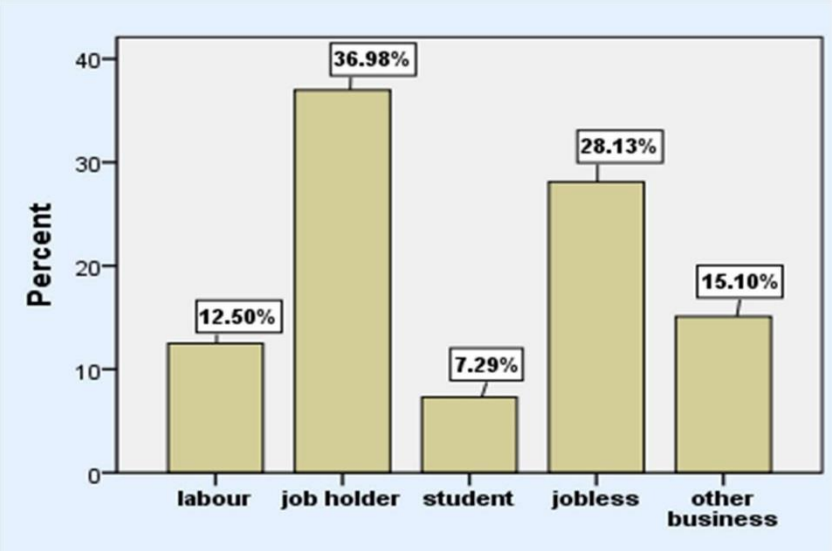

Figure: Occupation wise distribution of patients

Section II: Clinical history of low back pain

Variable: previous history of LBP

We were taking history about previous low back pain from our participants in the form of yes and no. Yes, for previous history of LBP, there were 153 patients, and no, for not at all previous history of low back pain, there were 231 out of 381 patients. The previous account of LBP was 39.8%, and without previous record of LBP, it existed 60.2%, progressive total is displayed by the "Cumulative Percent". Following the subtraction of the 39.8% of patients who were indicated "Yes," the total proportion comes to 39.8%. The inclusion of the whole 384-patient sample was indicated by the sum of 100% when the individuals who selected "No" are added as shown in Table.

Table: Previous experienced low back pain

Variable: Have you previous experienced low back pain?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	153	39.8	39.8	39.8
	No	231	60.2	60.2	100.0
	Total	384	100.0	100.0	

Variable: previous lumbar MRI scan?

We were taking history about previous lumber MRI scans from our participants in the form of yes and no. Yes, for previously performed lumber MRI scan, there were 64 patients, and no, for no previous history of lumber MRI scan, there were 321 out of 381 patients. The previous history of lumber MRI scan was 16.7%, and without previous history of lumber MRI scan, it was 83.3, The progressive total is displayed by the "Cumulative

Percent". Taking into consideration the respondents who said "Yes," the total proportion comes to 16.7%. The "No" answers add up to 100%, indicating that the entire sample is covered as shown in table.

Table: Previous lumbar MRI scan

Variable: Have you undergone previous lumbar MRI scan?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	64	16.7	16.7%	16.7
	No	320	83.3	83.3%	100.0
	Total	384	100.0	100.0%	

Variable: Lumbar MRI scan because of LBP?

In our investigation's, 384 individuals were examined based on their previous MRI scan for low back pain. Only 34 patients (8.9%) received a lumber MRI scan to determine the causes of their low back discomfort. The "Cumulative Percent" displays the cumulative total, which represents the complete sample and reaches 8.9% after taking into consideration the "yes" responses. It then sums to 100% when the "no" responses are considered.The great majority of patients have no history of MRI scans for low back pain.

Lumbar MRI scan due to low back pain

Variable: The reason for undergoing the lumbar MRI scan is low back pain?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	8.9	8.9%	8.9
	No	350	91.1	91.1%	100.0
	Total	384	100.0	100.0%	

Previous MRI scan reveal any disc bulges

We were taking histories about previous lumber MRI scans from our participants in the form of yes, no, and don't know. Yes, for previously performed lumber MRIs for low back pain that revealed any disc bulge, there were 25 patients, and no, for no previous history of disc bulge, there were 350 participants, and I don't know if those participants who had a history of LBP but didn't know about disc bulge were 9 participants. The previous history of disc bulge for low back pain was 6.5%. The "Cumulative Percent" displays the cumulative total as it advances, reaching 6.5% when "Yes" responses are considered, 97.7% when "No" responses are included, and 100% when "Don't know" responses are included.

Table: Previous MRI scan reveal any disc bulges

Variable: Did the MRI scan reveal any disc bulges in your lumbar spine?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	6.5%	6.5	6.5
	No	350	91.1%	91.1	97.7
	Don't know	9	2.3%	2.3	100.0
	Total	384	100.0%	100.0	

Previous levels of disc bulges

Out of 384 participants, 25 knew about their previous lumber disc bulge levels. 12 participants were disc slipped at Lumber4-Lumber5, Lumber5-Sacrum1. 6 participants were disc slipped level at Lumber4-Lumber5, while 7 participants were lumber disc bulge level at L5-S1.

Table: Previous levels of disc bulges

Variable: If yes, at which level(s) of the lumbar spine were the disc bulges identified?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	L5-S1	359	93.5	93.5	93.5
	L4-L5,	12	3.1	3.1	96.6
	L4-L5	6	1.6	1.6	98.2
	L5-S1	7	1.8	1.8	100.0
	Total	384	100.0	100.0	

Severity of lower back pain?

The chronic low back pain of patients was divided into 3 categories: 1 = mild LBP, 2 = moderate LBP, and 3 = severe LBP. The result was identified as 1=69, 2=153, 3=162. Total patients in category 1 were 18.0%, in category 2 were 39.8%, and in category 3 were 42.2%. Most of the patients are affected by severe LBP, followed by moderate LBP.

Table: Severity of low back pain

Variable: How would you describe the severity of your low back pain?					
		frequency	**percentage**	**Valid percent**	**Cumulative percent**
Valid	Mild LBP Pain	69	18.0	18.0	18.0
	Moderate LBP Pain	153	39.8	39.8	57.8
	Severe LBP Pain	162	42.2	42.2	100.0
	Total	384	100.0	100.0	

Time period of lower back pain.

We were divided among LBP patients according to the time of lower dorsal discomfort. With respect to the duration of LBP, we were divided into 3 categories. 1 = LBP less than 2 months; 2 = LBP lasting from 3 months; 3 LBP lasting from more than three months. The results were identified as 1=75 patients, 2=142 patients, 3=167 patients. Table 4.7. also shows that three steps or stage of low back pain severity, in 3rd stage of low back pain 43.5% of patients are affected by LBP from more than three months indicating chronic LBP, followed by 37.0% of patients affected by LBP from the last three months (sub-acute LBP) or 2nd stage of LBP severity. While 19.5% of patients are affected by less than two months indicating acute LBP or 1st stage of pain. As shown in the table.

Table: Time period of lower back pain

Variable: How long have you experienced lower back pain?					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Less than 2 months	75	19.5	19.5	19.5
	Last three months	142	37.0	37.0	56.5
	More than three months	167	43.5	43.5	100.0
	Total	384	100.0	100.0	

Low back pain radiates to other areas?

A total 384 patients with low back pain responded to their pain radiating to other areas of the body (buttocks) in response to yes = 145 and no = 239. Table 4.8 shows that 37.8% of patients were affected by LBP radiates to other areas like buttocks.

Table: Low back pain radiates to other areas

Variable: Does your low back pain radiate to other areas, such as the legs or buttocks?				
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**

	Yes	145	37.8	37.8	37.8
Valid	No	239	62.2	62.2	100.0
	Total	384	100.0	100.0	

Numbness or tingling sensation in your lower extremities along with lower back pain?

We were examining the LBP patients for either any numbness or tingling sensations in their lower extremities along with LBP. We were managing questions in the form of yes and no. i.e. yes =29, No=355. Table 4.8 shows that the majority of patients (92.2%) don't have any numbness and sensitivity along with LBP. 7.8% of total patients have numbness and sensitivity along with LBP.

Table: Numbness or tingling sensation in your lower extremities along with low back pain.

Variable: Have you experienced any numbness or tingling sensation in your lower extremities along with low back pain?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	29	7.6	7.6	7.6
Valid	No	355	92.4	92.4	100.0
	Total	384	100.0	100.0	

Any difficulty performing daily activities

Our examination data on LBP participants show that most people were difficulties in their daily life activities with low back pain. Table 4.10 shows that 337 (87.8%) are responding to yes, while the other 47 (12.2%) cannot face any difficulty in their daily activities with LBP and respond with "No".

Table: Do you have any difficulty performing daily activities due to your low back pain?

Variable: Do you have any difficulty performing daily activities due to your low back pain?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	337	87.8	87.8	87.8
Valid	No	47	12.2	12.2	100.0
	Total	384	100.0	100.0	

Have you sought medical treatments for LBP?

We examine the medical treatment ratio in our 384 patients for their LBP. 324 patients have sought medical treatment for LBP, and 60 patients can't seek any medical treatment for LBP.

Table: Have you sought medical treatment for your LBP.

Variable: Have you sought medical treatment for LBP?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	324	84.4	84.4	84.4
	No	60	15.6	15.6	100.0
	Total	384	100.0	100.0	

Disc bulge levels

The data on lumbar spine disc bulging levels show a varied distribution across different lumbar spine levels across 384 patients. Notably, 24.7% of the patients had a disc bulge at Lumber 5-Sacrum 1 level, which is the most prevalent single level affected. Following that, the combination of L4-L5 and L5-S1 levels occurs in 24.2% of cases, indicating that these nearby levels are frequently damaged. jointly. The L4-L5 level alone is impaired in 18.8% of persons, emphasizing their vulnerability. On the other hand, some patients have bulges at numerous levels, such as L3-L4, L4-L5, and L5-S1, which bulges 8.9% of instances. Similarly, bulges at the L2-L3 and L3-L4 levels account for 8.9% of cases, demonstrating that, while less prevalent, upper lumbar levels are nonetheless significantly affected. A lower proportion of people (6.5%) have disc bulges at all levels of the lumbar spine, indicating a more severe disease. In contrast, 3.6% of patients have no disc bulge at any lumbar spine level, indicating a small subset without disc disease. Overall, these distributions show that the L5- S1 and L4-L5 levels are the most impacted by disc bulges, whether alone or in combination with other levels, emphasizing the crucial need of focusing clinical attention on these specific regions of the lumbar spine.

Table: Disc bulge levels

Disc bulge levels

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	All Levels of Lumber Spine Disc Bulge	25	6.5	6.5%	6.5
	No Disc Bulge at Lumbar Spine Level	14	3.6	3.6%	10.2
	L3-L4, L4-L5, L5-S1	34	8.9	8.9%	19.0
	L4- L5, L5-S1	93	24.2	24.2%	43.2
	L4-L5	72	18.8	18.8%	62.0

L5-S1	95	24.7	24.7%	86.7
L3-L4, L5-S1	17	4.4	4.4%	91.1
L2-L3, L3-L4	34	8.9	8.9%	100.0
Total	384	100.0	100.0%	

Association of Levels of disc bulges of lumber spine and severity of pain.

The total number of observations is 384, with varying degrees of disc bulging and pain severity. The disc bulging levels are classified into various lumber spine locations, and the degree of LBP is indicated as mild, moderate, or severe.

Table: Chi-Square Tests of Association of Levels of disc bulges of lumber spine and severity of pain.

Chi-Square Tests of Association of Levels of disc bulges of lumber spine and severity of pain.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.227[a]	14	.000
Likelihood Ratio	59.765	14	.000
Linear-by-Linear Association	2.029	1	.154
N of Valid Cases	384		

a. 3 cells (12.5%) have expected count less than 5. The minimum expected count is 2.52.

All levels of lumbar spine disc bulge: This data shows that 25 patients were lumber disc bulge at levels, 2 cases (8.0%) show mild and moderate pain, while most cases 21 (84.0%) show severe pain. This indicates the more severe pain of all those patients who have lumber disc bulges at all levels.

No disc bulge at lumbar spine level: This data shows that a total of 14 cases that have no disc bulge at any level of lumber spine, low back pain in this case shows most of the patients (76.6%) were mild low back pain. while 7.1% patients experience moderate pain, and 14.3% patients experience severe LBP.

Disc bulges at Lumber3-4, Lumber4-5, Lumber 5-Sacrum1: This data shows a total of 34 cases of disc bulges at multiple levels of lumber spine at L3-L4, L4-L5, L5-S1 levels. Severe low back pain is leading in 18 cases (52.9%) and followed by moderate low back pain in 11 cases (32.4%), while mild low back pain was in 5 cases (14.7%) and less common in this multi-disc bulge level.

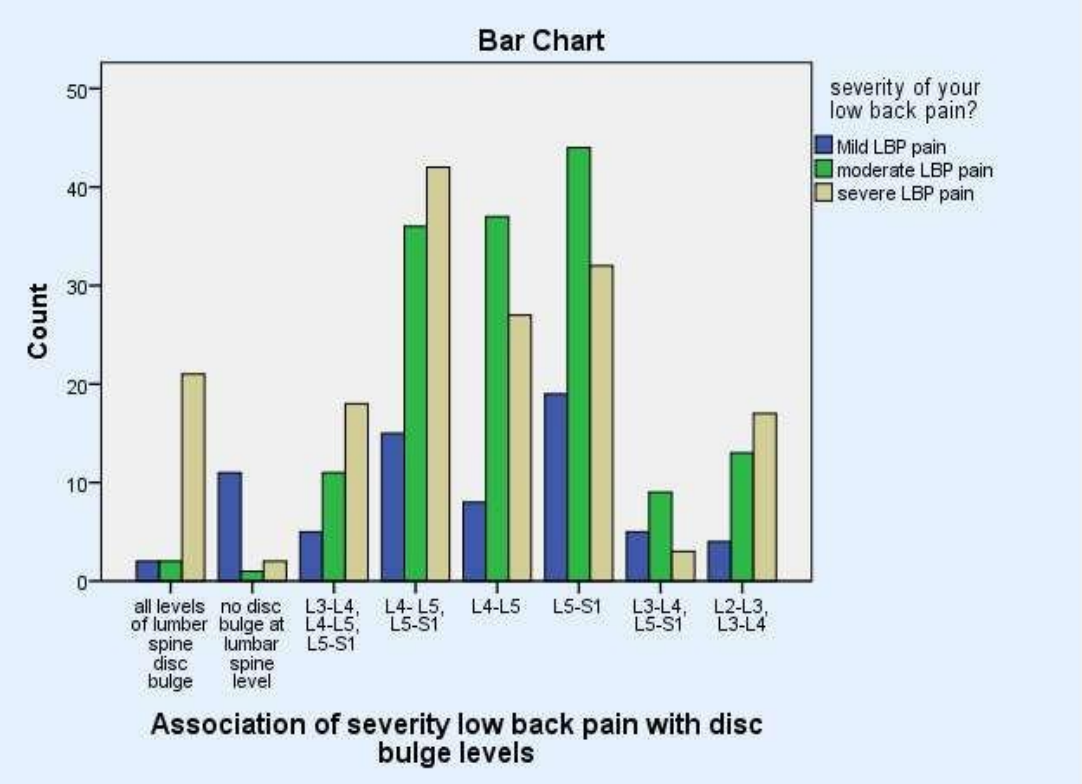

Figure: Association of severity of low back pain with the levels of LBP.

Disc bulges at Lumber4-5, Lumber5-Sacrum1: This data shows that a total of 93 cases of disc bulges at multiple levels of lumber spine at L4-L5, L5-S1. Severe low back pain was leading in 42 cases (45.2%) and followed by moderate low back pain were in 36 cases (38.7%) at this multi-disc levels. While Least 15 (16.1%) were mild low back pain cases at these multi-levels of disc bulge patients.

Disc bulge at L4-L5: According to the data, disc bulge at the Lumber4-Lumber5 level was a frequent point of LBP, with 72 cases reported. Most patients (37 out of 72) 51.4% experienced moderate pain, showing that disc bulges at this level commonly cause discomfort that is greater than mild but less than severe pain. A significant number of patients (27 out of 72) 37.5% experienced severe pain, indicating that disc bulges at L4-L5 can cause intense and potentially debilitating pain for many people. A small number of patients (8 out of 72) 11.1% had mild pain, demonstrating that while disc bulges at this level can produce just minor discomfort, it is less common compared to moderate or severe pain.

Disc bulge at L5-S1: Notably, L5-S1 disc bulge was the most common, accounting for 95 patients, out of 95 patients, 19 (20.0%) patients were mild low back pain, 44 (46.3%) were moderate LBP and 32 (33.7%) were experienced severe low back pain. This demonstrates a significant prevalence of pain severity in this lumber spine level.

Disc bulges at Lumber3-4, Lumber5-Sacrum1: According to the findings, most patients with disc bulges at the Lumber3-Lumber4, Lumber5-Sacrum1 vertebral point experienced moderate pain 52.9% (9 patients), followed by mild pain 29.4% (5 patients) and severe pain 17.6% (3 patients).

Disc bulges at L2-L3, L3-L4: Most patients 50.0% (17 out of 34) suffered from severe pain, indicating

that disc bulges at these levels are particularly prone to producing more discomfort.

38.2% (13 patients) experienced moderate discomfort. Only 11.8% (4 individuals) experienced mild pain, indicating that disc bulges at these levels were mostly cause chronic discomfort.

Low back pain severity distribution

We evaluated the severity of low back pain by using the Brief Pain Inventory (BPI) tool.

Mild low back pain:

- Without disc bulges of the lumber spine 15.9% of patients experienced acute LBP.
- Bulges in the disc at the level of Lumber4-Lumber5, Lumber5-Sacrum1, 21.7% patients experienced mild LBP.
- slipped disc at the level of lumber5-Sacrum1, 27.5% patients experienced mild low back pain.

Moderate LBP:

- Intervertebral disc slipped at the L5-S1 level 28.8% patients experienced moderate low back pain.
- Intervertebral disc slipped at Lumber4-5 and Lumber5-Sacrum1 level, 24.2% patients feel moderate low back pain.
- Slipped disc at the level of Lumber4-Lumber5 level, 23.5% patients experienced moderate LBP.

Severe or chronic LBP:

- Disc bulge at the Lumber4-5 and Lumber5-Sacrum1 levels, 25.9% Patients' low dorsal discomfort was excruciating.
- Disc bulge at the Lumber5-Sacrum1 level, 19.8% Patients had excruciating low back ache.
- Disc slipped at the Lumber4-Lumber5 point 16.7% patients felt chronic LBP.

Total disc bulges distribution:

- Lumber disc bulges at all levels were 6.5% of whole sample.
- No disc bulges at any lumber spine levels were 3.6% of whole sample.
- Lumber disc bulges at levels lumber3-4, lumber4-5, lumber5-sacrum1 were 8.9% of whole sample.
- Lumber disc bulges at lumber4-5, lumber5-sacrum1 levels were 24.2% of whole sample.
- Lumber disc bulges at lumber4-5 levels were 18.8% of whole sample
- Lumber disc bulges at lumber5-sacrum1 level were 24.7% of whole sample.
- Lumber disc bulges at levels lumber3-4, lumber5-sacrum1 were 4.4% of whole sample.
- Lumber disc bulges at levels lumber2-3, lumber3-4 were 8.9% of whole sample.

Gender-based distribution of LBP severity.

In our study 384 low back patients were examined. The cross tabulation presented demonstrates association between the patient's gender and severity of LBP as shown in table.

Females:

- 11.0% of females reported mild low back pain.
- 37.6% of females affected from moderate low back pain.
- 51.4% of females suffer from severe low back pain
- Total females of the sample were 47.1%

Males:

- 24,1% of male were felt from mild low back pain.
- 41.9% of male were ached from moderate LBP.
- 34.0% of male were experienced from severe LBP.

Severity of pain distribution across gender from cross tabulation

- 71.0% of male's patients and 29.0% of females were experienced mild low back pain.
- 55.6 of male's patients and 44.4% of females were experienced moderate low back pain
- 42.6% of male's patients and 57.4% of females were experienced severe low back pain
- Total population of the males were 52.9% and female were 47.1%
- Mild low back pain patients were 18.0% from the overall population.
- Moderate low back pain patients were 39.8% from the overall population.
- Severe low back pain patients were 42.2% from the overall population.

Table: Chi-Square Tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.426[a]	2	.000
Likelihood Ratio	16.776	2	.000
N of Valid Cases	384		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.52.

Table: Gender of patient * severity low back pain.

Gender of patient * severity low back pain. Crosstabulation

			Severity of your low back pain?			Total
			Mild LBP	Moderate LBP	Severe LBP	
Gender of Patient	Female	Count	20	68	93	181
		% within gender of patient	11.0%	37.6%	51.4%	100.0%
		% within severity of your low back pain?	29.0%	44.4%	57.4%	47.1%
		% of total	5.2%	17.7%	24.2%	47.1%
	Male	Count	49	85	69	203
		% within gender of patient	24.1%	41.9%	34.0%	100.0%
		% within severity of your low back pain?	71.0%	55.6%	42.6%	52.9%
		% of total	12.8%	22.1%	18.0%	52.9%
		Count	69	153	162	384

	% within gender of patient	18.0%	39.8%	42.2%	100.0%
Total	% within severity of your low back pain?	100.0%	100.0%	100.0%	100.0%
	% of total	18.0%	39.8%	42.2%	100.0%

Gender wise distribution of disc bulges

The presented crosstabulation investigates the association between lumbar disc bulge levels and patient gender in a sample of 384 participants.

Females:

- Lumber disc bulges were at all levels in females 5.5%.
- No disc bulge level was detected in females' population with low back pain 2.2%
- Lumber spine disc bulges were at levels lumber3-lumber4, lumber4- lumber5, lumberr5-sacrum1 in females' population were 12.2%
- Lumber disc affected were at levels lumber4-5, lumber5-sacrum1 were 24.3% in females' population
- Lumber disc bulges were at the level umber4-5 were 20.4%
- Lumber disc bulges were at the level lumber3-4, L5-sacrum1 were 0.0%
- Lumber disc bulges were at the level L5-S1 were 26.5%
- Lumber disc bulges were at the levels L2-L3, L3-L4 were 8.8%

Males:

- Lumber disc bulges at all the levels in males were 7.4%.
- No disc bulge level was detected in males' population with low back pain 4.9%.
- Lumber disc bulges were at the levels lumber3-4, lumber4-5, lumber5- sacrum1 in males' population were 5.9%.
- Lumber disc bulges were at the levels lumber4-5 and 5-sacrum1 were 24.1% in males population
- Lumber disc bulges were at the level lumber4-5 were 17.2%
- Lumber disc bulges were at the level lumber3-L4 and L5-S1 were 8.4%
- Lumber disc bulges were at the level L5-S1 were 23.2%
- Lumber disc bulges at the levels lumber2-L3 and L3-L4 were 8.9%.

Table: Chi-Square Tests

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	22.780[a]	7	.002
Likelihood Ratio	29.407	7	.000
Number of Valid Cases	384		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.60.

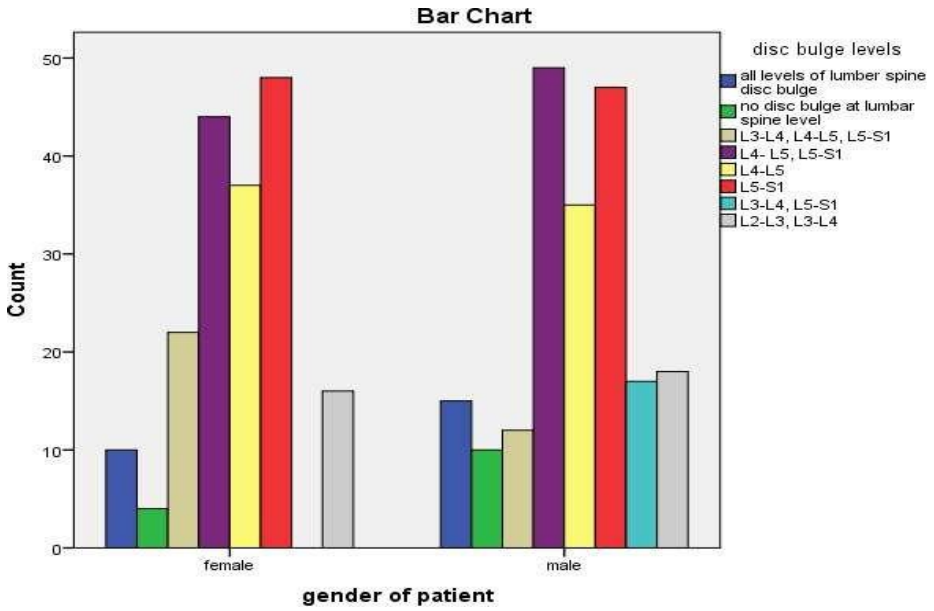

Figure: Cross tabulation between gender of patients and disc bulges

DISCUSSION

This study evaluated the frequency of lumbar disc bulges at different lumbar levels (L1/L2, L3/L4, L4/L5, L5/S1) and their association with the severity of low back pain (LBP). The findings provide insight into demographic, socioeconomic, and clinical factors associated with LBP among 384 patients. Low back pain is a multifactorial condition influenced by age, gender, occupation, lifestyle, trauma, psychological factors, and comorbidities (F. Zafar et al., 2018; Patrick et al., 2016).

In the present study, males represented 52.9% and females 47.1% of participants. Although males showed a slightly higher frequency of LBP, severe pain was more common among females (57.4%) compared with males (42.6%). Previous studies reported that LBP affects both genders, with some evidence suggesting a higher prevalence among females (Leboeuf-Yde et al., 2009). The increased severity among females may be associated with multiple contributing factors including posture, sedentary lifestyle, hormonal changes, psychosocial stress, structural abnormalities, occupational factors, and obesity (Asif et al., 2024).

Most participants belonged to the 35–50 years age group (55.7%), followed by 20–35 years (26.0%). These findings are consistent with previous research reporting a higher occurrence of LBP among middle-aged individuals. The mean age reported in previous studies was approximately 38–42 years, supporting the relationship between increasing age, occupational stress, physical demands, and degenerative spinal changes (Khumalo, 2018). Lumbar disc herniation commonly affects middle-aged and older adults, particularly those involved in prolonged sitting or manual work (Qi et al., 2023).

Regarding weight distribution, 50.8% of participants weighed between 65–80 kg, while 26.8% were between 50–65 kg. Previous studies have established a relationship between obesity, body mass index, and increased LBP severity and disability (Hussain et al., 2017). Increased body weight may increase mechanical stress on intervertebral discs and contribute to degenerative changes.

The majority of participants had a height between 5.0–5.5 feet (58.9%). Although height is less commonly investigated as an independent risk factor for LBP, previous literature has reported associations between anthropometric characteristics including height, weight, age, and gender with disc morphology and disc bulging (Hung et al., 2021). Education status showed that 50.3% of participants were undergraduates, followed by illiterate individuals (28.6%). Education level may influence health awareness, occupational exposure, and healthcare accessibility. Previous studies suggest that lower education levels are associated with greater physical workload and socioeconomic challenges, which may increase LBP risk (Prel et al., 2024).

Most participants were married (87%), which may be associated with psychological stress, family responsibilities, and lifestyle factors contributing to LBP. Chronic LBP has been linked with depression, anxiety, sleep disturbances, and other psychological factors (Li et al., 2023). Occupational factors were also prominent, with job holders (37%) and unemployed individuals (28.1%) representing a large proportion of patients. Previous research identified occupation, repetitive activities, prolonged sitting, and physical workload as important contributors to LBP (Campbell & Muncer., 2005).

Lumbar disc bulges and severity of low back pain

In this study, 40% of patients had previous LBP history, while 16.7% had previous MRI examination. Only 6.5% had MRI-confirmed disc bulges. Among these, disc bulges were most frequent at L4-L5 and L5-S1 levels. Previous research reported that degenerative disc disease, including disc bulging, herniation, reduced disc height, and dehydration, is strongly associated with LBP (Anjum et al., 2024).

Disc bulges at different lumbar levels showed variation in relation to pain severity. Previous studies reported that disc bulging at L2-L3, L3-L4, L4-L5, and L5-S1 levels was associated with previous episodes of LBP (Tonosu et al., 2017a). Disc bulging has also been linked with annular tears, suggesting a relationship between disc structural changes and symptom severity (Do et al., 2011).

Multiple-level disc bulges were observed in 6.5% of patients, with severe pain reported in 84% of these cases. This suggests that involvement of multiple lumbar levels may increase the possibility of nerve compression and greater symptom severity. Similar findings were reported by Lin et al. (2024), who identified lumbar disc bulging/herniation as an important cause of spinal stenosis and nerve compression. The distribution of disc bulges showed higher involvement of lower lumbar levels. Previous studies reported disc bulging frequencies of 4.5% at L1-L2, 15.9% at L2-L3, 22.7% at L3-L4, 52.3% at L4-L5, and 59.0% at L5-S1 (Atilabey et al., 2016). In the current study, L4-L5 and L5-S1 were also the most affected levels, supporting previous findings.

At L3-L4, L4-L5, and L5-S1 multiple-level disc bulges were observed in 8.9% of patients, with more than half reporting severe pain. Previous studies also demonstrated that lower lumbar disc levels are commonly affected, particularly L3-L4 and L4-L5 (Suthar et al., 2015). Disc bulges may produce symptoms through nerve compression, although the severity depends on bulge size, location, and individual anatomical differences (Jakaria & Kuan, 2024). The highest frequency of disc bulges was observed at L5-S1 (24.7%) and L4-L5 (24.2%). These levels experience greater mechanical stress due to their anatomical position and load-bearing function. Previous studies have shown that L4-L5 and L5-S1 are the most common

sites of lumbar disc degeneration and herniation (Kreiner et al., 2014; Brinjikji et al., 2015). Similar findings have been reported regarding nerve root compression, particularly at L4-L5 and L5-S1 levels (Salam et al., 2023).

However, disc bulging was not always associated with pain. Patients without disc bulges also reported mild LBP, suggesting that other factors such as muscular strain, ligament injury, or facet joint problems may contribute to symptoms (Wagh, 2022). Previous evidence also indicates that disc bulges are frequently found in asymptomatic individuals, with prevalence increasing with age (Elnour, 2022).

Clinical history and treatment patterns

In the present study, 37.8% of patients reported radiating pain toward the buttocks and 7.8% experienced numbness or sensory symptoms. Previous studies demonstrated that lumbar nerve root compression may cause radiation of pain into the lower limbs and buttocks (Thiese et al., 2014). Foraminal stenosis caused by disc changes may compress exiting nerve roots and produce radicular symptoms (Murata et al., 2024).

Most patients (84.4%) sought medical treatment for LBP, indicating the significant impact of symptoms on daily life. Similar findings have shown that many patients use medications and healthcare services for managing LBP, while current guidelines also recommend exercise and non-pharmacological approaches including massage, acupuncture, yoga, and spinal manipulation (Nasim et al., 2024; Low et al., 2024).

Prevalence of LBP and disc bulges

The current study found that severe LBP was more common among females, while males showed higher proportions of mild and moderate pain. Previous studies reported that lifetime prevalence of LBP ranges between 70–90% worldwide (Lee et al., 2013). Global estimates also demonstrate that LBP prevalence remains high and continues to represent a major cause of disability (Zang & Yan, 2024).

Disc bulges were predominantly observed at L4-L5 and L5-S1 levels among both genders. Previous research from Pakistan reported disc bulging as the most common type of lumbar disc pathology, with L4 and L5 levels being frequently affected (Yousof et al., 2021). Similar findings have been reported regarding lumbar disc bulges and associated mild to moderate spinal canal stenosis due to nerve root compression (Azeem et al., 2022).

Overall, the findings demonstrate that lumbar disc bulges, particularly at lower lumbar levels, are associated with increased severity of LBP. However, clinical symptoms should be interpreted together with imaging findings because disc abnormalities may also occur in asymptomatic individuals.

CONCLUSION

This study evaluated the frequency of lumbar disc bulges at different lumbar levels and their association with the severity of low back pain among patients undergoing MRI examination. The findings demonstrated that low back pain was more common among middle-aged adults and was frequently associated with factors such as increased body weight, occupational demands, and female gender. Although low back pain affected both sexes, severe pain was observed more frequently among females, whereas males showed a higher proportion of mild and moderate symptoms.

Lumbar disc bulges were predominantly identified at the lower lumbar levels, particularly L4–L5 and L5–S1, supporting the concept that these segments are subjected to greater biomechanical stress and are more vulnerable to degenerative changes. Patients with disc bulges at these levels, especially those with involvement of multiple lumbar segments, tended to report greater pain severity.

However, the presence of low back pain among some individuals without disc bulges highlights the multifactorial nature of the condition and indicates that imaging findings should be interpreted alongside clinical assessment rather than in isolation.

Overall, the study suggests that lumbar disc bulges, particularly at L4–L5 and L5–S1, are common MRI findings among patients with low back pain and are associated with increased symptom severity. These findings emphasize the importance of comprehensive clinical evaluation and appropriate use of MRI in the assessment of low back pain. Further large-scale, multicenter, and longitudinal studies are warranted to clarify the causal relationship between lumbar disc abnormalities and pain severity and to explore additional biological, mechanical, and psychosocial factors contributing to low back pain.

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