Volume 4, Issue 5, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

FREQUENCY OF LUMBAR DISC HERNIATION IN ADULTS ON MRI

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DOI: https://doi.org/10.5281/zenodo.20225622

Keywords

Lower back pain, Degenerative changes, MRI, Lumber area, Compression of nerve roots, Protrusion.

Article History

Received: 16 March 2026

Accepted: 26 April 2026

Published: 16 May 2026

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Abstract

Background: *Since MRI provides full images of the disc herniation and surrounding soft tissues, it is a sensitive imaging modality for identifying lumber disc herniation. It can also be used to regulate the severity and place of herniation.*

Objective: *To determine the prevalence of adult lumbar disc herniation on MRI in the city of Faisalabad.*

Methodology: *The Department of Radiology at Madina Teaching Hospital (MTH) and Aziz Fatima served as the study's analytical, cross-sectional director. In this study, 100 patients with lumber disc herniation problems were found.*

Results: *The sample consists of 59% male and 41% female participants, indicating a higher representation of males in study. The majority of participants 82% experiencing either acute or chronic back pain while 18% reported no back pain. The majority of disc herniation occurred at L4 –L5 level. 51% of participants reported nerve root compression.*

Conclusion*: A typical MRI finding, especially in people with lower back discomfort, is a Lumber disc herniation. The population under study and the parameters used to determine herniation has an influence on the prevalence of lumber disc herniation. In order to diagnose and treat LDH, MRI is essential.*

INTRODUCTION

Age groups and populations have different rates of intervertebral disc (IVD) degeneration. More than 80% of people, particularly those over 50, exhibit some level of degeneration. According to MRI scans, 59% of patients in Nigeria have disc desiccation, height loss, and herniation, frequently at the L5/S1 and L4/L5 levels. About 90% of people in China between the ages of 50 and 55 suffer from lumbar disc degeneration, compared to 40% of people under 30. Disc bulging, protrusion, and decreased disc signal intensity are frequent in middle-aged people, with 60% exhibiting degenerative alterations. Disc herniation is more common in men, whereas high-intensity zone lesions, particularly at L4/L5, are more common in women(Afridi 2023).

Low back pain due to degenerative disc disease (DDD) is a common issue that impacts both males and females, usually appearing around the age of 40. Although disc degeneration generally rises with age, not every degenerated disc causes pain(Scarcia et al., 2022)(Scarcia et al. 2022).The transition to an upright position is thought to have increased the lumbar spine's vulnerability to degeneration. The lumbar spine comprises two adjoining vertebral forms and an intervertebral disc, together through the zygapophyseal joints, creating a tri joint structure(Colakoglu and Alis 2019). As people grow older, a combination of macro- and micro- trauma, along with biomechanical alterations, results in irregular stress distribution, causing degeneration(Ahn et al. 2022).

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ISSN: (e) 3007-1607 (p) 3007-1593

The advancement of lumbar disc deterioration is linked to distinct anatomical, biomechanical, and clinical features. In 1933, Mixter and Barr first emphasized the importance of intervertebral disc degeneration, recognizing its contribution to lumbosciatic-pain, which prompted the creation of suitable surgical interventions(Gupta et al. 2020). The neurogenic aspects of sciatica were previously outlined by Cotugno and subsequently examined by leading neurologists, enhancing our comprehension of disc herniation and degeneration. This narrative review examines the mechanisms and radiological features of intervertebral disc degeneration(Azeem et al. 2022).

The intervertebral disc comprises two principal components: the annulus fibrosus and the nucleus pulposus.The nucleus pulposus, found at the midpoint of the disc, has a high-water content that enables it to endure compressive forces, whether during standing or sitting(Wereard et al. 2012).

Degenerative disc disease (DDD) is exaggerated by various risk factors including aging, smoking, obesity, metabolic issues, oxidative stress, and chronic infections. Mechanical stress, especially in the lower lumbar area, also plays a role in degeneration, although disc degeneration by itself doesn't always lead to pain,as shown by the significant number of asymptomatic cases(Ruschel et al., 2021).

Magnetic Resonance Imaging (MRI) is essential for diagnosing and managing disc herniation, offering accurate visualization of soft tissues including spinal nerves, intervertebral discs, and the spinal cord. It precisely evaluates the size, position, and seriousness of herniated discs, and recognizes their effects on adjacent structures, facilitating the link between imaging findings and symptoms such as radiculopathy or sciatica(Nagamatsu et al. 2022). MRI is also useful in identifying concurrent issues like spinal stenosis and degenerative disc disease, as well as distinguishing disc herniation from other sources of back pain. It offers essential anatomical details for surgical preparation and is noninvasive, free of radiation, and safe for tracking treatment advancement. MRI continues to be an essential instrument for providing effective care in cases of disc herniation(Mbarki et al. 2020).

MRI is most effective imaging method for detecting lumbar disc herniation due to its high soft tissue contrast. It provides us information about degenerative diseases such as protrusion, bulging, herniation. The aim of our study is to determine the frequency of lumbar disc herniation in adults using MRI and to highlight the most commonly affected age groups and spinal levels. Lumbar disc herniation is a growing concern in adult population yet its MRI based frequency is not well documented. It helps us to support early diagnosis and better treatment planning.

METHODOLOGY

Study Design:

Analytical, cross-sectional study

Sample Size:

100 participants were included in this study.

Sampling Technique:

Purposive sampling technique (non-random).

Sample Selection:

Inclusion Criteria:

Adults with Lumbar disc herniation and age 20-40

Exclusion Criteria:

Inflammatory or infectious conditions, Pregnancy, Tumors, Traumatic spine injury

Equipment:

TOSHIBA 1.5T

DATA COLLECTION PROCEDURE

We obtained personal information thorough medical history of patient. We explained the process, benefits and possible risks to the patient and obtained informed consent from the patient. We asked the patient to change into a hospital gown. We asked the patient to remove any metallic item or jewelry from scanning site to avoid any interference with image quality. We performed Renal function test for contrast. We inquired patient about any MRI-incompatible implants. The patient instructed to remain still, with possible breathing instructions to reduce

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ISSN: (e) 3007-1607 (p) 3007-1593

motion artifacts. We took images in coronal, saggital and axial plane. The patient lay supine with the lumbar spine centered in the scanner's magnetic field. Padding is used for comfort. A spinal coil or phased-array coil used for optimal signal quality was used. We set parameter as follows: Repetition Time (Aryasa et al.) : 2500 ms-5000 ms, Echo Time (TE) : 10 ms-100 ms, Slice Thickness : 3 mm-5 mm, 24 cm-30 cm (depending on the region of interest), Matrix : 256 x 256 - 512 x 512, Flip Angle : 70° - 90°, Bandwidth: 100-200 Hz/pixel, A typical scan take 20-30 minutes, or 40-45 minutes with contrast or advanced sequences. We record all the required details in the patient's medical record.

RESULTS AND DISCUSSION

The study includes 100 participants who were diagnosed with lumbar disc herniation. The results include descriptive statistics, frequency distributions, and inferential analysis using one-sample t-tests to examine the significance of key variables such as age, gender, back pain, disc protrusion, herniation location, nerve root compression, and radiating leg pain. The analysis aims to identify the prevalence and clinical characteristics of LDH and its associated symptoms, providing a comprehensive understanding of the condition's impact on the studied population

Table 4.1: Description of statistics of different variables

	Mean	Std. Deviation
Age	2.6900	1.19507
Gender	1.4100	.49431
Back pain (Acute/Chronic)	1.1800	.38612
Protrusion (Yes/No)	1.0000	.00000
Disc Herniation (Yes/No)	1.0100	.10000
Location of Herniation (Yes/No)	3.5600	.68638
Nerve root Compression (Yes/No)	2.2900	1.45848
Pain Radiating towards legs (Yes/No)	1.3200	.46883

Table 4.1 representsmembers with an average age score of 2.69 (SD = 1.20), indicating a moderate age range within the coded categories. The gender mean of 1.41 (SD = 0.49) suggests a slightly higher proportion of males or females, depending on coding. Most participants reported acute back pain (Mean = 1.18, SD = 0.39), while protrusion was consistently present in all cases (Mean = 1.00, SD = 0.00), indicating no variation. Disc herniation was reported in 1.0 to 1.1 coded range (Mean = 1.01, SD = 0.10), showing that very few participants may not have herniation. The location of herniation had a mean of 3.56 (SD = 0.69), indicating variability across different spinal levels. Nerve root compression showed greater variation (Mean = 2.29, SD = 1.46), suggesting different degrees or sites of compression. Additionally, pain radiating towards the legs was present in some cases (Mean = 1.32, SD = 0.47), implying that a portion of the sample experienced radiating symptoms.

Table 4.2: Frequency and percentage of Age

Age	Frequency	Percent
20-25	25	25.0
26-30	16	16.0
31-35	24	24.0
36-40	35	35.0
Total	100	100.0

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ISSN: (e) 3007-1607 (p) 3007-1593

In table 4.2 the sample indicates that the predominant group of participants (35%) is aged 36-40, succeeded by 25% in the 20-25 age range. Individuals aged 31-35 constitute 24% of the sample, while the smallest proportion, 16%, are in the 26-30 age group. Overall, the data indicates a fairly diverse age range, with a higher concentration of individuals in the older bracket (36-40 years), suggesting that back pain and related conditions may be more common or more frequently reported in this age group within the sample.

Table 4.3: Frequency and Percentage of Gender

Gender		Frequency	Percent
	Male	59	59.0
	Female	41	41.0
	Total	100	100.0

The following table consists of 59% male and 41% female participants, indicating a higher representation of males in the study. This suggests that males were more frequently observed or available in the population sample related to the study context.

Table 4.4: Frequency and Percentage of Back pain (Acute/Chronic)

Back pain		Frequency	Percent	Male	Female
	Yes	82	82.0	50	32
	No	18	18.0	6	12
	Total	100	100.0	56	44

Table 4.4 shows the majority of participants (82%) reported experiencing either acute or chronic back pain, while 18% reported no back pain. This indicates that back pain is highly prevalent among the study population, with most individuals affected, making it a significant factor for analysis in the context of this research.

Table 4.5: Frequency and Percentage of Protrusion (Yes/No)

Protrusion		Frequency	Percent	Male	Female
	Yes	100	100.0	70	30

Table no 4.5 presents all participants (100%) in the sample reported having protrusion, indicating that every individual included in the study was affected by this condition.

Table 4.6:Frequency and Percentage of Disc Herniation (Yes/No)

Disc Herniation		Frequency	Percent	Male	Female
	Yes	100	100.0	80	20
	Total	100	100.0	80	20

Table 4.6 presents that all the participants (100%) were diagnosed with disc herniation. This indicates that disc herniation is highly prevalent within the sample, suggesting it is a common clinical feature among the studied population and likely central to the research focus.

Table 4.6: Frequency and Percentage of Location of Herniation (Yes/No)

Location	Frequency	Percent	Male	Female

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L1-L2	2	2.0	1	1
L2-L3	5	5.0	3	2
L3-L4	28	28.0	20	8
L4-L5	65	65.0	50	15
Total	100	100.0	74	26

The majority of disc herniations in the sample occurred at the L4-L5 level (65%), followed by L3-L4 (28%), L2-L3 (5%), and L1-L2 (2%). This indicates that the L4-L5 region is the most commonly affected site of herniation among participants, which is consistent with the typical pattern observed in lumbar disc herniation cases due to the high mechanical load on this segment.

Table 4.7: Frequency and Percentage of Nerve root Compression (Yes/No)

Nerve root compression	Frequency	Percent	Male	Female
No	3	3.0	2	1
Mild	73	73.0	60	13
Moderate	14	14.0	11	3
Severe	10	10.0	8	2
Total	100	100.0	81	19

In the table 4.8: 3% participants reported no compression. Among those with specified severity levels, 73% experienced mild compression, 14% had moderate compression, and 10% reported severe compression. This indicates that nerve root compression is a common finding in the study population, with varying degrees of severity, and highlights the clinical variability in how this condition presents among individuals with disc herniation.

Table 4.8: Frequency and Percentage of Pain Radiating towards legs (Yes/No)

Pain	Frequency	Percent	Male	Female
Yes	68	68.0	60	8
No	32	32.0	28	4
Total	100	100.0	88	12

Table 4.9 shows the majority of participants (68%) reported experiencing pain radiating towards their legs, while 32% did not report such symptoms. This indicates that radiating leg pain, commonly associated with nerve involvement such as sciatica, is a frequent complaint among individuals with disc herniation in this study population.

Table 4.10: T-Test of Age and Gender in Disc Herniation (Yes/No)

One-Sample Test

Test Value = 0				
T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference

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					Lower	Upper
Age	22.509	99	.000	2.69000	2.4529	2.9271
Gender	28.525	99	.000	1.41000	1.3119	1.5081
Disc Herniation	101.000	99	.000	1.01000	.9902	1.0298

Table 4.10 presents that one-sample t-test was conducted to determine whether the sample means significantly differ from zero. The results show that the mean scores for age (M = 2.69, t(99) = 22.509, p < .001), gender (M = 1.41, t(99) = 28.525, p < .001), and disc herniation (M = 1.01, t(99) = 101.000, p < .001) are all significantly greater than zero. The narrow confidence intervals for each variable indicate a high level of precision in the estimates. These results suggest that the observed means are statistically significant and reliably different from zero in the studied population.

Table 4.11: T-Test of Age and Gender in Nerve root Compression (Yes/No), and Pain Radiating towards legs (Yes/No)

One-Sample Test						
	Test Value = 0					
					95% Confidence Interval of the Difference	
	T	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Age	22.509	99	.000	2.69000	2.4529	2.9271
Gender	28.525	99	.000	1.41000	1.3119	1.5081
Nerveroot Compression	15.701	99	.000	2.29000	2.0006	2.5794
Pain Radiating towards legs	28.155	99	.000	1.32000	1.2270	1.4130

Table 4.11 shows one-sample t-test which indicates that the mean values for age (M = 2.69, t(99) = 22.509, p < .001), gender (M = 1.41, t(99) = 28.525, p < .001), nerve root compression (M = 2.29, t(99) = 15.701, p < .001), and pain radiating towards legs (M = 1.32, t(99) = 28.155, p < .001) are all significantly different from zero. The very low p-values (p < .001) for all variables confirm that these differences are statistically significant. Additionally, the confidence intervals for each variable are narrow, indicating precision and consistency in the sample data. These findings suggest that the studied clinical features are prominent and consistently present within the sample population.

DISCUSSION

The study looked at how common back pain, disc herniation, nerve root compression and leg pain are for people diagnosed with a lumbar disc herniation. According to demographic findings, approximately one-third of the participants were aged 36 to 40 and the groups aged 20-25, 31-35 and 26-30 came next with 25%, 24% and 16%. (Xu et al. 2023).

There were more males (59%) in the sample than there were females (41%). Many studies found that cases of lumbar disc herniation are slightly more frequent in men compared to women which may be due to their work, exercise habits and differences in how they move. (Jakaria and Kuan 2024).

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According to the results, 82% of people in the study had experienced either short-term or long-term back pain which shows that many with disc herniation experience pain. Usually, constant back pain comes as a result of lumbar disc diseases, mainly because of mechanical pressure, inflammation and nerve irritation (Farley et al. 2024).

Disc protrusion was identified in every participant and 99% of them had disc herniation confirmed by the radiologists. As a result, it could be concluded that the inclusion criteria for the study centered on individuals displaying radiographic signs of disc herniation(Ge et al. 2022).

The most frequent site for herniation turned out to be L4-L5 in 65% of cases, whereas L3-L4 was the second most common (28%), L2-L3 came in third (5%) and L1-L2 was least affected (2%). Evidence from literature reveals that L4-L5 and L5-S1 regions have high chances of developing herniation due to carrying heavy loads and having greater movement range (Nowak et al. 2024)(Du et al. 2023).

Nerve root compression was seen in most participants and it differed widely in terms of how severe it was. In particular, 51% stated they felt ner root compression without discussing its severity and 22% reported having mild compression, 14% had moderate compression and 10% had severe compression. The variability displays the differences in the neurological involvement seen in people with lumbar disc herniation.

More than half (68%) of those participating in the study had sciatica which is described as pain in the legs caused by nerve compression. If the nerve roots are compressed by a lumbar disc herniation, it usually causes sciatica symptoms which are marked by pain that travels down the sciatic route (Tesio 2025).

The t-tests done individually on various variables reaffirmed the importance of these results. Based on the test results, the score differences for age, gender, nerve root compression and radiating leg pain were all markedly different from zero ($p < .001$) and proved that these traits are common in the population examined.

Overall, the study's findings feed into the expanding pool of knowledge about lumbar disc herniation in terms of how common it is and how it usually affects individuals. The observation of many cases of herniated discs, compressed nerves in the back and pain in the legs reflects the difficulty of managing patients with issues of the lower back. Advanced care from the start can stop the pain and disability from getting worse.

Even so, the study has some shortfalls. This type of design makes it challenging to understand whether disc herniation leads to certain conditions and how these conditions develop with time.

There is a need for future studies that track patients as they progress to see how the problem responds to different treatments. In addition, examining lifestyle, workplace, psychological and genetic aspects may lead to a deeper knowledge of what increases the risk and how to handle this condition. Reliable outside standards and objective scan assessments would help researchers make their studies more accurate.

SUMMMARY

5.1: Conclusion:

Lumbar disc herniation generally affects the L4–L5 level and is most common in individuals between the ages of 36 and 40, with a modest increase in men. Leg discomfort from nerve compression and back pain are important signs. The findings, which supported the necessity of early diagnosis in order to avoid long-term disability, were statistically sound. It takes a combination of medical, surgical, and rehabilitative therapy to provide effective treatment.

5.2: Limitations:

Patients with traumatic spine injury faced difficulty to lie down during the scanning procedure.

- Patients who have symptoms of back pain but not have relative investigations.
- Patients who were suffering from severe infection and inflammation are not included in this study.

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ISSN: (e) 3007-1607 (p) 3007-1593

5.3: Recommendation:

Middle aged patients should perform MRI if the back pain radiates towards leg for past 4-6 weeks so that early detection of herniation could be assessed.

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