ORIGINAL ARTICLE

EVALUATION OF COMMON LUMBAR VERTEBRAL PATHOLOGIES USING MRI IN PATIENTS WITH CHRONIC LOWER BACK PAIN IN POPULATION OF DERA ISMAIL KHAN

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ABSTRACT

BACKGROUND: The lower back, also known as the lumbar spine, consists of five different lumbar vertebrae and intervertebral discs, placed in the lowest region of the spinal column. The pain that occurs in the region between lower ribs and hips is called lower back pain which is the most frequent among young and middle-aged adults. The major cause of lower back pain is degenerative disc disease around the globe. **AIM:** The aim of this research work is to evaluate common lumbar vertebral pathologies on MRI in patients with chronic lower back pain in Dera Ismail Khan and determine their prevalence and pattern. **METHODOLOGY:** A descriptive cross-sectional study was conducted in the population of Dera Ismail Khan by collecting data through research questionnaires and MRI reports. The collected data was analyzed on SPSS having version 2025. The convenient sampling technique was used for selection of participants. **RESULTS:** A total number of 377 patients with chronic lower back pain were included in the study. The majority of patients belonged to the economically active age groups, with the highest proportion observed in the age rang 18-30 years (30.2%) and followed by 31-40 years (29.7%), 41-50 years (18.6%). Compared to men, women were more often impacted (54.1% vs. 45.9%). The highest distribution of chronic lower back pain was by in tehsil Kulachi (29%), with (22%) have in tehsil Paharpur (22.30%), in tehsil Dera ismail khan with (20.4%), Paroa (20.2%). Most patients were taller >5.8 feet. 93.9% of cases the pain persisted for more than three months. The primary cause (69.5%) was disc bulging with spinal stenosis whereas the most common associated disease (87.0%) was musculoskeletal issues. **CONCLUSION:** Young and early middle aged adults frequently have chronic lower back pain especially women. The most common lumbar disease identified by MRI was disc bulging with spinal stenosis which is frequently linked to functional restriction and radiating discomfort. Accurate diagnosis and better patient care depend on early MRI examination.

Keywords: Radiating pain, Degenerative disc disease, Lumbar spine, Disc bulging, Spinal Stenosis, Magnetic resonance imaging, chronic lower back pain.

Introduction

1.1 Anatomy of the Lower Back:

The term lumbar spine refers to the lower part of the spinal column that houses the five lumbar vertebrae. These lumbar vertebrae are referred to as L1 through L5 in decreasing order.[4]

a. Lumbar Vertebrae (L1-L5):

The lumbar vertebrae are the biggest and strongest

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bones in the vertebrae column. The lumbar vertebrae support a substantial amount of the body weight and help maintain the stability of the upper body. The lumbar vertebrae column is distinguished by its dimensions and composition the vertebral body's structure, and the unique form of its spinous processes in addition to others anatomical feature. Because the front section of the vertebral is higher than the posterior part, it seems to be a wedge.[4]

b. Intervertebral Disc:

The three primary parts of the intervertebral disc the nucleus pulposus, annulus fibrosus and cartilaginous endplate. The nucleus pulposus located close to the center of the disc is surrounded by a complicated structure called the annulus fibrosus. The vertebral end plate is covered with cartilaginous tissue cartilaginous end plate. The annulus fibrosus side has fibrocartilage while the vertebral side contains hyaline cartilage.[5]

c. Facet Joints:

An essential part of the posterior spinal column is the facet joints. These attachment sites are found in the vertebrae's posterior arch. A robust fibrous capsule that connects the articular facets of adjacent vertebrae surrounds these synovial joints which are situated between the lamina and pedicle of each vertebra. They allow for some movement inside the spinal column while offering crucial structural support.[5]

d. Ligaments:

The dorsal longitudinal ligament also called the posterior longitudinal ligament (PLL) is a collection of ligamenta flava (intertransverse, interspinous and supraspinous ligaments) that join the laminae of adjacent vertebrae. Whereas the intertransverse ligaments are located between the vertebral transverse processes the interspinous ligaments are located between the spinous processes. The supraspinous ligament that joins the apices of the spinous processes.[5]

1.2 Normal Lumbar Spine Functions:

Key roles of the lumbar vertebra include supporting considerable weight and protecting the spinal cord during movement and trunk flexion. It gives both necessary support and controlling how the trunk moved with relation to the hips and pelvis. This portion of the spine must be especially strong because of the major

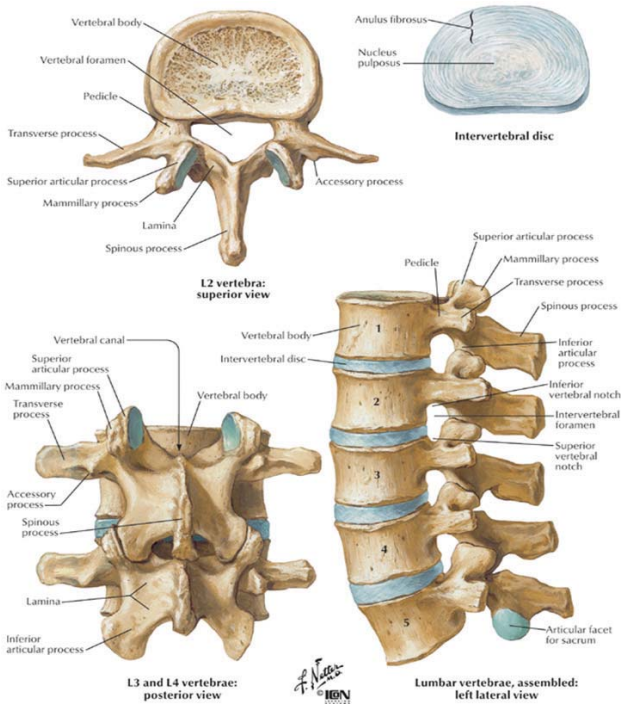

Figure 1: Normal Lumbar Spine Anatomy.[6]

responsibilities it performs, since it sustains practically the whole weight transmitted from the higher regions of the spinal region.[7]

1.3 Chronic Lower Back Pain:

The term chronic lower back pain refers to chronic lumbar discomfort that lasts for three months or more without a known underlying cause such as a spinal fracture, structural deformity, neural compression, an infection or neoplastic disease. According to epidemiology studies the lifetime prevalence of persistent lower back pain varies between 60% and 85% with an adult population point prevalent can interfere with day-to-day activities and is expensive it is a significant public health concern. Lumber disc degenerative disease refers to a variety of age-related anatomical and physiological alterations that affect the facet joints and intervertebral disc. Both acute and chronic lower back pains are known to be mostly caused by it.[8]

1.4 Role of MRI in Diagnosing Chronic Low Back Pain (CLBP):

Magnetic resonance imaging (MRI) is a non-invasive method allows for fine-grained visualization of internal anatomy and certain physiological processes. It operates

using non-ionizing electromagnetic radiation and is regarded as safe with no known risks associated with exposure. To provide accurate cross-sectional pictures of the body in any orientation the device applies radio-frequency (RF) waves within precisely controlled magnetic fields. The subject is placed within a powerful magnet to capture these images.[9]

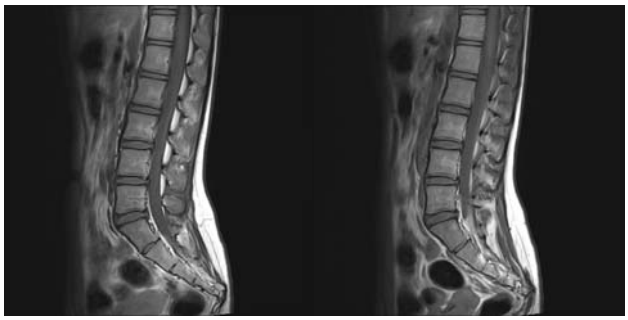

Figure 2: Normal anatomy T1-weighted images of the lumbar spine.[10]

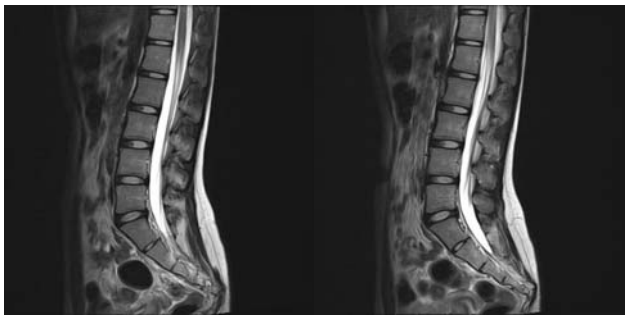

Figure 3: Normal anatomy T2-weighted images of the lumbar spine.[10]

1.5 Rationale:

This study is justified because chronic lower back pain is common and often poorly evaluated in regions like Dera Ismail Khan due to limited MRI availability. By assessing lumbar spine pathologies using open MRI, the research will provide local data on the prevalence and pattern of common vertebral abnormalities. These findings will support more accurate diagnosis, improve clinical decision making, and promote timely management. The study will also help raise awareness and contribute to better planning of radiological services for spinal disorders in the region.

1.6 Research Objectives:

1. To identify the types of lumbar vertebral pathologies detected on open MRI in patients presenting with chronic lower back pain.
2. To determine the risk factors of lumber vertebral pathologies leading to CLBP using MRI in Dera Ismail Khan Populations.

Methodology

2.1 Study Design:

The Descriptive cross sectional-studies was carried out.

2.2 Study Settings:

The study was conducted at Department of Radiology Al-Qassar Institute of Health Sciences, Dera Ismail Khan, Shifa Hospital and Maternity Home, Dera Ismail Khan, and Biomed Diagnostic Center, Dera Ismail Khan. Approved by Institute Ethical Committee.

2.3 Sample Size:

A total number of 377 patients were included in the study with the sample size determined using the Raosoft online sample size calculator.

2.4 Sampling Technique:

The non-probability Consecutive sampling technique was applied.

2.5 SAMPLE SELECTION:

2.5.1 Inclusion Criteria:

1. Patients presenting with lower back pain lasting more than 3 months.
2. Adults who had age of 18 to 80 years.
3. Patients referred for lumbar spine open MRI in the study setting.
4. Patients who consent to participate in the study.

2.5.2 Exclusion Criteria:

1. Patients with spinal infections such as tuberculosis or osteomyelitis.
2. Patients with known spinal tumors or metastatic disease.
3. Diagnosis of inflammatory spondyloarthropathy (e.g., ankylosing spondylitis).
4. Patients with congenital spinal deformities.
5. Patients with post-operative lumbar spine conditions or scheduled surgery within 2-4 weeks.
6. Non-lumbar predominant pain (Thorax, Cervical) or non-spine origin pain (Renal determine pain).

2.6 DATA COLLECTION PROCEDURE:

For this study data were collected from individuals who were referred for lumbar spine MRI due to lower back discomfort. Clinical information such as age, gender, occupation, lifestyle, and relevant medical history was recorded using a structured form. All eligible patients underwent standard MRI of the lumbar spine using sagittal and axial views. MRI findings including disc degeneration, herniation, bulging, and other alterations were recorded. To ensure reliability two radiologists independently reviewed the images and recorded their conclusions on a standard form. Before the research started ethical approval was secured informed consent was obtained from each participant and absolute confidentiality was maintained at all times.

2.7 DATA ANALYSIS PROCEDURE:

The Statistical Package for Social Science (SPSS version 25) computer program was used for the analysis and interpretation of the data.

Results

3.1 Age wise distribution of Chronic Lower Back pain:

The (Tab.3.1) Demonstrates the age distribution of individuals with persistent lower back pain exhibited different trends across different age groups. The highest frequency among the 377 patients under study was found in the 18-80 years age range. There were 114 patients (30.2%), followed by the 18-30 years age group. There were 112 patients (29.7%) in the 31-40 years age range and 70 patients (18.6%) in the age group 41-50 years. There were 54 patients (14.3%), followed by the 51-60 years age range and 20 patients (5.3%) in the age group 61-70 years. while the least number of 7 patients (1.9%) in the age group 71-80 years.

	Frequency	Percent	Valid Percent	Cumulative Percent
18 to 30 years	114	30.2	30.2	30.2
31 to 40 years	112	29.7	29.7	59.9
41 to 50 years	70	18.6	18.6	78.5
51 to 60 years	54	14.3	14.3	92.8
61 to 70 years	20	5.3	5.3	98.1
71 to 80 years	7	1.9	1.9	100.0
Total	377	100.0	100.0	

Table 3.1: Age wise distribution of chronic lower back pain.

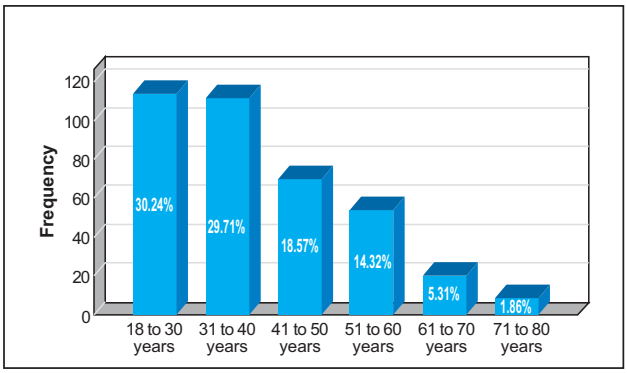

Figure 3.1: Age wise distribution of chronic lower back pain.

3.2 Gender wise distribution of Chronic Lower Back pain:

The (Tab.3.2) shows that the gender-wise distribution of chronic lower back pain patients showed a notable difference between males and females. Out of the 377 patients studied, the majority were female, with 204 individuals (54.1%), indicating that chronic lower back pain was more prevalent than in the 173 male patients (45.9%).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	173	45.9	45.9	45.9
	Female	204	54.1	54.1	100.0
	Total	377	100.0	100.0	

Table 3.2: Gender wise distribution of chronic lower back pain.

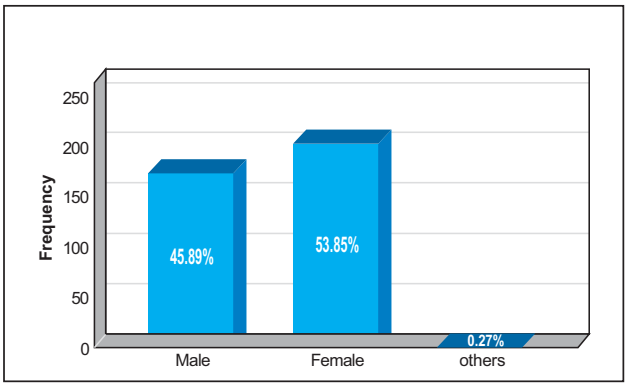

Figure 3.2: Gender wise distribution of chronic lower back pain.

3.3 Area wise distribution of Chronic Lower Back pain:

The (Tab.3.3) shows the area-wise distribution of chronic lower back pain patients in the Dera Ismail Khan population. The highest frequency among the 111 patients (29.4%) under study was found in Kulachi.

There were 84 patients (22.3%) under the study found in Paharpur and 77 patients (20.4%) found in Dera Ismail Khan (city). There were 76 patients (20.2%) under study found in Paroa, while the least number of 29 patients (7.7%) were found in Daraban.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dera Ismail Khan (city)	77	20.4	20.4	20.4
	Kulachi	111	29.4	29.4	49.9
	Paroa	76	20.2	20.2	70.0
	Paharpur	84	22.3	22.3	92.3
	Daraban	29	7.7	7.7	100.0
	Total	377	100.0	100.0	

Table 3.3: Area wise distribution of chronic lower back pain.

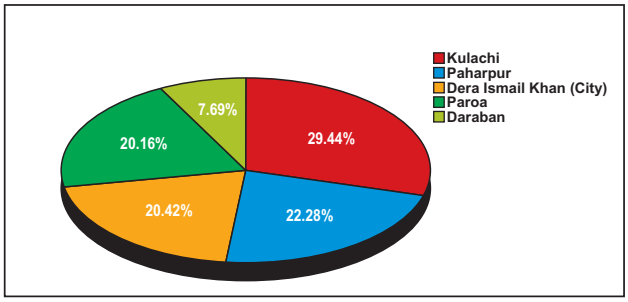

Figure 3.3: Area wise distribution of chronic lower back pain.

3.4 Height wise distribution of Chronic Lower Back pain:

The (Tab.3.4) shows the height-wise distribution of chronic lower back pain patients in the Dera Ismail Khan population. The highest frequency was among the 153 patients (40.6%), followed by the >5.8 ft height group. There were 129 patients (34.2%) in the height group of 5.1-5.7 ft. While the least number of 95 patients (25.2%) in the height group was 4.3-5 ft.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.3 to 5 ft	95	25.2	25.2	25.2
	5.1 to 5.7 ft	129	34.2	34.2	59.4
	> 5.8 ft	153	40.6	40.6	100.0
	Total	377	100.0	100.0	

Table 3.4: Height wise distribution of chronic lower back pain.

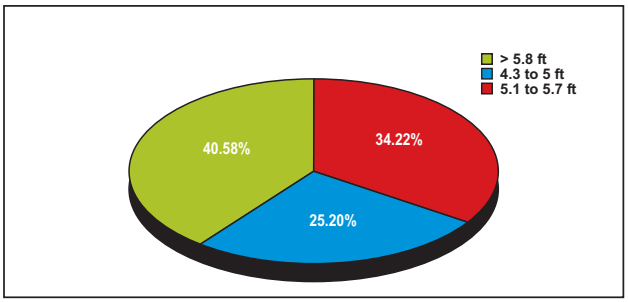

Figure 3.4: Height wise distribution of chronic lower back pain.

3.5 Duration wise Distribution of Chronic Lower Back Pain:

The (Fig.3.5) shows that the highest frequency was among the 354 patients (93.9%), followed by the >3 months pain range group. There were 12 patients (3.2%) found in the 1-month pain range group. While the least number of patients, 11 (2.9%), are found in the 2-month pain range group.

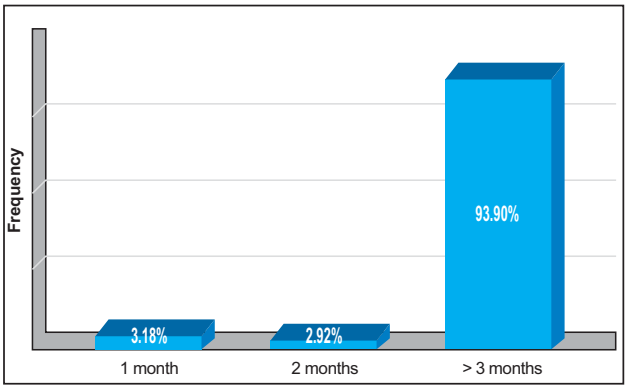

Figure 3.5: Duration wise distribution of chronic lower back pain.

3.6 Distribution of Major Causes in Chronic Lower Back pain:

The (Fig.3.6) shows that the highest frequency among the 262 patients (69.5%) under study was found in the disc bulging spinal stenosis group range. There were 30 patients (8.0%) found in the disc bulging, disc herniation, and spinal stenosis group, and 25 patients (6.6%) were found in the disc bulging Disc herniation and degenerative disc disease and spinal stenosis group, 21 patients (5.6%) were found to have bulging discs and degenerative disc disease. There were 17 patients (4.5%) found in the "no cause" group, 8 patients (2.1%) found in the "disc herniation/spinal stenosis" group, 6 patients (1.6%) in the "disc bulging" group, and 5 patients (1.3%) in the "disc bulging/spinal stenosis/spondylolisthesis" group.

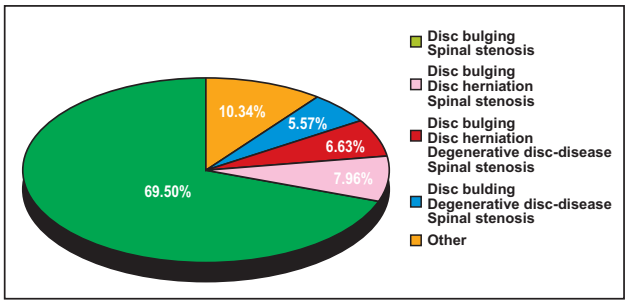

Figure 3.6: Distribution of major causes in chronic lower back pain.

3.7 Others causes wise Distribution of Chronic Lower Back Pain:

The (Fig.3.7) shows that The highest frequency among the 328 patients (87.0%) under study was found in the musculoskeletal issues group. While the least numbers of 49 patients (13.0%) was found in the No Cause group.

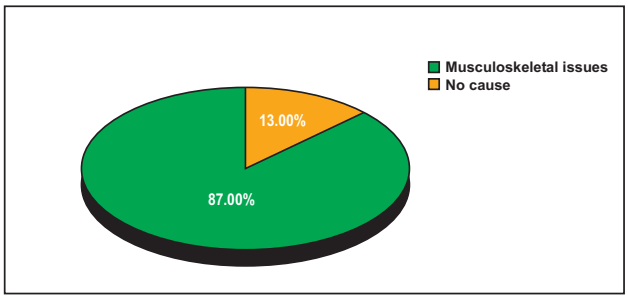

Figure 3.7: Others causes wise distribtuion of chronic lower back pain.

Overall Chi-square test

Overall the results demonstrate that age and height are strongly linked with many characteristics of persistent lower back pain ($p<0.05$). Residence area has a substantial impact on primary causes and interference with pain ($p<0.001$) but not on the kind of pain. These findings highlight how crucial biological and environmental elements are to comprehending and treating persistent lower back pain.

Association between Age and pain-related variables Chi-square test:

The (Tab.3.5) demonstrates to assess the relationship between categorical variables (age and pain-related factors) we used the chi-square test. The findings show a statistically significant relationship between age and primary causes of chronic lower back pain ($p < 0.001$) and pain type ($p < 0.001$), pain duration ($p = 0.005$) and pain severity ($p = 0.004$). Age did not, however significantly correlate with daily activity interference ($p = 0.082$) or other reasons ($p = 0.173$).

Variable	Chi-square (x^2)	df	p-value
Pain severity	25.845	10	0.004
Pain type	25.370	5	0.000
Pain duration	25.390	10	0.005
Daily activity interference	114.771	95	0.082
Major causes	114.437	50	0.000
Other causes	7.715	5	0.173

Table 3.5: Association between age and pain-related variables Chi-square test.

Association between Height and pain-related variables Chi-square test:

The (Tab.3.6) demonstrates to examine categorical variables (height and pain-related factors) we used the chi-square test. The findings showed a statistically significant correlation between height and major causes ($p < 0.001$) and daily activity interference ($p < 0.001$), pain severity ($p = 0.013$), pain type ($p = 0.006$) and pain duration ($p = 0.034$). However there was no discernible correlation ($p = 0.414$) between height and other factors.

Variable	Chi-square (x^2)	df	p-value
Pain severity	12.720	4	0.013
Pain type	10.332	2	0.006
Pain duration	10.431	4	0.034
Daily activity interference	80.807	38	0.000
Major causes	68.631	20	0.000
Other causes	1.764	2	0.414

Table 3.6: Association between height and pain-related variables Chi-square test.

Discussion

The study was conducted to evaluate common lumbar vertebral pathologies using MRI in patients with chronic lower back pain (CLBP) in the population of Dera Ismail Khan. Degenerative and structural anomalies of the lumbar spine were identified and their distribution across several demographic characteristics was examined using magnetic resonance imaging (MRI) as a diagnostic technique.[11,12]

Persistent lower back pain was more common in younger and early middle-aged individuals according to the study's findings. Approximately 60% of the patients

were in the 18-40 age range. This result challenges the conventional belief that CLBP mostly affects the elderly and supports recent findings that indicate low back pain is becoming common in younger adults.[13,14] This propensity may be caused by a variety of modern lifestyle difficulties such as prolonged sitting, less physical activity, poor posture, excessive use of electronic devices and stress at work.[15]

The current study's patients were somewhat more likely to be female (54.1%) than male (45.9%). This finding is consistent with worldwide studies showing that persistent lower back pain is more common in women than in males.[16,17] Numerous biological factors including as altered hormones, diminished muscle mass and heightened pain sensitivity, might be responsible for this disparity.[18]

The majority of individuals (93.9%) who reported discomfort lasting more than three months supported the chronic nature of lower back pain in the study group. Radiating pain was far more common than localized discomfort suggesting that nerve root involvement may be caused by either spinal canal restriction or disc degeneration.[19] The substantial correlation between degenerative MRI findings and radiating pain highlights the value of MRI in identifying the underlying reasons of persistent complaints especially when conservative treatment fails.[20]

An MRI investigation found that the most common lumbar pathology accounting for most patients was disc bulging with spinal stenosis. Other frequently seen anomalies were spondylolisthesis, degenerative disc disease and disc herniation, either alone or in combination. Degenerative processes of the intervertebral discs are a major cause of persistent lower back pain in this population as evidenced by the high incidence of spinal stenosis and disc bulging.[21,22] Disc bulging, dehydration and height loss brought on by degeneration may compress neural structures and constrict the spinal canal, causing long-term pain.[23]

LIMITATIONS: This research has certain limitations despite its useful results. First, the research was only carried out in a small geographic region, which would limit how broadly the findings can be applied to other groups. Second, the use of a low-field open MRI system may have limited the detection of subtle or early pathological changes compared to high-field MRI systems. Future studies involving larger sample sizes, multicenter settings, high-field MRI systems, and longitudinal follow-up are recommended to overcome these limitations and provide more comprehensive insights into chronic lower back pain.

Conclusion

The goal of this study was to assess prevalent lumbar vertebral pathologies in individuals with persistent lower back pain in the Dera Ismail Khan community using magnetic resonance imaging (MRI). The results show that young and early middle-aged persons are more likely to possess persistent lower back pain, with a slightly greater incidence in women. This demonstrates that persistent lower back pain is not only a problem for the elderly; it is also becoming more prevalent in younger people.

According to MRI results, the most prevalent lumbar vertebral pathology was disc bulging linked to spinal stenosis. This was followed by disc herniation, degenerative disc disease, and spondylolisthesis, either separately or in combination. Radiating pain was more common than localized discomfort, suggesting nerve root involvement, and most patients had suffering for more than three months.

CONFLICT OF INTEREST: None

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