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MAGNETIC RESONANCE IMAGING OF LUMBAR SPINE IN ELDERLY PATIENTS OF FAISALABAD DIVISION: AGE RELATED CHANGES AND PATHOLOGIES

Original Research

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ABSTRACT

Background: Spinal disorders are increasingly prevalent in aging populations, significantly impacting mobility, functional independence, and overall quality of life. Magnetic resonance imaging (MRI) serves as a valuable tool in diagnosing and assessing degenerative and pathological spinal conditions without exposing patients to ionizing radiation. This study aimed to explore the epidemiology of lumbar spine disorders using MRI, identify their prevalence and severity, and provide insights to aid clinical management and improve patient outcomes.

Objective: To evaluate the prevalence, severity, and associated factors of lumbar spine disorders among older adults using MRI.

Methods: This cross-sectional study was conducted at Allied Hospital Faisalabad over six months, involving 120 patients who underwent lumbar spine MRI. Participants were selected using stratified random sampling and categorized into four age groups: 41–50 years (38.3%), 51–60 years (29.2%), 61–70 years (20.8%), and over 70 years (11.7%). A standardized questionnaire collected data on demographics, clinical history, and MRI findings. MRI scans were performed on a 1.5 Tesla machine, and data were analyzed using SPSS version 25. Descriptive statistics summarized findings, and Chi-square tests were applied to assess age- and gender-based variations.

Results: The cohort included 82 males (68.3%) and 38 females (31.7%) with a mean age of 55.15 ± 10.63 years. Back pain was reported by 64.2% of patients, trauma by 21.7%, spinal surgery by 17.5%, and osteoporosis by 40.8%. Facet joint osteoarthritis was present in 11.7% (mild), 6.7% (moderate), and 4.2% (severe), while 77.5% showed no signs of osteoarthritis. Lumbar spinal stenosis was observed in 62.5% of patients, categorized as mild (20.8%), moderate (34.2%), or severe (7.5%). Vertebral fractures occurred in 17.5% of patients, and other pathologies were present in 26.7%.

Conclusion: The study highlights the high prevalence of lumbar spine disorders, particularly lumbar spinal stenosis and facet joint osteoarthritis, in older adults. These conditions, closely associated with back pain, osteoporosis, and trauma, emphasize the importance of early diagnosis through MRI. Tailored treatment strategies can improve mobility and quality of life in aging populations.

Keywords: Aging population, Back pain, Facet joint osteoarthritis, Lumbar spine, Lumbar spinal stenosis, Magnetic resonance imaging, Spinal disorders.

INTRODUCTION

Low back pain is a pervasive public health concern worldwide, with a lifetime prevalence ranging from 11% to 84% (1). It has progressively become one of the most significant health issues, imposing substantial physical, social, and economic burdens globally (2). Accurate diagnosis and management of low back pain rely on a combination of comprehensive history taking, physical examination, and advanced imaging techniques such as magnetic resonance imaging (MRI), computed tomography (CT), and plain radiography (3). Among these modalities, MRI is regarded as the gold standard due to its superior sensitivity and specificity (4). MRI provides exceptional visualization of both bony and soft tissue structures of the spine, including the spinal cord, intervertebral discs, vertebral bodies, nerve roots, and spinal ligaments, enabling precise identification of pathologies such as disc degeneration, disc bulges, spinal stenosis, and facet joint hypertrophy, which are common causes of back pain requiring either medical or surgical intervention (5, 6). Degenerative changes in intervertebral discs are strongly correlated with advancing age. Studies report that at least one stage of disc degeneration is present in 35% of individuals aged 20–39 years and nearly 100% of individuals aged 60–80 years (7). Disc degeneration typically begins with dehydration and loss of signal intensity on MRI, progressing to structural alterations such as disc bulges, disc space narrowing, mucinous degeneration, and intradiscal gas. These changes may also lead to reactive modifications in the surrounding bone and marrow, such as endplate sclerosis and Modic changes (7). Lumbar spinal stenosis (LSS), another common age-related condition, results from progressive narrowing of the spinal canal due to degenerative changes in facet joints, intervertebral discs, and ligamentum flavum. This condition primarily affects individuals over 50 years of age and presents with neurogenic claudication due to compression of neurovascular structures (8).

Lumbar disc herniation (LDH) is defined as a localized displacement of disc material beyond the intervertebral disc space, often triggered by acute stress or chronic factors such as improper posture and lifestyle habits. With aging, discs lose hydration, elasticity, and structural integrity, making them more susceptible to herniation, especially at the L4-L5 and L5-S1 levels. Severe cases may result in compression of the spinal canal and nerve roots, manifesting as significant neurological symptoms (9, 10). Similarly, disc bulges, characterized by more generalized displacement of disc material, are another frequent cause of back pain (1). Osteophytes, or spondylophytes, represent reactive bone hypertrophy often extending horizontally from vertebral endplates. These changes are hallmark features of age-related degeneration and are commonly associated with lumbar osteoarthritis (OA) (11). Degenerative changes also affect lumbar facet joints (LFJ), which play a critical role in stabilizing the spine. Lumbar facet joint osteoarthritis (LFJ-OA) is a prevalent condition in aging populations, with studies indicating its presence in over 89% of individuals older than 60 years in the United States (12). Other serious conditions, such as spinal infections, fractures, malignancies, and cauda equina syndrome (CES), although less common, pose significant diagnostic and therapeutic challenges due to their potential for catastrophic outcomes, including severe neurological deficits and mortality if left untreated (13). With the aging population growing rapidly, spine-related diseases and disabilities are becoming increasingly prevalent, severely affecting mobility, functional independence, and overall quality of life among older adults. This study aims to utilize magnetic resonance imaging (MRI) to investigate the epidemiology and age-related changes in lumbar spine pathologies in elderly individuals. The findings are expected to enhance understanding, guide clinical management, and ultimately improve patient outcomes.

METHODS

This cross-sectional study was conducted at Allied Hospital Faisalabad to evaluate the prevalence of lumbar spine anomalies in patients undergoing magnetic resonance imaging (MRI). A total of 120 patients who had lumbar spine MRI scans were included in the study, with participants selected using a stratified random sampling technique to ensure a representative sample across different age groups. The inclusion criteria encompassed patients aged 40 years and older who underwent lumbar spine MRIs during the six-month study period. Patients younger than 40 years were excluded to focus on the aging population and age-related spinal pathologies. The study was conducted after obtaining approval from the Allied Hospital Faisalabad Ethical Review Board. All participants were thoroughly informed about the study's objectives, and written informed consent was obtained. Participant confidentiality and privacy were maintained throughout the study in accordance with ethical standards. Data collection was facilitated using a standardized questionnaire designed to capture demographic details, clinical findings, MRI results, and medical history. Participants were categorized into four age

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groups: 40–50 years, 50–60 years, 60–70 years, and 70+ years, to enable a detailed assessment of the prevalence of lumbar spine anomalies across age subgroups. MRI scans were performed using a 1.5 Tesla MRI machine, operated by a trained technologist, with a qualified radiologist interpreting the findings. The study ensured standardization of MRI protocols to optimize the reliability and accuracy of the results.

Data analysis was performed using SPSS version 25. Descriptive statistics were used to summarize the data, while the prevalence of lumbar spine anomalies in each age group was assessed using the Chi-square test. Statistical significance was determined to evaluate the variations in prevalence rates across age groups, thereby identifying age-related patterns of lumbar spine pathologies. This comprehensive approach aimed to ensure accurate and meaningful conclusions about the epidemiology of lumbar spine disorders in the aging population.

RESULTS

The cross-sectional study was conducted on 120 patients undergoing lumbar spine MRI at Allied Hospital Faisalabad. The findings revealed that the study population comprised 68.3% males (n=82) and 31.7% females (n=38). The mean age of the participants was 55.15 ± 10.63 years, with an age range of 41 to 88 years. Patients were categorized into four age groups, with 38.3% aged 41–50 years, 29.2% aged 51–60 years, 20.8% aged 61–70 years, and 11.7% aged over 70 years.

Table 1: Demographic Distribution of Patients

Category	Frequency (%age)
Gender	
Male	82 (68.3)
Female	38 (31.7)
Age (Years)	
41-50	46 (38.3)
51-60	35 (29.2)
61-70	25 (20.8)
>70	14 (11.7)
Total	120 (100.0)

Table 2: Clinical History and Severity of Lower Back Pain

Category	Frequency (%age)
History	
Back pain (Yes)	77 (64.2)
Back pain (No)	43 (35.8)
Trauma (Yes)	26 (21.7)
Trauma (No)	94 (78.3)
Spinal surgery (Yes)	21 (17.5)
Spinal surgery (No)	99 (82.5)
Osteoporosis (Yes)	49 (40.8)

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Category	Frequency (%age)
Osteoporosis (No)	71 (59.2)
Severity of Lower Back Pain	
Occasionally	15 (12.5)
Never	26 (21.7)
Frequently	56 (46.7)
Always	23 (19.2)
Total	120 (100.0)

A detailed analysis of the patients' clinical history revealed that 64.2% reported back pain, 21.7% had a history of trauma, 17.5% had undergone spinal surgery, and 40.8% had osteoporosis. Regarding the intensity and frequency of lower back pain (LBP), 46.7% of patients experienced frequent LBP, 19.2% reported constant pain, 21.7% never experienced LBP, and 12.5% reported occasional LBP. The mean pain intensity, measured using a visual analog scale, was 7.06 ± 0.94, ranging from a minimum of 5 to a maximum of 8. The prevalence of lumbar spine pathologies varied, with 11.7% of patients exhibiting mild facet joint osteoarthritis, 6.7% showing moderate involvement, and 4.2% experiencing severe osteoarthritis, while 77.5% had no facet joint osteoarthritis. Lumbar spinal stenosis was present in 62.5% of patients, with 20.8% classified as mild, 34.2% as moderate, and 7.5% as severe cases, while 37.5% exhibited no signs of stenosis. Vertebral fractures were noted in 17.5% of patients, and 26.7% had other significant pathologies.

Table 3: Functional Status, Quality of Life, Mental Health, and Treatment Distribution

Category	Frequency (%age)
Difficulty in Daily Activities	
Mild	21 (17.5)
Moderate	40 (33.3)
Severe	24 (20.0)
No	35 (29.2)
Overall Quality of Life	
Excellent	16 (13.3)
Moderate	55 (45.8)
Fair	23 (19.2)
Poor	26 (21.7)
Impact on Mental Health	
No Impact	47 (39.2)
Little Impact	56 (46.7)
Severe Impact	17 (14.2)
Treatment Received	
Yes	89 (74.2)
No	31 (25.8)
Total	120 (100.0)

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Table 4: Distribution of patients according to Type of Pathology

		Frequency
Facet joint osteoarthritis	Mild	14 (11.7%)
	Moderate	8 (6.7%)
	Severe	5 (4.2%)
	No	93 (77.5%)
Lumbar spinal stenosis	Mild	25 (20.8%)
	Moderate	41 (34.2%)
	Severe	9 (7.5%)
	No	45 (37.5%)
Any Vertebral fracture	Yes	21 (17.5%)
	No	99 (82.5%)
Any Other Serious pathology	Yes	32 (26.7%)
	No	88 (73.3%)

The study also assessed the impact of lumbar spine disorders on daily activities, with 17.5% of patients reporting mild difficulty, 33.3% moderate difficulty, 20% severe difficulty, and 29.2% reporting no difficulty. The overall quality of life was rated as excellent by 13.3% of patients, moderate by 45.8%, fair by 19.2%, and poor by 21.7%. Mental health analysis indicated that 39.2% of patients reported no impact on their mental health, 46.7% reported a little impact, and 14.2% experienced a severe impact due to lumbar spine disorders. Treatment data revealed that 74.2% of patients received treatment for their conditions, while 25.8% did not seek or receive treatment. Statistical analysis of pathologies by gender showed no significant differences in the distribution of degenerative disc disease, lumbar spinal stenosis, or facet joint osteoarthritis between males and females ($P > 0.05$). However, when age-wise distribution of pathologies was examined, degenerative disc disease showed a statistically significant variation among the age groups ($P = 0.037$), while other pathologies, including lumbar spinal stenosis and facet joint osteoarthritis, did not demonstrate significant differences across age groups.

Table 5: Gender wise distribution of patients according to Type of Pathology

		Gender		Total	P Value
		Male	Female		
Degenerative disc disease	Mild	29(35.4)	15(39.5)	44(36.7)	0.761
	Moderate	26(31.7)	12(31.6)	38(31.7)	
	Severe	15(18.3)	8(21.1)	23(19.2)	
	No	12(14.6)	3(7.9)	15(12.5)	
Lumbar spinal stenosis	Mild	20(24.4)	5(13.2)	25(20.8)	
	Moderate	30(36.6)	11(28.9)	41(34.2)	

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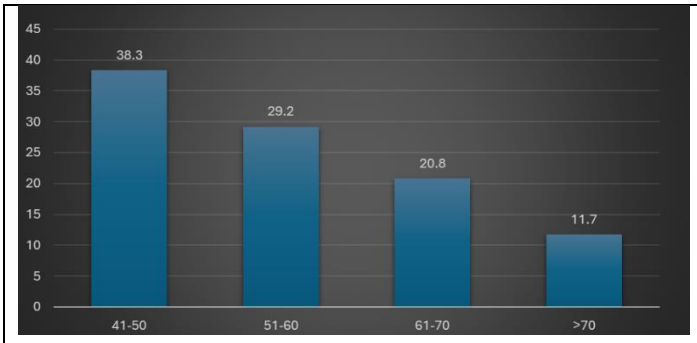
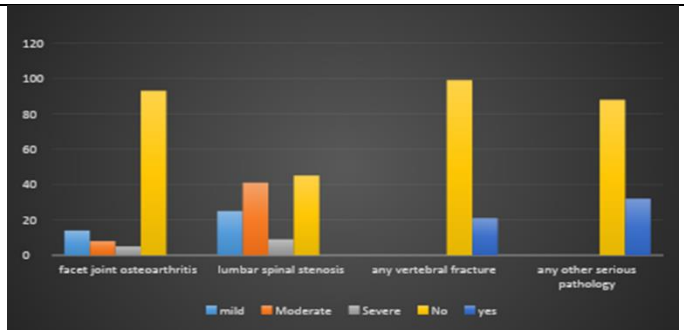
		Gender		Total	P Value
		Male	Female		
	Severe	6(7.3)	3(7.9)	9(7.5)	0.227
	No	26(31.7)	19(50.0)	45(37.5)	
Facet joint osteoarthritis	Mild	9(11.0)	5(13.2)	14(11.7)	0.369
	Moderate	6(7.3)	2(5.3)	8(6.7)	
	Severe	4(4.9)	1(2.6)	5(4.2)	
	No	63(76.8)	30(78.9)	93(77.5)	
Total		82(100)	38(100)	120(100)	

Table 6: Age-wise distribution of patients according to type of pathology

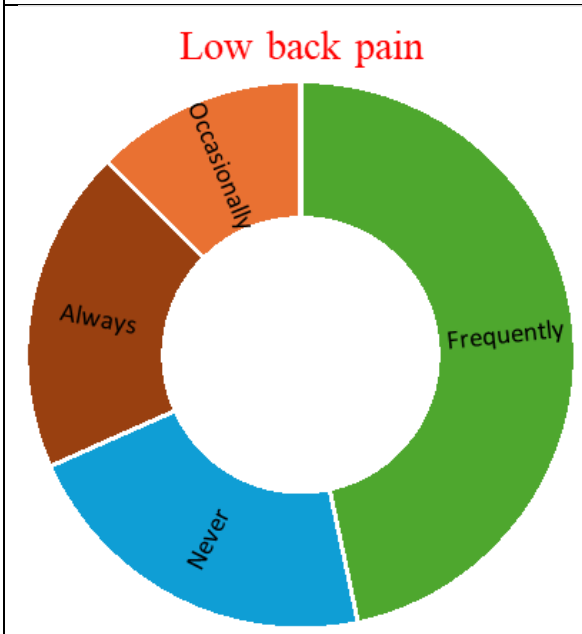
		Age Groups				P Value
		41-50	51-60	61-70	>70	
Degenerative disc disease	Mild	16(34.8)	16(45.7)	7(28)	5(35.7)	0.037
	Moderate	23(50)	6(17.1)	7(28)	2(14.3)	
	Severe	4(8.7)	7(20)	7(28)	5(35.7)	
	No	3(6.5)	6(17.1)	4(16)	2(14.3)	
Lumbar spinal stenosis	Mild	8(17.4)	6(17.1)	6(24.0)	5(35.7)	0.283
	Moderate	17(37.0)	16(45.7)	5(20.0)	3(21.4)	
	Severe	2(4.3)	3(8.6)	4(16.0)	0(0.0)	
	No	19(41.3)	10(28.6)	10(40.0)	6(42.9)	
Facet joint osteoarthritis	Mild	6(13.0)	2(5.7)	4(16.0)	2(14.3)	0.369
	Moderate	3(6.5)	2(5.7)	3(12.0)	0(0.0)	
	Severe	0(0.0)	2(5.7)	1(4.0)	2(14.3)	
	No	37(80.4)	29(82.9)	17(68.0)	10(71.4)	
Total		46(100)	35(100)	25(100)	14(100)	



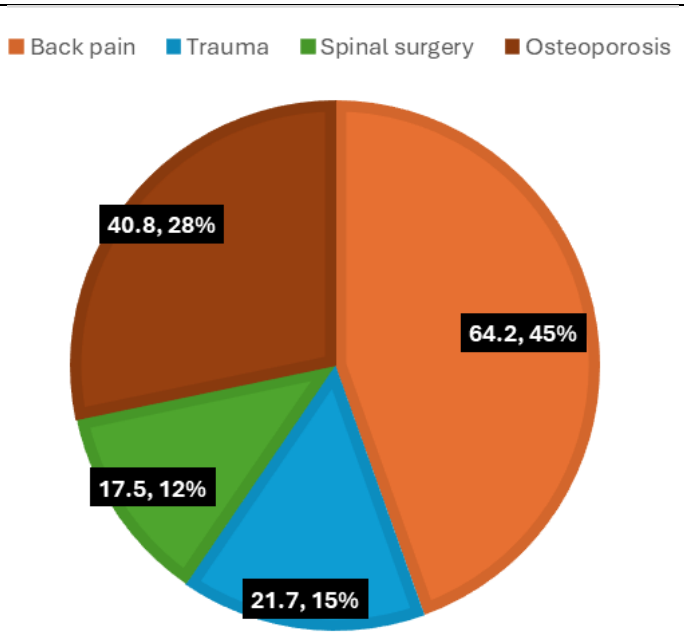
Age-wise distribution of patients



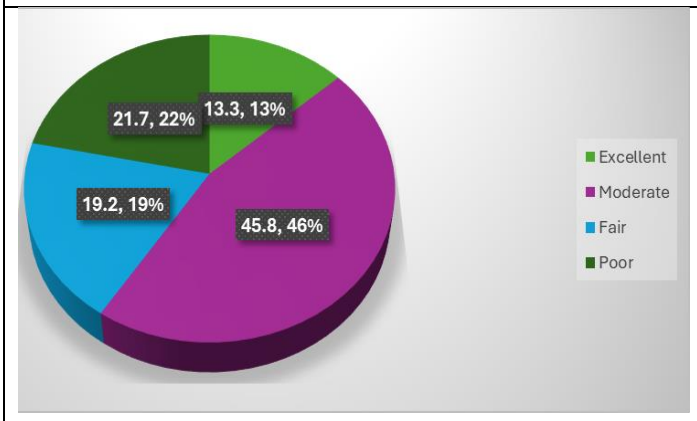
Distribution of patients according to Type of Pathology



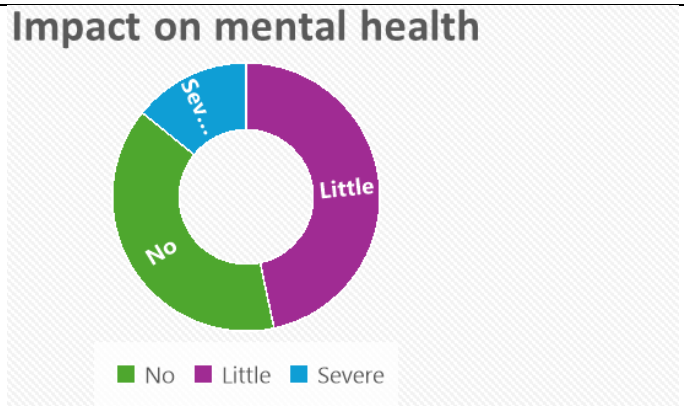
Distribution of Patients according severity of Lower back pain



Distribution of Patients according History



Distribution of patients according to overall quality of life



Impact on mental health

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DISCUSSION

The increasing prevalence of spine-related diseases in aging populations has significant implications for mobility, functional independence, and overall quality of life. Magnetic resonance imaging (MRI) has proven to be a valuable diagnostic tool in assessing soft tissue pathologies without exposing patients to ionizing radiation, enabling a comprehensive evaluation of degenerative and pathological changes in the lumbar spine. It is well established that degenerative disc disease is a natural part of the aging process, often occurring without clinical symptoms. However, the severity and manifestation of degenerative changes vary widely among individuals, making early detection and classification crucial for timely management (14). The findings of this study are consistent with previous literature, highlighting that degenerative disc disease is a leading cause of neck and low back pain in the aging population. The study population consisted predominantly of males (68.3%), with a mean age of 55.15 ± 10.63 years, and the majority of patients were aged between 41 and 59 years. These demographic patterns align with other studies reporting similar age distributions for degenerative spinal conditions in middle-aged and elderly populations (15, 16, 17). Differences in absolute values across studies may be attributed to variations in sample sizes, inclusion criteria, and regional population characteristics.

Clinical history revealed a high prevalence of back pain (64.2%), osteoporosis (40.8%), and prior trauma (21.7%) or spinal surgery (17.5%), which aligns with the established association of these factors with lumbar spine degeneration. Interestingly, 46.7% of patients reported frequent lower back pain, and the average pain intensity was 7.06 ± 0.94 on the visual analog scale, highlighting the significant burden of spinal pathologies on quality of life. This observation is further supported by evidence from MRI studies of asymptomatic individuals, which demonstrate that structural changes such as disc bulges and protrusions can occur without corresponding symptoms (20). Pathological findings revealed that facet joint osteoarthritis was present in 22.6% of patients, with varying degrees of severity, while lumbar spinal stenosis was identified in 62.5% of the sample, predominantly at mild to moderate stages. Vertebral fractures were observed in 17.5% of patients, and 26.7% had other significant pathologies. These results are comparable to findings from studies that emphasize the progressive nature of facet joint arthritis and spinal stenosis with age, particularly among overweight and middle-aged individuals (21). The gender disparity observed in lumbar facet joint osteoarthritis, with women being more affected than men, may be attributable to hormonal differences and the sensitivity of cartilage to female sex hormones.

Strengths of this study include its stratified sampling approach, which allowed for a detailed examination of age-specific prevalence rates, and the use of standardized MRI protocols to ensure diagnostic accuracy. Furthermore, the study provided valuable insights into the relationship between clinical symptoms and imaging findings, which are essential for evidence-based management. However, the study's limitations include its single-center design, which may limit the generalizability of results to broader populations, and the exclusion of younger individuals under 40 years, which precluded the evaluation of early-onset degenerative changes. Additionally, potential confounding factors such as body mass index (BMI), lifestyle habits, and comorbidities were not assessed, which could have provided a more comprehensive understanding of risk factors. The results of this study align with existing evidence that degenerative spinal conditions are among the most common musculoskeletal disorders in clinical practice, with a lifetime prevalence of up to 90% for low back pain (22). However, it is important to note that not all imaging abnormalities correlate with clinical symptoms. For example, multilevel degenerative disc disease and spinal stenosis may be asymptomatic or present with minimal symptoms (23). Studies have also shown that Modic changes and other MRI findings, such as bulging discs and endplate irregularities, are strongly age-dependent but are not always indicative of specific pathological processes (25).

Despite the extensive data on lumbar spine degeneration, gaps remain in understanding the interplay between imaging findings and clinical outcomes. This study highlights the need for larger multicenter research that incorporates additional variables, such as genetic predisposition, biomechanical factors, and occupational stress, to better understand the natural history and progression of spinal pathologies. Continued research in this domain is essential to refine diagnostic approaches and optimize treatment strategies, ultimately improving the quality of life for affected individuals.

CONCLUSION

This study provides valuable insights into the prevalence and impact of lumbar spine disorders among older adults, emphasizing the significant health challenges associated with aging. Conditions such as facet joint osteoarthritis, lumbar spinal stenosis, and vertebral fractures were found to be common, highlighting the diverse ways in which these disorders manifest and progress in individuals. The findings underscore the importance of early detection, personalized treatment strategies, and preventative measures to address the wide

spectrum of spinal pathologies and their implications on mobility, functionality, and quality of life. By prioritizing routine spinal health assessments and timely interventions, the burden of these conditions can be minimized, ultimately enhancing the overall well-being and independence of the aging population.

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