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Evaluation of Lumbar Disc Degenerative Disease on MRI in Disability Index

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ABSTRACT

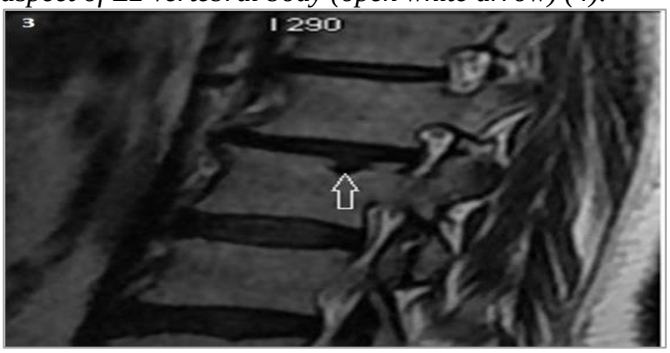
Background: Lumbar disc degeneration (LDD) results from aging, mechanical stress, genetics, and lifestyle factors, causing disc dehydration, height loss, and herniation. MRI helps assess these changes, which often correlate with disability indices like the Oswestry Disability Index (ODI). Understanding this link improves diagnosis and treatment. This study explores the relationship between MRI findings and disability scores for better patient care. **Objective:** Evaluation of lumber disc degeneration on MRI in disability index. **Methodology:** This cross-sectional and observational study was conducted over four months with a sample size of 96 participants, selected through convenience sampling. It included patients with radiating or non-radiating limb pain and chronic back pain lasting over three months from October 2024 to January 2025. Patients with congenital spinal abnormalities or MRI contraindications were excluded to ensure imaging accuracy and safety. **Results:** This study analyzed 96 patients to evaluate the impact of lumbar disc degeneration on the disability index using MRI findings. Right leg pain was reported in 63 (65.6%) patients, while left leg pain was noted in 66 (68.8%) cases. Disc degeneration and stenosis were observed in 43 (44.8%) patients each, while disc bulge was the most prevalent finding in 70 (72.9%) cases. Moderate to severe disability was recorded in 87 (90.6%) patients, highlighting a strong correlation between MRI findings and functional impairment. **Conclusions:** Increased lumbar IDD in MRI goes along with an increased DI. Thus, MRI is a strong indicator of a patient's clinical appearance. However, low back pain and left/right leg numbness/pain cannot be explained by imaging alone. Clinical correlation is imperative for an adequate diagnostic advance in patients with low back pain, left/right leg pain/ numbness.

INTRODUCTION

Non-specific low back pain is a multifaceted condition characterized by its heterogeneity in etiology, presentation, and response to treatment (1). Potential causes and corresponding medical imaging features can be categorized into different types, such as discogenic (e.g., related to disc degeneration), neuropathic (e.g. related to spinal cord compression in canal stenosis), and osseous (e.g., related to defects in vertebral endplates)(2). Magnetic resonance imaging (MRI) offers unparalleled insights into structural abnormalities within the spine, facilitating the objective assessment of pathophysiological changes associated with low back pain. Concurrently, self-reported outcomes provide invaluable subjective measures of pain intensity, functional limitations, and overall disability experienced by individuals. Understanding the intricate interplay between objective imaging findings and subjective symptomatology can help elucidate the underlying mechanisms of low back pain and optimize patient care. Several studies have explored the potential associations between radiological measurements of lumbar spine alterations and self-reported pain and disability outcomes. A recent review has indicated that disc degeneration, spinal stenosis, and endplate lesions have generally high probability of relationship with low back pain and functional disability (3).

Image 1

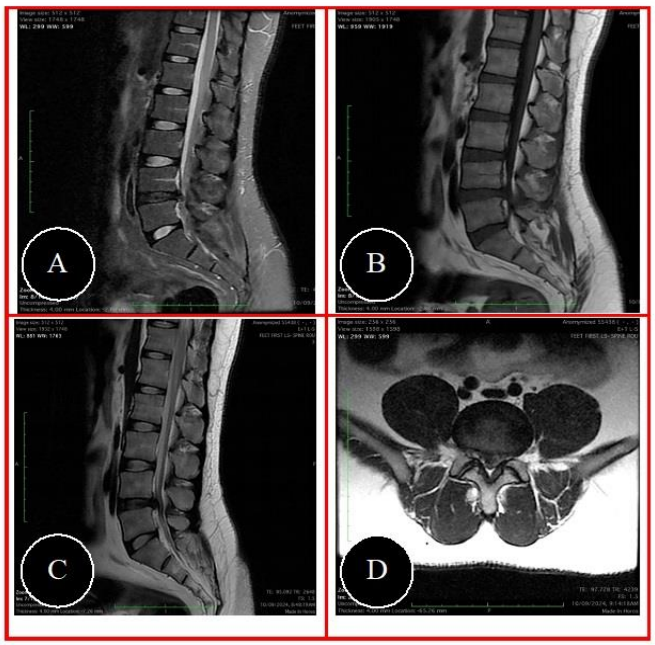
Sagittal T2 WI shows Schmorl's node at the superior aspect of L2 vertebral body (open white arrow) (4).



However, some results remain controversial. For example, while disc degeneration has been associated with low back symptom severity, suggesting a discogenic origin, it has also been found in a consistent percentage of asymptomatic subjects (5). Multiple MRI findings have been associated with greater pain severity(6),and studies have shown that several lesions such as disc protrusion, nerve root displacement/compression, disc degeneration, and spinal stenosis, correlate with low back pain (7–8). Conversely, other studies have found that degenerative changes do not correlate with pain intensity and are not associated with pain history or long-term disability (9–11). Regarding functional disability, weak correlations with disc degeneration have generally been reported (12–14). Other measurements of spine alterations, such as canal stenosis, have been poorly associated with self-reported outcomes (15, 16). The relationship between pain score and disability index, as well as between these measures and MRI fndings, has been only partially confrmed (17). Low back pain (LBP) is one of the typical clinical symptoms of IDD. It is not only a common reason for patients to go to the hospital, but also one of the leading causes of disability.(18,19). Almost all people have transient attacks of LBP in their lives, and a small number of people will experience chronic LBP, which places a significant burden on the social economy, including not only the costs of treating patients (direct costs) but also the loss of social productivity (indirect costs) (20,21).

Image 2

Sagittal STIR (A), T1 (B) and T2 (C) and Axial T2 (L4/L5 level) (D) MRI images of the lumbosacral region of a 33-year-old male depicting diffuse bulging of the L4/L5 degenerative disc causing severe spinal canal stenosis and compression of the L5 transverse nerves (22)



IDD can be induced by a variety of factors, such as aging, heredity factors, mechanical loading, obesity, and even smoking(23-26).The degeneration of IVD happens earlier than in other tissues of the body, as early in adolescence (27,28).Also increase of age, the number of people affected by IVD increases sharply. Currently, the commonly used drugs for the treatment of LBP are non-steroidal anti-inflammatory drugs (NSAIDs), opioid painkillers, muscle relaxants, benzodiazepines, antidepressants, corticosteroids, antiepileptic drugs, and so on. NSAIDs are widely used to treat LBP patients, including non-selective NSAIDs and selective COX-2 NSAIDs. A published Cochrane review suggested that NSAIDs are more effective than placebo for treating LBP (small magnitude) and low risk of side effects (maybe underestimated because of small sample size)(29). Opioids are mainly used in patients with acute attacks, severe pain and are difficult to relieve. Constipation and sedation are the most common adverse symptoms (30). but the dosage and duration of opioids are controversial because of their addiction and central dependence. Muscle relaxants can relieve muscle spasm around the spine and are effective for patients with LBP. As adjunctive therapy, it could be more effective, however, with a higher risk of central nervous system adverse effects(31).Benzodiazepines have been used as muscle relaxants to treat LBP and the most common side effects are drowsiness and dizziness(32).Another random controlled trial suggested that benzodiazepines should be considered standard of care for patients with sciatica associated with lumbar disc prolapse(33).Regarding antidepressants, two systematic reviews reported that they can relieve physical pain,(34,35)but a randomized clinical trial suggested there was no difference in improvement in pain intensity between intervention group (low-dose amitriptyline) and control group (placebo) after 6 months of treatment(36).Epidural steroid injections are one of the most common pain relief injections. Steroids inhibit the production of inflammatory chemicals in the body's immune system, which may be a source of pain. Chou *et al*. (37) suggested that using epidural corticosteroid injections to treat spinal stenosis could reduce pain immediately but had no long-term benefit. Antiepileptic drugs are also considered a useful treatment for LBP. In one study(38) the researchers chose topiramate for 48 patients with LBP and the results indicated that topiramate is a relatively safe and effective agent in the treatment of LBP. Taken together, these drugs have their unique effects and complications. In clinical practice, the severity of pain, the duration of symptoms, the risk factors of complications, and the cost of treatment should be considered when weighing and selecting treatment drugs. The drug chosen for the patient should be the best choice to balance all factors. The gold standard for assessing the relationship of disc material to soft tissue

and neural structure is magnetic resonance imaging (MRI)s (39). The IVD is a fibrocartilaginous structure made up of three distinct components (nucleus pulposus, annulus fibrosus, and the cartilaginous endplates). If the integrity of those three structures is disturbed, this may result in a compromised function of the whole IVD leading to dynamic morphologic and cellular alterations with age and degeneration. Pfirrmann et al. suggested a morphologic grading system which is based on T2-weighted sagittal images that showed a good inter observer accuracy (40).

METHODS

Cross sectional study was conducted at radiology department of agnostic the diagnostic center, Lahore, to evaluate the Lumber disc degeneration on MRI in disability index. Overall 96 patients are noticed within 4 months from October 2024 to January 2025. The study was used a convenient sampling technique to recruit participants. Patients experiencing radiating or non-radiating limb pain and those with a history of back pain for more than three months was included. Individuals with congenital spinal abnormalities or contraindications to MRI scanning, such as pacemaker or cochlear implants, will be excluded. Data was collected through MRI scans to assess spinal conditions. Ethical approval was obtained before participant recruitment, and informed consent was taken from all subjects. The findings helped in understanding spinal pathologies in patients with chronic back pain.

RESULTS

This study, conducted on 96 patients, analyzed the impact of lumbar disc degeneration on the disability index and functional impairment using MRI findings. Among the patients, 63 (65.6%) reported right leg pain, while 33 (34.4%) had no such complaints. Left leg pain was present in 66 (68.8%) patients, whereas 30 (31.3%) reported its absence. Numbness was observed in 21 (21.9%) patients, with 75 (78.1%) experiencing no numbness. Traumatic pain was reported by 16 (16.7%) patients, while 80 (83.3%) had no history of trauma-related discomfort. MRI findings revealed that 43 (44.8%) patients exhibited disc degeneration, whereas 53 (55.2%) showed no signs of degeneration. Similarly, spinal stenosis was present in 43 (44.8%) cases and absent in 53 (55.2%). Disc bulge was detected in 70 (72.9%) patients, while 26 (27.1%) had no disc bulging. Disc compression was noted in 35 (36.5%) cases, with 61 (63.5%) unaffected. Sclerosis was found in 29 (30.2%) patients, while 67 (69.8%) showed no signs of sclerosis. Annular DBT was observed in 32 (33.3%) cases, whereas 64 (66.7%) had no such findings. Disc protrusion was detected in 36 (37.5%) patients, while 60 (62.5%) did not exhibit this condition. Vertebral involvement analysis indicated that 70 (72.9%) patients had no affected vertebrae, while L1, L2, and L3 were involved in 7 (7.3%), 8 (8.3%), and 11 (11.5%) patients, respectively. Assessment of the disability index revealed that 8 (8.3%) patients had mild disability, 43 (44.8%) had moderate disability, and 44 (45.8%) had severe disability.

Table 1

Clinical Findings			
		Frequency	Percent
Right Leg	No	33	34.4
	Present	63	65.6
Left Leg	No	30	31.3
	Present	66	68.8
Numbness	No	75	78.1
	Present	21	21.9
Traumatic Pain	N0	80	83.3
	Present	16	16.7

Figure 3

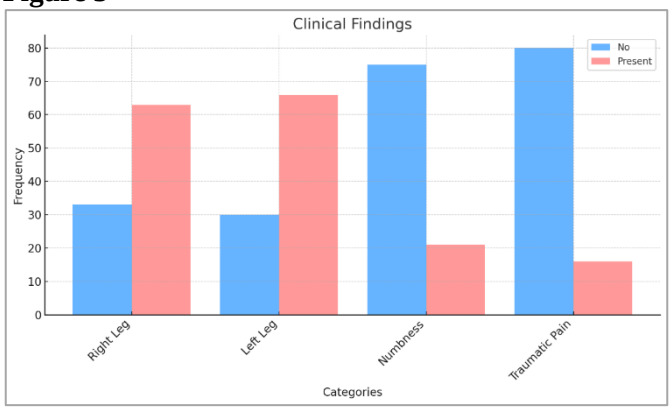


Table 2

MRI Findings			
		Frequency	Percent
Disc Degeneration	No	53	55.2
	Present	43	44.8
Stenosis	No	53	55.2
	Present	43	44.8
Disc Bulge	No	26	27.1
	Present	70	72.9
Disc Compression	N0	61	63.5
	Present	35	36.5

Figure 4

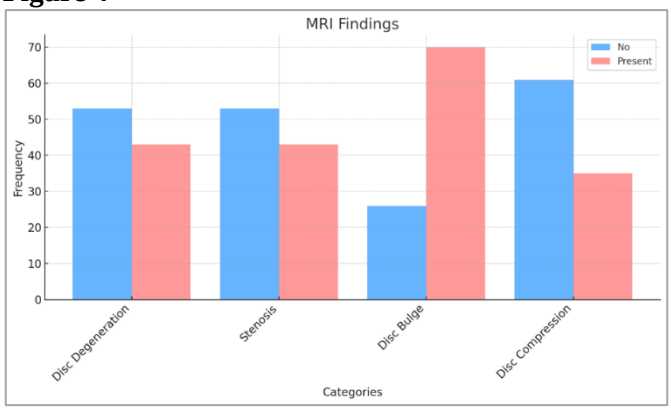


Table 3

MRI Findings			
		Frequency	Percent
Sclerosis	No	67	69.8

	Present	29	30.2
Protrusion	No	60	62.5
	Present	36	37.5
Annular DBT	No	64	66.7
	Present	32	33.3

Figure 5

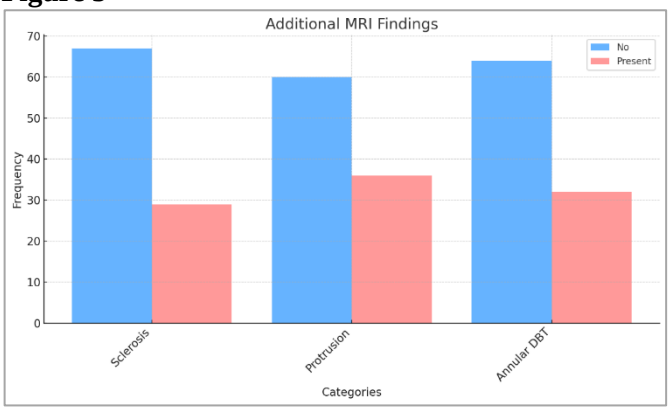
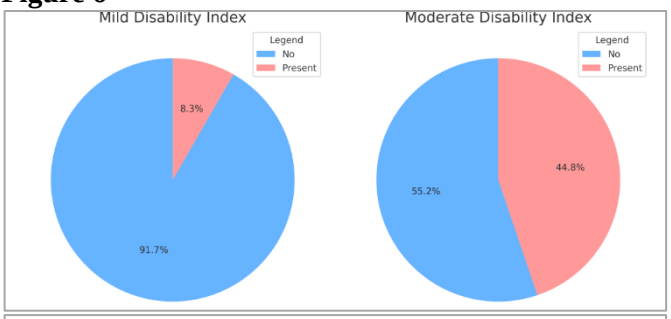
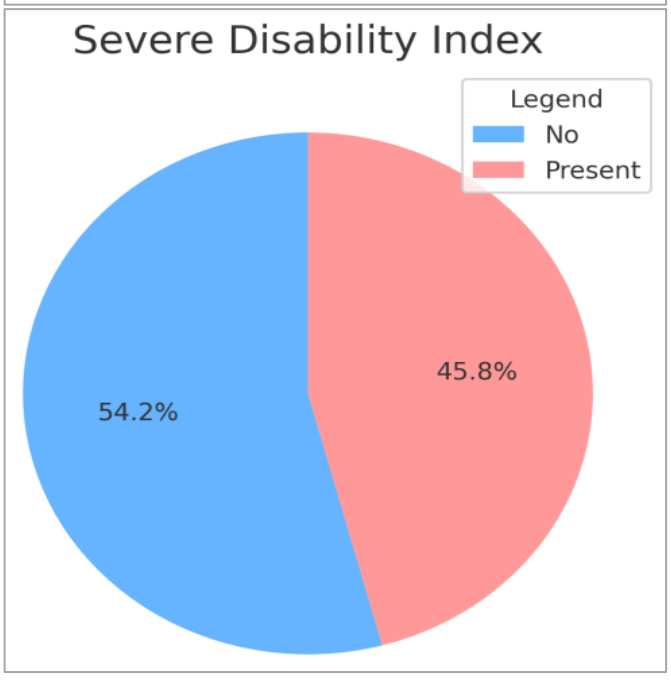


Table 4

Disability Index			
		Frequency	Percent
Mild	No	88	91.7
	Present	8	8.3
Moderate	No	53	55.2
	Present	43	44.8
Severe	No	52	54.2
	Present	44	45.8

Figure 6





DISCUSSION

Lumbar disc degeneration occurs due to multiple factors and leads to various conditions. Changes in the vertebral endplate disrupt disc nutrition, accelerating degeneration. Aging, cell apoptosis, collagen abnormalities, vascular ingrowth, mechanical stress, and proteoglycan imbalances all contribute to this process. In some cases, degeneration causes a loss of disc height, altering segment biomechanics. This can result in disc herniation with radiculopathy or chronic discogenic pain, reflecting the progressive nature of the condition (41). Low back pain (LBP) is generally associated with signs of disc degeneration, but not all types of degeneration directly cause pain. Sciatic pain, which radiates down the leg, is specifically linked to posterior disc bulges that may compress nerve roots. Interestingly, local LBP (pain confined to the lower back) does not show a direct connection to disc degeneration. Additionally, both LBP and sciatic pain are strongly influenced by occupational factors, such as jobs involving heavy lifting, repetitive movements, or prolonged sitting, which can accelerate spinal wear and tear.(42) Studies report wide variations in the prevalence of lumbar spine degeneration, with disc narrowing ranging from 3% to 56%. These inconsistencies cannot be fully explained by age or known risk factors and are likely due to differences in case definitions and measurement methods, which hinder epidemiological research. Over the past decade, understanding of disc degeneration has shifted significantly. While heavy physical loading was once considered the main risk factor, twin studies suggest that occupation and sports-related loading play a minor role beyond normal daily activities. Instead, genetics has emerged as the dominant factor, accounting for 74% of variance in adults. Since 1998, multiple genetic markers linked to disc degeneration have been identified, confirming heredity as a key contributor(43). As we studied 96 patient of lumber disc degeneration whose having different clinical symtoms of pain(16.7%), pain radiates to right and left leg(65.6%/68.8%), and numbness(21.9%). Similar finding is reported in a study conducted in 2014 at all Zigler JE The Oswestry Disability Index (ODI) is a widely used tool for assessing disability related to low back pain. It consists of 10 sections, each evaluating a specific daily activity, such as pain intensity, walking, sitting, lifting, and personal care. Each section is scored from 0 to 5, with the total score converted into a percentage. The interpretation of the ODI score ranges from minimal disability (0-20%) to crippling disability (61-80%), with 81-100% indicating extreme limitations or symptom exaggeration. This index is commonly used in clinical settings and research to track the severity of lumbar disc degeneration, guide treatment decisions, and evaluate surgical outcomes(44). In 96 patients disability index of different clinical symtoms related to history of

stenosis(44.8%), annular disc bulge tear (33.3%), disc compression(36.5%), related studied done in 1997 at al Stratford, The Roland-Morris Disability Questionnaire (RMDQ) is a 24-item tool used to assess disability caused by low back pain. It measures how back pain affects daily activities like walking, bending, and dressing. Each item is scored 1 (yes) or 0 (no), with a total score ranging from 0 (no disability) to 24 (severe disability). RMDQ is widely used in clinical practice and research to track pain-related functional limitations and evaluate treatment effectiveness for conditions like lumbar disc degeneration and chronic back pain(58). Overall 96 patients evaluation of lumber disc degeneration(L1-7.3%,) (L2-8.3%), (L3-11.5%) (L4-14.6%), (L5-29.2%), (S1-21.9%) disability index involvement of different lumber diseases and clinical history helps in treatment planing a related study in 2008 at al Leah Y. Carreon MD surgical and non surgical outcomes on disability index have examined treatments for symptomatic lumbar degenerative disease, but comparisons are difficult due to differences in patient selection, surgical techniques, and outcome measures. Randomized controlled trials (RCTs) face criticism for inconsistent treatment methods and high crossover rates. While several systematic reviews exist, none have analyzed a common clinical outcome measure like the Oswestry Disability Index (ODI) or SF-36. This study aims to systematically review lumbar fusion vs. nonsurgical treatments using ODI as the primary outcome and assess whether outcomes vary by diagnosis(45). Disability index of 96 patients varies according to thier clinical presentation having (mild-8.3%), (moderate-44.8%), (severe-45.8%) similar study published in 2005 at al Bertel Rune Kaale which tells about examined treatments for symptomatic lumbar degenerative disease, but comparisons are difficult due to differences in patient selection, surgical techniques, and outcome measures. Randomized controlled trials (RCTs) face criticism for inconsistent treatment methods and high crossover rates. While several systematic reviews exist, none have analyzed a common clinical outcome measure like the Oswestry Disability Index (ODI) or SF-36. This study aims to systematically review lumbar fusion vs. nonsurgical treatments using ODI as the primary outcome and assess whether outcomes vary by diagnosis (46,47).

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