Original Research

TO STUDY THE CORRELATION BETWEEN MAGNETIC RESONANCE IMAGING FINDINGS AND CLINICAL SEVERITY IN PATIENTS WITH LOW BACK PAIN

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ABSTRACT

Background: Low back pain (LBP) is a common musculoskeletal disorder and a major cause of disability worldwide. The Modified Oswestry Disability Index (MODI) is a validated tool used to assess disability related to LBP.Magnetic Resonance Imaging (MRI) is widely used to evaluate degenerative changes in the lumbosacral spine;however, degenerative findings may also be present in asymptomatic individuals, leading to variability between imaging and clinical severity.

Aims and Objectives: To correlate the radiological changes in low back pain by Magnetic Resonance Imaging (MRI) with clinical severity by Modified Oswestry Disability Index (MODI) in patients with low back pain.

Materials and Methods: In this prospective observational study, 80 patients aged ≥18 years presenting with LBP were assessed using the Modified Oswestry Disability Index (MODI) questionnaire. Subsequently, MRI of the lumbosacral spine was performed, and degenerative changes across five lumbar intervertebral disc levels were graded and correlated with MODI scores.

Results: The mean age of the study population was 46.84 ± 16.2 years with a slight female predominance. Degenerative changes were most frequent atL4/L5 and L5/S1 levels. Most patients demonstrated mild MRI degeneration (82.5%), and minimal disability was observed in 53.75%. MRI grading showed a statistically significant association with disability categories ($P < 0.001$) along with a strong positive correlation (Spearman's $r = 0.950$).

Conclusion: Higher MRI grades of lumbar degeneration were associated with greater functional disability in patients with LBP. MRI grading may aid structural assessment in appropriately selected symptomatic patients, but findings should be interpreted in conjunction with clinical evaluation.

Keywords: Low Back Pain, Lumbar Disc Degeneration, MRI, Modified Oswestry Disability Index, Lumbosacral Spine.

INTRODUCTION

Low back pain (LBP) is among the most common musculoskeletal complaints encountered in clinical practice worldwide and affects individuals across all age groups irrespective of sex, with peak incidence in the third decade of life.[1,2] LBP represents a major cause of disability and reduced quality of life, imposing significant socioeconomic burden.

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Intervertebral disc degeneration (IVDD) is considered one of the principal contributors to chronic LBP.[3]IVDD is a progressive biochemical and structural process characterized by loss of disc hydration, reduced disc height, decreased elasticity, and compromised biomechanical integrity.[4] Several factors including aging, repetitive axial loading, abnormal posture, genetic predisposition, vascular in-growth, and abnormalities in collagen and proteoglycan metabolism contribute to this degenerative cascade. Over time, these changes result in morphological alterations such as disc desiccation, annular fissuring, disc bulge or herniation, endplate changes, and secondary degenerative findings including osteophyte formation.[5]Magnetic Resonance Imaging is the imaging modality of choice for evaluating intervertebral disc pathology because of its excellent soft tissue contrast and

multiplanar capability.[6,7] On MRI, degenerative changes may be identified as reduced T2-weighted signal intensity, disc bulge or herniation, annular fissures, Modic endplate changes, Schmorl's nodes, and osteophyte formation.[8] Among the various grading systems available, the Modified Pfirrmann grading system is widely accepted for standardized assessment of disc degeneration based on disc signal intensity, distinction between nucleus pulposus and annulus fibrosus, and preservation of disc height.[9]Clinical evaluation remains equally important in assessing the functional impact of LBP. The Modified Oswestry Disability Index (MODI) is a validated patient-reported questionnaire widely used to assess pain-related disability and functional limitation in patients with LBP.[10,11] However, discrepancies are often observed between radiological severity and clinical symptoms, with some patients demonstrating significant degenerative changes on imaging despite minimal disability, while others experience severe functional impairment with relatively mild imaging findings.

Therefore, the present study was undertaken to evaluate the correlation between radiological severity of IVDD on MRI using the Modified Pfirrmann grading system and clinical severity measured by MODI in patients presenting with LBP.

METHODOLOGY

This prospective observational, non-interventional study was conducted in the Departments of Radiodiagnosis and Orthopaedics at Christian Medical College and Hospital over an 18-month period (May 2024–October 2025) after approval from the Institutional Research Committee and Institutional Ethics Committee. Adult patients (>18 years) presenting with low back pain and undergoing Magnetic Resonance Imaging of the lumbosacral spine as part of routine clinical evaluation were consecutively enrolled after obtaining written informed consent.

Patients with a history of spinal malignancy, trauma, previous lumbosacral surgery, infective pathology, congenital spinal anomalies, systemic diseases involving the spine, significant motion artefacts, or contraindications to MRI were excluded.

Baseline demographic details were recorded. Functional disability due to low back pain was assessed using the Modified Oswestry Disability Index (MODI), a validated patient-reported questionnaire comprising ten sections evaluating pain intensity and its effect on activities of daily living. The questionnaire consists of ten sections assessing different aspects of daily activities affected by low back pain, including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, travelling, and employment.Each section of the questionnaire was scored on a scale from 0 to 5. From all the completed sections, scores were summed to calculate a total score, with a minimum possible score of 0 and a maximum score of 50. The score disability level was categorized as no disability (0-4), mild disability (5-14), moderate disability (15-24), severe disability (25-34) and completely disabled (35-50).

The percentage (%) of disability for each patient was then evaluated using the following formula[12]: [Patient's score/(number of sections completed x 5)] x 100

Then the % of disability was categorized as minimal (0–20%), moderate (21–40%), severe (41–60%), crippled (61–80%) and either bed bound or exaggerating symptoms (81 to 100%).

MRI examinations were performed on a 3-T scanner (Siemens HealthineersMagnetom Spectra, Erlangen, Germany) using sagittal T1-weighted, sagittal and axial T2-weighted, and sagittal T2 fat-suppressed sequences. Images were independently evaluated by a radiology resident and a senior radiologist using OsiriX MD.

The MRI data of total five lumbar intervertebral discs (L1/L2, L2/L3, L3/L4, L4/L5 and L5/S1) were evaluated based on Modified Pfirrmann grading of lumbar disc degeneration, disc extension beyond interspace, annular fissure, Modic changes, endplate integrity, and osteophytes. These parameters were assigned to each intervertebral disc and quantified using a scoring system ranging from 0 to 3 for each parameter. The total MRI score across all disc levels was calculated to obtain a cumulative score ranging from 0 to 90. Based on this total score, the severity of degeneration was categorized as mild (1–23), moderate (24–45), severe (46–67), and very severe (68–90). This composite scoring system was study-specific and designed to provide an overall estimate of structural degeneration across the lumbar spine.This scoring methodology was adapted from a previously published study[12], which utilized a similar composite MRI scoring system and was also study-specific and not a universally validated scoring method, although it was based on well-established individual MRI parameters of lumbar disc degeneration.

In our study, Modified Pfirrmann grading was used in place of T2 signal intensity, as it is a standardized and widely accepted MRI-based classification system for lumbar disc degeneration that incorporates multiple structural features, thereby providing a more comprehensive assessment of disc degeneration. It was developed to improve discrimination of degeneration severity and has demonstrated good interobserver and intraobserver reliability in previous studies.Both MRI score and % disability were compared at the

end of this study to find a correlation between them.

Radiologicalfindings: MRI Parameters and Scores [12]

Scores/ Parameters	0	1	2	3
Modified Pfirrmann Grading	Grade 1/2/3	Grade 4/5	Grade 6/7	Grade 8
Disc extension beyond interspace (DEBIT)	Intact	Bulge	Protrusion	Extrusion/ sequestration
Annular fissure	Intact	Concentric tear	Radial tears	Transverse tears
Modic changes	Normal	Type I	Type II	Type III
Endplate integrity	Intact	Isolated defects	Schmorl's node <5 mm	Schmorl's node >5 mm
Osteophytes	Absent	Marginal	Discontinuous	Continuous

Categorization as "Normal" of a disc means that the disc is normally developed and is free of any changes of ageing.

Modified Pfirrmann Grading System of Lumbar Disc Degeneration [9]

Grades	Signal from nucleus and inner fibers of annulus	Distinction between inner and outer fibers of annulus at posterior aspect of disc	Height of disc
1	Uniformly hyperintense (equal to CSF)	Distinct	Normal
2	Hyperintense (>presacral fat and <CSF)	Distinct	Normal
3	Hyperintense (<presacral fat)	Distinct	Normal
4	Mildly hyperintense (slightly>outer fibers of annulus)	Indistinct	Normal
5	Hypointense (=outer fibers of annulus)	Indistinct	Normal
6	Hypointense	Indistinct	<30% reduction
7	Hypointense	Indistinct	30%-60% reduction
8	Hypointense	Indistinct	>60% reduction

Sample Size

The sample size was calculated using OpenEpi version 3 software. Based on the prevalence of low back pain (19%) observed from an earlier publication[12], with a power of 80%, 95% confidence interval, two-sided alpha error level of 8%, and 8% absolute precision, a sample size of 80 was calculated for this study.

N = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)]

Statistical Analysis

Categorical variables were presented as number and percentage (%), while quantitative data was expressed as mean ± standard deviation (SD) or median with 25thand 75thpercentiles (interquartile range). Normality of data distribution was assessed using the Shapiro–Wilk Test. Non-parametric tests were applied where the data were not normally distributed.

The association between quantitative variables was analysed using Analysis of Variance (ANOVA). The association between qualitative variables was analysed using Fisher's Exact Test. Correlation between MRI grading anddisability measures (disability score level and percentage disability) was assessed using the Spearman Rank Correlation Coefficient.

Data entry was performed using Microsoft Excel and statistical analysis was carried out using IBM SPSS Statistics version 28.0. A p-value <0.05 was considered statistically significant.

RESULTS AND ANALYSIS

A total of 80 patients presenting with low back pain to the Departments of Radiodiagnosis and Orthopaedics at Christian Medical College and Hospital, Ludhiana, who underwent Magnetic Resonance Imaging (MRI) of the lumbosacral spine, were included in this prospective observational study. All patients were aged 18 years and above and fulfilled the predefined inclusion criteria. The clinical severity of low back

pain was assessed using the Modified Oswestry Disability Index (MODI), while radiological findings were evaluated using MRI of the lumbosacral spine. The study analyzed the correlation between radiological changes observed on MRI and the clinical severity of disability as measured by MODI scores.

Table 01: Age Distribution

Age	Frequency	Percentage
19 to 20 years	5	6.25%
21 to 30 years	10	12.50%
31 to 40 years	13	16.25%
41 to 50 years	20	25.00%
51 to 60 years	16	20.00%
61 to 70 years	10	12.50%
71 to 80 years	6	7.50%
Mean ± SD	46.84 ± 16.2	

The age distribution of the study subjects showed that the majority belonged to the 41–50 years age group, 20 (25.00%) and the mean ± SD age was 46.84 ± 16.2 years(Table 01).

Table 02: Gender Distribution

Gender	Frequency	Percentage
Female	43	53.75%
Male	37	46.25%
Total	80	100.00%

Of the study subjects, 43 (53.75%) were females and 37 (46.25%) were males (Table 02).

Table 03: Body Mass Index Distribution

Body mass index (kg/m²)	Frequency	Percentage
Normal weight (18.5-24.9)	27	33.75%
Overweight(25-29.9)	41	51.25%
Obese(>30)	12	15.00%
Mean ± SD	26.43 ± 3.56	

The distribution of body mass index (BMI) among the study subjects was as follows: normal weight (18.5–24.9 kg/m²) in 27 (33.75%), overweight (25–29.9 kg/m²) in 41 (51.25%), and obese (>30 kg/m²) in 12 (15.00%). The mean ± SD BMI was 26.43 ± 3.56 kg/m² (Table 03).

Table 04(A): MRI Parameters Distribution

Scores	L1-2 level				L2-3 level				L3-4 level				L4-5 level				L5-S1level			
	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
Modified Pfirrmann Grading	56 (70%)	16 (20%)	7 (8.75%)	1 (1.25%)	49 (61.25%)	27 (33.75%)	4 (5%)	0(0%)	43 (53.75%)	28 (35%)	7 (8.75%)	2 (2.50%)	28 (35%)	38 (47.50%)	11 (13.75%)	3 (3.75%)	29 (36.25%)	36 (45%)	13 (16.25%)	2 (2.50%)
DEBIT*	67 (83.75%)	9 (11.25%)	2 (2.50%)	2 (2.50%)	59 (73.75%)	17 (21.25%)	3 (3.75%)	1 (1.25%)	37 (46.25%)	33 (41.25%)	8 (10%)	2 (2.50%)	16 (20%)	36 (45%)	24 (30%)	4 (5%)	35 (43.75%)	25 (31.25%)	19 (23.75%)	1 (1.25%)
Annular fissure	76 (95%)	3 (3.75%)	1 (1.25%)	0(0%)	73 (91.25%)	4 (5%)	0(0%)	3 (3.75%)	68 (85%)	8 (10%)	1 (1.25%)	3 (3.75%)	47 (58.75%)	23 (28.75%)	4 (5%)	6 (7.50%)	67 (83.75%)	8 (10%)	3 (3.75%)	2 (2.50%)

Modic changes	66 (82.50%)	0(0%)	12 (15%)	2 (2.50%)	65 (81.25%)	2 (2.50%)	12 (15%)	1 (1.25%)	60 (75%)	0(0%)	18 (22.50%)	2 (2.50%)	57 (71.25%)	1 (1.25%)	19 (23.75%)	3 (3.75%)	58 (72.50%)	1 (1.25%)	15 (18.75%)	6 (7.50%)
Endplate integrity	58 (72.50%)	14 (17.50%)	5 (6.25%)	3 (3.75%)	58 (72.50%)	17 (21.25%)	4 (5%)	1 (1.25%)	52 (65%)	19 (23.75%)	7 (8.75%)	2 (2.50%)	51 (63.75%)	23 (28.75%)	3 (3.75%)	3 (3.75%)	53 (66.25%)	23 (28.75%)	3 (3.75%)	1 (1.25%)
Osteophytes	59 (73.75%)	19 (23.75%)	1 (1.25%)	1 (1.25%)	51 (63.75%)	24 (30%)	1 (1.25%)	4 (5%)	51 (63.75%)	21 (26.25%)	2 (2.50%)	6 (7.50%)	52 (65%)	27 (33.75%)	0(0%)	1 (1.25%)	54 (67.50%)	25 (31.25%)	0(0%)	1 (1.25%)

*DEBIT-disc extension beyond interspace

Table 04 (B): MRI Parameters Distribution

Disc levels parameters		L1/L2	L2/L3	L3/L4	L4/L5	L5/S1
Modified Pfirrmann Grading	Mean ± SD scores	0.41 ± 0.71	0.44 ± 0.59	0.6 ± 0.76	0.86 ± 0.79	0.85 ± 0.78
DEBIT*	Mean ± SD scores	0.24 ± 0.62	0.32 ± 0.61	0.69 ± 0.76	1.2 ± 0.82	0.82 ± 0.84
Annular fissure	Mean ± SD scores	0.06 ± 0.29	0.16 ± 0.6	0.24 ± 0.66	0.61 ± 0.89	0.25 ± 0.6
Modic changes	Mean ± SD scores	0.38 ± 0.83	0.36 ± 0.78	0.52 ± 0.93	0.6 ± 0.98	0.61 ± 1.04
Endplate integrity	Mean ± SD scores	0.41 ± 0.77	0.35 ± 0.64	0.49 ± 0.76	0.48 ± 0.75	0.4 ± 0.63
Osteophytes	Mean ± SD scores	0.3 ± 0.56	0.48 ± 0.76	0.54 ± 0.87	0.38 ± 0.56	0.35 ± 0.55

*DEBIT-disc extension beyond interspace

Among the MRI parameters evaluated across different lumbar disc levels, Modified Pfirrmann grading showed that score 0 was the most common finding at L1/L2 (70.00%) and L2/L3 (61.25%). At the lower lumbar levels, particularly L4/L5 and L5/S1, score 1 was more frequently observed, accounting for 47.50% and 45.00% of cases, respectively. Higher grades of degeneration were comparatively less common but were seen more frequently at the lower lumbar levels.For disc extension beyond interspace (DEBIT), score 0 was the predominant finding at L1/L2 (83.75%) and L2/L3 (73.75%). However, higher scores representing disc bulge, protrusion, and extrusion or sequestration were relatively more frequent at lower lumbar levels, particularly L4/L5 and L5/S1.Annular fissure was predominantly score 0 across all levels, with the highest proportions at L1/L2 (95.00%) and L2/L3 (91.25%). Concentric tears, radial tears, and transverse tears were observed more frequently at the lower lumbar segments.Modic changes were also most commonly score 0 across all levels, with the highest proportion at L1/L2 (82.50%). Modic type I , type II and type III changes were relatively more common at L4/L5 and L5/S1.Endplate integrity showed score 0 in the majority of cases, particularly at L1/L2 and L2/L3 (72.50% each). Mild abnormalities such as isolated defects, small Schmorl's nodes <5 mm, and larger Schmorl's nodes >5 mm were more frequently observed at the lower lumbar levels.Osteophytes were most commonly absent across all disc levels, with the highest proportion at L1/L2 (73.75%). Marginal osteophytes, discontinuous osteophytes, and continuous osteophytes were relatively more frequent at L2/L3 and L3/L4.The mean ± SD scores of MRI parameters demonstrated an increasing trend of degenerative changes toward the lower lumbar spine. The mean Modified Pfirrmann grading score increased from 0.41 ± 0.71 at L1/L2 to 0.86 ± 0.79 at L4/L5 and 0.85 ± 0.78 at L5/S1. Similarly, mean DEBIT scores increased from 0.24 ± 0.62 at L1/L2 to 1.2 ± 0.82 at L4/L5. Annular fissure, Modic changes, and endplate integrity also showed relatively higher mean scores at L4/L5 and L5/S1(Tables 04a,04b).

Table 05: MRI Grading Distribution

MRI grading	Frequency	Percentage
Mild(1-23)	66	82.50%
Moderate(24-45)	11	13.75%
Severe(46-67)	2	2.50%
Very severe(68-90)	1	1.25%
Mean ± SD	14.4 ± 12.77	

The distribution of MRI grading showed that the majority of patients had mild grading (1–23), accounting for 66 (82.50%) cases, followed by moderate grading (24–45) in 11 (13.75%) cases. The mean ± SD MRI grading score was 14.4 ± 12.77(Table 05).

Table 06: Disability Score Level Distribution

Disability score level	Frequency	Percentage
No disability(0 to 4)	43	53.75%
Mild disability(5 to 14)	18	22.50%
Moderate disability(15 to 24)	11	13.75%
Severe disability(25 to 34)	5	6.25%
Completely disabled(35 to 50)	3	3.75%
Mean ± SD	12.88 ± 11.91	

More than half of the patients had no disability (43, 53.75%). Mild disability was observed in 18 (22.50%) patients, moderate disability in 11 (13.75%), severe disability in 5 (6.25%), and complete disability in 3 (3.75%). The mean disability score was 12.88 ± 11.91(Table 06).

Table 07: Percentage of Disability Distribution

Percentage of disability	Frequency	Percentage
Minimal disability (0 to 20%)	43	53.75%
Moderate disability (21 to 40%)	18	22.50%
Severe disability (41 to 60%)	11	13.75%
Crippled (61 to 80%)	5	6.25%
Either bed bound or exaggerating symptoms (81 to 100%)	3	3.75%
Mean ± SD	25.75 ± 23.82	

Minimal disability (0–20%) was observed in 43 (53.75%) patients, followed by moderate disability (21–40%) in 18 (22.50%), severe disability (41–60%) in 11 (13.75%), crippled (61–80%) in 5 (6.25%), and either bed-bound or exaggerating symptoms (81–100%) in 3 (3.75%). The mean ± SD percentage of disability was 25.75 ± 23.82(Table 07).

Table 08: Correlation of MRI Grading With Disability Score Level and Percentage of Disability

Variables	Disability score level	Percentage of disability
MRI grading		
Correlation coefficient	0.950	0.950
P value	<0.0001	<0.0001

Spearman rank correlation coefficient

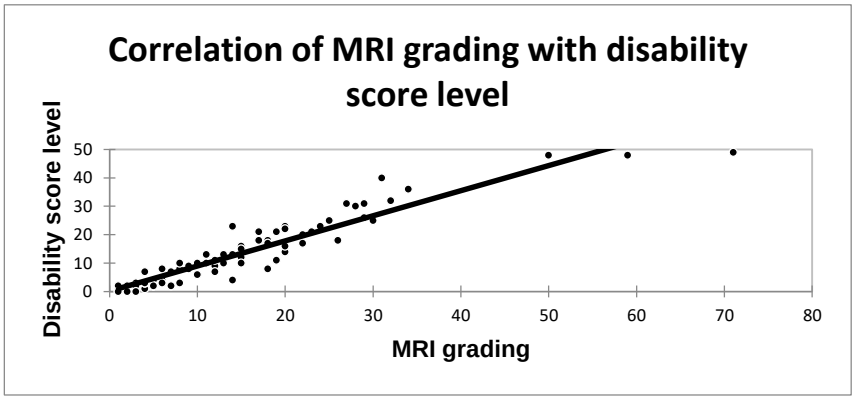

Figure 01 (A): Correlation of MRI Grading with Disability Score Level

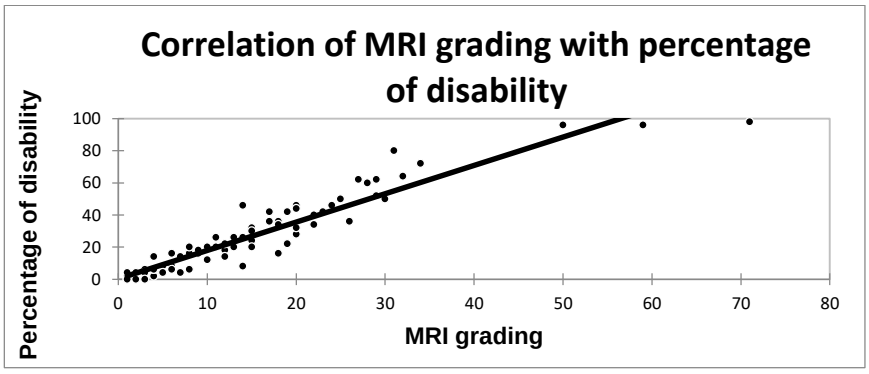

Figure 01 (B): Correlation of MRI Grading with Percentage of Disability

Correlation analysis showed a strong positive association between MRI grading and disability severity. MRI grading had a strong positive correlation with disability score level (Spearman's correlation coefficient r = 0.950, p < 0.0001) and with percentage of disability (r = 0.950, p < 0.0001). This indicates that higher MRI grading was associated with higher disability scores and greater percentage of disability among patients with low back pain (Table 08, Figures01a and 01b).

Figure 02: Multilevel Degenerative Changes in the Lumbosacral Spine in a 70-Year-Old Male. Sagittal T1-Weighted (Left) and T2-Weighted (Right) MRI Images of the Lumbosacral Spine Demonstrate Multilevel Disc Desiccation With Marginal Osteophyte Formation. A Schmorl's Nodeis noted at the Superior Endplate of the L2 Vertebral Body. Modic Type II Endplate Changes are Also Seen at the L3/L4 Level

Figure 03: Degenerative Discal Changes with Disc Bulges in a 70-Year-Old Female. Sagittal T2 FAT SAT MRI Image of the Lumbosacral Spine Demonstrates Disc Desiccation Consistent with Modified Pfirrmann Grade 5. Associated Posterior Disc Bulges are noted at the L3/L4 and L4/L5 Levels

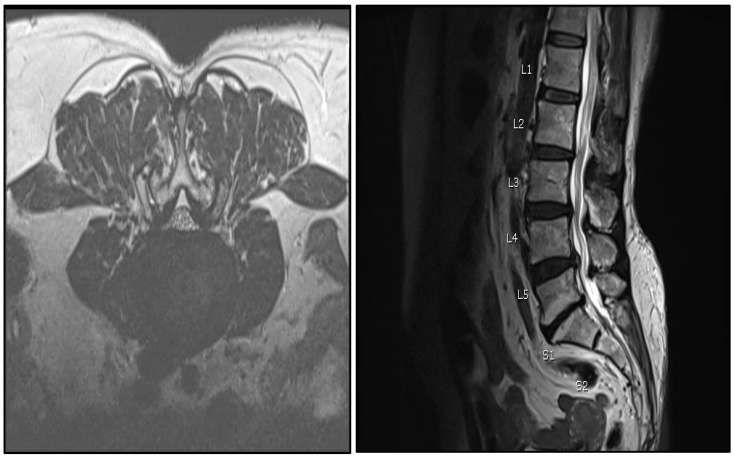

Figure 04: Multilevel Degenerative Changes with Disc Bulges in a 68-Year-Old Female. Sagittal (Right) And Axial (Left) T2-Weighted MRI Images of the Lumbosacral Spine Demonstrate Degenerative Disc Changes with Modified Pfirrmann Grade 4 at the L1/L2 Level, Grade 5 at the L3/L4 and L4/L5 Levels, and Grade 7 at the L5/S1 Level. Associated Posterior Disc Bulges are noted at the L4/L5 and L5/S1 Levels

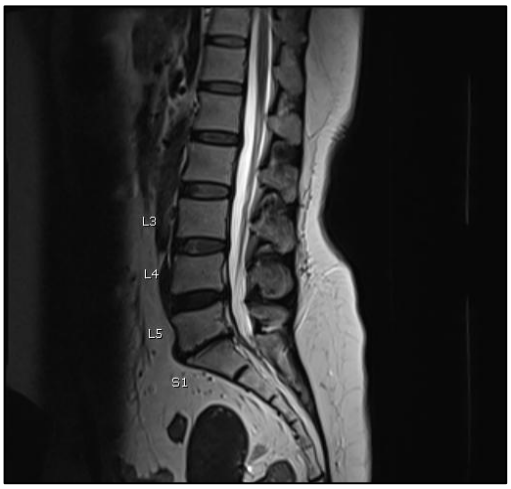

Figure 05: Degenerative Disc Disease with Posterior Disc Bulges in a 50-Year-Old Female. Sagittal T2-Weighted MRI Image of the Lumbosacral Spine Demonstrates Degenerative Discal Changes with Modified Pfirrmann Grade 5 at the L4/L5 Level and Grade 8 at the L5/S1 Level. Associated Posterior Disc Bulgesare also noted. Note The Focal Endplate Defects at L5/S1 Level

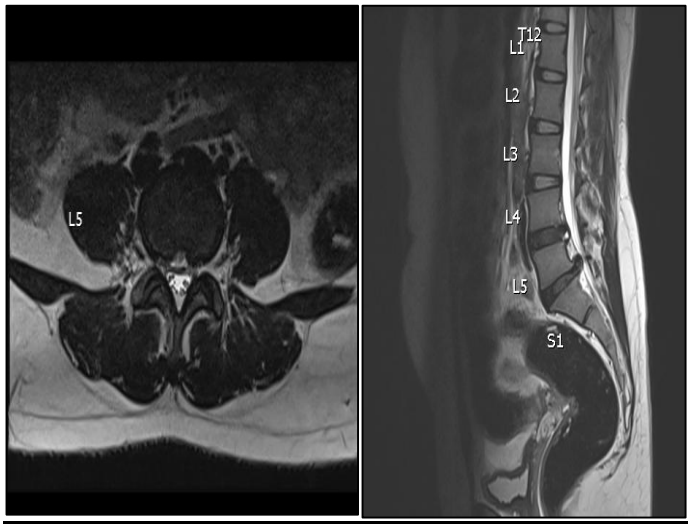

Figure 06: Annular Fissure with Disc Bulge and Disc Extrusion in a 22-Year-Old Female. Sagittal (Right) And Axial (Left) T2-Weighted MRI Images of the Lumbosacral Spine Demonstrate an Annular Fissure (Transverse) with Modified Pfirrmann Grade 5 and Associated Disc Bulge at the L4/L5 Level. Additionally, Modified Pfirrmann Grade 6 with Disc Extrusion Is noted at the L5/S1 Level

DISCUSSION

Our study was conducted among 80 patients presenting with LBP who underwent MRI evaluation of the lumbar spine. Clinical severity was assessed using the Modified Oswestry Disability Index (MODI), which is a widely accepted tool for assessing functional disability in patients with LBP.

In our study, the majority of patients belonged to the 41–50 years age group. These findings indicate that symptomatic lumbar spine degeneration is most commonly observed in middle-aged individuals. Degenerative changes of the spine typically begin in early adulthood but become clinically significant during middle age when structural deterioration becomes more pronounced.Similar observations have been reported in previous studies evaluating lumbar spine degeneration. Suthar et al reported that most patients with lumbar disc degenerative disease were in the 31–50 years age group.[13]Meucci et al conducted a systematic review to determine the prevalence of chronic LBP and reported that the prevalence increased with advancing age, rising from approximately 4.2% in younger adults to about 19.6% in individuals aged 20–59 years.[14]

In this study, females constituted 53.75% of the study population, while males accounted for 46.25%, demonstrating a slight female predominance.

Previous epidemiological studies have also reported a higher prevalence of chronic pain conditions among females. Similarly, Meucci et al reported that chronic LBP was more prevalent among women compared to men, indicating that sex-related biological and social factors may contribute to the higher burden of LBP in females.[14]

In our study, a greater proportion of patients with LBP were found to be overweight. Although the association between BMI categories and MRI grading was not statistically significant, the mean BMI showed a significant variation across different MRI severity groups, with higher BMI values observed among patients exhibiting more severe degenerative changes.

These findings partially support the observations of Samartzis et al, suggesting that increased body weight may still play a role in the progression of lumbar disc degeneration.[15]

In the present study, a composite MRI grading system was used to evaluate degenerative changes across all lumbar intervertebral disc levels using multiple parameters, including Modified Pfirrmann grading, disc extension beyond interspace (DEBIT), annular fissure, Modic changes, vertebral endplate integrity, and osteophyte formation.[12] Previous studies by Hancock et al. and Dragsbæk et al. also demonstrated that cumulative MRI scoring or combining multiple imaging parameters provides a better correlation with clinical symptoms than isolated imaging findings.[16,17]

Degenerative changes in our study were relatively less frequent at the upper lumbar levels and progressively increased toward the lower lumbar segments, particularly L4/L5 and L5/S1. Similar observations were reported by Samartzis et al., Eswara et al., and Suthar et al., who found that lumbar disc degeneration was more prevalent and severe at the lower lumbar levels.[12,13,15] Takatalo et al. further reported that multiple degenerative MRI abnormalities at lower lumbar levels may contribute to greater symptom severity in low back pain.[18]

For DEBIT, intact disc margins were the predominant finding at upper lumbar levels, whereas disc bulge, protrusion, and extrusion/sequestration were more frequently observed at lower lumbar

levels. These findings are comparable with those of Janardhana et al. and the meta-analysis by Brinjikji et al., which demonstrated a higher prevalence of disc abnormalities at lower lumbar segments.[19,20]

Similarly, annular fissures, including concentric, radial, and transverse tears, were more frequently observed at lower lumbar levels, consistent with findings by Rafiee et al., who reported that annular tears commonly coexist with advanced disc degeneration and herniation.[21] Modic changes and endplate abnormalities, including isolated defects and Schmorl's nodes, were also more commonly observed at L4/L5 and L5/S1, in agreement with studies by Wei and Wu, and Chen et al.[22,23] Osteophytes were relatively more frequent at L2/L3 and L3/L4, reflecting degenerative vertebral remodeling, which is partially consistent with the findings of Perera et al.[24] Overall, these findings support that the lower lumbar spine bears the greatest degenerative burden and may have greater clinical relevance in patients with low back pain.

Furthermore, analysis of the mean ± SD scores of MRI parameters in the present study demonstrated a clear increasing trend of degenerative changes toward the lower lumbar spine.

In our study, the majority of patients demonstrated mild MRI grading, followed by moderate, severe, and very severe grades. The predominance of mild degenerative changes in our study population may reflect early presentation of patients for diagnostic evaluation before advanced degeneration develops.

Similar findings have been reported in previous studies evaluating MRI features of lumbar spine degeneration. For example, Eswara et al reported that most patients with lumbar disc degeneration demonstrated mild degenerative changes on MRI.[12]

Clinical severity in the present study was evaluated using the MODI, which is standardised and self reported measurement tool for evaluating functional impairment in patients with LBP. In this study, the majority of patients had no disability, followed by mild disability, moderate disability, severe disability, and complete disability.

Our study demonstrated a strong positive correlation between MRI grading and both disability score level and percentage disability ($r = 0.950$, $p < 0.0001$). These findings indicate that increasing severity of structural abnormalities on MRI is associated with greater functional impairment.

Although the present study demonstrated a strong correlation between MRI grading and disability scores, these findings should not be interpreted to imply that MRI alone can guide clinical decision-making. Degenerative changes of the lumbosacral spine are frequently observed even in asymptomatic individuals, and therefore imaging findings must always be interpreted in conjunction with clinical history and physical examination.

Brinjikji et al and Kasch et al reported that degenerative changes in the lumbar spine are frequently observed even in individuals without symptoms, emphasizing that imaging findings alone cannot fully explain the presence or severity of LBP.[20,25] These observations support our approach of correlating MRI findings with clinical disability rather than relying on imaging in isolation.

Recent advances in quantitative MRI techniques such as T1ρ, T2 mapping, and gagCEST imaging may further improve the assessment of biochemical disc degeneration and its correlation with clinical outcomes.[26] In addition, psychosocial, occupational, and neural factors may significantly influence pain perception and disability and were not specifically evaluated in the present study.[19,27,28]

Current clinical guidelines emphasize that routine MRI in nonspecific LBP may not significantly alter management; however, our study supports the selective and judicious use of MRI when combined with standardized clinical assessment tools.

Thus, the present study reinforces the importance of integrated clinico-radiological evaluation in the assessment of LBP.

Strengths: The strengths of this study include the use of a comprehensive composite MRI grading system, assessment of functional disability using the validated MODI questionnaire, direct clinico-radiological correlation, and use of MRI as the primary imaging modality for lumbar degeneration assessment.

Limitations: Limitations include relatively small sample size, single time-point imaging assessment, lack of interobserver variability analysis, absence of psychosocial and occupational factor assessment, and non-separate evaluation of nerve root compression or radicular symptoms.

CONCLUSION

Our study was conducted to evaluate the relationship between Magnetic Resonance Imaging (MRI) findings and clinical severity in patients with low back pain (LBP) using a composite MRI grading system and the Modified Oswestry Disability Index (MODI).Degeneration was most commonly observed at the lower lumbar levels, particularly L4/L5 and L5/S1, with a predominance in middle-aged individuals.A strong positive correlation between MRI grading and disability score levelas well as percentage disability indicated that increasing structural degeneration is associated with greater functional impairment. However, as imaging findings may not always correspond with clinical symptoms, an integrated clinico-radiological approach remains essential.Thus, the combined use of MRI and standardized disability assessment tools such as MODI provides a more comprehensive evaluation of disease severity and can aid in better clinical decision-making and patient management.

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