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Original Article

Correlation Between Degenerative Changes in Lumbar Intervertebral Discs and Major Primary Complaints: A Retrospective MRI-Based Study

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Abstract

Objectives: This study aimed to evaluate the association between lumbar intervertebral disc height and degenerative changes on magnetic resonance imaging (MRI) and then assess its relationship with patients' clinical complaints.

Design: Cross-sectional observational study.

Setting(s): Single-center imaging-based study.

Participants: A total of 110 patients with low back pain who underwent lumbar MRI.

Interventions: No therapeutic intervention was performed, and lumbar MRI examinations were retrospectively analyzed.

Outcome measures: Intervertebral disc height at the L4–L5 and L5–S1 levels measured on MRI, and its association with disc herniation, disc bulging, Pfirrmann degeneration grade, Modic changes, spinal canal stenosis, radicular pain, and paresthesia.

Results: A total of 110 patients (mean age, 61 years; 52 females and 58 males) were included. Reduced intervertebral disc height was significantly associated with disc herniation ($P = 0.002–0.011$), radicular pain ($P < 0.001$), and paresthesia ($P < 0.001$). Disc height also differed significantly between patients with mild and moderate disc bulging ($P = 0.018–0.048$), whereas no significant difference was observed between moderate and severe bulging ($P > 0.05$). Furthermore, disc height showed a significant inverse association with increasing Pfirrmann degeneration grade ($P < 0.001$) and was significantly lower in patients with spinal canal stenosis than in those without stenosis ($P = 0.019–0.030$), although no significant differences were found among stenosis severity grades ($P > 0.05$).

Conclusions: Lumbar intervertebral disc height is a clinically relevant imaging parameter associated with multiple degenerative spinal conditions and pain-related symptoms, and it may be useful for diagnostic evaluation and follow-up assessment.

Keywords: Low back pain, Intervertebral disc degeneration, Magnetic resonance imaging, Lumbar spine, Radiculopathy

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Introduction

Low back pain (LBP) is considered a common musculoskeletal condition that is associated with disability and reduced quality of life. In addition, it represents a major health concern in older adults and is predominantly related to spinal pathology.[1,2] In industrialized societies, 40–70% of adults experience LBP at least once in their lifetime, and 60–85% develop recurrence within two years.[3] Degenerative disc disease is among the most frequent etiologies of LBP. Although the precise mechanisms linking disc degeneration to pain remain unclear, the severity of degeneration is linked with symptom onset.[4]

It should be noted that disc degeneration results from annular rupture and depletion of nucleus pulposus fluid, leading to reduced disc height and potential disc herniation. This process is frequently accompanied by degenerative changes in adjacent spinal structures,

contributing to transient or sustained impairments of segmental stability.[5,6] Common diagnostic modalities, including plain radiography, myelography, discography, and computed tomography, expose patients to ionizing radiation and are unsuitable for broad population screening. Furthermore, ultrasonography has limited utility in the evaluation of disc pathology. In early degeneration, loss of proteoglycans and type II collagen within the intervertebral disc produces decreased signal intensity on T2-weighted magnetic resonance imaging (MRI) sequences.[5,6]

MRI is the only modality that can safely and comprehensively evaluate spinal discs without exposure-related limitations. More precisely, it is the most sensitive, reliable, and safest technique for detecting degenerative disc changes, particularly during early stages.[7] The lumbar spine is especially susceptible to disc herniation due to its high mobility. According to some studies, approximately 75% of lumbar flexion occurs within the lumbar vertebral joints, with 15–20% occurring specifically at the L4–L5 level.[8,9] Additionally, pathology in this region can cause movement restriction and functional disability since 90–95% of the clinically significant compressive radiculopathies arise at this level. [10,11]

Given these considerations, there remains a clinical knowledge gap regarding the relationship between quantitative lumbar intervertebral disc height and both MRI-defined degenerative changes and patients' primary clinical complaints. Although disc degeneration is commonly graded using qualitative MRI-based systems, the clinical value of objective disc height measurements in relation to symptom patterns has not been perfectly established yet. Therefore, the present study aims to investigate the relationship between intervertebral disc height at the L4–L5 and L5–S1 levels and degenerative disc changes on MRI. It is hypothesized that reduced lumbar disc height at these levels correlates with the increasing severity of degenerative alterations and is associated with patients' primary complaints of chronic LBP and related symptoms.

Materials and methods

Study Design and Imaging Acquisition

This retrospective cross-sectional analytic study was conducted at Imam Reza Hospital, Tabriz University of Medical Sciences, Tabriz, Iran. Consecutive patients who were referred for lumbar MRI due to LBP between April 2019 and April 2020 were included in this study. A total of 110 eligible patients met the inclusion criteria during the study period and were included in the analysis. It should be noted that no a priori sample size calculation was performed, as all available and eligible cases during the defined study period were included. However, individuals with scoliosis exceeding a Cobb angle of 20 degrees and those with significant vertebral abnormalities (e.g., vertebral fractures or neoplasms) were excluded from the investigation. Similarly, patients classified as Kellgren–Lawrence grade 3 or 4 were excluded because advanced osteophyte formation, endplate sclerosis, and joint space narrowing at these stages can obscure intervertebral disc margins, thereby reducing the accuracy and reproducibility of disc height measurements on imaging. Then, lumbar MRI was performed using a standard 1.5-T scanner (MAGNETOM Avanto or MAGNETOM Symphony Vision; Siemens Healthineers). Ultimately, images were independently reviewed by two experienced radiologists at separate time points. In cases of disagreement, a third radiologist re-evaluated the images.

Data Interpretation

Intervertebral disc height at the L4–L5 and L5–S1 levels underwent measurement. Three measurements were obtained, and the mean value was calculated for analysis. In this study, the central disc height was defined as the ratio of the intervertebral disc space to the length of the upper border of the lower vertebral body, which was measured between the central points of the opposing endplates. Additionally, anterior and posterior disc heights were computed at the attachment points of the anterior and posterior vertebral body margins, respectively.

Disc protrusion was defined as a herniation in which the edges of the displaced disc material were smaller than the base of the herniated segment. Likewise, disc extrusion was defined as a herniation in which the distance between the edge of the herniated material and the outer margin of the disc exceeded the width of the herniated base in at least one MRI plane. Sequestration, characterized by discontinuity between the herniated material and the parent disc, was classified as extrusion. Further, disc bulging was defined as the extension of the disc margin beyond the edges of the adjacent vertebral bodies, involving more than 25% of the disc circumference, and was graded as mild, moderate, or severe.

Moreover, Modic changes were classified into three types. Type 1 reflects fibrovascular changes in the subchondral bone marrow, including edema and inflammation, and appears as high signal intensity on T2-weighted images and low signal intensity on T1-weighted images. Additionally, type 2 denotes fatty replacement of the bone marrow, with increased signal intensity on both T1-weighted and T2-weighted images. Furthermore, type 3 represents subchondral bone sclerosis, which is characterized by low signal intensity on both T1-weighted and T2-weighted images and visible sclerotic changes on radiographs. In this study, disc degeneration was evaluated using the Pfirrmann grading system on T2-weighted images; loss of clear distinction between the nucleus pulposus and annulus fibrosus (grades 3–5) would indicate degeneration.

In addition, facet joint degeneration was graded according to Weishaupt's criteria. Grade 1 indicates normal joint space (2–4 mm), and grade 2 denotes narrowing of the joint space (< 2 mm), small osteophytes, or mild hypertrophy of the articular process. Likewise, grade 3 represents joint space narrowing accompanied by moderate osteophytes, moderate hypertrophy, or mild

subarticular erosion, Similarly, grade 4 reflects marked narrowing with large osteophytes, severe hypertrophy, severe subarticular erosion, or cyst formation. Central lumbar stenosis was assessed using Bartynski's grading system, with grades 0 to 3 implying no stenosis, mild stenosis, moderate stenosis, and severe stenosis, respectively. Finally, patient complaints, typically back pain, paresthesia, or radicular pain, were obtained from medical records associated with diagnostic imaging.

Statistical Analysis

Statistical analyses were conducted using SPSS, version 26.0. Quantitative and qualitative variables were reported as means (standard deviations) and frequencies (percentages), respectively. The Kolmogorov–Smirnov test was used to assess normality. Further, parametric tests were applied since normality testing demonstrated an approximately normal distribution for intervertebral disc height variables, parametric tests were applied. Furthermore, one-way analysis of variance (ANOVA) was employed to compare continuous variables across groups with more than two categories, and the independent-samples t-test was applied for two-group comparisons. For significant ANOVA results, Tukey's post hoc analysis was performed to identify intergroup differences.

Moreover, regression analyses were conducted to evaluate associations between disc height (the dependent variable) and degenerative imaging findings (independent variables). Due to sample size considerations, age and gender were not included as covariates in the regression models. A two-sided P-value < 0.05 was considered statistically significant.

Results

Overall, 110 patients with LBP who underwent lumbar MRI were included in the analysis. Intervertebral disc height measurements at the L4–L5 and L5–S1 levels were evaluated in relation to degenerative MRI findings and clinical complaints (Table 1).

Based on the results, disc height was sharply reduced in patients with lumbar disc herniation compared with those without herniation across all measured parameters at both levels (Table 2). Moreover, a progressive decline in disc height was observed with increasing age, particularly among male patients, and multilevel disc space narrowing was more frequently identified in older individuals. In both genders, higher degrees of disc degeneration were found with advancing age, especially in younger patients with early degenerative changes.

The analysis of disc bulging severity demonstrated significant differences in disc height between discs without bulging and those with mild-to-moderate bulging (Table 3). However, no statistically significant differences were noted between moderate and severe bulging, indicating a plateau effect in disc height reduction at advanced stages of bulging.

Disc height showed a strong inverse association with the severity of disc degeneration as graded by the Pfirrmann classification. Likewise, significant differences were found between early (grades 1–2) and advanced (grades 4–5) degeneration across all disc height measurements (Table 4). In contrast, differences between adjacent advanced grades were less pronounced, suggesting that most disc height loss occurs during earlier degenerative stages.

The analysis of disc height in relation to Modic endplate changes revealed no significant differences between Modic type 1 and type 2 changes at either the L4–L5 or L5–S1 level (Table 5).

Regarding spinal canal stenosis, disc height significantly differed between patients without stenosis and those with stenosis (Table 6). Nevertheless, no stepwise decrease in disc height was observed across increasing stenosis grades, indicating that disc height reduction alone does not reliably reflect stenosis severity.

Patients reporting paresthesia demonstrated remarkably lower disc height measurements compared with those without paresthesia across all evaluated levels (Table 7). Similarly, patients with radicular pain displayed substantially reduced disc height values compared with asymptomatic individuals (Table 8).

Figure 1 illustrates the method used for intervertebral disc height measurement on midsagittal T2-weighted images, with measurements obtained at the anterior margin, midpoint, and posterior margin between adjacent vertebral endplates (Figure 1). Moreover, Figure 2 depicts representative axial and sagittal T2-weighted images from a 67-year-old woman with LBP, demonstrating asymmetric disc bulging at the L4–L5 level with advanced disc degeneration and associated degenerative changes (Figure 2).

Discussion

Lumbar disc degeneration is a common imaging

Table 1. Participants' Demographic Information

	Female	Male
Participants	52	58
Mean age	62	60
Mean body weight	74.6	88.6
Mean body height	163.6	179.4
BMI	27.8	27.5

Note. BMI: Body mass index.

Table 2. Intervertebral Disc Height at Different Levels and Presence of Disc Herniation in Patients With Back Pain

Disk	Disk Hernia	No Disk Hernia	*P*-Value
L4-L5	11.93 (1.47)	11.14 (1.30)	0.004
L4-L5-Ant	11.70 (1.59)	10.82 (1.33)	0.002
L4-L -Pos	8.54 (1.64)	7.61 (1.42)	0.002
L5-S1	10.96 (1.49)	10.14 (1.31)	0.003
L5-S1-Ant	10.67 (1.54)	9.77 (1.46)	0.002
L5-S1-Pos	6.42 (1.61)	5.63 (1.58)	0.011

Note. Height is reported as means (standard deviations) in millimeter unit.

Table 3. The Height of the Intervertebral Disc at Different Levels and the Intensity of Bulging in Patients With Back Pain

Disk	No Bulging	Mod- Bulging	Severe- Bulging	*P*-Value	Regression Analysis	Mean Difference	*P*-Value
L4-L5	12.91 (1.66)	11.24 (1.39)	11.54 (1.36)	0.022	1 vs. 2	0.66	0.018
L4-L5-Ant	13.18 (1.91)	11.02 (1.43)	11.14 (1.40)	0.003	1 vs. 2 1 vs. 3	2.16 2.04	0.002 0.004
L4-L5-Pos	10.02 (1.72)	7.77 (1.51)	8.01 (1.49)	0.004	1 vs. 2 1 vs. 3	2.24 2.01	0.002 0.007
L5-S1	11.84 (1.62)	10.24 (1.38)	10.58 (1.41)	0.029	1 vs. 2	1.59	0.026
L5-S1-Ant	11.74 (1.71)	9.93 (1.48)	10.20 (1.52)	0.024	1 vs. 2	1.80	0.018
L5-S1-Pos	7.44 (1.97)	5.79 (1.58)	5.97 (1.59)	0.062	1 vs. 2	1.65	0.048

Note. Height is represented as means (standard deviations) in millimeter unit.

Table 4. The Height of the Intervertebral Disc at Different Levels and the Severity of Degeneration in Patients With Back Pain Based on the Pfirrmann Classification

Disk	Pfirrmann-1	Pfirrmann-2	Pfirrmann-3	Pfirrmann-4	Pfirrmann-5	*P*-Value	Regression Analysis	Mean Difference	*P*-Value
L4-L5	12.61 (1.24)	11.48 (1.29)	10.98 (1.27)	9.75 (0.76)	8.62 (0.72)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.12 1.62 2.85 1.73	0.003 < 0.001 < 0.001 0.005
L4-L5-Ant	12.40 (1.32)	11.22 (1.38)	10.65 (1.24)	9.30 (0.73)	7.89 (0.68)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.17 1.75 3.1 1.92	0.003 < 0.001 < 0.001 0.002
L4-L5-Pos	9.19 (1.32)	8.01 (1.43)	7.55 (1.45)	6.05 (1.20)	5.42 (1.12)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.18 1.63 3.14 1.96	0.006 0.001 < 0.001 0.004
L5-S1	11.60 (1.34)	10.50 (1.28)	10.01 (1.27)	8.77 (0.99)	7.73 (0.89)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.09 1.58 2.83 1.73	0.005 < 0.001 < 0.001 0.006
L5-S1-Ant	11.32 (1.37)	10.17 (1.48)	9.61 (1.24)	8.47 (1.18)	7.34 (1.02)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.14 1.70 2.85 1.70	0.008 < 0.001 < 0.001 0.015
L5-S1-Pos	7.03 (1.43)	5.87 (1.59)	5.73 (1.45)	4.27 (1.39)	3.86 (1.22)	< 0.001	1 vs. 2 1 vs. 3 1 vs. 4 2 vs. 4	1.16 1.30 2.76 1.59	0.016 0.018 < 0.001 0.047

Note. Height is indicated as means (standard deviations) in millimeter unit.

Table 5. Intervertebral Disc Height at Different Levels and Modic Changes in Patients With Low Back Pain

Disk	Type 1	Type 2	Type 3	*P*-Value	Regression Analysis	Mean Difference	*P*-Value
L4-L5	12.93 (1.42)	11.92 (1.33)	10.85 (1.20)	< 0.001	1 vs. 3 2 vs. 3	2.08 1.06	< 0.001 < 0.001
L4-L5-Ant	13.12 (1.64)	11.57 (1.37)	10.56 (1.24)	< 0.001	1 vs. 2 1 vs. 3 2 vs. 3	1.05 2.56 1.01	0.008 < 0.001 0.001
L4-L5-Pos	9.97 (1.46)	8.33 (1.40)	7.41 (1.44)	< 0.001	1 vs. 2 1 vs. 3 2 vs. 3	1.63 2.56 0.92	0.009 < 0.001 0.004
L5-S1	11.87 (1.40)	10.93 (1.35)	9.87 (1.25)	< 0.001	1 vs. 3 2 vs. 3	1.99 1.05	< 0.001 < 0.001
L5-S1-Ant	11.64 (1.52)	10.65 (1.37)	9.47 (1.40)	< 0.001	1 vs. 3 2 vs. 3	2.16 1.17	< 0.001 < 0.001
L5-S1-Pos	7.42 (1.83)	6.46 (1.48)	5.29 (1.45)	< 0.001	1 vs. 3 2 vs. 3	2.13 1.16	< 0.001 < 0.001

Note. Height is reported as means (standard deviations) in millimeter unit.

finding and an important contributor to LBP and related neurological symptoms. In the present study, intervertebral disc height demonstrated a significant association with MRI-defined degenerative changes and patients' primary clinical complaints. Specifically, reduced disc height was observed in the presence of disc dehydration, disc herniation, and radicular symptoms, supporting the clinical relevance of quantitative disc height assessment in lumbar spine MRI.

A key finding of this study was the graded reduction in disc height with the increasing severity of degeneration as classified by the Pfirrmann grading system. Additionally, considerable differences were identified between the early and advanced stages of degeneration, whereas differences between adjacent advanced grades were less remarkable. This pattern suggests that the majority of disc height

Table 6. The Height of the Intervertebral Disc at Different Levels and the Severity of Spinal Canal Stenosis Among Participants With Back Pain

Disk	No Stenosis	Mild- Stenosis	Mod- Stenosis	Severe - Stenosis	*P*-Value	Regression Analysis	Mean Difference	*P*-Value
L4-L5	12.15 (1.16)	11.24 (1.48)	11.13 (1.42)	12.07 (1.07)	0.019	1 vs. 2 1 vs. 3	0.91 1.01	0.028 0.047
L4-L5 -Ant	12.00 (1.25)	10.87 (1.57)	10.82 (1.35)	12.14 (1.05)	0.002	1 vs. 2 1 vs. 3	1.12 1.17	0.008 0.021
L4-L5 -Pos	8.94 (1.25)	7.59 (1.60)	7.75 (1.53)	8.69 (1.16)	0.002	1 vs. 2 1 vs. 3	1.35 1.19	0.002 0.026
L5-S1	11.21 (1.15)	10.26 (1.49)	10.10 (1.45)	11.01 (1.20)	0.014	1 vs. 2 1 vs. 3	0.94 1.10	0.030 0.028
L5-S1 -Ant	10.86 (1.21)	9.99 (1.58)	9.62 (1.58)	10.84 (1.46)	0.016	1 vs. 3	1.23	0.021
L5-S1 -Pos	6.64 (1.37)	5.77 (1.59)	5.43 (1.58)	6.97 (2.08)	0.013	1 vs. 3	1.21	0.035

Note. Height is represented as means (standard deviations) in millimeter unit.

Table 7. Intervertebral Disc Height at Different Levels and Presence of Paresthesia in Patients With Back Pain

Disk	Paresthesia	No-Paresthesia	*P*-Value
L4-L5	11.85 (1.37)	10.55 (1.11)	< 0.001
L4-L5-Ant	11.60 (1.47)	10.21 (1.08)	< 0.001
L4-L5-Pos	8.38 (1.51)	7.09 (1.38)	< 0.001
L5-S1	10.85 (1.39)	9.60 (1.17)	< 0.001
L5-S1-Ant	10.55 (1.53)	9.20 (1.16)	< 0.001
L5-S1-Pos	6.31 (1.64)	5.14 (1.29)	< 0.001

Note. Height is reported as means (standard deviations) in millimeter unit.

Table 8. Intervertebral Disc Height at Different Levels and Radicular Pain in Patients With Back Pain

Disk	Pain	No-Pain	*P*-Value
L4-L5	11.76 (1.33)	10.70 (1.40)	< 0.001
L4-L5-Ant	11.48 (1.37)	10.44 (1.60)	0.001
L4-L5-Pos	8.29 (1.45)	7.26 (1.69)	0.002
L5-S1	10.77 (1.34)	9.74 (1.47)	0.001
L5-S1-Ant	10.47 (1.42)	9.33 (1.61)	< 0.001
L5-S1-Pos	6.24 (1.54)	5.23 (1.67)	0.003

Note. Height is shown as means (standard deviations) in millimeter unit.

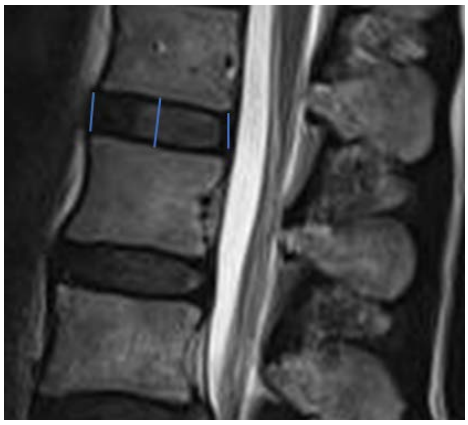

Figure 1. Disc Height Measurement on T2 Midsagittal Image
Note. The disc height between the neighboring endplates is measured at three points: anterior edge, posterior edge, and midpoint of the vertebrae

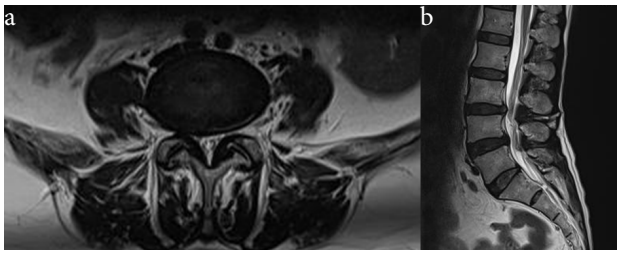

Figure 2. Axial T2-weighted image at the L4–L5 level (a) and midsagittal T2-weighted image of the lumbar spine (b) in a 67-year-old woman with low back pain demonstrating asymmetric disc bulging at the L4–L5 level. Note. Disc degeneration was classified as Grade IV according to the Pfirrmann grading system, characterized by a dark gray disc with loss of distinction between the nucleus and annulus and slightly decreased disc height. Facet joint degeneration was classified as Grade I according to the Weishaupt grading system, with narrowing of the facet joint space, small osteophytes, and mild hypertrophy. Lateral recess stenosis was graded according to Bartynski's classification as Grade II on the right and Grade I on the left.

loss occurs during the earlier phases of the degenerative process, with relative stabilization of disc collapse in more advanced stages. Similar observations have been reported in prior MRI-based studies evaluating disc height changes across degenerative stages.[12-14]

The analysis of disc bulging severity further confirmed this observation. Disc height substantially differed between discs without bulging and those with mild-to-moderate bulging; however, no significant differences were detected between moderate and severe bulging. This plateau effect indicates that once a certain degree of structural compromise is reached, further bulging does not necessarily correspond to additional measurable loss of disc height, which is consistent with the findings of previous radiologic investigations.[12,15]

With regard to Modic endplate changes, disc height did not differ significantly between Modic type 1 and type 2 changes at the L5–S1 level. This finding aligns with prior reports, suggesting that biomechanical factors specific to the lumbosacral junction (higher axial loading and transitional anatomy) may play a dominant role in disc pathology at this level and may partially outweigh the contribution of disc height reduction alone.[15,16] De Schepper et al similarly reported weaker associations between disc height loss and degenerative features at L5–S1 compared with other lumbar levels in a large population-based cohort.[16]

Disc height was markedly lower in patients with spinal canal stenosis compared with those without stenosis; nonetheless, no stepwise reduction in disc height was observed across the increasing grades of stenosis. This finding suggests that although disc height reduction may contribute to the presence of stenosis, it does not reliably represent stenosis severity, which is also influenced by

facet joint hypertrophy, ligamentum flavum thickening, and other degenerative changes.[16-18]

The association between reduced disc height and radicular pain and paresthesia found in this study further highlights the potential clinical value of disc height measurements. It should be noted that disc space narrowing may alter segmental biomechanics and contribute to neural element compromise, thereby increasing the likelihood of radicular symptoms.[19,20] While this study did not establish a causal relationship, the observed associations confirmed the role of disc height as a complementary imaging parameter in the evaluation of symptomatic lumbar degeneration.

Although a detailed discussion of therapeutic strategies is beyond the scope of the present study, accurate MRI-based assessment of intervertebral disc height may assist clinicians in stratifying degenerative severity, guiding diagnostic decision-making, and monitoring disease progression during the follow-up. It is noteworthy that incorporating quantitative disc height evaluation alongside established qualitative grading systems may enhance the radiologic assessment of lumbar degenerative disease.

This study had several limitations. First, its retrospective design may have introduced selection bias, as only patients referred for lumbar MRI were included in this investigation. In addition, the sample encompassed a broad age range, which could complicate the interpretation of the findings; age-stratified analyses could provide more precise insights. Further, gender-specific effects were not analyzed, although gender-related differences in disc height and degeneration were reported. Moreover, all participants were of a single racial background, limiting the generalizability of the results to more diverse populations. Furthermore, the overall sample size was relatively small, which may have reduced statistical power. Additionally, interobserver reliability indices (e.g., intraclass correlation coefficients) were not calculated, which may have affected the reproducibility of intervertebral disc height measurements.

Likewise, quantitative clinical outcome measures, such as pain intensity scores (e.g., visual analog scale) or disability indices (e.g., Oswestry disability index), were unavailable, which limited direct correlation between imaging findings and clinical severity. Although MRI is the reference standard for evaluating spinal degeneration and has formed the basis of this study, correlation with intraoperative or surgical findings could have provided additional validation of disc space measurements. Finally, potential confounding factors, including body mass index, physical activity level, occupational loading, smoking status, lifestyle factors, and genetic predisposition, were not assessed in our study, and future prospective studies should address them.

Conclusions

Intervertebral disc height is an important imaging parameter in the evaluation of lumbar degenerative changes and their clinical manifestations. Accordingly, incorporating disc height measurements into routine MRI assessment may improve the radiologic characterization of disease severity and assist in clinical evaluation and follow-ups. Similarly, early identification of disc height reduction may facilitate timely clinical decision-making and risk stratification in patients with lumbar degenerative disc disease.

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Data availability statement

The data that support our findings are available upon reasonable request from the corresponding author.

Intelligence Use Disclosure

During the preparation of this work, the authors used ChatGPT (OpenAI) to assist with editing the language and improving text clarity. After using this tool, the authors reviewed and edited the content as necessary. It is noteworthy that they take full responsibility for the content of the published article.

Ethics approval and Consent to publication

This study was approved by the Institutional Ethics Committee of Tabriz University of Medical Sciences, Tabriz, Iran. Moreover, all procedures were performed in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments.

Conflict for interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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