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Original Article

Evaluation of Morphological Patterns of Lumbar Disc Herniation on MRI and Their Clinical Correlation with Sedentary Occupations and Lifestyle Risk Factors

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ABSTRACT

Background: Lumbar disc herniation is a common cause of low back pain and radicular symptoms, and magnetic resonance imaging is the preferred modality for assessing disc morphology, level involvement, and nerve root compression. Sedentary lifestyle and prolonged sitting may contribute to lumbar spine loading, but imaging findings require careful clinical correlation. Objective: To evaluate MRI-based morphological patterns of lumbar disc herniation and their clinical association with sciatica, nerve root compression, disc level involvement, and sitting-duration category among symptomatic adults with sedentary lifestyle. Methods: This cross-sectional observational study was conducted at Lahore General Hospital over 90 days and included 69 adults aged 22–60 years referred for lumbar spine MRI because of low back pain with or without radicular symptoms. Demographic, occupational, lifestyle, clinical, and MRI variables were analyzed using SPSS version 27. Categorical variables were summarized as frequencies and percentages, and associations between clinical and imaging variables were assessed with inferential testing where appropriate. Results: The mean age was 37.87 ± 9.05 years, and 36 participants (52.2%) were female. Disc bulge was present in 55 participants (79.7%), disc protrusion in 25 (36.2%), and no extrusion or sequestration was observed. L4–L5 and L5–S1 were the most frequently involved levels. Sciatica was strongly associated with nerve root compression ($p < 0.001$) and disc protrusion (OR ≈ 5.51; 95% CI 1.87–16.21; $p = 0.001$). Participants with disc protrusion had a higher sitting-duration category index than those without protrusion (2.24 ± 0.97 vs 1.77 ± 0.89; $p = 0.046$). Conclusion: Disc bulge and protrusion were the predominant MRI findings, with lower lumbar levels most frequently affected. MRI-detected disc protrusion and nerve root compression correlated meaningfully with sciatica, supporting the importance of clinical-imaging correlation in symptomatic sedentary adults. Keywords: Lumbar disc herniation; MRI; disc protrusion; nerve root compression; sciatica; sedentary lifestyle; low back pain.

INTRODUCTION

Lumbar disc herniation is a common spinal disorder in which intervertebral disc material, including nucleus pulposus, annular tissue, or cartilaginous endplate components, becomes displaced beyond the normal disc space and may produce mechanical or inflammatory irritation of adjacent neural structures

(1). The lumbar spine is particularly vulnerable because it carries substantial axial load while permitting flexion, extension, rotation, and weight transfer between the trunk and pelvis. Degenerative changes in the intervertebral disc, including proteoglycan depletion, dehydration of the nucleus pulposus, annular fissuring, and reduced disc elasticity, progressively compromise the disc's capacity to distribute mechanical stress and may eventually lead to bulging, protrusion, extrusion, or sequestration (2). These changes are especially relevant in young and middle-aged adults because lumbar disc herniation can interfere with mobility, occupational productivity, and quality of life during economically active years.

The clinical presentation of lumbar disc pathology varies according to the morphology, level, direction, and severity of disc displacement, as well as the degree of nerve root or thecal sac involvement. Patients may present with localized low back pain, radicular leg pain, sciatica, numbness, sensory disturbance, muscle weakness, or restricted functional activity, although imaging abnormalities do not always correspond directly with symptom severity (3). Lower lumbar levels, particularly L4–L5 and L5–S1, are commonly affected because of their greater mobility and load-bearing role, and posterolateral disc displacement is clinically important because of its proximity to traversing nerve roots (4). This makes clinical correlation essential, as MRI findings alone may not fully explain patient symptoms and may also be detected in asymptomatic individuals.

Sedentary occupational patterns and lifestyle behaviors are increasingly relevant to lumbar spine health. Prolonged sitting, low physical activity, poor posture, reduced ergonomic support, obesity, smoking, and repetitive mechanical loading have been reported as potential contributors to lumbar disc degeneration and low back pain (5). Sedentary behavior may increase sustained intradiscal pressure, reduce spinal muscle endurance, impair disc nutrition and hydration, and promote maladaptive postural loading, all of which may contribute to degenerative lumbar changes over time (6). However, the relationship between sedentary lifestyle and lumbar disc herniation is complex and cannot be assumed from imaging findings alone. Because disc abnormalities may be influenced by age, sex, occupation, activity level, genetic predisposition, body composition, and clinical referral patterns, studies evaluating lumbar disc morphology must distinguish descriptive imaging patterns from statistically tested clinical associations.

Magnetic resonance imaging is the preferred imaging modality for evaluating suspected lumbar disc disease because it provides high soft-tissue contrast, multiplanar visualization, and detailed assessment of intervertebral discs, spinal canal compromise, thecal sac indentation, foraminal narrowing, and nerve root compression without ionizing radiation (7). MRI can classify disc pathology into bulge, protrusion, extrusion, and sequestration, while also identifying the involved vertebral level and the relationship of the displaced disc material to neural structures (8). Standard lumbar MRI evaluation commonly includes sagittal and axial T1- and T2-weighted sequences, with additional sequences used according to clinical indication and institutional protocol (9). Despite these advantages, MRI interpretation requires careful clinical integration because structural abnormalities may be present in patients with variable symptoms, and not every disc change is clinically meaningful (10).

Existing literature supports the diagnostic value of MRI in lumbar disc disease and has described the frequent involvement of lower lumbar levels, particularly L4–L5 and L5–S1, in symptomatic patients (11). Prior studies have also shown that disc bulging and protrusion are commonly observed MRI patterns, whereas extrusion and sequestration generally represent more advanced morphology and may occur less frequently in routine symptomatic cohorts (12). At the same time, evidence from occupational and lifestyle studies suggests that prolonged sitting, desk-based work, and low physical activity may be relevant to low back pain and disc degeneration, but local data from Pakistan remain limited regarding how MRI-defined disc morphology corresponds with clinical symptoms among patients with sedentary lifestyles (13). This gap is important because clinical decision-making in symptomatic lumbar disc disease should not depend only on the presence of MRI abnormalities; it should also consider the patient's symptom pattern, occupational exposure, sitting duration, physical activity level, and nerve root involvement.

Using a PICO-based framework, the population of interest in this study comprised adults aged 22–60 years with low back pain, with or without lower-limb radicular symptoms, who were referred for lumbar spine MRI in a hospital setting. The exposure context was sedentary occupation or sedentary lifestyle with variable sitting duration and physical activity level. The main comparison was between clinical and imaging subgroups, including participants with and without disc protrusion, sciatica, and nerve root compression. The outcomes were MRI-defined morphological patterns of lumbar disc herniation, involved disc levels, nerve root compression, and clinical symptom correlation. Therefore, this study aimed to evaluate MRI-based morphological patterns of lumbar disc herniation and determine their clinical association with sciatica, nerve root compression, disc level involvement, sitting-duration category, and related lifestyle characteristics among symptomatic adults with sedentary lifestyle.

MATERIAL AND METHODS

This cross-sectional observational study was conducted at Lahore General Hospital over a period of 90 days after approval of the synopsis. The study was designed to evaluate MRI-based morphological patterns of lumbar disc herniation and their clinical correlation with symptoms and sedentary lifestyle characteristics among adults referred for lumbar spine MRI. A cross-sectional design was appropriate because clinical symptoms, occupational and lifestyle variables, and MRI findings were assessed at a single point in time without intervention or follow-up, allowing estimation of the frequency of disc pathology patterns and evaluation of associations between imaging findings and clinical variables within the study population.

The study population consisted of adults aged 22–60 years who presented with low back pain, with or without radicular leg discomfort, and were referred for lumbar spine MRI for suspected lumbar disc pathology. Male and female participants were eligible if they had a sedentary occupation or sedentary lifestyle and fulfilled the clinical indication for MRI evaluation. Participants were excluded if they were younger than 22 years or older than 60 years, were unable or unwilling to provide informed consent, had acute spinal trauma, lumbar fracture or dislocation, or had contraindications to MRI. Eligible participants presenting during the study period were screened according to the predefined selection criteria before enrolment.

The sample size was calculated using the formula for estimating a single population proportion, using a 95% confidence level, an expected prevalence of 76.6%, and a 10% margin of error. This calculation produced a required sample size of 69 participants, and all 69 enrolled participants were included in the final analysis. Recruitment was limited to patients meeting the eligibility criteria and referred for lumbar spine MRI during the study period, ensuring that the analyzed sample represented symptomatic adults undergoing clinically indicated imaging rather than asymptomatic community participants.

Data collection included demographic information, occupational category, sedentary lifestyle status, sitting duration per day, physical activity level, clinical symptoms, and MRI findings. Age was recorded in years and sex was recorded as male or female. Occupation was categorized as housewife, teacher, desk officer, business, call centre worker, student, or none. Sitting duration was recorded in predefined categories, including 4–6 hours, 6–8 hours, 7–9 hours, and 8–10 hours per day. Physical activity level was categorized as low, moderate, or high according to the participant's reported routine activity level. Clinical variables included low back pain, lower-limb radiating pain, sciatica, numbness, and other symptoms relevant to lumbar disc disease. Sciatica was treated as a clinical symptom pattern suggestive of radiating nerve-related pain, while nerve root compression was recorded as an MRI-based finding.

Lumbar spine MRI was performed using a 1.5 Tesla scanner with standard sagittal and axial imaging planes. MRI assessment focused on the presence and type of lumbar disc pathology, involved disc level, and nerve root compression. Disc morphology was categorized as disc bulge, disc protrusion, disc extrusion, or disc sequestration. Disc level involvement was recorded according to the affected lumbar level or combination of levels, including L3–L4, L4–L5, L5–S1, and multilevel involvement. Nerve root

compression was recorded according to MRI evidence of neural compromise and categorized as present, absent, or mild as reported in the dataset. Because more than one MRI feature could be present in the same participant, disc bulge and disc protrusion were treated as independently coded imaging findings rather than mutually exclusive diagnostic categories.

To reduce selection and information bias, eligibility criteria were applied before data entry, and MRI findings were recorded using predefined morphology categories. Standardized data extraction was used for demographic, clinical, lifestyle, and imaging variables to maintain consistency across participants. The interpretation of associations was restricted to variables with adequate variation in the dataset. Because sedentary lifestyle was present in all participants, it was treated as a defining characteristic of the study population rather than as an exposure variable for inferential comparison. Therefore, statistical association between sedentary lifestyle and disc pathology was not tested as a valid comparative analysis. Instead, clinically meaningful comparisons were focused on variables that showed variability, including disc protrusion status, sciatica, nerve root compression, disc level involvement, sitting-duration category, and physical activity level.

Data were analyzed using SPSS version 27. Continuous variables were summarized using mean and standard deviation when approximately normally distributed, while categorical variables were summarized using frequencies and percentages. Age was reported as mean ± standard deviation with minimum and maximum values. Gender, occupation, sedentary lifestyle, sitting-duration category, physical activity level, disc pathology type, disc level involvement, and nerve root compression were reported as categorical variables. Associations between categorical clinical and MRI variables, including sciatica, nerve root compression, disc protrusion, and disc level involvement, were assessed using chi-square testing where assumptions were met; when variables were constant or sparse, inferential testing was not interpreted as evidence of association. Sitting-duration category was compared between participants with and without disc protrusion using the available coded sitting-duration data, with statistical significance set at $p < 0.05$. Findings were interpreted cautiously because coded ordinal sitting-duration categories do not represent exact continuous hours unless raw sitting-time values are available.

The primary descriptive outcomes were the frequency of disc bulge, disc protrusion, disc extrusion, disc sequestration, involved lumbar disc levels, and nerve root compression. The main inferential outcomes were the association between sciatica and nerve root compression, the association between sciatica and disc protrusion, the relationship between sciatica and disc level involvement, and the difference in sitting-duration category according to disc protrusion status. Missing or incomplete observations were checked during data entry, and analyses were conducted using valid available cases. Data integrity was maintained through structured variable coding, consistency checks between table totals and denominators, and verification that all percentages were calculated using the correct denominator. Participant confidentiality was maintained throughout data handling and reporting, and only aggregated findings were presented.

RESULTS

A total of 69 participants with low back pain and suspected lumbar disc pathology were included in the final analysis. The mean age of the participants was 37.87 ± 9.05 years, with an age range of 22–55 years. Females represented 36/69 participants (52.2%), while males represented 33/69 participants (47.8%). The most frequent occupational categories were housewives, reported by 19 participants (27.5%), followed by teachers in 15 participants (21.7%) and desk officers in 12 participants (17.4%). All participants were classified as having a sedentary lifestyle; therefore, sedentary lifestyle was treated as a defining characteristic of the study population rather than as a variable for inferential comparison. Most participants reported prolonged sitting, with 31/69 (44.9%) sitting for 6–8 hours per day and 25/69 (36.2%) sitting for 8–10 hours per day. Physical activity was most commonly moderate, reported by 39/69

participants (56.5%), followed by low physical activity in 26/69 participants (37.7%) and high physical activity in only 4/69 participants (5.8%) (Table 1).

Table 1. Demographic, occupational, and lifestyle characteristics of participants (n = 69)

Variable	Category	Frequency (n)	Percentage (%)
Age, years	Mean ± SD	37.87 ± 9.05	—
	Minimum–maximum	22–55	—
Gender	Male	33	47.8
	Female	36	52.2
Occupation	Housewife	19	27.5
	Teacher	15	21.7
	Desk officer	12	17.4
	Business	9	13.0
	Call centre	6	8.7
	Student	5	7.2
	None	3	4.3
Sedentary lifestyle	Yes	69	100.0
	4–6 hours	12	17.4
	6–8 hours	31	44.9
	7–9 hours	1	1.4
	8–10 hours	25	36.2
Physical activity level	Low	26	37.7
	Moderate	39	56.5
	High	4	5.8

MRI evaluation showed that disc bulge was the most frequent morphological finding, observed in 55/69 participants (79.7%), whereas disc protrusion was present in 25/69 participants (36.2%). No participant showed disc extrusion or disc sequestration. Because disc bulge and disc protrusion were coded as separate MRI findings, these categories were interpreted as independently recorded imaging features rather than mutually exclusive diagnostic groups. The most commonly involved disc level was L4–L5, reported in 23/69 participants (33.3%), followed by L5–S1 in 21/69 participants (30.4%). Combined L4–L5 and L5–S1 involvement was observed in 12/69 participants (17.4%), while multilevel involvement including L3–L4, L4–L5, and L5–S1 was present in 5/69 participants (7.2%). Nerve root compression was present in 30/69 participants (43.5%), absent in 37/69 participants (53.6%), and reported as mild in 2/69 participants (2.9%) (Table 2).

Table 2. MRI-based lumbar disc pathology and level involvement among participants (n = 69)

MRI variable	Category	Frequency (n)	Percentage (%)
Disc bulge	Present	55	79.7
	Absent	14	20.3
Disc protrusion	Present	25	36.2
	Absent	44	63.8
Disc extrusion	Present	0	0.0
	Absent	69	100.0
Disc sequestration	Present	0	0.0
	Absent	69	100.0
Disc level involvement	L4–L5	23	33.3
	L5–S1	21	30.4
Disc level involvement	L4–L5 and L5–S1	12	17.4
	L3–L4, L4–L5, and L5–S1	5	7.2
Disc level involvement	L3–L4 and L4–L5	4	5.8
	L3–L4	4	5.8
Nerve root compression	Present	30	43.5
	Absent	37	53.6
Nerve root compression	Mild	2	2.9

Clinical-imaging association analysis showed a strong relationship between sciatica and nerve root compression. Among participants with sciatica, 28/32 (87.5%) had nerve root compression, while only 3/32 (9.4%) had no compression and 1/32 (3.1%) had mild compression. In contrast, among participants without sciatica, 34/37 (91.9%) had no nerve root compression, while only 2/37 (5.4%) had definite nerve

root compression. This association was statistically significant ($p < 0.001$). Disc protrusion was also significantly associated with sciatica. Sciatica was present in 18/25 participants (72.0%) with disc protrusion compared with 14/44 participants (31.8%) without disc protrusion. The estimated odds of sciatica were approximately 5.51 times higher in participants with disc protrusion than in those without disc protrusion, with an approximate 95% confidence interval of 1.87–16.21 and a reported p-value of 0.001 (Table 3).

Table 3. Clinical association of sciatica with nerve root compression and disc protrusion

Association	Category	Sciatica present n (%)	Sciatica absent n (%)	Total	p-value
Nerve root compression	Present	28 (93.3% within NRC present)	2 (6.7% within NRC present)	30	<0.001
Nerve root compression	Absent	3 (8.1% within NRC absent)	34 (91.9% within NRC absent)	37	—
Nerve root compression	Mild	1 (50.0% within mild NRC)	1 (50.0% within mild NRC)	2	—
Disc protrusion	Present	18 (72.0% within protrusion present)	7 (28.0% within protrusion present)	25	0.001
Disc protrusion	Absent	14 (31.8% within protrusion absent)	30 (68.2% within protrusion absent)	44	—

Sciatica distribution also varied by disc level involvement. Among the 32 participants with sciatica, isolated L4–L5 involvement was observed in 9 participants, combined L4–L5 and L5–S1 involvement in 8 participants, isolated L5–S1 involvement in 7 participants, and multilevel L3–L4/L4–L5/L5–S1 involvement in 5 participants. All 5 participants with three-level involvement had sciatica, whereas none of the 4 participants with isolated L3–L4 involvement had sciatica. These findings suggest that sciatica was more frequent in participants with lower lumbar or multilevel disc involvement, particularly when L4–L5 and L5–S1 were affected (Table 4).

Table 4. Distribution of sciatica according to disc level involvement

Disc level involvement	Total n	Sciatica present n (%)	Sciatica absent n (%)
L4–L5 and L5–S1	12	8 (66.7)	4 (33.3)
L3–L4, L4–L5, and L5–S1	5	5 (100.0)	0 (0.0)
L4–L5	23	9 (39.1)	14 (60.9)
L5–S1	21	7 (33.3)	14 (66.7)
L3–L4 and L4–L5	4	3 (75.0)	1 (25.0)
L3–L4	4	0 (0.0)	4 (100.0)

Sitting-duration category differed between participants with and without disc protrusion. Participants with disc protrusion had a higher coded sitting-duration mean of 2.24 ± 0.97 compared with 1.77 ± 0.89 among participants without disc protrusion. This difference was statistically significant ($p = 0.046$). Because sitting duration was recorded as an ordinal category rather than exact continuous hours, this finding should be interpreted as a difference in sitting-duration category rather than a precise difference in mean daily sitting hours (Table 5).

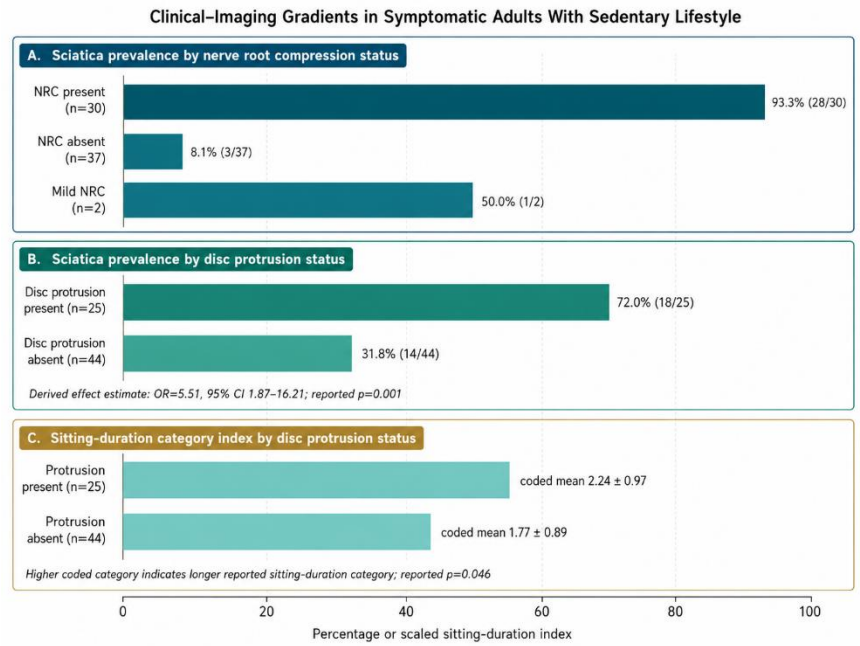

Figure 1. Clinical–Imaging Gradients in Symptomatic Adults with Sedentary Lifestyle.

The panelled figure demonstrates that sciatica clustered strongly with MRI-confirmed nerve root compression, affecting 28/30 participants (93.3%) with definite compression compared with 3/37 participants (8.1%) without compression and 1/2 participants (50.0%) with mild compression. Disc protrusion also showed a clinically meaningful symptom gradient, with sciatica present in 18/25 participants (72.0%) with protrusion versus 14/44 participants (31.8%) without protrusion, corresponding to an estimated odds ratio of 5.51 and an approximate 95% confidence interval of 1.87–16.21. Participants with disc protrusion also had a higher sitting-duration category index than those without protrusion (2.24 ± 0.97 vs 1.77 ± 0.89; p = 0.046), supporting a pattern in which longer reported sitting duration, disc protrusion, nerve root compression, and sciatica align clinically within this symptomatic sedentary cohort.

Table 5. Sitting-duration category according to disc protrusion status

Variable	Disc protrusion status	n	Mean coded category ± SD	Standard error	p-value
Sitting duration per day	Present	25	2.24 ± 0.97	0.194	0.046
	Absent	44	1.77 ± 0.89	0.134	—

No inferential comparison was performed between sedentary lifestyle and disc bulge, protrusion, extrusion, or sequestration because sedentary lifestyle was present in all 69 participants. Therefore, the dataset does not permit estimation of a statistical association between sedentary lifestyle and MRI-defined disc pathology. The findings instead indicate that, within this symptomatic sedentary sample, disc bulge and protrusion were common, lower lumbar levels were most frequently involved, disc protrusion was associated with sciatica, and sciatica showed a strong clinical-imaging relationship with nerve root compression.

DISCUSSION

This cross-sectional observational study evaluated MRI-based morphological patterns of lumbar disc herniation and their clinical correlation among symptomatic adults with sedentary lifestyle. The principal findings were that disc bulge and disc protrusion were the dominant MRI abnormalities, lower lumbar levels were most frequently involved, and clinically meaningful associations were observed between sciatica, nerve root compression, and disc protrusion. Disc bulge was identified in 55 of 69 participants (79.7%), while disc protrusion was present in 25 participants (36.2%); no cases of disc extrusion or sequestration were observed. L4–L5 was the most frequently affected level, followed closely by L5–S1, supporting the established understanding that lower lumbar segments are more susceptible

to degenerative and herniation-related changes because of greater axial loading, mobility, and biomechanical stress. These findings are consistent with previous MRI-based studies reporting that disc bulging and protrusion are common morphological patterns in symptomatic lumbar spine populations, while extrusion and sequestration are less frequent and generally reflect more advanced pathology (4,11,12).

The predominance of L4–L5 and L5–S1 involvement has important clinical relevance because these levels are anatomically and mechanically predisposed to disc degeneration and nerve root irritation. In the present study, isolated L4–L5 involvement was observed in 23 participants (33.3%), isolated L5–S1 involvement in 21 participants (30.4%), and combined L4–L5/L5–S1 involvement in 12 participants (17.4%). Multilevel involvement including L3–L4, L4–L5, and L5–S1 was present in 5 participants (7.2%), and all participants in this subgroup had sciatica. Although the small number of multilevel cases limits statistical stability, this distribution suggests that broader lower lumbar involvement may be clinically relevant in patients presenting with radicular symptoms. Previous literature similarly indicates that L4–L5 and L5–S1 are the most frequently affected levels in lumbar disc herniation, likely because these segments bear substantial mechanical load and are exposed to repeated flexion-extension and compressive forces during routine activity (3,10,19).

A strong clinical-imaging relationship was observed between sciatica and nerve root compression. Among participants with definite nerve root compression, 28 of 30 (93.3%) had sciatica, whereas only 3 of 37 participants (8.1%) without nerve root compression reported sciatica. This association was statistically significant, with a reported p-value of <0.001, and supports the clinical relevance of MRI-detected neural compromise in symptomatic patients. Mechanistically, displaced disc material may compress or irritate adjacent nerve roots, producing radicular pain through both mechanical deformation and inflammatory pathways. This finding is in agreement with studies showing that lumbar disc pathology becomes more clinically meaningful when imaging abnormalities correspond with dermatomal pain, sciatica, sensory disturbance, or objective neural compression rather than being interpreted as isolated structural findings (3,20).

Disc protrusion also showed a significant association with sciatica. Sciatica was present in 18 of 25 participants (72.0%) with disc protrusion compared with 14 of 44 participants (31.8%) without protrusion, giving an estimated odds ratio of approximately 5.51 with an approximate 95% confidence interval of 1.87–16.21 and a reported p-value of 0.001. This indicates that participants with disc protrusion had substantially higher odds of sciatica than those without protrusion. This result is clinically plausible because protruded disc material may narrow the lateral recess or neural foramen and increase the likelihood of nerve root irritation, especially when protrusion occurs at lower lumbar levels. Earlier MRI-clinical correlation studies have also emphasized that protrusion, foraminal narrowing, and nerve root compression are more likely to correspond with radicular symptoms than nonspecific degenerative findings alone (20).

All participants in the present study had a sedentary lifestyle, and most reported prolonged daily sitting. Specifically, 31 participants (44.9%) reported sitting for 6–8 hours per day and 25 participants (36.2%) reported sitting for 8–10 hours per day. Participants with disc protrusion had a higher sitting-duration category index than those without disc protrusion (2.24 ± 0.97 versus 1.77 ± 0.89; p = 0.046). This suggests that longer reported sitting-duration category may be associated with disc protrusion within this sedentary symptomatic sample. However, this finding must be interpreted cautiously because sitting duration was recorded as an ordinal category rather than exact continuous hours. Moreover, because every participant was sedentary, the study could not validly compare sedentary and non-sedentary individuals or estimate the independent effect of sedentary lifestyle on disc pathology. Therefore, the findings support a within-sample clinical pattern rather than a causal conclusion that sedentary lifestyle produces lumbar disc herniation.

The occupational distribution further contextualizes these findings. Housewives accounted for 19 participants (27.5%), teachers for 15 participants (21.7%), and desk officers for 12 participants (17.4%). These groups may experience prolonged sitting, repetitive bending, static postures, or limited ergonomic support, but the current study did not directly measure ergonomic exposure, lifting behavior, body mass index, smoking, or work-specific mechanical load. Previous occupational and lifestyle studies have proposed that prolonged sitting, inadequate physical activity, poor posture, and occupational loading may contribute to low back pain and degenerative lumbar changes, but the magnitude and direction of these relationships vary across populations and are influenced by confounding factors (5,6,13,16,18). Therefore, the present findings should be interpreted as locally relevant clinical observations among symptomatic MRI-referred adults rather than definitive evidence of occupational causation.

The absence of disc extrusion and sequestration in this cohort may indicate that most participants had early or moderate lumbar disc pathology rather than advanced disc displacement. Disc bulge was substantially more frequent than protrusion, and no participant showed free disc fragment separation. This pattern may reflect referral timing, patient selection, age distribution, or the fact that the cohort included symptomatic individuals undergoing routine diagnostic MRI rather than a surgical population. Previous studies have shown that extrusion and sequestration are usually less common than bulge and protrusion in general imaging cohorts, while surgical or severe radiculopathy cohorts may show a higher frequency of advanced morphology (8,10,12). This distinction is important because the clinical implications of disc morphology depend not only on the type of herniation but also on size, direction, neural contact, canal dimensions, inflammatory response, and patient-specific symptom patterns.

The study reinforces the importance of correlating MRI findings with clinical presentation. MRI is highly valuable for identifying disc morphology, level involvement, and nerve root compression, but imaging abnormalities alone may not fully explain symptoms. Degenerative disc changes and even herniation-like findings may be observed in individuals without major symptoms, making clinical correlation essential for appropriate diagnosis and management (10,13). In the present study, the strongest clinically interpretable findings were not the high prevalence of disc bulge alone but the significant relationships between sciatica, nerve root compression, and disc protrusion. This supports the view that MRI findings should be interpreted in relation to radicular symptoms and neurological features rather than used as standalone determinants of disease severity.

Several limitations should be considered. First, the sample size was relatively small, with only 69 participants, limiting the precision of subgroup estimates and reducing the stability of analyses involving sparse categories such as mild nerve root compression or multilevel involvement. Second, the study was conducted at a single tertiary-care hospital, which may limit generalizability to community populations or non-referred patients. Third, the cross-sectional design prevents causal inference, and the findings cannot determine whether prolonged sitting preceded or contributed to disc pathology. Fourth, all participants were sedentary, so no valid statistical comparison could be made between sedentary and non-sedentary groups. Fifth, important potential confounders such as body mass index, smoking status, ergonomic exposure, occupational load, symptom duration, pain severity, and neurological examination findings were not fully incorporated into adjusted analyses. Finally, sitting duration was analyzed using coded ordinal categories, which limits interpretation of mean differences as exact daily sitting hours.

Despite these limitations, the study provides useful local evidence on MRI-defined lumbar disc pathology among symptomatic adults with sedentary lifestyle. The findings indicate that disc bulge and protrusion are common, lower lumbar levels are predominantly affected, and disc protrusion and nerve root compression show clinically meaningful relationships with sciatica. These results highlight the diagnostic value of MRI when interpreted alongside clinical symptoms and support the need for preventive and rehabilitative strategies focused on posture education, ergonomic modification, regular physical activity, and early clinical evaluation of persistent low back pain with radicular symptoms. Future multicenter studies with larger samples, non-sedentary comparison groups, standardized

ergonomic exposure assessment, continuous sitting-duration measurement, and adjusted regression modeling are needed to clarify the independent contribution of sedentary behavior and occupational factors to lumbar disc pathology.

CONCLUSION

This study found that disc bulge and disc protrusion were the most frequent MRI-based morphological patterns among symptomatic adults with sedentary lifestyle, with predominant involvement of the L4–L5 and L5–S1 levels. Sciatica showed a strong clinical-imaging association with nerve root compression, and disc protrusion was significantly associated with higher sciatica frequency and higher sitting-duration category. Because all participants were sedentary, the study cannot establish a comparative or causal relationship between sedentary lifestyle and lumbar disc herniation; rather, it demonstrates that within this sedentary symptomatic cohort, MRI findings—particularly disc protrusion and nerve root compression—correlated meaningfully with radicular clinical presentation. These findings support the clinical value of correlating MRI morphology with symptoms and reinforce the need for early assessment, ergonomic awareness, reduction of prolonged sitting, and promotion of regular physical activity in individuals at risk of lumbar disc-related symptoms.

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