

Prevalence of Lumbar Intervertebral Disc Herniation in Asymptomatic Individuals on MRI

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Received: 5th January, 2026; Revised: 18th January 2026; Accepted: 25th January, 2026; Available Online: 28th January, 2026

ABSTRACT

Objectives:

To determine the prevalence and distribution of lumbar intervertebral disc herniation in asymptomatic individuals aged 20–80 years undergoing MRI.

Methods:

This one-year hospital-based cross-sectional study included 89 participants aged 20–80 years who underwent whole-spine MRI at the Department of Radio-diagnosis, KLE'S Prabhakar Kore Hospital and Medical Research Centre, Belagavi. Participants with low back pain, lower-limb paresthesia/radiculopathy, major spinal deformity, prior spinal trauma or surgery, inflammatory/systemic spinal disease, or radiotherapy exposure were excluded. MRI was performed on a 3.0-T Siemens Magnetom Spectra system using sagittal and axial T1-weighted, T2-weighted, and STIR sequences. Demographic, clinical, lifestyle, and MRI findings were summarized using frequencies, percentages, means, and standard deviations; reported association p-values were retained from the source analysis.

Results:

The mean age was 39.29 ± 13.29 years (range, 20–76 years); 50 participants (56.2%) were male and 39 (43.8%) female. Disc bulges were identified in 2.2% at L1–L2, 4.5% at L2–L3, 4.5% at L3–L4, 29.2% at L4–L5, and 18.0% at L5–S1. Protrusions occurred in 1.1% at L3–L4, 9.0% at L4–L5, and 9.0% at L5–S1. No extrusions or sequestrations were recorded. The source dataset reported herniation in 47/89 participants (52.8%) by person count and 67/445 discs (15.0%) by disc count.

Conclusions:

Incidental lumbar disc abnormalities were common in this asymptomatic cohort, particularly at L4–L5 and L5–S1. The findings support careful clinical correlation when interpreting MRI abnormalities in individuals without corresponding symptoms.

Clinical Relevance:

Recognition of asymptomatic disc abnormalities may reduce overinterpretation of MRI findings and help avoid attributing symptoms to incidental structural changes without appropriate clinical correlation.

Keywords: lumbar disc herniation; magnetic resonance imaging; asymptomatic; disc bulge; disc protrusion; degenerative changes; prevalence

How to cite this article: Santosh D Patil¹ Polireddy P S Shivani² Manjunatha YC^{3*}. Prevalence of Lumbar Intervertebral Disc Herniation in Asymptomatic Individuals on MRI. *Int J Drug Deliv Technol.* 2026;16(85s):1191-1198. DOI: 10.25258/ijddt.16.85s.125.

Source of support: Nil.

Conflict of interest: None

Introduction

Lumbar intervertebral disc herniation is a common imaging finding and an important cause of low back pain and radiculopathy. However, structural disc abnormalities may also be present in individuals without corresponding symptoms, creating a clinically important distinction between an imaging abnormality and symptomatic disease. [1–3]

Degenerative changes of the lumbar discs are influenced by age, mechanical loading, genetic susceptibility, and environmental factors. MRI provides high-resolution visualization of these changes and has demonstrated that disc degeneration and herniation can occur before the onset of symptoms. [1,4–7]

The clinical significance of incidental MRI abnormalities remains an important issue because detection of asymptomatic abnormalities can lead to overdiagnosis and potentially unnecessary interventions. Conversely, imaging findings should not be dismissed when they correlate with symptoms or neurological deficits. [3,8–10]

The natural history of many lumbar disc abnormalities is favorable, with spontaneous regression or improvement occurring in a substantial proportion of symptomatic patients managed conservatively. The relationship between morphology, level, and extent of a disc abnormality and its clinical expression is therefore complex. [10,17,21]

Against this background, the present study evaluated the prevalence and distribution of lumbar intervertebral disc herniation in asymptomatic individuals aged 20–80 years undergoing MRI, with particular attention to age, sex, lifestyle factors, and lumbar level.

Methods

This was a hospital-based cross-sectional study conducted over one year in the Department of Radiodiagnosis, KLE'S Prabhakar Kore Hospital and Medical Research Centre, Belagavi.

Participants were selected from individuals referred for whole-spine MRI screening. The study included healthy volunteers aged 20–80 years, individuals with cervical spine-related symptoms without low back pain or lower-limb paresthesia, and individuals undergoing whole-spine screening for chronic headache or cerebral symptoms. Exclusion criteria were structural spinal deformities such as scoliosis or kyphosis; previous spinal surgery or trauma; lumbosacral radiculopathy; known osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, or osteoporosis; systemic conditions such as tuberculosis, systemic lupus erythematosus, metastasis, or osteomyelitis; and previous radiotherapy.

Purposive sampling was used. The sample size calculation was based on an expected prevalence of 28.2%, $Z = 1.96$ for a 95% confidence level, and an absolute error of 10%, yielding a minimum sample size of 78; 89 participants were ultimately included.

MRI was performed with participants in the supine position on a 3.0-T Siemens Magnetom Spectra system. Standardized lumbar-spine imaging included sagittal and axial T1-weighted, T2-weighted, and STIR sequences. The assessed parameters included the presence or absence of disc bulge, protrusion, extrusion, and sequestration at L1–L2 through L5–S1, together with demographic and relevant clinical/lifestyle variables.

Data were obtained from MRI examinations and participant records. Statistical analysis was performed using R version 4.2.1 and Microsoft Excel. Categorical variables were summarized as frequencies and percentages, while continuous variables were summarized using means and standard deviations or medians and ranges. Association p-values reported in the source thesis were retained in the manuscript. The statistical test used to generate each p-value and the prespecified significance threshold were not stated in the source document and should be verified before submission.

Ethical approval was obtained from the institutional ethics committee, and participants provided informed consent. The study involved no additional intervention or cost to participants.

Results

Eighty-nine participants were included. The mean age was 39.29 ± 13.29 years (range, 20–76 years). The largest age group was 20–30 years (29/89, 32.6%), followed by 31–40 years (25/89, 28.1%) and 41–50 years (20/89, 22.5%). Fifty participants (56.2%) were male and 39 (43.8%) were female. Mean height was 168.53 ± 7.24 cm, mean weight was 69.52 ± 7.76 kg, and mean BMI was 24.45 ± 2.23 kg/m².

Most participants were moderately active (58.4%), while 31.5% were classified as active and 10.1% as sedentary. A total of 66.3% reported no regular exercise, 15.7% attended a gym, 11.2% participated in sports, and 6.7% practiced yoga. Smoking was reported by 13.5%, diabetes by 6.7%, and hypertension by 3.4%.

Disc abnormalities were predominantly observed in the lower lumbar spine. Bulging was present in 2.2% at L1–L2, 4.5% at L2–L3, 4.5% at L3–L4, 29.2% at L4–L5, and 18.0% at L5–S1. Protrusion was present in 1.1% at L3–L4, 9.0% at L4–L5, and 9.0% at L5–S1. No disc extrusion or sequestration was recorded at the assessed levels.

The source analysis reported age-related differences in disc bulging, including significant p-values at L1–L2 ($p < 0.001$ as reported), L2–L3 ($p = 0.025$), L3–L4 ($p = 0.020$), and L4–L5 ($p = 0.001$), whereas the L5–S1 bulge distribution was not statistically significant ($p = 0.152$). For protrusion, a significant age-group association was reported at L3–L4 ($p = 0.019$), while associations at L4–L5 and L5–S1 were not significant ($p = 0.307$ and 0.493 , respectively).

Sex-based analysis showed a significant difference for L3–L4 protrusion ($p = 0.024$), while differences for L4–

L5 and L5–S1 protrusions were not significant. The source data also reported associations between several lifestyle/systemic variables and selected disc findings; these should be interpreted cautiously because subgroup sizes were small and the source did not document adjustment for multiple comparisons or multivariable confounding.

The source thesis reported overall herniation in 47 of 89 participants (52.8%) by person count and 67 of 445 assessed discs (15.0%) by disc count. Because the level-specific tables in the source document yield a different total when bulges and protrusions are summed, the disc-count figure should be reconciled against the original dataset before submission.

Table 1. Participant demographic and anthropometric characteristics.

Variable	Category / statistic	n	% / value
Age, years	Mean $\pm$ SD	89	39.29 $\pm$ 13.29
Age, years	Range	89	20–76
Age group	20–30	29	32.6
Age group	31–40	25	28.1
Age group	41–50	20	22.5
Age group	51–60	7	7.9
Age group	>60	8	9.0
Sex	Male	50	56.2
Sex	Female	39	43.8
Height, cm	Mean $\pm$ SD	89	168.53 $\pm$ 7.24
Weight, kg	Mean $\pm$ SD	89	69.52 $\pm$ 7.76
BMI, kg/m ²	Mean $\pm$ SD	89	24.45 $\pm$ 2.23
BMI, kg/m ²	Range	89	18.9–34.5

Table 2. Lifestyle and selected clinical characteristics.

Variable	Category	n	%
Occupation	Active	28	31.5
Occupation	Moderately active	52	58.4
Occupation	Sedentary	9	10.1
Diet	All	58	65.2
Diet	Vegetarian	29	32.6
Diet	Vegan	2	2.2
Exercise	None	59	66.3
Exercise	Gym	14	15.7
Exercise	Sports	10	11.2
Exercise	Yoga	6	6.7
Smoking	Yes	12	13.5
Diabetes	Yes	6	6.7
Hypertension	Yes	3	3.4

Note: The source thesis also reports no medication use, no family history, no previous COVID-19 infection, and no other medical conditions in the cohort.

Table 3. Level-specific lumbar MRI findings.

Level	Bulge n (%)	Protrusion n (%)	Extrusion	Sequestration
L1–L2	2 (2.2)	0 (0.0)	0	0
L2–L3	4 (4.5)	0 (0.0)	0	0
L3–L4	4 (4.5)	1 (1.1)	0	0
L4–L5	26 (29.2)	8 (9.0)	0	0
L5–S1	16 (18.0)	8 (9.0)	0	0

Note: Percentages are based on 89 participants. No extrusion or sequestration was reported at any assessed level.

Table 4. Age-group distribution of disc bulges and protrusions.

Age group	Bulge PC	Bulge DC	Protrusion PC	Protrusion DC	p value
20–30	5	5	5	6	0.856
31–40*	12	14	4	4	0.025
41–50*	10	12	1	1	0.001
51–60	5	9	2	3	0.000
>60	5	12	3	3	0.000

Note: PC = person count; DC = disc count. Age labels were harmonized to the main demographic table; the source table used “30–40” and “40–50” in two rows.

Table 5. Sex-specific distribution of lumbar disc abnormalities.

MRI finding	Female n	Male n	p value
L1–L2 bulge	0	2	0.206
L2–L3 bulge	2	2	0.799
L3–L4 bulge	1	3	0.438
L4–L5 bulge	14	12	0.221
L5–S1 bulge	10	6	0.480
L3–L4 protrusion	1	0	0.024
L4–L5 protrusion	4	4	0.712
L5–S1 protrusion	3	5	0.706

Table 6. Exercise status and selected disc findings.

MRI finding	Gym	No exercise	Sports	Yoga	p value
L1–L2 bulge	0	1	0	1	0.325
L2–L3 bulge	0	4	0	0	0.024
L3–L4 bulge	0	3	0	1	0.470
L4–L5 bulge	1	23	1	1	0.036
L5–S1 bulge	0	14	1	1	0.001
L3–L4 protrusion	0	1	0	0	0.597
L4–L5 protrusion	2	4	1	1	0.035
L5–S1 protrusion	3	4	1	0	0.047

Table 7. Selected smoking, diabetes, and hypertension associations.

Factor	MRI finding	With factor	Without factor	p value
Smoking	L2–L3 bulge	1	3	0.048
Smoking	L3–L4 bulge	0	4	0.047
Smoking	L4–L5 bulge	4	22	0.036
Smoking	L5–S1 bulge	2	14	0.021
Diabetes	L4–L5 bulge	5	21	0.003
Diabetes	L4–L5 protrusion	0	8	0.042
Hypertension	L4–L5 bulge	3	23	0.006
Hypertension	L5–S1 bulge	2	14	0.025

Note: These are unadjusted source-reported associations. Small subgroup sizes and multiple comparisons limit causal interpretation.

Table 8. Overall herniation prevalence as reported in the source thesis.

Unit of analysis	Total	Herniation	Prevalence
Person count (PC)	89	47	52.8%
Disc count (DC)	445	67	15.0%

Note: The source thesis reports these values. The level-specific counts in Table 3 sum to 69 bulges/protrusions,

so the disc-count figure should be reconciled with the original dataset before submission.

Discussion

This study demonstrates that lumbar disc abnormalities are frequently detectable on MRI in individuals without low back pain or lower-limb symptoms. The predominance of abnormalities at L4–L5 and L5–S1 is consistent with the distribution of mechanical loading in the lower lumbar spine and with previous reports of incidental degenerative findings on MRI. [1,4–7,18]

The mean age of the cohort was 39.29 years, and disc bulging was more frequent at several lumbar levels with increasing age. This pattern is consistent with the recognized relationship between cumulative mechanical stress, age-related disc degeneration, and changes in lumbar disc morphology. [1,5,6,20]

The lower lumbar levels showed the greatest burden of imaging abnormalities. L4–L5 had the highest frequency of bulging (29.2%), followed by L5–S1 (18.0%); protrusions were present in 9.0% at both L4–L5 and L5–S1. No extrusion or sequestration was identified. The absence of severe morphologies in this cohort may reflect the study's asymptomatic selection criteria, although a causal explanation cannot be established from this cross-sectional design. [3,7,10,14]

Sex-related differences were limited. Although the source analysis reported a significant difference in L3–L4 protrusion, most level-specific comparisons did not show significant sex differences. The findings therefore do not support a broad sex-based difference in incidental lumbar disc abnormalities in this cohort.

Associations were also reported for exercise, smoking, diabetes, and hypertension at selected levels. Because the study was observational, the sample was modest, and subgroup sizes were uneven, these associations should be considered exploratory rather than causal. In particular, the absence of multivariable analysis and the multiple comparisons increase the possibility that some statistically significant findings may represent confounding or chance associations.

The clinical implication is that MRI findings should be interpreted in the context of symptoms and examination rather than in isolation. Previous work has emphasized that asymptomatic imaging abnormalities are common and that imaging alone should not determine treatment. [8–10,15,19,21]

Several limitations should be recognized. The study was single-center and used purposive sampling, which limits generalizability. The sample size was relatively small, subgroup sizes for some comorbidities were very limited, and the study was cross-sectional without longitudinal clinical follow-up. The source document also does not specify the statistical tests used for the reported p-values. Finally, the reported overall disc-count prevalence requires reconciliation with the level-specific counts before final submission.

Conclusions

Lumbar intervertebral disc abnormalities were common among the 89 asymptomatic individuals studied, with the

greatest prevalence of bulges and protrusions at L4–L5 and L5–S1. Age-related differences were observed for several findings, whereas most sex-based differences were limited. The results reinforce that incidental lumbar MRI abnormalities may occur in individuals without corresponding symptoms and should be interpreted with appropriate clinical correlation. The overall disc-count prevalence reported in the source dataset should be verified against the underlying data before submission.

Declarations

Ethics approval and consent to participate: Institutional ethics committee approval was obtained and informed consent was obtained from participants. Add the approval number/date if available.

Funding: None

Competing interests: None

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PICTURES:

Picture 1

A 77 year old male laborer with history of heavy weight lifting came with complaints of neck pain radiating to right shoulder. Lumbar spine MRI images T2WI sagittal [a] & axial [c] and T1WI sagittal [b] images show disc bulges at L4-L5 and L5-S1 level with ligamentum flavum hypertrophy on both sides. In combination with grade I anterolisthesis of L4 over L5, the disc bulge is resulting in spinal canal narrowing at L4-L5 level

Picture 2

A 56-year-old female with a moderately active lifestyle and no engagement in additional exercise presented with complaints of chronic occipital headache. MRI screening of the spine was advised to evaluate for cervical myelopathy.

T2-weighted axial [a] and sagittal [b] images revealed a posterocentral disc protrusion at the L5-S1 level with an associated focal annular fissure.

[b]



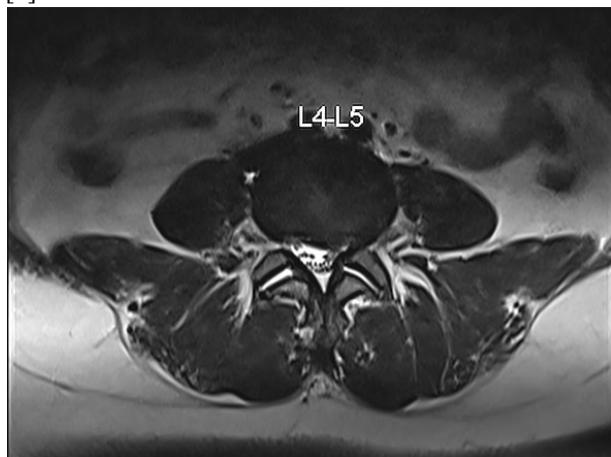
[a]

Picture 3

A 36 year female with desk job who does heavy workouts at gym came with complaints of tingling sensation in bilateral upper limbs and was advised MRI spine. Lumbar MRI T2WI axial [a] and sagittal [b] images shows posterocentral & left paracentral disc protrusion at L4- L5 level with focal annular fissures involving both discs.

There is also seen a disc bulge at D11- D12 level in image [b]

[b]



[a]