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# MRI Evaluation Of Lumbar Spine In Young Adults With Non-Traumatic Lower Back Pain

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## Abstract

***Background:*** Lower back pain (LBP) is a leading cause of disability worldwide and is increasingly prevalent among young adults due to sedentary lifestyles, poor posture, prolonged screen exposure, and occupational stress. Magnetic resonance imaging (MRI) is the preferred modality for evaluating non-traumatic LBP because of its superior soft tissue resolution and ability to detect early spinal abnormalities. The present study aimed to evaluate the spectrum of lumbar spine MRI findings in young adults presenting with non-traumatic lower back pain. ***Materials and Methods***: The present hospital-based observational descriptive study was conducted in the Department of Radiodiagnosis, People's College of Medical Sciences and Research Centre, Bhopal among a total of 150 patients aged 18–40 years with non-traumatic low back pain underwent lumbar spine MRI using a 1.5 Tesla scanner. Patients with spinal trauma, previous spinal surgery, MRI contraindications, or severe claustrophobia were excluded. Demographic and clinical details were recorded, and MRI findings were systematically analyzed. Statistical analysis was performed using SPSS version 23.0. ***Results:*** The mean age of the participants was 31.57 ± 5.73 years. Degenerative and mechanical disorders were the commonest MRI diagnosis (60.0%), followed by inflammatory axial spondyloarthritis (14.0%) and infective pathologies (12.0%). Among degenerative abnormalities, disc desiccation (75.56%) and disc herniation (60.0%) were the predominant findings, with disc bulge being the commonest herniation subtype. Other findings included peri-discal osteophytes (45.56%), facetal arthropathy (30.0%), annular tears (26.67%), ligamentum flavum hypertrophy (24.44%), Modic changes (21.11%), and Schmorl's nodes (15.56%). In infective spondylodiscitis, spondylitis/spondylodiscitis was observed in all patients (100%), vertebral destruction in 77.78%, and soft tissue abscesses in 66.67%. ***Conclusion:*** MRI is an invaluable, radiation-free imaging modality for evaluating non-traumatic lower back pain in young adults. Degenerative disc disease was the predominant pathology, with disc desiccation and disc herniation representing the most frequent MRI findings. MRI also effectively identified inflammatory and infective spinal disorders, enabling comprehensive evaluation and facilitating early diagnosis and appropriate clinical management.

**Keywords:** Magnetic resonance imaging, lumbar spine, lower back pain, young adults, degenerative disc disease, spondylodiscitis.



## INTRODUCTION

Lower back pain (LBP) is one of the leading causes of disability worldwide and represents a major public health challenge because of its high prevalence, recurrent nature, and substantial socioeconomic burden.(1) It is a significant contributor to years lived with disability and disproportionately affects young adults, resulting in reduced productivity, impaired quality of life, and increased healthcare utilization during the most economically active years of life.(2) The World Health Organization estimated that approximately 619 million people were living with LBP in 2020, with this number expected

to increase to 843 million by 2050 owing to population growth and ageing.(3) Although many episodes of LBP resolve spontaneously, a considerable proportion of patients develop persistent symptoms requiring detailed evaluation to identify the underlying pathology.

In India, LBP is increasingly recognized as a major health concern, with nearly one-third of adults experiencing chronic or recurrent symptoms.(4-6) Epidemiological evidence indicates that the incidence of LBP peaks during the third decade of life, coinciding with increasing exposure to sedentary lifestyles, prolonged screen time, poor posture, occupational stress, and inadequate physical activity.(7) Chronic LBP in young adults is associated with absenteeism, reduced work efficiency, psychological distress, and escalating healthcare costs, emphasizing the need for accurate diagnosis and timely intervention.(8-9).

Conventional radiography remains the most commonly used initial imaging modality in many healthcare settings; however, its diagnostic utility is limited because of poor visualization of soft tissues and early spinal abnormalities. Furthermore, exposure to ionizing radiation, particularly in young individuals, necessitates judicious use of radiographic imaging.(10) Magnetic resonance imaging (MRI) has emerged as the preferred imaging modality for evaluating non-traumatic LBP because it provides excellent visualization of intervertebral discs, vertebral bodies, spinal canal, neural structures, ligaments, and paraspinal soft tissues without radiation exposure.(11) MRI is particularly valuable in detecting degenerative, inflammatory, infectious, neoplastic, and congenital spinal abnormalities, thereby facilitating accurate diagnosis and guiding appropriate management.(12).

Despite its diagnostic advantages, interpretation of lumbar MRI in young adults remains challenging. Early degenerative changes and incidental abnormalities may not correlate with clinical symptoms, creating uncertainty regarding their clinical significance.(13) Moreover, most published literature has focused on older populations, while data describing MRI findings in young adults with non-traumatic LBP, particularly in the Indian population, remain limited.(14) This knowledge gap highlights the need for studies evaluating the spectrum of lumbar MRI abnormalities in symptomatic young adults. Therefore, the present study was undertaken to systematically evaluate MRI findings of the lumbar spine in young adults presenting with non-traumatic lower back pain and to provide evidence that may improve diagnostic accuracy and clinical decision-making.

## MATERIALS AND METHODS

The present hospital-based observational descriptive study was conducted in the Department of Radiodiagnosis, People's College of Medical Sciences and Research Centre (PCMS & RC), Bhopal, from 1st April 2024 to December 2025. A total of 150 participants were enrolled using a convenient non-probability sampling technique. The study population comprised patients with a history of chronic lower back pain who were referred for MRI of the lumbar spine to the Department of Radiodiagnosis during the study period and fulfilled the predefined eligibility criteria.

Patients aged 18–40 years with complaints of low back pain who were referred for MRI of the lumbar spine were included in the study. Patients younger than 18 years or older than 40 years, those with a history of spinal trauma or previous spinal surgery, patients with contraindications to MRI such as metallic implants, cardiac pacemakers, cochlear implants, or other incompatible devices, and those with non-manageable claustrophobia were excluded from the study.

After obtaining written informed consent, demographic information, clinical history, and findings of physical examination were recorded using a structured case reporting form. Whenever feasible, consultation with the referring clinician was undertaken to understand the clinical background, indication for MRI, and specific diagnostic concerns. Data collected included age, sex, occupation, working hours, body mass index (BMI), level of physical activity, presenting symptoms including pain, tingling and numbness, duration of symptoms, pain intensity assessed using the Visual Analogue Scale (VAS), and relevant medical history such as tuberculosis or HLA-B27 positivity.

All MRI examinations were performed on a Vision Plus 1.5 Tesla MRI scanner using a standardized lumbar spine imaging protocol. MRI findings were systematically evaluated for vertebral abnormalities, intervertebral disc involvement including level, signal intensity, disc height and contour (bulge, protrusion, or extrusion), facet joint changes, nerve root compression, pre- and paravertebral soft tissue abnormalities, sacroiliac joint involvement, and associated hip joint abnormalities. All imaging findings were documented in a structured case reporting form.

The collected data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 for Windows. Descriptive statistics were used to summarize demographic characteristics, clinical variables, and MRI findings. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Appropriate statistical tests were applied wherever indicated, and a p-value $<0.05$ was considered statistically significant.

## RESULTS

The present hospital-based observational descriptive study was conducted in the Department of Radiodiagnosis at People's College of Medical Sciences and Research Centre (PCMS & RC). It included 150 patients who underwent MRI of the lumbar spine and fulfilled the defined inclusion and exclusion criteria.

**Table 1: Age wise distribution of patients**

| Age (in Years) | Frequency (n) | Percentage (%) |
|---|---|---|
| 18 - 24 | 21 | 14.00% |
| 25 - 30 | 35 | 23.33% |
| 31 - 35 | 48 | 32.00% |
| 36 - 40 | 46 | 30.67% |
| Total | 150 | 100.00% |
| Mean ± SD | 31.57 ± 5.73 years | |

**Table 2: Sex wise distribution of patients**

| Sex | No. of patients | Percent (%) |
|---|---|---|
| Male | 85 | 56.67% |
| Female | 65 | 43.33% |
| Total | 150 | 100.00% |

**Table 3: Distribution of Patients According to Pathologies**

| Pathologies | No. of patients | Percent (%) |
|---|---|---|
| Degenerative & Mechanical (Most common overall) | 90 | 60.00% |
| Inflammatory axial Spondyloarthritis (including Ankylosing Spondylitis, seronegative spondyloarthropathies, RA) | 21 | 14.00% |
| Infective (Tubercular / pyogenic) | 18 | 12.00% |
| Congenital & Developmental | 9 | 6.00% |
| Neoplastic (bone as well as spinal neoplasms) | 6 | 4.00% |
| Miscellaneous | 6 | 4.00% |
| Total | 150 | 100.00% |

**Table 4: MRI Findings in Patients with Degenerative Disc Disease**

| Degenerative Disc (90) | Present n (%) | Absent n (%) |
|---|---|---|
| Disc desiccation | 68(75.56%) | 22(24.44%) |
| Disc herniation | 54(60.00%) | 36(40.00%) |
| Bulge | 28(51.85%) | 16(44.44%) |
| Protrusion | 16(29.63%) | 12(33.33%) |
| Extrusion | 7(12.96%) | 3(8.33%) |
| Sequestration | 3(5.56%) | 5(13.89%) |
| Annular tear / fissure | 24(26.67%) | 66(73.33%) |
| Peri-discal osteophytes | 41(45.56%) | 49(54.44%) |
| Schmorl's nodes | 14(15.56%) | 76(84.44%) |
| Modic changes | 19(21.11%) | 71(78.89%) |
| Ligamentum flavum hypertrophy | 22(24.44%) | 68(75.56%) |
| Facetal arthropathy | 27(30.00%) | 63(70.00%) |

**Table 5: MRI Findings in Patients with Infective Spondylodiscitis**

| Infective Spondylodiscitis (18) | Present n (%) | Absent n (%) |
|---|---|---|
| Spondylitis / Spondylodiscitis (with or without involvement of posterior elements) | 18(100.00%) | 0(0.00%) |
| Vertebral erosion / destruction | 14(77.78%) | 4(22.22%) |
| Soft tissue abscess and inflammation | 12(66.67%) | 6(33.33%) |
| Discal | 4(33.33%) | 2(33.33%) |
| Pre-paravertebral | 3(25.00%) | 1(16.67%) |
| Epidural | 2(16.67%) | 1(16.67%) |
| Psoas | 2(16.67%) | 1(16.67%) |
| Paraspinal | 1(8.33%) | 1(16.67%) |
| Facetal arthropathy | 4(22.22%) | 14(77.78%) |
| Myelitis / neuritis | 3(16.67%) | 15(83.33%) |
| Granuloma (Neurocysticercosis / Tuberculoma) | 2(11.11%) | 16(88.89%) |

As presented in Table 1, the majority of patients belonged to the 31–35 years age group (48 patients; 32.00%), followed closely by the 36–40 years age group (46 patients; 30.67%). Patients aged 25–30 years constituted 35 (23.33%) of the study population, whereas the 18–24 years age group had the lowest representation (21 patients; 14.00%). The overall mean age of the participants was 31.57 ± 5.73 years, indicating that non-traumatic low back pain was predominantly observed during the third and fourth decades of life.

Table 2 shows the sex distribution of the study participants. Of the 150 patients, 85 (56.67%) were males and 65 (43.33%) were females, demonstrating a slight male predominance among young adults undergoing MRI evaluation for non-traumatic low back pain.

The distribution of MRI-diagnosed lumbar spine pathologies is summarized in Table 3. Degenerative and mechanical disorders represented the largest pathological category and were identified in 90 patients (60.00%). Inflammatory axial spondyloarthritis, including ankylosing spondylitis, seronegative spondyloarthropathies, and rheumatoid arthritis, was diagnosed in 21 patients (14.00%). Infective pathologies, comprising tubercular and pyogenic spondylodiscitis, accounted for 18 patients (12.00%). Congenital and developmental abnormalities were observed in 9 patients (6.00%), while neoplastic lesions and miscellaneous conditions each contributed 6 cases (4.00%). These findings indicate that degenerative and mechanical abnormalities constituted the predominant cause of non-traumatic low back pain in the study population.
MRI findings among the 90 patients diagnosed with degenerative disc disease are shown in Table 4. Disc desiccation was the most common abnormality, present in 68 patients (75.56%). Disc herniation was identified in 54 patients (60.00%), of which disc bulge was the commonest subtype (28 patients; 51.85%), followed by disc protrusion (16 patients; 29.63%), disc extrusion (7 patients; 12.96%), and disc sequestration (3 patients; 5.56%).

Other frequently observed degenerative changes included peri-discal osteophytes in 41 patients (45.56%), facetal arthropathy in 27 patients (30.00%), annular tear/fissure in 24 patients (26.67%), ligamentum flavum hypertrophy in 22 patients (24.44%), Modic changes in 19 patients (21.11%), and Schmorl's nodes in 14 patients (15.56%). These findings demonstrate that disc degeneration and associated structural changes constituted the predominant MRI abnormalities among young adults with non-traumatic low back pain.

MRI findings in the 18 patients diagnosed with infective spondylodiscitis are presented in Table 5. Spondylitis/spondylodiscitis was observed in all patients (100.00%), confirming its universal presence within this subgroup. Vertebral erosion or destruction was identified in 14 patients (77.78%), while soft tissue abscess and inflammatory changes were present in 12 patients (66.67%). Among soft tissue collections, discal abscesses were observed in 4 patients (33.33%), pre/paravertebral abscesses in 3 patients (25.00%), epidural abscesses in 2 patients (16.67%), psoas

abscesses in 2 patients (16.67%), and paraspinal abscesses in 1 patient (8.33%). Facetal arthropathy was present in 4 patients (22.22%), myelitis/neuritis in 3 patients (16.67%), and granulomatous lesions including neurocysticercosis or tuberculoma in 2 patients (11.11%). These observations highlight the ability of MRI to comprehensively evaluate vertebral, discal, soft tissue, and neurological involvement in infective spinal disorders.

## DISCUSSION

Low back pain in young adults has emerged as an important clinical and public health problem, even in the absence of trauma. Traditionally regarded as a disorder affecting older individuals, its increasing prevalence among younger adults has been attributed to sedentary lifestyles, prolonged screen exposure, poor posture, and occupational stress. MRI has become the imaging modality of choice because of its excellent soft tissue resolution and ability to detect early pathological changes involving the intervertebral discs, vertebral bodies, spinal canal, neural elements, and surrounding soft tissues that are often undetectable on conventional radiography. The present study evaluated the spectrum of MRI findings in 150 young adults with non-traumatic low back pain and demonstrated that degenerative and mechanical disorders constituted the predominant pathology, followed by inflammatory and infective lesions.

The present study included 150 patients with a mean age of 31.57 ± 5.73 years, with the majority belonging to the 31–35 years (32.00%) and 36–40 years (30.67%) age groups. These findings indicate that non-traumatic low back pain predominantly affects individuals during the third and fourth decades of life, which represents the most economically productive period. The increasing burden of lumbar spine disorders in this age group may be explained by prolonged sitting, sedentary occupations, poor ergonomics, obesity, and reduced physical activity.

Our findings are comparable with previous reports, although slight differences in age distribution have been described. Babu S et al. (2025) reported a higher mean age of 43.0 ± 13.1 years among patients undergoing lumbar spine MRI.(15) Similarly, Narra RK et al. (2017) observed a mean age of 43.6 ± 11.7 years in patients presenting with low back pain.(1) In contrast, Shukla M et al. (2024) reported a younger mean age of 33 years, while Lukecha KR et al. documented a median age of 33 years among patients aged 18–39 years.(16) The relatively younger age observed in the present study reflects the increasing occurrence of lumbar spine disorders in young adults, possibly resulting from modern lifestyle modifications and occupational demands. Overall, the present findings support existing evidence that non-traumatic low back pain is increasingly encountered during early adulthood.

The present study demonstrated a male predominance, with 85 (56.67%) males and 65 (43.33%) females. Similar observations have been reported in several MRI-based studies evaluating lumbar spine disorders. Babu S et al. (2025) reported 78 males and 72 females in their study population.(15) Narra RK et al. (2017) also observed a male predominance with a male-to-female ratio of 1.38:1.(1) Villagrán JM et al. (2023) reported that lumbar disc herniation was more frequently detected among males, particularly during the fourth decade of life.(17)

The higher prevalence among males may be explained by greater occupational exposure to heavy physical work, repetitive spinal loading, prolonged driving, and mechanical stress on the lumbar spine. Although some investigators have reported either female predominance or an almost equal gender distribution, the overall evidence suggests that males continue to constitute the majority of patients undergoing MRI evaluation for non-traumatic low back pain. Therefore, the sex distribution observed in the present study is largely consistent with previously published literature.

Degenerative and mechanical disorders constituted the largest pathological group, accounting for 60.00% of all patients. Inflammatory axial spondyloarthritis represented 14.00%, while infective lesions accounted for 12.00%. Congenital and developmental abnormalities, neoplastic lesions, and miscellaneous conditions collectively represented a relatively smaller proportion of cases.

These observations agree with previous studies that consistently identified degenerative pathology as the principal cause of chronic non-traumatic low back pain. Babu S et al. (2025) reported degenerative disc disease in 46.7% of patients. (15) Reddy et al. (2016) documented degenerative lumbar pathology in 48% of patients presenting with chronic low back pain. (18) Narra RK et al. (2017) similarly identified degenerative disc displacement as the most frequent MRI abnormality. (1) In contrast, Shukla M et al. (2024) reported a higher prevalence of degenerative disease (78.1%). (12)

The comparatively higher proportion of inflammatory and infective disorders observed in the present study may reflect regional epidemiological differences, referral bias to a tertiary care centre, and the continued burden of spinal tuberculosis in developing countries. These findings reinforce the importance of MRI in differentiating degenerative disorders from inflammatory, infective, congenital, and neoplastic conditions that often present with similar clinical symptoms.

Among the 90 patients with degenerative disease, disc desiccation (75.56%) was the commonest MRI abnormality, followed by disc herniation (60.00%), peri-discal osteophytes (45.56%), facetal arthropathy (30.00%), ligamentum flavum hypertrophy (24.44%), annular tears (26.67%), Modic changes (21.11%), and Schmorl's nodes (15.56%). These findings demonstrate that degeneration begins with biochemical dehydration of the intervertebral disc, followed by progressive structural alterations involving adjacent osseous and ligamentous structures.

Lukecha KR et al. (2022) reported disc desiccation in 41.4% of patients, which was lower than that observed in the present study. (12) Samartzis D et al. (2011) similarly described disc degeneration, annular tears, disc bulges, and Schmorl's nodes as frequent MRI findings in young adults with low back pain.(19) The higher frequency of disc desiccation in the present study may be attributed to occupational factors, prolonged sitting, and delayed clinical presentation.

Disc herniation represented another major MRI finding, with bulge (51.85%) being the most frequent subtype, followed by protrusion (29.63%), extrusion (12.96%), and sequestration (5.56%). These observations are comparable with Babu S et al. (2025), who reported disc bulges and protrusions predominantly among individuals aged 31–50 years. (15) Villagrán JM et al. (2023) also identified disc herniation as one of the commonest lumbar MRI abnormalities. (17) Narra RK et al. (2017) similarly reported disc bulging as the predominant imaging abnormality in patients with chronic low back pain. (1) Annular tears, peri-discal osteophytes, Schmorl's nodes, and Modic changes were observed with varying frequency, indicating different stages of degenerative progression. Lukecha KR et al. (2022) reported Schmorl's nodes in 10.2% of patients. (16) Modic et al. demonstrated the strong clinicopathological significance of vertebral endplate signal changes, emphasizing the diagnostic value of MRI in lumbar degeneration. (20)

Overall, the findings indicate that disc desiccation and disc herniation represent the earliest and most prevalent degenerative abnormalities in young adults with non-traumatic low back pain. MRI therefore provides comprehensive assessment of early degenerative changes before advanced structural deterioration develops.

Among the 18 patients with infective pathology, spondylitis/spondylodiscitis was present in 100% of cases, highlighting MRI as the most sensitive imaging modality for detecting spinal infection. Vertebral destruction was observed in 77.78%, while soft tissue inflammatory extension and abscess formation occurred in 66.67% of patients. MRI also demonstrated epidural, psoas, paraspinal, and prevertebral collections, illustrating its ability to accurately define disease extent.

Babu S et al. (2025) reported spinal tuberculosis in 6.7% of their study population, reflecting its continuing prevalence in India.(15) Tuli SM emphasized the indispensable role of MRI in the early diagnosis of spinal tuberculosis, particularly before radiographic abnormalities become apparent.(21) The present findings further support the superior capability of MRI in demonstrating vertebral marrow involvement, disc destruction, soft tissue collections, neural compression, and posterior element involvement.

Neurological complications including myelitis or neuritis were identified in 16.67% of cases, while granulomatous lesions such as tuberculoma or neurocysticercosis were observed in 11.11%, demonstrating the diverse spectrum of infective spinal disease. Although limited literature is available regarding detailed MRI patterns of infective spondylodiscitis in young adults, the present study highlights the importance of MRI for early diagnosis, assessment of disease severity, and treatment planning.

Overall, the present study demonstrates that MRI provides comprehensive evaluation of both common degenerative disorders and less frequent inflammatory and infective spinal pathologies in young adults with non-traumatic low back pain. Early identification of these abnormalities facilitates appropriate clinical management, prevents disease progression, and minimizes long-term disability. Further multicentric prospective studies involving larger populations are warranted to validate these findings and establish stronger clinicoradiological correlations.

## CONCLUSION

To conclude, the present study demonstrated that non-traumatic low back pain in young adults was most frequently encountered during the third and fourth decades of life and showed a slight male predominance. Degenerative and mechanical disorders constituted the most common MRI diagnosis, accounting for 60% of all cases. Among degenerative abnormalities, disc desiccation and disc herniation were the predominant MRI findings, while infective lesions were characterized by universal spondylodiscitis with frequent vertebral destruction and soft tissue extension. These findings underscore the importance of MRI as a comprehensive, radiation-free imaging modality capable of accurately identifying both degenerative and non-degenerative spinal pathologies, thereby facilitating early diagnosis, appropriate clinical management, and prevention of long-term disability in young adults with non-traumatic low back pain.

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