



Comprehensive Analysis of Lumbar Degenerative Disc Disease Using MRI

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ABSTRACT

Study Design

This study is a hospital based cross sectional descriptive study.

Purpose

Our study aims to comprehensively analyse the spectrum of MRI findings of lumbar degenerative disc disease in a population from Eastern Nepal.

Overview of Literature

Diagnostic imaging plays a crucial role in assessing spine degenerative diseases, aiming to evaluate neural tissue status and guide therapeutic decisions. Despite the availability of multiple imaging modalities, MRI has emerged as the preferred initial investigation of choice for lower back pain evaluation. While numerous studies have explored MRI findings in spinal pathologies, there remains a scarcity of research focused on specific geographic regions, particularly in the challenging terrains of hilly areas.

Methods

The study was conducted at a tertiary care centre in eastern Nepal over one year. All patients with suspected degenerative spinal disease underwent detailed clinical assessments and lumbar spine MRI scans using a 0.35 Tesla open magnet MR scanner. Standard protocols were followed for image acquisition and findings were recorded. Data analysis utilized Microsoft Excel and SPSS version 20.0, employing Pearson's chi-square for categorical variables.

Results

A total of 120 patients (68 males, 52 females) underwent lumbar spine MRI. Most patients (27%) fell within the 31-40 years age group. Disc bulge was the most common finding (100%), followed by neural foramina narrowing (97.5%), disc desiccation (80%), and disc herniation (45%). Radiculopathy patients showed significantly higher prevalence of disc herniations, central canal stenosis, and ligamentum flavum hypertrophy ($p < 0.05$). Males exhibited more severe degenerative findings. Predominant involvement occurred at L4-L5 and L5-S1 disc levels. Modic changes were common at L5 vertebra (34.5%). Schmorl's nodes were frequent at L3 vertebrae (31.9%).

Conclusion

Our study underscores the effectiveness of MRI as a superior imaging modality for assessing degenerative changes in the lumbar spine. We recommend its application as the primary diagnostic tool for all symptomatic patients, serving as an initial investigation of choice. This approach ensures early detection and facilitates the development of personalized treatment plans, thereby offering timely relief for each patient.

Keywords: Lumbar degenerative disc disease, Magnetic resonance imaging (MRI), Low back pain, Lumbar spine degeneration, Intervertebral disc herniation.

INTRODUCTION

Structures is compromised due to aging or pathologic processes [1]. The symptomatic individuals can present with low back pain or radicular pain syndrome i.e. sciatica [2]. Low back pain (LBP) with or without sciatica, is a common cause of disability worldwide, with a lifetime prevalence of 60-85% [3,4]. Only 5% of LBA is caused by serious underlying pathology such as disc herniation, spinal stenosis, infection, inflammation, tumour or fractures [5,6] with the primary disorder being disc degeneration [7]. The degenerated disc is weakened hence causing instability of the spine, which may result in Modic changes, disc displacement, nerve root compression and canal stenosis [7]. Ageing is the main factor implicated in spine degenerative disease [7]. Apart from age other factors have been implicated as causes of spine degenerative disease, these include; genetic inheritance, physical loading history, trauma and impaired nutrition. Multiple imaging modalities for evaluating lumbar disc diseases are available including radiography, dynamic radiography, multidetector CT (MDCT), MDCT myelography & discography and MRI. Plain X Ray examination of the lumbar spine is the usual initial imaging technique, even though it cannot directly visualize the intervertebral disc and is insensitive in the detection of mild facet joint disease. Hence treatment options cannot be planned solely based on radiographic findings. In comparison with standard radiographs, CT provides excellent visualisation of the bony structures of the spine. The degenerative findings depicted in CT are disc space narrowing, bulging, herniation, calcification, vacuum phenomenon and osteophytes and improves delineation of the facet joints. The major limitations of spinal CT are in evaluating disc degeneration due to limited soft tissue contrast and thus is insensitive to early degenerative changes. In addition, it utilizes ionising radiation. Also with respect to low back pain CT cannot distinguish between symptomatic and incidental findings. [8] The advent of MRI has made possible the non-invasive imaging of the lumbar spine with excellent spatial and contrast resolution. It has become the initial imaging technique of choice in evaluation of patients having lower back pain or radicular pain for demonstration of objective evidence of pathology in a location consistent with clinical findings. Eastern Nepal is predominantly a hilly region with the general population being more involved in activities related to heavy physical load like farmers, labourers etc. along with steep climbing in hilly areas. In these challenges, LBP is a very common complaint in the local residents. As most of the studies were done in other parts of the world, and not much studies have been done in eastern Nepal geographical region, thus this hospital based study of the symptomatic patients was done to assess the spectrum of findings of lumbar degenerative disc disease on MRI and to correlate MRI findings with the symptomatology. This work is original and adheres to the STROCSS 2025 guidelines [9], ensuring clarity, transparency, and completeness in reporting.

MATERIALS & METHODS

Ethics statement: Study was started only after approval from the Institutional Review Board (IRB).

Study design: hospital based cross-sectional descriptive study

Inclusion criteria: The following patients were included in the study-

All patients presenting with low backache and with or without radiculopathy.

All patients referred from clinicians suspecting degenerative disease of lumbar spine.

Exclusion criteria:

Patient with history of acute trauma, surgical intervention, infection, tumors and tumors like conditions,

Patients with metallic implants

Paediatric age group

Patients who do not consent for participating in the study.

Control group(s): None

Study period: One year (August 2015 to August 2016).

Population/Participants: All the patients referred to the Department of Radio-Diagnosis and Imaging at a tertiary care centre with suspected degenerative disease of lumbar spine.

Methodology -

Patients with clinical suspicion of degenerative disease were included in the study. After taking informed consent the detailed clinical history, general and systemic examination findings were recorded in structured proforma. Standard MRI protocol for evaluation of lumbar spine was done. Lumbar MRI scans were performed through L1 to S1 intervertebral disc spaces. All the patients were evaluated on 0.35 Tesla open magnet MAGNETOM C! SYNgo MR Scanner of Siemens. Initially noncontrast T1 weighted (T1W) in axial and sagittal planes, T2 weighted (T2W) in axial, sagittal and coronal planes and short tau inversion recovery (STIR) sequences in sagittal plane were taken in 5x5 mm or thinner slice thickness, wherever required T1 weighted postcontrast study was obtained in axial and sagittal planes. Initially, all images were screened for evidence of neoplastic, inflammatory, infectious disorders or surgical scars and if any, the patients were excluded from the study. Images were examined for presence of disc degeneration, Modic changes, disc bulge, disc herniation, annular tears, facet degeneration, canal stenosis and nerve root compression, then each spinal level was examined separately for these findings. The data collected were tabulated in Microsoft Excel and analysis was carried out using Statistical Package for Social Sciences (SPSS) version 20.0. Pearson's chi-square was used whenever required to assess

relationships and statistical significance between categorical variables. P-value less than 0.05 was considered to be statistically significant (confidence level=95%)

RESULTS

A total of 120 patients were evaluated on MRI appearance of degenerative disease of Lumbar Spine. Out of 120 patients, 68 patients (56.7 %) were male and 52 patients (43.3 %) were female. The most frequent age group affected in our study was between 31-40 years of age (27 %) followed by 25-30 years of age group (21 %). Disc herniations, central canal stenosis and hypertrophy of ligamentum flavum were more common in patients with radiculopathy than in patients with LBP only ($p < 0.05$). None of the patients with LBA as isolated symptoms had canal stenosis, ligamentum flavum hypertrophy, disc height reduction, facet joint hypertrophy and spondylolisthesis. (Table 1)

Table 1. -Clinical correlation with imaging findings on MRI (% in parenthesis).

Imaging findings	LBP + R (n=96)	LBP (n=24)	P-value
Bulge	96 (100)	24 (100)	-
Neural foramina narrowing	96 (100)	21 (87.5)	0.174
Desiccation	77 (80.2)	19 (79.2)	0.909
Herniation	49 (51.4)	5 (20.8)	0.008
Annular fissures	43 (44.8)	10 (41.7)	0.783
Modic changes	28 (29.2)	6 (25)	0.685
Central canal stenosis	21 (21.8)	0 (0)	< 0.001
Ligamentum Flavum hypertrophy	16 (16.7)	0 (0)	0.036
Disc height reduction	8 (8.3)	0 (0)	0.154
Spondylolisthesis	11 (11.5)	0 (0)	0.09
Facet joint hypertrophy	6 (6.3)	0 (0)	0.209

Disc bulge was the most frequent finding seen in 120 (100 %) patients, followed by narrowing of neural foramina 117 (97.5 %), disc desiccation 96 (80%), disc herniation 54 (45 %), annular fissure 53 (44.2 %), osteophytes 43 (35.8 %), Modic changes 34 (28.3%), central canal stenosis 21 (17.5 %), schmorl's node 19 (15.8 %), hypertrophy of ligamentum flavum 16 (13.3 %), anterolisthesis 8 (6.7%), reduced disc height 8 (6.7 %) and hypertrophy of facet joint 6 (5 %). (Fig.1,2,3) The least common finding was posterolisthesis which was seen in 3 patients (2.5 %). The prevalence of lumbar degenerative findings were most common in 31- 40 years, herniation was most common in 61-70 years of age group Modic changes and osteophytes were commonly seen in 51-60 years of age and Schmorl's node was most commonly seen in less than 30 years of patient group (5.8%). (Table 2) (Fig.1, 3. G)

Table 2 - Distribution of MRI imaging findings in cases of lumbar degenerative disease in different age group (% in parenthesis).

Imaging findings on MRI	Age Group (Years)					
	25-30	31-40	41-50	51-60	61-70	71-80
Desiccation	13 (10.8)	29 (24.2)	15 (12.5)	19 (15.8)	16 (13.3)	4 (3.3)
Bulge	26 (21.7)	33 (27.5)	18 (15)	23 (19.2)	16 (13.3)	4 (3.3)
Herniation	12 (10)	12 (10)	7 (5.8)	10 (8.3)	13 (10.8)	0 (0)
Neural foramina narrowing	24 (20)	33 (27.5)	18 (15)	22 (18.3)	16 (13.3)	4 (3.3)
Central canal stenosis	2 (1.7)	3 (2.5)	3 (2.5)	7 (5.8)	6 (5)	0 (0)
Annular fissures	8 (6.7)	18 (15)	9 (7.5)	5 (4.2)	12 (10)	1 (0.8)
Modic changes	2 (1.7)	9 (7.5)	7 (5.8)	10 (8.3)	6 (5)	0 (0)
Schmorl's Node	7 (5.8)	5 (4.2)	1 (0.8)	4 (3.3)	1 (0.8)	1 (0.8)
Osteophytes	0 (0)	10 (8.3)	7 (5.8)	10 (8.3)	14 (11.7)	2 (1.7)
Disc height reduction	1 (0.8)	1 (0.8)	3 (2.5)	2 (1.7)	0 (0)	1 (0.8)
Antero-listhesis	0 (0)	1 (0.8)	2 (1.7)	1 (0.8)	2 (1.7)	2 (1.7)
Postero-listhesis	0 (0)	1 (0.8)	0 (0)	0 (0)	2 (1.7)	0 (0)
Facet joint hypertrophy	1 (0.8)	1 (0.8)	0 (0)	2 (1.7)	2 (1.7)	0 (0)
Ligamentum Flavum hypertrophy	2 (1.7)	1 (0.8)	4 (3.3)	3 (2.5)	4 (3.3)	2 (1.7)

Most of the degenerative findings were seen at lower lumbar levels i.e L4-L5 and L5-S1. Modic changes were most commonly seen at L5 vertebra (34.5 %), while schmorl's node was mostly seen at L3 level (31.9 %). (Table 3)

Disc bulge was the most common of all findings, and most commonly affected is L4-L5 disc (36.3 %) followed by L5-S1 (29 %). L1-L2 disc level (1.8 %) was least commonly involved. The signal intensity of the protruded segment was generally, but not invariably, the same as those of the non-herniated portion. Seventy-one discs (97.3 %) of all herniated discs were protrusion, 70 were focal and 1 was with broad based. Only 2 (2.7 %) migrated discs were noted. Out of 71 protruded discs, focal protrusions were commonly seen at L4-L5 level (47.9 %) and least at L1-L2 (1.4 %). Broad based protrusion was only seen in one disc at L4-L5 level (1.4 %). Out of 2 extruded discs, only migrated type of extrusion was seen at L4-L5 and L5- S1 level (0.8% each). Sequestered extrusion was not seen at any level and in any patients examined in our study. The most common location for disc herniation was postero-central seen in 31 (44.3 %) discs, followed by paramedian 28 (40.0 %) and foraminal 10 (14.3 %). Postero-central disc herniation was most commonly found at L4-L5 and L5-S1 disc level (11.7 % each), while paramedian disc herniation was also commonly seen at L4-L5 level (10%) followed by L5-S1 level (7.5%). Paramedian disc herniation was more common than central herniation at L3-L4 level, being 4.2% and 1.7 % respectively and was the only type of herniation seen at L1-L2 level (0.8%). Extraforaminal herniation was seen at only L4-L5 level (1.4 %). (TABLE 3)

Narrowing of neural foramina was most commonly seen at L4-L5 disc level (38.6 %) followed by L5-S1 level (30.7 %) and the least affected level was L1-L2 (0.7%) (Fig. 1). Central canal stenosis was most commonly seen at L4-L5 disc level (53.8 %) and L3-L4 level was least affected (3.8%). Canal stenosis was not seen at L1- L2 and L2-L3 levels. It was defined as mild stenosis with separation of all cauda equina, moderate stenosis with some cauda equina aggregated making it impossible to visually separate them; and severe stenosis with none of the cauda equina separated and was found to be mild in most of the levels (24 levels; 92.3 %), L4-L5 level (50 %) being most commonly involved followed by L5-S1 level (38.5 %). L1-L2 and L2-L3 level were not involved in canal stenosis. Moderate canal stenosis was only seen at L5-S1 level (3.8%) and severe canal stenosis was only seen at L4-L5 level (3.8 %). (Table 3)

Table 3 -Distribution of degenerative imaging findings on MRI at various disc levels (% in parenthesis)

Imaging findings on MRI	Disc level				
	L1-L2	L2-L3	L3-L4	L4-L5	L5-S1
Desiccation	12 (5)	25 (10.5)	52 (21.8)	79 (33.2)	70 (29.4)
Bulge	6 (1.8)	33 (10.1)	75 (22.9)	119 (36.3)	95 (29)
Herniation	1 (1.4)	2 (2.8)	7 (9.6)	36 (49.3)	27 (37)
Neural foramina narrowing	2 (0.7)	20 (6.8)	68 (23.3)	113 (38.6)	90 (30.7)
Central canal stenosis	0 (0)	0 (0)	1 (3.8)	14 (53.8)	11 (42.3)
Annular fissures	1 (1.6)	2 (3.2)	5 (7.9)	32 (50.8)	23 (36.5)
Disc height	2 (1.7)	1 (0.8)	1 (0.8)	3 (2.5)	2 (1.7)
Antero-listhesis	0 (0)	0 (0)	0 (0)	2 (18.2)	6 (54.5)
Postero-listhesis	0 (0)	0 (0)	0 (0)	3 (27.3)	0 (0)
Facet joint hypertrophy	0 (0)	0 (0)	0 (0)	6 (100)	0 (0)
Ligamentum Flavum hypertrophy	0 (0)	1 (4.5)	8 (36.4)	13 (59.1)	0 (0)

Out of total 63 discs involved, annular fissures were seen most commonly at L4-L5 level (50.8 %) followed by L5-S1 level (36.5 %). Least affected level was L1-L2 (1.6 %). Type 2 radial annular fissure 49 (77.8 %) was commonly seen and the most commonly involved was L4-L5 disc level followed by L5-S1. Type 3 transverse fissures 3 (4.8 %) was least commonly seen. (Table 3)

Modic changes were most common in L5 vertebra and L1 vertebra was least commonly involved. Type 2 Modic changes (61 vertebrae, 50.8 %) was most common followed by type 1 changes, (17 vertebrae, 14.1 %). Schmorl's node was seen on the sagittal sequences and exhibited the same signal characteristics as the adjacent disc, with a thin rim of sclerosis at the margins and was most commonly seen at the L3 vertebra. (Table 3) (Fig.1, 3)

Reduction of disc height was commonly seen at L4-L5 level (33.3 %) while least commonly affected vertebral level was L2-L3 and L3-L4 level each (22.2 %).(TABLE 4)

Table 4 - Distribution of findings on MRI at vertebral levels (% in parenthesis)

Imaging findings on MRI	Vertebral level				
	L1	L2	L3	L4	L5
Modic changes	3 (3.4)	7 (8)	21 (24.1)	26 (29.9)	30 (34.5)
Schmorl's Node	6 (6.4)	12 (25.5)	15 (31.9)	11 (23.4)	3 (6.4)

Spondylolisthesis, displacement of one vertebra relative to another in the sagittal plane, was most commonly seen at L5-S1 level (55 %). Overall and at L5-S1, antero-listhesis was more commonly seen as compared to posterolisthesis (most common at L4-L5). Spondylolisthesis was not seen at L1-L2, L2-L3 and L3-L4 levels. (TABLE 4) (Fig 1.)

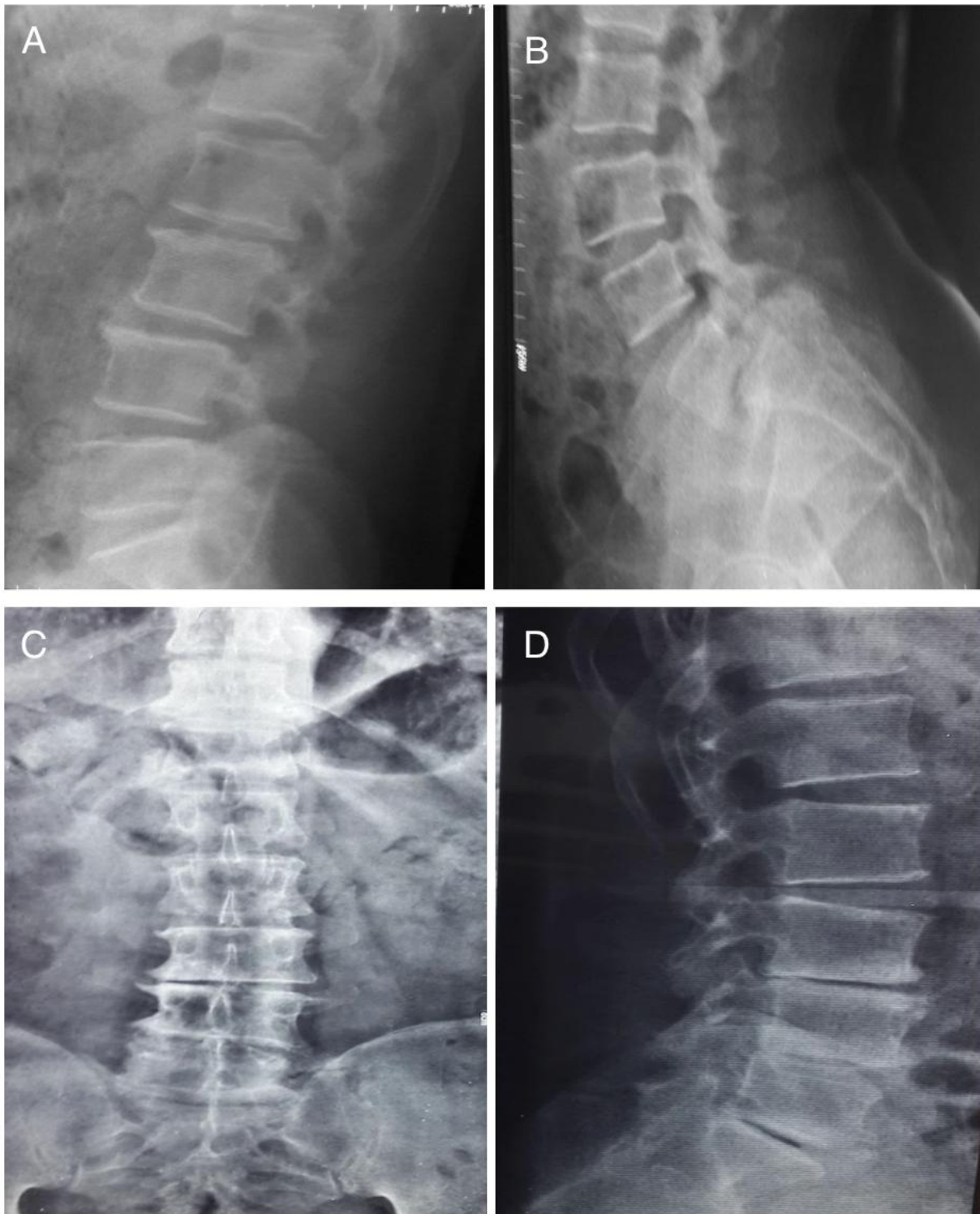


Figure 1: Radiographic findings in lumbar degenerative disc disease.

- A. Lateral view of the lumbar spine showing osteophytes and endplate sclerosis at multiple levels.*
B. Lateral view demonstrating anterior displacement of L5 over S1, consistent with grade II spondylolisthesis.
C. Anteroposterior (AP) view showing reduced disc height at L3–L4, L4–L5, and L5–S1 levels.
D. Lateral view highlighting decreased disc height at L3–L4, L4–L5, and L5–S1 levels

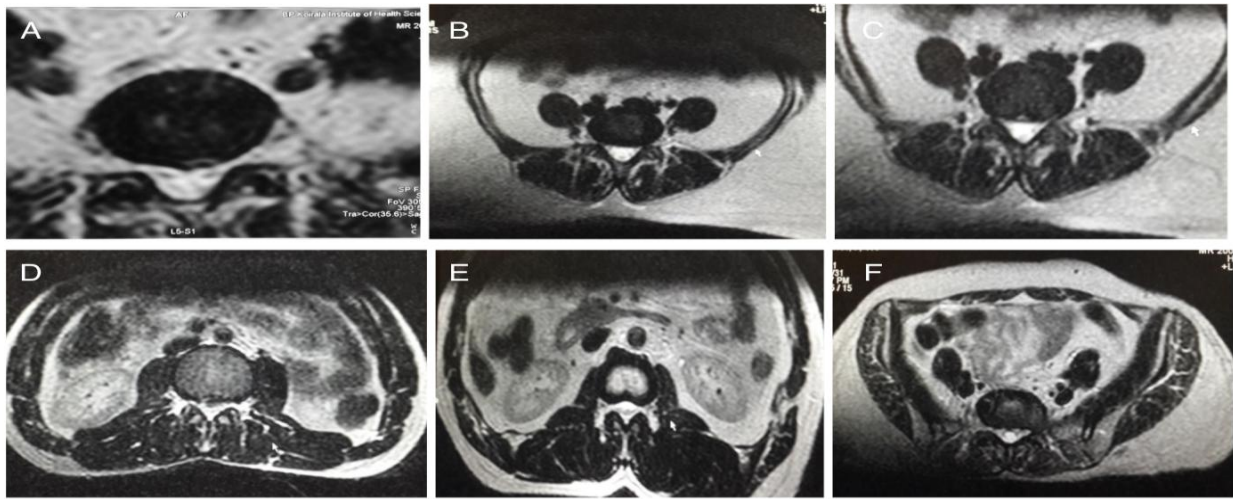


Figure 2: T2-weighted axial MRI findings in lumbar degenerative disc disease.

- A. High signal intensity in the posterior annulus fibrosus of the L5–S1 disc, suggestive of an annular fissure.
- B. Narrowing of bilateral neural foramina at the L4–L5 level.
- C. Annular fissure in the posterior annulus fibrosus at L4–L5 disc level.
- D. Postero-central disc protrusion at the L2–L3 level.
- E. Ligamentum flavum hypertrophy and facet joint sclerosis at L4–L5.
- F. Left paracentral disc protrusion at L4–L5 level.

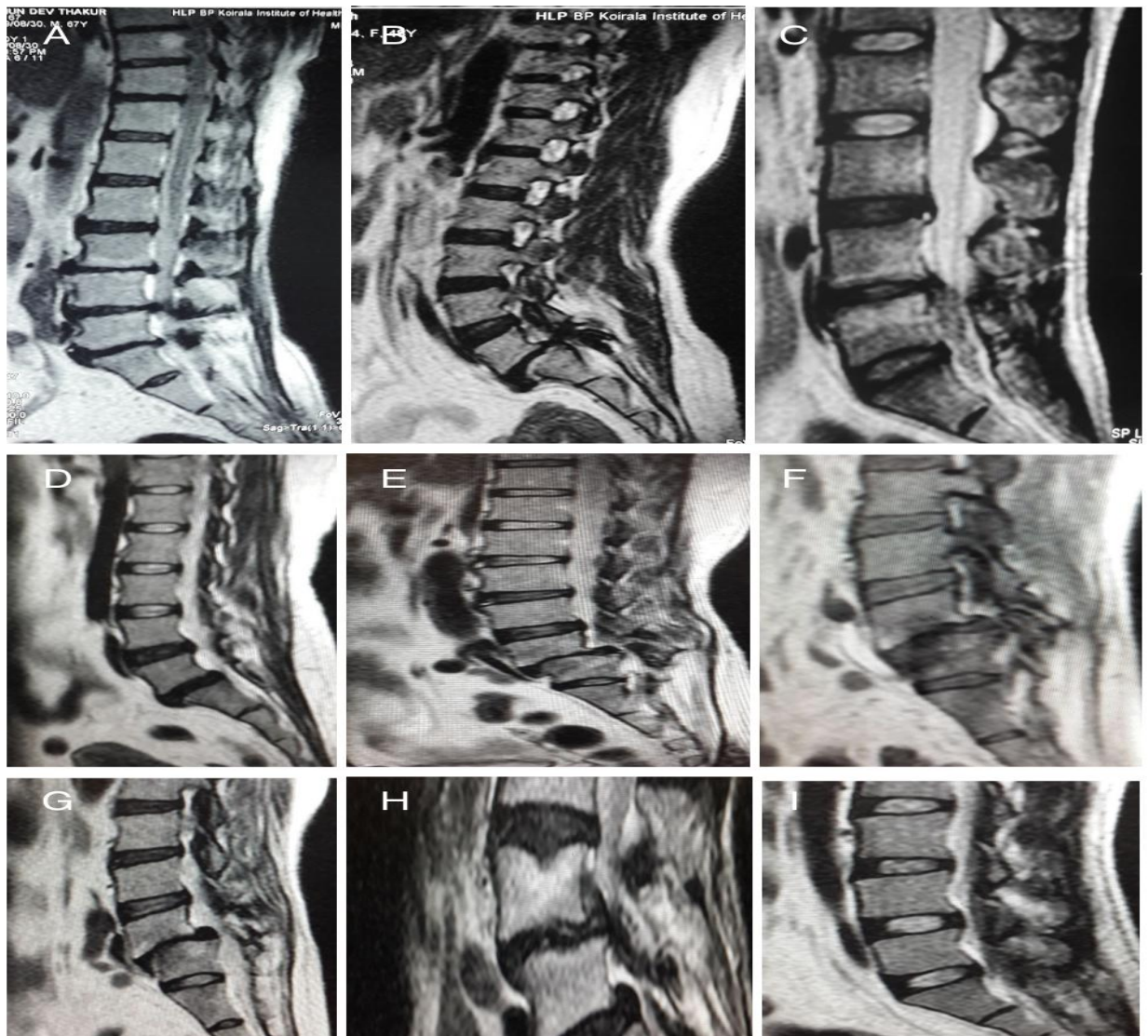


Figure 3: T2-weighted sagittal MRI findings in lumbar degenerative disc disease.

- A. Reduction in disc height at L3–L4, L4–L5, and L5–S1 levels.
- B. Grade II anterolisthesis of L5 over S1.
- C. Diffuse disc bulge with disc desiccation at L3–L4 and L4–L5. Annular fissure at L3–L4 and extrusion with central canal stenosis at L4–L5.
- D. Grade I anterolisthesis of L5 over S1 with disc desiccation and diffuse disc bulge at L4–L5 and L5–S1.
- E. Grade I anterolisthesis of L5 over S1 with loss of disc height at the same level.
- F, G. Hyperintensity in T1 and T2 sequences at the postero-inferior part of L5 vertebra, suggestive of Type II Modic changes.
- H. Schmorl's node at the superior endplate of L4 vertebra.
- I. Diffuse disc bulge at L4–L5 and L5–S1 levels.

DISCUSSION

The increasing longevity and improved socioeconomic conditions have led to a higher proportion of aging populations, subsequently elevating the prevalence of degenerative musculoskeletal diseases. Non-invasive and accurate diagnostic imaging is essential to provide precise anatomic information for tailoring patient specific management. Our study focussed on the use of MRI to describe and diagnose spinal degenerative changes in the study population. Among the 120 patients of lower back pain included in the study, 57% were male. This gender predominance among males was also observed in previous other studies by Wassenaar et al. [10], Takarad et al. [11] and Miller et al. [12], who reported that males are more commonly affected than females. This result confirms the general perception that men are more susceptible to degenerative spine disease than women, most probably due to increased mechanical stress, wear and tear and more prone to injuries because of more outdoor activities [13].

The most frequent age group with degenerative spinal disease in our study were of 31-40 years, which is in contrast to previous studies done by Takatalo et al. [14] and Kasdan & Howard [15] where highest prevalence was seen in individuals above 40 years of age which increased progressively to over 90% by 50 to 55 years of age. Prevalence of heavy labour workers and other occupations which involve carrying heavy physical loads in hilly areas of eastern Nepalese geographic region can explain the degenerative findings in the younger age group in our study.

Nerve root compression because of narrowing of neural foramina or ligamentum flavum hypertrophy or facet joint hypertrophy was previously observed to be most common among sciatica patients [16,17] and lower among patients with LBP [16]. This is comparable to our study which showed increased prevalence of narrowing of neural foramina in patients with LBP with radiculopathy than in LBP alone. It was also suggested that low back pain with neurologic signs of compression of the cauda equina may be caused by hypertrophied LF. There was significant association of ligamentum flavum hypertrophy with sciatica patients (P value = 0.036) in our study. Hypertrophy of ligamentum flavum and facet joint all were only seen in patients with LBP with radiculopathy.

Disc desiccation, loss of central high T2 signal on MRI, was observed in 96 (80%) patients in the present study. The prevalence was observed to vary with age (most common being 31-40 years of age group being 24%, while in 51 to 60 and 61 to 70 years of age group it was 15.8% and 13.3% respectively). The prevalence observed between the various age groups in our study was different as compared with the findings of other previous studies by Cheung et al. [18] and Kasdan & Howard [15] who reported that 40 % of individuals under 30 years of age had lumbar intervertebral disc degeneration (LDD), the prevalence of LDD increasing progressively to over 90% by 50 to 55 years of age. The prevalence of disc degeneration in young individuals (31-40 years) could probably be explained as a result of genetic predisposition; though, other factors like repeated traumatic injuries and physical loading history can play a role in causing disc degeneration [14,18,19]. Proportion of disc desiccation progressively increased with the lower spine level, and the most common spinal levels involved were L4/L5 and L5/S1 was observed by Cheung et al. [18] and Takatalo et al. [14], similar to what was observed in our study. At L1/L2 level, 90 % of the discs had normal signal intensity, which then progressively decreased to 35 % at L4/L5 level, this finding is similar to the previous report by Ong et al. [20]. The observation that disc desiccation is not significantly associated with LBP (P value > 0.05), is similar to the findings from previous report by Sivas et al. [21], however, Cheung et al. [18] reported a significant association of lumbar disc desiccation on MRI with low back pain.

Most of the degenerative findings in our study were observed at L4/L5 and L5/S1 levels. In similar studies by Ong et al. [20] and Cheung et al. [18] most common disc levels were found to be L4/L5 and L5/S1. This could partly be explained by the fact that lumbar spine is subjected to heavy mechanical stress and thus is a common area affected by degenerative changes [22]. Also, multiplicity in the disc level involvement was common as compared to single disc involvement, which is also in concordance with previous study by Takatalo et al. [14].

Disc bulges were more common than herniations (100% and 45%, respectively) in our study, similar to the findings reported by Sivas et al. [21] and Ong et al. [20], who observed that 58% of discs showed displacement, most of which were bulges. The prevalence of disc herniation in our study was lower than that reported by Shobeiri et al. [16] and Siddiqui et al. [17] (89%). Among the herniated discs, the majority (97.3%) were of the protrusion type, while only 2.7% were extrusions.

The most common location for disc herniation was postero-central, observed by us in 44.3 %, followed by postero-lateral and foraminal, 40% and 14.3 % respectively. This finding differs to previous reports by Wolfgang [23] in which the most common location was postero-lateral. It was also observed that there was significant association of disc herniation with sciatica (p value = 0.008) with 51.4% of patients having sciatica with disc herniation as compared to 20.8% in those with disc herniation with LBP only. Our study is comparable to the study by Modic et al. [24] who reported that in cases of low backache with radiculopathy there was a strong probability of disc protrusion or extrusion (herniation) causing nerve root compression. However, there was no significant correlation between the severity of disease, patient's function, severity of pain and MRI findings.

Twenty-one (17.5%) patients in our study had central canal stenosis (Fig. 1C), which is slightly lower as compared to that reported by Shobeiri et al. [16], who observed that 37% of sciatica patients had spinal canal stenosis. This difference could be due to the slightly younger study population in our series. Canal stenosis was frequently observed at L4/L5 and L5/S1 levels, while none were found at L1/L2 and L2/L3 levels, similar to previous studies by Shobeiri et al. [16]. The prevalence of canal stenosis among patients with radiculopathy was 21.8%, and none was found among patients with LBP only (0%) (P value <0.001). These findings are comparable to those reported by Shobeiri et al. [16], who noted that 11% of LBP patients and 37% of sciatica patients had spinal canal stenosis.

The small canal in patients with stenosis causes the thecal sac or nerve roots to impinge against the bony spinal elements, leading to radiculopathy and activity-dependent pain [25]. Disc protrusion and facet joint involvement were present in almost all cases of spinal canal stenosis in our study. Disc degeneration, resulting in loss of disc height, causes increased stress on the facet joints with craniocaudal subluxation, loss of T2 hyperintense signals, hypertrophy, and osteophytosis-collectively termed facet joint arthropathy.

Annular fissures were found in 44 % of present study patients which is lower in prevalence than in previous study by Kim et al. [26] who reported it to be 76 %. It was highest in the 31-40 years age group (15 %) followed by 61-70 years age (10%). (Fig . 1. A)

Modic changes were seen as signal intensity alterations adjacent to the endplates of degenerated intervertebral discs on MRI. Type 1 appeared as decreased signal on T1 and increased signal on T2, Type 2 showed increased signal on T1 and followed fat signal on T2, while Type 3 appeared as decreased signal on both T1 and T2. In our study, Modic changes were most commonly observed in the 51-60 years age group (8.3%) and were absent in the 71-80 years group. They were slightly more frequent in patients presenting with low back pain with radiculopathy compared to those with isolated low back pain (29.2% vs 25%). The lower prevalence in older patients may be attributed to the smaller number of participants in that age group (4 out of 120). Type II Modic changes were more common than Type I (50.8% and 14.1%, respectively). The frequency of Modic changes progressively increased at lower lumbar levels, with L5 and L4 being the most commonly affected vertebrae.

Spondylolisthesis in our study was commonly seen at L5/S1 followed closely by L4/L5 level. It has been well-established by previous studies that degenerative spondylolisthesis is associated with degenerative changes in FJ and occurs most commonly at the L4-L5 level [27]. A possible reason for the high prevalence and severity of FJH at the L4- L5 spinal level may be the relatively greater stability of the L5-S1 spinal segment compared to L4-L5. Greater stability arises from a more coronal orientation of the L5-S1 facet joints as opposed to the more sagittal orientation of the L4-L5 facet joints [28], increased pedicle-facet angle at the L5-S1 level and additional anatomic stability provided the fifth lumbar vertebra by large transverse processes supported by strong iliolumbar ligaments. Contradictory result in our study can be due to small sample size.

The higher incidence of disc degeneration and spondylolisthesis at the L4-L5 and L5-S1 levels leading to subluxation and foraminal narrowing contributes to the increased susceptibility of the L4 and L5 nerve roots to static and dynamic compression. The lower lumbar nerve roots are also characterized by a more oblique course throughout the lateral canal, increasing their susceptibility to the effects of pedicular kinking and foraminal stenosis [29]. Our observations affirm that MRI is a highly reliable method for illustrating early end-plate marrow degeneration, reduction in disc height, and additional degenerative alterations.

CONCLUSIONS

Our study contributes valuable insights into the prevalence, clinical correlations, and diagnostic efficacy of MRI in lumbar degenerative disc disease within the specific demographic context of our study population. The findings enhance our understanding of the multifaceted nature of degenerative changes in the lumbar spine, paving the way for more targeted and effective management strategies in clinical practice.

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