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# MRI Evaluation of Degenerative Lumbar Spine in Population of Eastern Nepal

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## ABSTRACT

### Introduction:

Low back pain is the most commonly encountered symptom, with approximately 80% of individuals experiencing at least one instance of back pain throughout their lifetime. Magnetic resonance imaging is widely regarded as a highly effective diagnostic tool for assessing different factors contributing to back pain.

### Methods:

The study included all patients who had a history of chronic low back pain and were referred for Magnetic resonance imaging at the Radiology Department of Nobel Medical College between September 1, 2020, and September 1, 2021. These patients were suspected to have degenerative diseases of the lumbar spine.

### Results:

A total of 120 patients were included in the study, with ages ranging from 28 to 81 years (mean: 53.38 ± 11.5 years). Among these patients, 64 individuals (53.3%) were females. The most common finding observed was disc desiccation, which was present in 115 patients (95.8%). The prevalence of degenerative findings increased with age, indicating a correlation between age and degenerative changes in the lumbar spine.

### Conclusions:

The study's conclusion states that Magnetic resonance imaging is the most sensitive imaging technique for evaluating low back pain related to degenerative changes. The use of Magnetic resonance imaging is recommended due to its lack of known side effects, absence of radiation exposure, and noninvasive nature. It was found that various types of degenerative changes can be present in symptomatic patients aged over 40.

***Keywords:*** *Adult; Back Pain, Magnetic ResonanceImaging, Prevalence; Radiology*

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## INTRODUCTION

Degenerative disease of the lumbar spine refers to a syndrome in which an intervertebral disc with adjacent spine structures is compromised, this can be due to ageing or pathologic process.[1]

Magnetic resonance imaging (MRI) allows a complete evaluation of static and dynamic factors related to degenerative disease of the spine and is useful in diagnosing the different aspects of spine degeneration.[2]

## METHODS

This study was a descriptive cross-sectional study conducted in the Department of Radiodiagnosis, Nobel Medical College Teaching Hospital, Kanchanbari, Biratnagar for a period of one year from 1st September 2020 to 1st September 2021. Patients with clinical suspicion of degenerative disease were included in the study. After taking informed consent the detailed clinical history, and general and systemic examination findings were recorded in structured proforma. Standard MRI protocol for evaluation of the lumbar spine was done. Lumbar MRI scans were performed through L1 to S1 intervertebral disc spaces. All the patients were evaluated on 3 Tesla open magnet MAGNETOM Skyra MR Scanner of Siemens. Initially, non-contrast 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. Initially, all images were screened for evidence of neoplastic, inflammatory, infectious disorders or surgical scars and if any, the patient were excluded from the study. Images were examined for the presence of disc desiccation, 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 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 relationship and statistical significance between categorical variables. A 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 for the evaluation of degenerative disease of the Lumbar Spine. Out of a total of 120 patients, the minimum age of the patient was 28 and the maximum of 81 with the mean age being 53. The most frequent age group affected in our study was between 51-60 years of age as shown in Figure 1.

**Age Distribution of Patients**

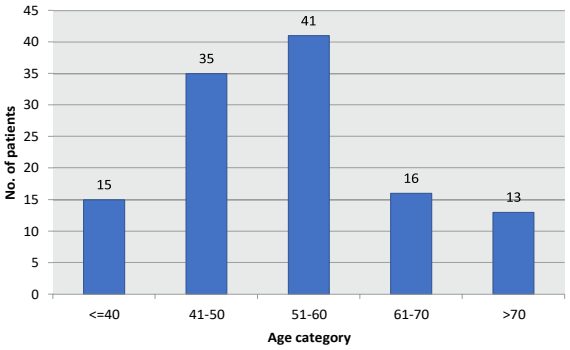


***Figure 1:*** *Bar diagram showing the age distribution of patients who underwent MRI evaluation of the lumbar spine*

In our study, a number of female patients (53.3 %) was higher than male patients (46.7 %) with male to female ratio of 1.14:1 which is shown in Figure 2.

**Gender Distribution of Patients**

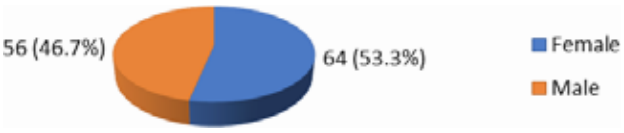


***Figure 2:*** *Pie chart showing gender distribution of patients who underwent MRI evaluation of the lumbar spine*

On lumbar MRI, disc desiccation was the most frequent finding seen in 115 (95.8%) patients followed by disc bulge seen in 96 (80%) patients, Modic changes in 51 (42.5%), endplates osteophytes in 45 (37.5%) narrowing of neural foramina in 41 ( 34.2%), central canal stenosis in 38 (31.7%), annular fissure in 36 (30.0%), disc herniation in 30 ( 25%), schmorl's node in 24 (20%), ligamentum flavum hypertrophy in 16 (13.3%), anterolisthesis in 9 (7.5%), hypertrophy of facet joint in 9% (7.5%) and posterolisthesis in 2 (1.7%). The aforementioned findings are shown in Table 1 and Figures 2 & 3 below.

***Table 1: Table showing the pattern of findings in cases of the lumbar degenerative disease on MRI***

| MRI Finding | No. of patients | Percentage (out of N=120) |
|---|---|---|
| Desiccation | 115 | 95.8% |
| Bulge | 96 | 80.0% |
| Herniation | 30 | 25.0% |
| Neural foramina narrowing | 41 | 34.2% |
| Central canal stenosis | 38 | 31.7% |
| Annular fissure | 36 | 30.0% |
| Anterolisthesis | 9 | 7.5% |
| Posterolisthesis | 2 | 1.7% |
| Facet joint hypertrophy | 9 | 7.5% |
| Ligamentum flavum hypertrophy | 16 | 13.3% |
| Modic changes | 51 | 42.5% |
| Schmorl's node | 24 | 20.0% |
| Osteophytes | 45 | 37.5% |
| Transitional vertebrae | 12 | 10.0% |
| - Sacralization of L5 | 9 | 7.5% |
| - Lumbarization of S1 | 3 | 2.5% |

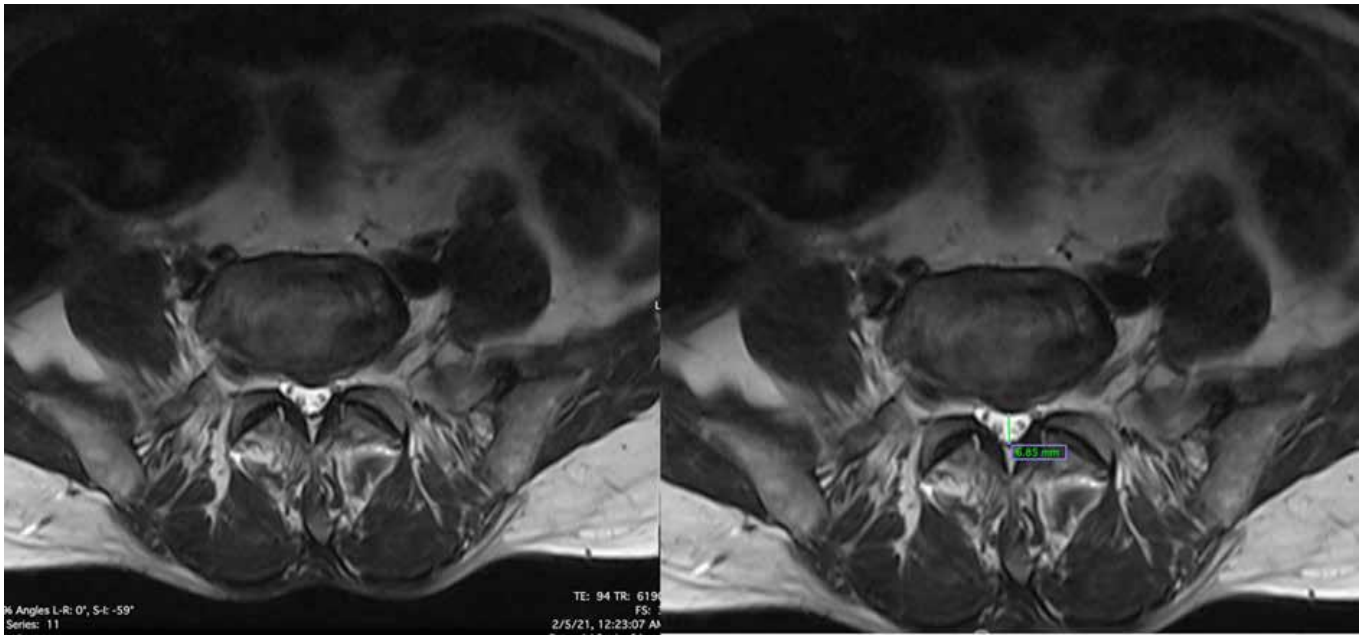

***Figure 2:*** *Diffuse asymmetrical disc bulge with central protrusion and indentation of the anterior CSF space causing central canal stenosis (AP diameter: 6.45mm)*

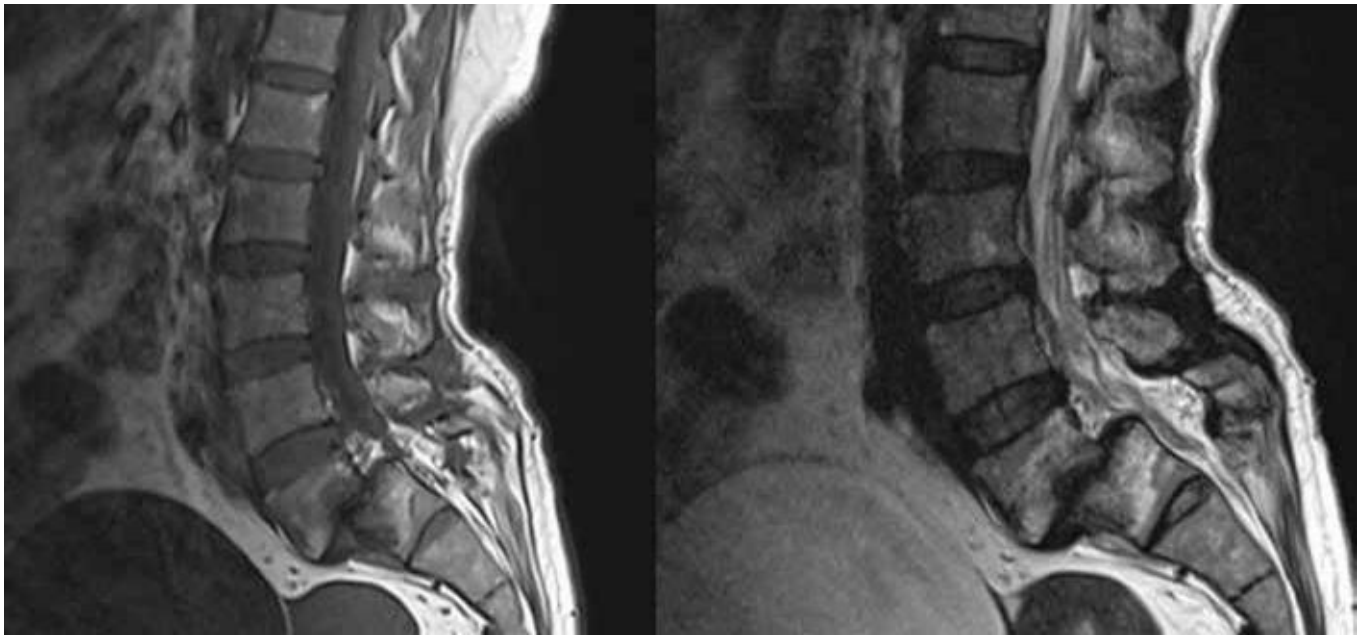

***Figure 3:*** *Anterior displacement of a L5 vertebral body over S1.( Anterolisthesis Grade II ). Type II Modic changes involve the inferior end plate of the L5 vertebra and the superior end plate of the S1 vertebra. Schmorl's node at the inferior endplate of the L5 vertebra*

Most of the degenerative findings were seen at lower lumbar levels i.e. L4-L5 and L5-S1 as shown in Table 2. Disc desiccation (85.8%), disc bulge (77.5%), narrowing of neural foramina (28.3%), herniation (16.7%), annular fissures (19.2%), central canal stenosis (25.0%), facet joint arthropathy (6.7%) and ligamentum flavum hypertrophy (10%) were more commonly seen at L4-L5 level. The findings in the study are shown in Table 2 below.

***Table 2: Table showing the distribution of degenerative imaging findings on MRI at various disc levels***

| MRI finding | Disc level | | | | |
|---|---|---|---|---|---|
| | L1-L2 | L2-L3 | L3-L4 | L4-L5 | L5-S1 |
| Desiccation | 41 (34.2%) | 56 (46.7%) | 78 (65.0%) | 103 (85.8%) | 99 (82.5%) |
| Bulge | 10 (8.3%) | 22 (18.3%) | 43 (35.8%) | 93 (77.5%) | 51 (42.5%) |
| Herniation | 1 (0.8%) | 3 (2.5%) | 1 (0.8%) | 20 (16.7%) | 8 (6.7%) |
| Neural foramina narrowing | 0 (0.0%) | 3 (2.5%) | 12 (10.0%) | 34 (28.3%) | 16 (13.3%) |
| Central canal stenosis | 1 (0.8%) | 4 (3.3%) | 10 (8.3%) | 30 (25.0%) | 16 (13.3%) |
| Annular fissures | 2 (1.7%) | 7 (5.8%) | 12 (10.0%) | 23 (19.2%) | 12 (10.0%) |
| Anterolisthesis | 0 (0.0%) | 0 (0.0%) | 1 (0.8%) | 4 (3.3%) | 4 (3.3%) |
| Posterolisthesis | 0(0.0%) | 0 (0.0%) | 1 (0.8%) | 0 (0.0%) | 1(0.8%) |
| Facet joint hypertrophy | 5 (4.2%) | 6 (5.0%) | 8 (6.7%) | 8 (6.7%) | 6 (5.0%) |
| Ligamentum flavum hypertrophy | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 12 (10.0%) | 7 (5.8%) |
| | Vertebral level | | | | |
| | L1 | L2 | L3 | L4 | L5 |
| Modic changes | 26 (21.7%) | 30 (25.0%) | 32 (26.7%) | 33 (27.5%) | 45 (37.5%) |
| Schmorl's node | 7 (5.8%) | 9 (7.5%) | 12 (10.0%) | 8 (6.7%) | 8 (6.7%) |
| *Percentages in parentheses expressed as out of total sample size (N=120) | | | | | |

## DISCUSSION

Improved healthcare and socioeconomic conditions have contributed to a gradual increase in life expectancy, which is considered a significant achievement of human civilization. However, this has resulted in a higher percentage of ageing populations and an increased prevalence of degenerative musculoskeletal diseases, leading to clinical disability. Diagnostic imaging plays a crucial role in providing accurate anatomical information, delineating pathology, and guiding treatment decisions. In this hospital-based study, MRI was used to evaluate factors or pathologies within the spine. Among the 120 cases of chronic low back pain included in our study, all of them had abnormal findings on MRI, indicating the presence of various types of degenerative diseases affecting different vertebral levels and intervertebral discs. None of the patients with chronic lower back pain showed normal MRI results during the study.

In our study, the average age of the patients was 53.38 years, with males averaging 46.7 years and females averaging 53.3 years. The highest number of patients (41 cases, 34.2%) fell within the age group of 51-60 years. The age range of patients in our study varied from 28 to 81 years. These findings align with studies conducted by Kasdan and Howard, as well as Takatalo et al., which also reported that degenerative changes are common in individuals above 40 years of age, and the prevalence progressively increases to over 90% between 50 and 55 years of age. Our study is also similar to the study conducted by Teraguchi et al., which found 889 cases (out of a total of 975 cases) with degenerative changes in the age groups of 50 years and above.[5]

In our study, we observed a higher number of female patients compared to male patients, with 56 males and 64 females out of the total 120 cases. This finding is consistent with a study conducted by Anderson et al. in 1999, which reported a higher incidence of chronic back pain in females (57 per 1000 population) compared to males (70 per 1000 population). Similar results were also reported by Takarad et al., indicating a greater prevalence of degenerative changes in females (44 males, 56 females). This conclusion can be attributed to the fact that our study had a larger number of female cases than male cases. Additionally, females experience postmenopausal osteoporotic changes, which can contribute to degenerative changes in the lumbar spine.[6,7]

In our study, the majority of degenerative findings were observed at the L4-L5 and L5-S1 levels. This is consistent with similar studies conducted by Ong et al. and Cheung et al., where the most common disc levels affected were also found to be L4-L5 and L5-S1. While degenerative changes in the discs typically start early in life and are partly associated with ageing, the exact cause is still unknown. However, several factors such as autoimmune responses, genetics, re-absorption, and biochemical processes have been implicated in accelerating the degenerative process. The lumbar spine, being subjected to significant mechanical stress, is a common area affected by degenerative changes. This partially explains the observations in our study group, as mentioned by Thomé et al. Furthermore, the involvement of multiple disc levels was more common than single disc involvement, which is in line with previous studies conducted by Takatalo et al.[8,9,10,11]

In our study, the most prevalent finding among the 120 patients was disc desiccation, with 115 patients showing this condition. Among the 29 patients in the age group of over 60, all of them exhibited disc desiccation. The occurrence of disc degeneration in young individuals (31-40 years) may be attributed to genetic predisposition, although other factors such as repeated traumatic injuries and a history of physical loading can also contribute to disc degeneration.[9,11,12]

In our study, disc desiccation was slightly more prevalent among females, with 22 cases (53.9%), compared to males with 53 cases (46%). This finding contradicts the results reported by Takarad et al. in their 2008 study. The proportion of disc desiccation increases progressively as we move lower in the spine, and the most common levels affected were L4-L5 and L5-S1, which aligns with the observations in our study.[7]

## CONCLUSION

MRI is considered the most sensitive imaging technique for assessing patients who present to the hospital with complaints of low back pain. It provides detailed visualization of degenerative changes in the lumbar spine. MRI is preferred due to its advantages, including no known side effects or morbidity, absence of radiation exposure, and non-invasiveness. It is highly advocated for evaluating degenerative changes in patients above the age of 40 who experience symptoms.

## CONFLICT OF INTEREST

None

## SOURCES OF FUNDING

None

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