

## Evaluation of Degenerative Changes in the Lumbosacral Spine Using MRI: A Prospective Observational Study

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### Abstract:

**Background:** Degenerative disorders of the lumbosacral spine are considered one of the most frequent causes of chronic back pain and disability worldwide. Magnetic Resonance Imaging (MRI) is considered of tremendous value for the early detection of degenerative disorders of the lumbosacral spine.

**Objectives:** To evaluate degenerative changes of the lumbosacral spine using MRI and to analyze their distribution with respect to age, gender, spinal level, and clinical presentation.

**Materials and Methods:** This study was a case series of patients who presented with low back pain and who had an MRI done on their lumbosacral region. The information obtained during this study was related to the presence of disc degeneration, disc bulge or herniation, facet arthropathy, hypertrophy of the ligamentum flavum, spinal canal stenosis, and nerve root compression. Disc degeneration was graded according to the Pfirrmann grading system.

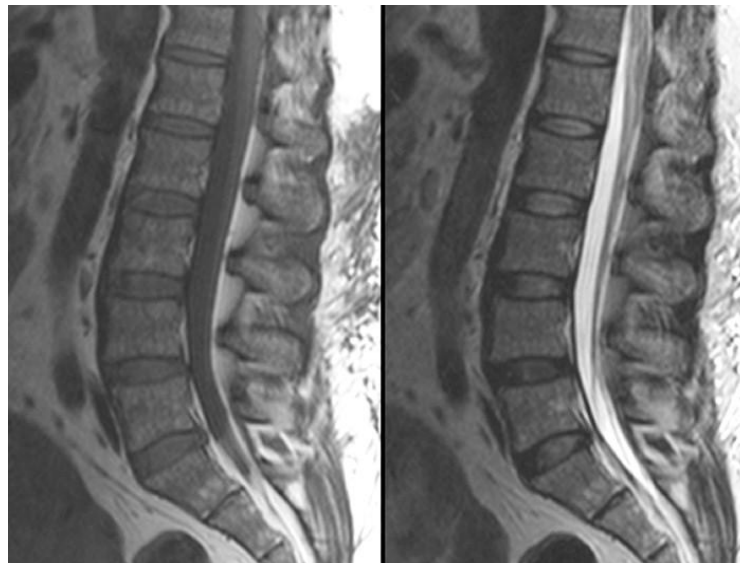
**Results:** The most commonly affected levels for degenerative changes were L4-5 and L5-S1. Intervertebral disc degeneration was most frequent, followed by disc bulge, facet arthropathy, and ligamentum flavum thickening. With increasing age, there was also an increase in the severity of disc degeneration. Though significant degenerative changes were observed with MRI, there was a variable relationship between clinical symptoms and imaging findings.

**Conclusion:** MRI is an essential investigation in the evaluation of degenerative changes in the lumbar spine. Degenerative changes in the lumbar spine increase with age. They usually involve the lower spinal segments. However, MRI findings must always be correlated with clinical findings in order to avoid overdiagnosis and unnecessary treatment.

**Keywords:** Low back pain; Lumbosacral spine; MRI; Disc degeneration, grading; Spinal stenosis.

### INTRODUCTION

Low back pain is a serious health issue confronted by people of all ages and ranks as one of the most disabling health disorders in terms of prevalence. The growing incidence of low back pain can be attributed to lifestyle changes, decreased physical activity, prolonged periods of sitting, work-related stress, obesity, and poor posture. Among all the etiological causes, degenerative changes involving the lumbosacral spine account for a substantial percentage of chronic low back pain syndromes<sup>(1,2)</sup>.



**Fig 1: Normal Mid-Sagittal MRI scans of the Lumbar Spine [doi:10.1148/radiol.2451051706]**

These include five lumbar vertebrae and sacrum. The lumbosacral segment is subject to mechanical stresses. For instance, L4/L5 and L5/S1 segments are greatly subjected to such stresses. As a result, it is more prone to degenerative changes<sup>(3)</sup>. Such degenerative changes include facets, intervertebral discs, ligaments, and vertebral endplates. Such processes may be simultaneous<sup>(4)(5)</sup>.

Magnetic Resonance Imaging (MRI) has been established as the imaging of choice for assessing degenerative spine disease, owing to improved tissue contrast and the absence of ionizing radiation. MRI provides excellent visualization of disc evaluation, nerve roots, spinal canal, and associated soft tissue structures<sup>(6)</sup>. Despite extensive use of MRI, there remains an inconsistent correlation between MRI results and clinical symptoms, with considerable degenerative changes observed even in asymptomatic individuals<sup>(7)</sup>.

This study seeks to systematically evaluate degenerative changes in the lumbosacral region using MRI techniques and relate such findings with demographic factors and presentation<sup>(8)</sup>.



Fig 2: MRI showing L4-L5 and L5-S1 degenerative disc disease [doi:10.2106/00004623-199072030-00013]

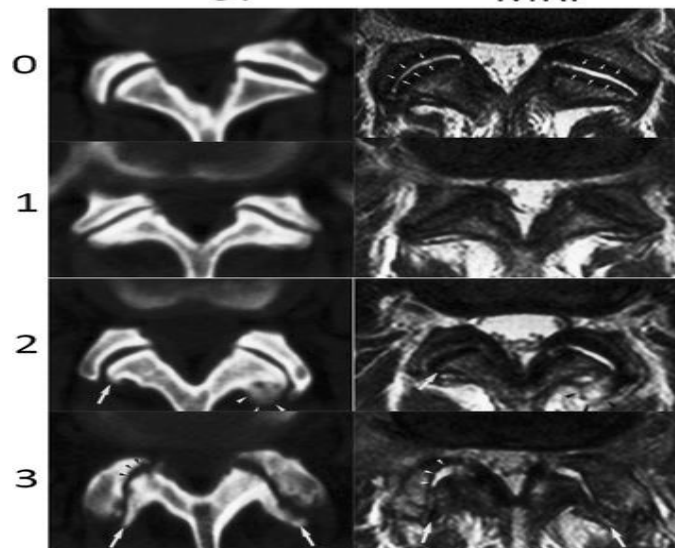


Fig 3: The Weishaupt grade of CT and MRI images of the lumbar facet joint [doi:10.1007/s002560050503]

## MATERIALS AND METHODS

### Study Design and Population

A prospective observational study was conducted on patients presenting with low back pain referred for MRI evaluation of the lumbosacral spine. Patients of both genders and varying age groups were included.

### Inclusion Criteria

- Patients presenting with low back pain with or without radiculopathy
- Patients undergoing MRI of the lumbosacral spine

### Exclusion Criteria

- History of spinal trauma or surgery
- Congenital spinal anomalies
- Spinal infections or tumors

### MRI Protocol

MRI examinations were performed using standard lumbosacral spine protocols, including T1-weighted and T2-weighted sequences in sagittal and axial planes<sup>(6)</sup>.

### Image Analysis

The following degenerative changes were evaluated:

- Intervertebral disc degeneration (graded using Pfirrmann grading)
- Disc bulge and disc herniation
- Facet joint arthropathy
- Ligamentum flavum hypertrophy
- Spinal canal stenosis
- Nerve root compression
- Modic endplate changes

### Statistical Analysis

Data were analyzed to determine the frequency and distribution of degenerative changes across different age groups, genders, and spinal levels. Correlation between MRI findings and clinical symptoms was assessed<sup>(7,8)</sup>.

**RESULTS**

Degenerative changes were also identified among most patients undergoing MRI evaluation. Intervertebral disc degeneration was observed to be the most common degenerative change, and it intensified with age. The lumbar levels L4-5 and L5-S1 were most commonly found to be affected.

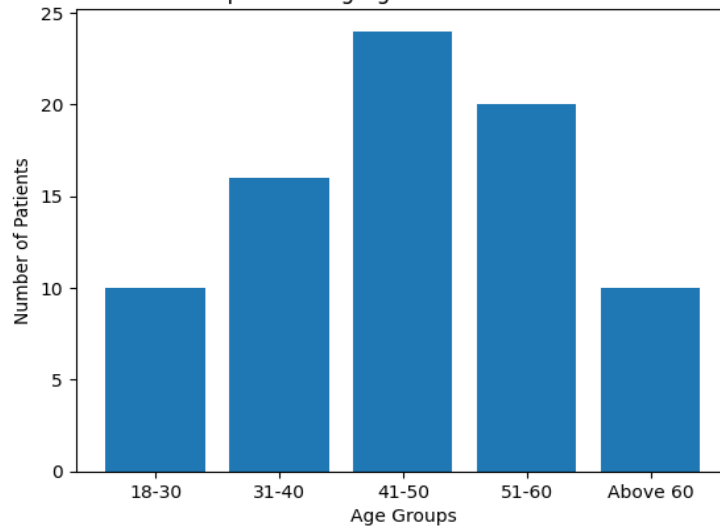
Disc bulge and disc herniation have commonly been related to nerve root compression, particularly in the lower lumbar regions. Facet joint arthropathy and hypertrophy of the ligamentum flavum have been more prevalent in older age groups, contributing significantly to spinal stenosis.

Although extensive degenerative changes were detected by MRI, not all correlated well with the severity of symptoms.

**Table 1.1 Age Distribution of Patients**

Age Group (Years)	Number of Patients	Percentage (%)
18-30	10	12.5
31-40	16	20.0
41-50	24	30.0
51-60	20	25.0
Above 60	10	12.5
<b>Total</b>	<b>80</b>	<b>100</b>

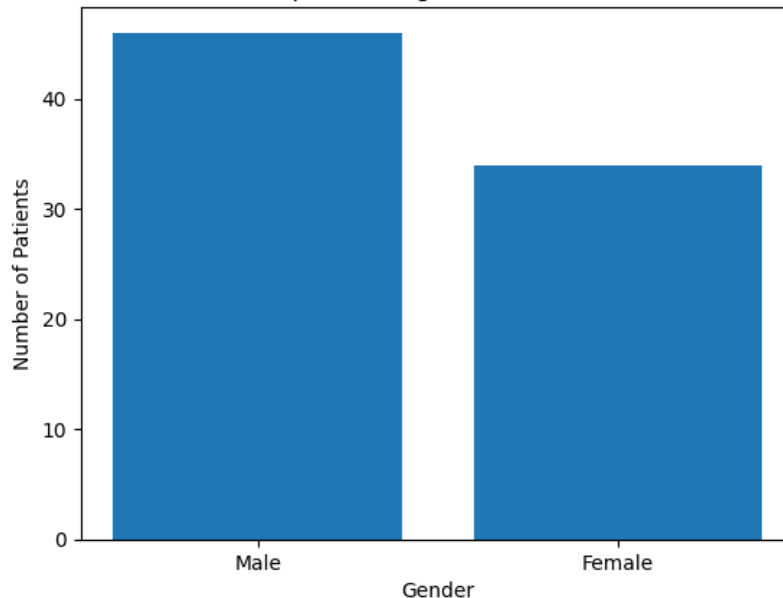
**Bar Graph Showing Age Distribution of Patients**



**Table 1.2 Gender Distribution of Patients**

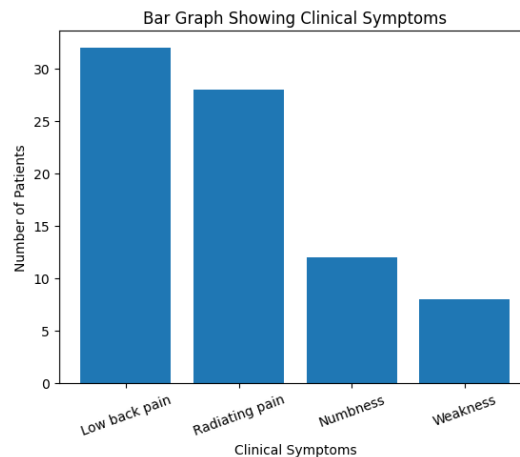
Gender	Number of Patients	Percentage (%)
Male	46	57.5
Female	34	42.5
<b>Total</b>	<b>80</b>	<b>100</b>

**Bar Graph Showing Gender Distribution**



**Table 1.3 Distribution of Clinical Symptoms**

Clinical Symptoms	Number of Patients	Percentage (%)
Low back pain only	32	40.0
Back pain with radiation	28	35.0
Numbness or tingling	12	15.0
Weakness or stiffness	8	10.0
<b>Total</b>	<b>80</b>	<b>100</b>



## DISCUSSION

Degenerative changes, which occur in the lumbosacral spine, are a significant cause of chronic low back pain as well as functional limitation<sup>(4)</sup>. The present study assessed degenerative changes in the spine by means of MRI, along with the distribution according to age, level, and symptom presentation<sup>(6)</sup>.

The commonest finding of degeneration in any of the structures under investigation was that of intervertebral disc degeneration, and this condition showed increasing prevalence with age<sup>(9)</sup>. The finding supports the generally held theory that degeneration of the disc is age-related, leading to overall dehydration and failure of the matrix of the disc<sup>(4)</sup>. The statistically significant relationship between age and disc degeneration in this study confirms existing literature<sup>(4)</sup>.

The most commonly affected levels in the lower lumbar region were L4-L5 and L5-S1<sup>(8)</sup>. This region was under more stress and more mobile, which predisposed these levels for earlier and severe degeneration<sup>(3)</sup>. This kind of level-wise distribution was observed in previously conducted studies analyzing the degeneration in the lumbar region of the spine<sup>(3)(8)</sup>.

Similarly, a high rate of disc bulges and disc herniation was observed on MRI, although a significant correlation was observed with clinical symptoms for the latter, whereas the former did not show any such significant correlation<sup>(7)</sup>. Disc bulges and mild degenerative changes are also observed in asymptomatic individuals, thus stressing the need to correlate clinical signs and symptoms with imaging findings<sup>(7)</sup>.

Facet joint arthropathy and ligamentum flavum hypertrophy were more common in older subjects and tended to occur together with disc degeneration. These alterations result in the narrowing of the spinal canal and are also important for the development of lumbar spinal stenosis<sup>(10)</sup>. The stenosis of the spinal canal was strongly related to symptoms of neurogenic claudication and radiculopathy in the current study<sup>(10)</sup>.

The variability in the correlation between MRI findings and clinical symptoms in this study confirms that imaging abnormalities, by themselves, cannot be predictable for pain severity or functional impairment<sup>(7)</sup>. It is perhaps psychosocial influences, inflammatory changes, and neural sensitization that affect symptom perception and should be looked for during the assessment of a patient<sup>(4)</sup>.

MRI has become a highly useful modality for the thorough evaluation of degenerative changes because it is able to demonstrate great detail of discs, facet joints, ligaments, dimensions of the spinal canal, and nerve roots<sup>(6)</sup>. However, its indiscriminate use will lead to over-diagnosis and intervention. Therefore, MRI findings always have to be interpreted in conjunction with clinical history and physical examination<sup>(7)</sup>.

## CONCLUSION

Degenerative changes of the lumbosacral spine are highly prevalent and predominantly affect the lower lumbar levels<sup>(3)(6)</sup>. MRI is an indispensable tool for their evaluation, providing detailed anatomical and pathological information<sup>(6)</sup>. Nevertheless, MRI findings must be interpreted in conjunction with clinical assessment to ensure appropriate diagnosis and management<sup>(7)</sup>.

**Limitations:** Single-center study

- Lack of long-term follow-up
- Symptom severity was not quantified using standardized pain scores

**Recommendations:** Further multicenter prospective studies with long-term follow-up and standardized clinical scoring systems are recommended to better understand the clinical relevance of MRI-detected degenerative changes<sup>(4)</sup>.

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