

# A Comprehensive Investigation of the Relationship Between Symptom Complex and Magnetic Resonance Imaging in Lumbar Disc Herniation: A Prospective Study

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Conflict of interest: Nil

## Abstract

**Aim:** To study the correlation between symptom complex and magnetic resonance imaging in lumbar disc herniation. **Method:** The present Prospective study was conducted in the Department of Orthopaedics, All India Institute of Medical Science, Patna, Bihar, India for 1 year. A total of 90 patients were studied. The patients with lumbar disc prolapse, diagnosed clinically, are included in the study. Patients with a pathological fracture in lumbar spine, post-traumatic low back pain, failed back syndrome or lower limb radiculopathy due to other causes and Age <20yrs and >80yrs are all excluded from the study. **Results:** Total number of patients studied was 90, out of which 50 were males and 40 were females. 10 patients were in the age group of 20-30 years, 28 were between 30-40 years, 24 were between 40-50 years, 22 were between 50-60 years and 6 patients were more than 60 years old. The mean age was found to be 45.9 years. Total levels of disc herniation were 110. Out of the 90 patients, 40 had specific dermatomal distribution and 50 had nonspecific dermatomal distribution. Among the 40 patients, 4 had L3 radiculopathy, 3 had L4 radiculopathy, 5 patients had L5, and 3 patients had S1 radiculopathy. Patients with L4 and L5 and L5 and S1 radiculopathy were 12 and 8 respectively. 5 patients had multiple level radiculopathy. Total number of patients presented with sensory deficits was 5. 18 patients suffered from motor deficits. Out of 110 levels of disc herniation, 30 levels had motor deficits. Out of 90 patients, 88 patients had positive SLRT and 70 had positive crossed SLRT test. Out of 110 levels of disc herniation, 52 showed disc bulge, 35 showed protrusion, 20 showed extrusion and 3 levels were with sequestration. Out of 110 levels of disc herniation, 27 showed anterior thecal sac compression, 49 showed nerve root contact and 34 showed nerve root compression. **Conclusion:** The disc bulge/ protrusion/ extrusion with central presentation were not significantly correlating with clinical features. But, independent of type of herniation, if there is PC/FL presentation of disc with neural foramen compromise, there is significant correlation with clinical features.

**Keywords:** Disc, Herniation, Lumbar Vertebra.

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## Introduction

Lumbar discs prolapse is one of the commonest causes of low back pain in the

working population[1,2]. The magnetic resonance imaging (MRI) has provided

clinicians with a noninvasive mechanism for viewing lumbar anatomy in great detail[2-6]. Various patho anatomical changes in lumbar disc prolapse can be visualized in MRI. However, the clinical significance of MRI findings is still controversial. Despite the fact that MRI is done routinely for patients with suspected intervertebral disc prolapse, one is not sure which of the MRI findings are clinically relevant and have diagnostic as well as prognostic value. Milette et al.[5] found that loss of disc height or abnormal signal intensity is highly predictive of symptomatic tears and the presence of a disc bulge or protrusion does not have additional significance. Beattie et al.[7] found that the presence of disc extrusion and severe nerve root compression at one or multiple sites is strongly associated with distal leg pain. However, Rankine et al.[8] in their study opined that pain drawing is not a good predictor of nerve compression on magnetic resonance imaging with poor correlation. Borenstein and others[3] clearly opined that MRI findings were not predictive of the development or duration of low back pain and that clinical correlation is essential. So, there are questions to be answered. Is MRI really essential in all patients with lumbar disc prolapse? If MRI is done, which of MRI findings will be clinically significant, and which of these findings are important from the management point of view? So, we decided to study the correlation between clinical features and MRI findings in lumbar disc prolapse and to know about its significance in decision making for treatment.

### Material and Methods

The present Prospective study was conducted in the Department of Orthopaedics, All India Institute of Medical Science, Patna, Bihar, India for 1 year.

### Methodology

A total of 90 patients were studied. The patients with lumbar disc prolapse, diagnosed clinically, are included in the study. Patients with a pathological fracture in lumbar spine, post- traumatic low back

pain, failed back syndrome or lower limb radiculopathy due to other causes and Age <20yrs and >80yrs are all excluded from the study.

The clinical criteria used are<sup>9</sup> Low back ache with lower limb radiculopathy, Specific dermatomal radiculopathy, Nerve root tension signs like straight leg raising test [SLRT] and

presence of neurological signs and symptoms.

Any 3 criteria should be present for the diagnosis of lumbar disc prolapse. Patients with MRI diagnosed disc prolapse were also included in the study, if at least 2 criteria are positive. All patients were clinically examined for pain distribution and neurological symptoms and signs.

The criteria used to find the dermatomal level was<sup>10</sup>

L3 level: Pain or paresthesia or numbness in anterior surface of thigh and knee.

L4 level: Pain or paresthesia or numbness in antero medial Surface of leg and ankle.

L5 level: Pain or paresthesia or numbness in anterolateral surface of leg and dorsum of foot.

S1 level: pain or paresthesia or numbness in posterior surface of leg and sole of foot.

Nonspecific pain: Pain in gluteal region or posterior aspect of thigh or any other pattern which does not fit into any of the above category.

All patients underwent MRI evaluation with a 1.5 tesla scanning machine. MRI findings analyzed were level of disc herniation, position and type of disc herniation, neural canal compromise. Disc herniation was classified as follows[11,12].

1. Disc bulge: Disc extension beyond the interspace with intact annulus.
2. Disc protrusion: Focal disc extension beyond the interspace with diameter of protrusion smaller than the base against parent disc in any diameter.
3. Disc extrusion: Focal disc extension beyond the interspace with diameter of extruding material larger than the base against parent disc.
4. Disc sequestration: Disc fragment that has separated completely from the disc of

origin. Neural foramen compromise was graded as anterior thecal sac compression, nerve root contact or abutment and nerve root compression[13].

All MRI films were reported by one senior most radiologist. To find the intra-observer variations, kappa coefficient was used. A kappa value of 0.5 and above is used as a good agreement.

### Results

Total number of patients studied was 90, out of which 50 were males and 40 were females. 10 patients were in the age group of 20-30 years, 28 were between 30-40 years, 24 were between 40-50 years, 22 were between 50-60 years and 6 patients were more than 60 years old. The mean age was found to be 45.9 years.

Total levels of disc herniation were 110. Out of the 90 patients, 40 had specific dermatomal distribution and 50 had nonspecific dermatomal distribution. Among the 40 patients, 4 had L3 radiculopathy, 3 had L4 radiculopathy, 5 patients had L5, and 3 patients had S1 radiculopathy. Patients with L4 and L5 and L5 and S1 radiculopathy were 12 and 8 respectively. 5 patients had multiple level radiculopathy.

Total number of patients presented with sensory deficits was 5. 18 patients suffered

from motor deficits. Out of 110 levels of disc herniation, 30 levels had motor deficits. Out of 90 patients, 88 patients had positive SLRT and 70 had positive crossed SLRT test.

Out of 110 levels of disc herniation, 52 showed disc bulge, 35 showed protrusion, 20 showed extrusion and 3 levels were with sequestration.

Out of 110 levels of disc herniation, 27 showed anterior thecal sac compression, 49 showed nerve root contact and 34 showed nerve root compression.

Anterior thecal sac compression seen in 13 levels of disc bulge, 10 levels of disc protrusion, 4 levels of disc extrusion and none in disc sequestration. Nerve root contact seen in 20 levels with disc bulge, 14 levels with disc protrusion, 8 levels with disc extrusion and 1 level with disc sequestration. Nerve root compression seen in 12 levels with disc bulge, 12 levels with disc protrusion, 8 levels with disc extrusion and 3 levels with disc sequestration. Chi-square test value with correlation of type of disc herniation and clinical features is 7.9 and  $p = 0.242$ , which is not significant. Chi-square test value with correlation of level of neural foramen compromise and clinical features is 15.7 and  $p$  value = 0.011, which is significant.

**Table 1: Showing type of disc herniation association with neurological deficit (DI-Diffuse, C-Central, P-Para-central, FL-Far lateral)**

Category	Disc Bulge			Disc Protrusion			Disc Extrusion			Disc Sequestration			
	DI	C	P	FL	C	P	FL	C	P	FL	C	P	FL
With neurological deficits	1	2	8	2	5	5	2	1	3	1	1	0	0
Without neurological deficits	11	9	16	3	11	11	1	3	9	3	1	1	0

**Table 2: Showing neurological compromise grade association with neurological deficit.**

Category	Anterior Thecal sac compression	Nerve root contact (abutment)	Nerve root compression
with neurological deficits	6	12	14
without neurological deficits	21	37	20
Total	27	49	34

### Discussion

Low back ache and sciatica is one of the common orthopaedic problems. The most

common cause being herniated disc. Other causes are lumbar canal stenosis, tumors etc. Studies done previously had contrasting reports. Beattie et al found that

distal leg pain is strongly associated with presence of disc extrusion and severe nerve root compression at one or multiple lumbar intervertebral sites[14]. However Rankine *et al*, opined that there is a poor correlation for pain drawing with nerve root compression on MRI[15].

In most cases, out of the 90 patients, 40 had specific dermatomal distribution and 50 had nonspecific dermatomal distribution. Among the 40 patients, 4 had L3 radiculopathy, 3 had L4 radiculopathy, 5 patients had L5, and 3 patients had S1 radiculopathy. Patients with L4 and L5 and L5 and S1 radiculopathy were 12 and 8 respectively. 5 patients had multiple level radiculopathy. The results of this study show that there is a good correlation between clinical level and MRI level. In this study, L4-L5 disc herniation did not cause only L5 radiculopathy, but also L4 and S1 radiculopathy. Similarly, L5- S1 herniation, apart from causing S1 radiculopathy, also caused L5 radiculopathy in few cases. These findings suggest that there is a need to assess level of neural foramen compromise by MRI before considering for surgery.

About 97.78% patients were SLRT positive among all patients showing disc prolapse in MRI, which indicates it to be sensitive test. About 77.78% and 50% patients were Braggard's and crossed SLRT positive patients respectively, which shows that crossed SLRT is less sensitive, compared to Braggard's test. Indirectly, it indicates that crossed SLRT is more specific test for lumbar disc prolapse.

From above results, it is seen that more than the type of disc herniation, symptomatic levels (neurological deficits) are more depending on the position of disc and level of neural foramen compromise, as seen by patients with disc bulge/protrusion and Para central position(57.78%) are more symptomatic than disc protrusion/extrusion with central disc position(22.22%) (Table 1). Disc herniation in PC/FL position is more associated with neural foramen

compromise, which also correlates well with clinical level. A pure central presentation in disc protrusion/extrusion is asymptomatic in most cases. About 64% patients with disc bulge and neural foramen compromise are symptomatic than disc protrusion/extrusion without compromise, which fall about only 36%. These findings are important when surgery is considered as treatment. In cases of more than one level of disc herniation, like central disc protrusion or extrusion and PC disc bulge with neural foramen compromise, one with the disc bulge is likely to cause symptoms which can be determined by clinical examination, and which needs surgical attention. Neurological signs are well correlated with neural foramen compromise than the type or position of disc [Table 2]. But not all patients with compromise had neurological deficits. This indicates that severity of compression is more important to produce deficits, which in turn depend mainly on size of disc and diameter of neural foramen than just nerve root compression. These findings clearly show that MRI evidence of neural foramen compromise produces symptoms more likely.

There is no widely accepted classification at present to detect the size of fragment, which needs a high-resolution MRI to accurately measure the size of fragment.

### Conclusion

There is a good correlation between clinical findings and MRI findings. Disc bulge/protrusion/extrusion with central presentation were not significantly correlating with clinical features. But, independent of type of herniation, if there is PC/FL presentation of disc with neural foramen compromise, there is significant correlation with clinical features. Therefore, from above findings, it is inferred that type of disc herniation has poor correlation than the level of neural foramen compromise and position of herniation with clinical features, which has surgical implications.

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