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Comprehensive study on correlation of symptom complex and magnetic resonance imaging in lumbar disc herniation

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Abstract
Introduction: Lumbar disc herniation is one of the common causes of low back pain throughout the world. Abnormalities detected in MRI do not always reflect low back pain, so these should be interpreted with consideration of thorough history and physical examination. Therefore clinical correlation is required to delineate the importance of abnormalities in MRI.
Materials and Methods: The study was a Prospective study conducted over 3 year period from 2013 to 2016 in the patients coming to our tertiary care center. We selected patients with lumbar disc herniation confirmed with MRI to find out correlation of clinical features and MRI findings in determining the level of lumbar disc herniation. MRI findings analyzed were level of disc herniation, position and type of disc herniation, neural canal compromise.
Results: Out of the 102 patients studied, 44 had specific dermatomal distribution and 58 had non-specific distribution. Out of 139 levels of disc herniation, 62 levels showed disc bulge, 46 showed protrusion, 27 showed extrusion and 4 levels were with sequestration. Out of 139 levels of disc herniation, 42 levels had motor deficits.
Conclusions: There is a good correlation between clinical findings and MRI findings.Disc bulge/protrusion/extrusion with central presentation was 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 was significant correlation with clinical features.

Keywords: magnetic resonance imaging, lumbar disc herniation**,** low back ache

Introduction

Lumbar disc herniation is one of the common cause of low back pain throughout world [1, 2]. Lumbar disc herniations are a common manifestation of degenerative disease [3, 4]. They tend to occur early within the degenerative cascade, representing the tensile failure of the annulus to contain the gel-like nuclear portion of the disc. With improvements in advanced imaging techniques, lumbar disc herniations have been increasingly recognized in symptomatic and asymptomatic individuals [5]. Lumbar disc herniation leads to inflammation in the nerve roots and dorsal root ganglions, which is induced by nucleus Pulposus [6].

Abnormalities detected in MRI do not always reflect low back pain, so these should be interpreted with consideration of thorough history and physical examination.[7]The value of clinical presentation in the diagnosis of lumbar disc herniation is highly specific but rather insensitive. Therefore clinical correlation is required to delineate the importance of abnormalities in MRI [8, 9].

We selected patients with lumbar disc herniation confirmed with MRI to find out correlation of clinical features and MRI findings in determining the level of lumbar disc herniation.

Materials and Methods

The study was a Prospective study conducted over 3 year period from 2013 to 2016 in the patients coming to our tertiary care center. A total of 102 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 >80yrsare all excluded from the study.

The clinical criteria used are [10]

- [a] Low back ache with lower limb radiculopathy.
- [b] Specific dermatomal radiculopathy
- [c] Nerve root tension signs like straight leg raising test[SLRT] and
- [d] 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 [11]

- **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 [12, 13]
- [a] Disc bulge: Disc extension beyond the interspace with intact annulus.
- [b] Disc protrusion: Focal disc extension beyond the interspace with diameter of protrusion smaller than the base against parent disc in any diameter.
- [c] Disc extrusion: Focal disc extension beyond the interspace with diameter of extruding material larger than the base against parent disc.
- [d] 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[14].

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 was102, out of which 55 were males and 47 were females. 12 patients were in the age group of 21-30 years, 32 were between 31-40 years, 28 were between 41-50 years, 23 were between 51-60 years and 7 patients were more than 60 years old. The mean age was found to be 47.5 years.
Total levels of disc herniation were 139.Out of the 102 patients, 44 had specific dermatomal distribution and 58 had nonspecific dermatomal distribution. Among the 44 patients, 2 had L3 radiculopathy, 3 had L4 radiculopathy, 4 patients had L5, and 4 patients had S1 radiculopathy. Patients with L4 and L5 and L5 and S1 radiculopathy were 14 and 10 respectively. 6 patients had multiple level radiculopathy.
Total number of patients presented with sensory deficits was six. 20 patients suffered from motor deficits. Out of 139 levels of disc herniation, 42 levels had motor deficits. Out of 102 patients, 100 patients had positive SLRT and 80 had positive crossed SLRT test.Out of 139 levels of disc herniation, 62 showed disc bulge, 46 showed protrusion, 27 showed extrusion and 4 levels were with sequestration.
Out of 139 levels of disc herniation, 34 showed anterior thecal sac compression, 57 showed nerve root contact and 48 showed nerve root compression. Anterior thecal sac compression seen in 16 levels of disc bulge, 12 levels of disc protrusion,6 levels of disc extrusion and none in disc sequestration. Nerve root contact seen in 28 levels with disc bulge, 18 levels with disc protrusion,10 levels with disc extrusion and 1 level with disc sequestration. Nerve root compression seen in 17 levels with disc bulge, 17 levels with disc protrusion, 11 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 8.1 and p =0.231, which is not significant. Chi-square test value with correlation of level of neural foramen compromise and clinical features is 16.1 and p value =0.013, which is significant.

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 [15].However Rankine *et al*, opined that there is a poor correlation for pain drawing with nerve root compression on MRI [16].
In most cases, about 43%, dermatomal pain distribution could be correlated with a particular MRI level, making it easy to compare the clinical and MRI levels. Out of 57% patients with non-specific pain distribution, in 39% patients, level of spinal tenderness is taken as MRI level. The results of this study show that there is a good correlation between clinical level and MRI level. Out of 102 patients, clinical levels of 19 Patients (18%) did not correlate with MRI levels.
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 98% patients were SLRT positive among all patients showing disc prolapse in MRI, which indicates it to be sensitive test. About 76% and 48.4% 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(56%) are more symptomatic than disc protrusion/extrusion with central disc position(25%)[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 66% patients with disc bulge and neural foramen compromise are symptomatic than disc protrusion/extrusion without compromise, which fall about only 38%. 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.

Tables and Figures

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	PC	FL	C	PC	FL	C	PC	FL	C	PC	FL
With neurological deficits	1	3	10	2	6	6	4	2	4	2	2	0	0
Without neurological deficits	12	11	20	3	14	14	2	4	11	4	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	7	17	18
without neurological deficits	27	40	30
Total	34	57	48

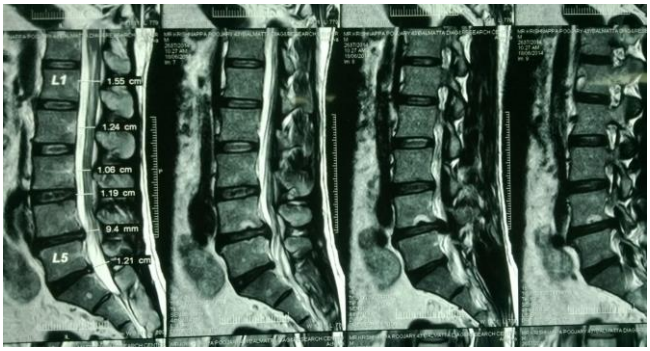

Fig 1: MRI saggital image showing disc extrusion at L4L5 and disc bulge at L5S1

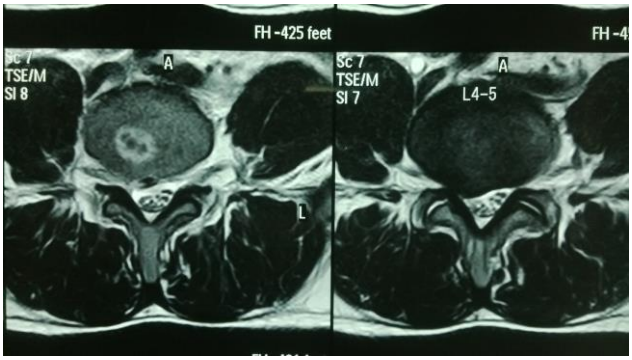

Fig 2: MRI axial image showing right sided para central disc protrusion with nerve root compression

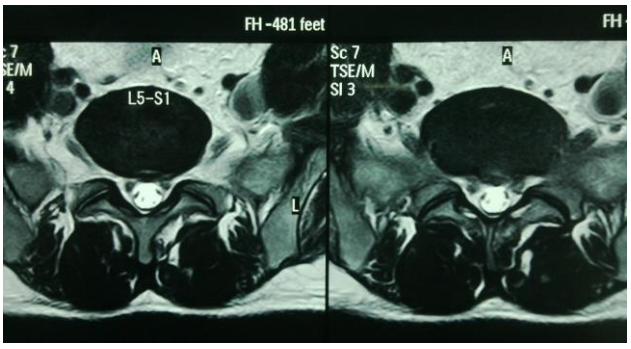

Fig 3: MRI axial image showing annular tear with disc bulge

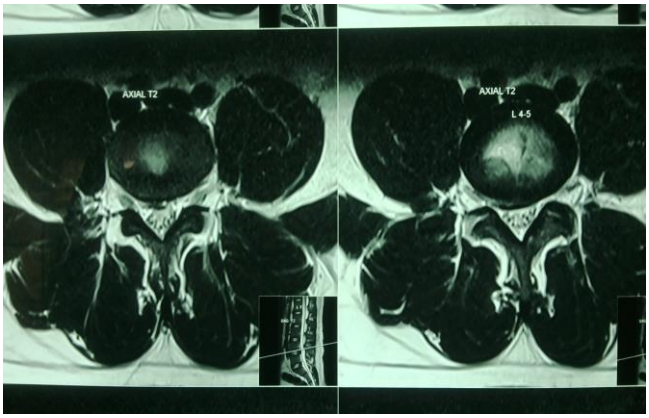

Fig 4: MRI axial image showing right sided para central disc bulge with abutment of nerve root

Conclusions

There is a good correlation between clinical findings and MRI findings. Disc bulge/ protrusion/ extrusion with central presentation was 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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