

Clinical Correlation of Magnetic Resonance Imaging with Symptom Complex in Prolapsed Intervertebral Disc Disease: A Cross-sectional Study

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Abstract

Introduction: Low back pain results from many causes including degenerative changes, spinal stenosis, neoplasm, infection, trauma, and inflammatory or arthritic processes. Herniated lumbar disc is one of the most commonly diagnosed abnormalities associated with low back pain.

Aim: To evaluate correlation between the clinical features of disc prolapse and magnetic resonance imaging (MRI) finding to determine the clinical importance of anatomical abnormalities identified by MRI technique.

Materials and Methods: The patients aged 18 years to 55 years with low back pain and radicular pain was included in this study. Patients selected were having the clinical features of low back pain with or without radiculopathy and neurological signs. Patients were thoroughly examined neurologically and signs involving motor and sensory dermatomal levels were noted. All the patients underwent MRI investigation with 1.5 tesla machine.

Results: 60.3% of patients in this study had involvement of L5S1 disc disease followed by 34.5% of L4L5 disc disease. The most commonly observed disc herniation was protrusion (35/58 cases-60%), Root involvement is noted only in 33.33% of cases of disc bulge. Among 35 cases of disc protrusion SLR positive in 21 cases (60%).

Conclusion: In our study, the correlation was made between clinical findings and MRI findings. It can safely be concluded that treating physician should put more emphasis on history, clinical examination, and make the inference by these and then should correlate the clinical findings with that of MRI to reach a final diagnosis.

Key words: Disc degeneration, Disc herniation, Magnetic resonance imaging

INTRODUCTION

Even in this modern age, one of the commonest symptoms encountered by the medical practitioners is low back pain, with about 80% of population enduring it

during their lifespan.¹ Low back ache results from many causes like lumbosacral disc prolapse, degeneration of spine due to age related changes, spinal canal stenosis, trauma, tumour, infections, and arthritic problems. Lumbar disc herniation is common among these etiologies causing the low back pain.² The same extend of lumbar disc herniation may be asymptomatic in few patients but can cause severe spinal nerve root involvement in others. The final diagnosis of the disc herniation can be a challenge because the exact structures involved which causes the pain and disability in the patient has to be identified.³ Magnetic Resonance Imaging (MRI) which is the investigation of choice for

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Month of Submission : 06-2017
Month of Peer Review : 07-2017
Month of Acceptance : 08-2017
Month of Publishing : 08-2017

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lumbosacral disc diseases has to be correlated with the clinical symptoms complex of the patient. But there is a controversial relationship between the clinical history, MRI imaging findings and the final outcome of the patients with lumbosacral disc disease. MRI can delineate the alterations in the anatomy and tissue properties of the lumbosacral disc, which then has to be considered in the clinical context.⁴ There is still a moderate correlation between the magnetic resonance imaging of disc herniation and the clinical symptoms. It is important to identify anatomic variations in MRI to correlate with symptom complex of the lumbar disc disease patients.⁵ Therefore, a study for correlation between the clinical features of disc prolapse and MRI is necessary to determine the clinical significance of anatomical abnormalities identified by MRI.

Aim

To evaluate correlation between the clinical features of disc prolapse and magnetic resonance imaging (MRI) finding to determine the clinical importance of anatomical abnormalities identified by MRI technique.

MATERIALS AND METHODS

This study was conducted in Institute of Neurosurgery, Madras Medical College after obtaining proper clearance from Ethics Committee. The patients aged 18 years to 55 years with low back pain and radicular pain was included in this study. Patients selected were having the clinical features of low back pain with or without radiculopathy and neurological signs. Exclusion Criteria: Patients with previous history of Spinal trauma, Infection, Tumour, Lumbar canal stenosis, Spondylolisthesis, Cauda equine syndrome, Myelopathy, Metabolic spinal disease, Radiological multiple level of disc involvement, H/o spinal surgeries and Patients with pacemakers and metal prosthesis in the body were excluded in this study. Patients who were admitted underwent, routine physical examination, hip joint problems, abdominal wall hernia were ruled out. All the neurological symptoms were recorded. Patients were thoroughly examined neurologically and signs involving motor and sensory dermatomal levels were noted. All the patients underwent MRI investigation with 1.5 tesla machine. The findings analysed were the various of Types of Disc herniation-bulge, protrusion and extrusion, Nerve root compression, Modic changes and the disc morphology. The radiological level of involvement with MRI examination was also noted. The results were analysed, the clinical symptoms and signs and the MRI findings were correlated. Statistical study was done to find the association of clinical symptoms complex and the MRI findings.

RESULTS

The most common age group affected is between 41-50 years with 21 cases noted among 58 (36.2%). The male patients are more affected than female patients with 39 cases noted among 58 (67.2). With regards to employment patients involved in hard labour work were more affected than patients with sedentary life style (62.1% vs 37.9%). 60.3% of patients in this study had involvement of L5S1 disc disease followed by 34.5% of L4L5 disc disease.

The most commonly observed disc herniation was protrusion (35/58 cases-60%), followed by disc bulge (15/58 cases-25.9%) and the least was disc extrusion (8/58 cases-14%) (Table 1). Nerve root compression was noted in only 55.2% of cases of total disc disease.

It was more commonly associated with disc protrusion with 60% of cases of disc protrusion having nerve root compression. When comparing the nerve root compression in protrusion and in the other 2 disc morphologies put together it was note that the two-sided P value is < 0.0001, considered extremely significant. S1 root was most commonly involved 32.8% followed by L5 root involvement -27.6%. Also in few cases poly radicular involvement was noted in 19 % of cases. There is no significant correlation between clinically suspected nerve root involvement based on sensory involvement and the radiological level of disc disease (p=0.641). The absence of DTR does not correlate with radiological diagnosis (p value 0.083). SLR was positive in 70.7% of cases with disc disease (41/58 patients). Femoral stretch test was positive in 10.3%(6/58) and correlation was highly significant between femoral stretch test positivity and upper level lumbar disc disease. Irrespective of whether motor or sensory or DTR involvement a clinical diagnosis of nerve root involvement correlates significantly with radiological level of disc disease (Table 2).

Root involvement is noted only in 33.33% of cases of disc bulge. And there is highly significantly correlation between root involvement and level of disc disease. Straight leg raising test was positive in 14/15 patient with disc bulge. There was significant correlation between straight leg raising test positivity and presence of disc bulge (p- 0.025) (Table 3).

Table 1: Types of disc herniation

Disc herniation	Percentage of patients
Bulge	30
Protrusion	60
Extrusion	14

There is highly significant correlation between disc protrusion and clinical symptomatology of lumbar disc disease (p value 0.002) (Table 4).

Among 35 cases of disc protrusion SLR positive in 21 cases (60%), there is significant correlation between SLR positivity and disc protrusion (0.027 p value). Motor power was affected and there was 57.1% of disc protrusion and there was significant correlation between loss of motor power and disc protrusion(0.046). Areflexia noted in 9 patients with disc protrusion (25.7%). There was no significant between areflexia and disc protrusion. There was insignificant correlation between disc protrusion vs sensory symptoms (p- 0.531) (Table 5).

There is multiple nerve root involvement in 19% of cases and its association with disc extrusion is statistically significant (p- 0.0042) (Table 6).

DISCUSSION

In this study each clinical finding was individually analyzed and tried to correlate with capability to predict the radiological level.

When the patient has a motor weakness, it has the highest correlation with radiologic level noted on MRI (p – 0.000). Sensory deficit based on the dermatome does not correlate

significantly with the radiologic level (p- 0.641). Similarly the loss a deep tendon reflex is unable to predict the radiological level involved but has a better correlation than loss of sensation (p- 0.083).

Straight leg raising test is positive in most of the cases (70.7%) but is not helpful in diagnosing the radiological level of disc involvement. In Cochrane database systemic review, van der Windt DA *et al.*,⁶ has noted that SLR is a highly sensitive and variably specific test in localizing the Lumbar disc disease. But when femoral stretch test is considered, it is not positive in all cases of lumbar disc disease but when femoral stretch test is positive it has a very high correlation for a possibility of a higher level lumbar disc involvement (p- 0.000).

When all the clinical findings noted in a patient were combined and analyzed in this study, clinical evidence of nerve root involvement (radiculopathy) correlates very well with the MRI level of disc involvement (p- 0.000).

On the other hand in this study analysis was also done between different types of disc morphology and various clinical presentations noted in each of them.

In patients with disc bulge alone radiculopathy was not noted in most of the cases (66%). But in those patients in whom radiculopathy was noted they correlated very well with radiological level of disc involvement (p-0.000) but nerve root compression could not be identified on the MRI. Among the two most efficient classification systems of lumbar disc herniations, namely ‘Combined Task Force classification’ and ‘van Rijn Classification’, the CTF classification divides lumbar discs as normal, focal protrusion, broad-based protrusion and extrusion. The CTF classification excludes the disc bulge as a source of confusion and disagreement.⁷

Straight leg raising test was positive in 93.34% of the cases indicating that low back ache and sciatica was more common than radiculopathy in cases of disc bulge. A dynamic MRI could have given a better picture regarding nerve root

Table 2: Nerve root compression- disc morphology

Root compression	Disc bulge	Disc protrusion	Disc extrusion	Total
Present	0	28	4	32
Absent	15	7	4	26
Total	15	35	8	58

Table 3: Disc bulge vs clinical symptoms

Disc herniation – bulge	Percentage of patients
Root involvement	34
Straight leg raise test	93

Table 4: Disc protrusion vs clinical symptomatology of lumbar disc disease

Disc herniation - protrusion	Clinically suspected nerve root involvement							
	No nerve root involvement	L3	L4	L5	S1	L3L4L5	L4L5	L5S1
Present								
Count	0	0	1	13	13	1	1	6
% within disc herniation – protrusion	0.0	0.0	2.9	37.1	37.1	2.9	2.9	17.1
% within clinically suspected nerve root involvement	0.0	0.0	100.0	81.3	68.4	100.0	50.0	75.0
Absent								
Count	10	1	0	3	6	0	1	2
% within disc herniation – protrusion	43.5	4.3	0.0	13.0	26.1	0.0	4.3	8.7
% within clinically suspected nerve root involvement	100.0	100.0	0.0	18.8	31.6	0.0	50.0	25.0

compression in cases of radiculopathy which could not be done in this study which is one of the limitations of this study. Tarantino *et al.*,⁸ have emphasized the need for upright MRI, to identify occult disc degeneration in patient with chronic back pain with normal recumbent MRI. Also other causes of radiculopathy needs to be considered when nerve root compression is not noted on MRI.

Table 5: Disc protrusion vs SLR

Disc herniation – protrusion	Percentage of patients
Straight leg raise test	60
Power - LL	57
DTR	26
Sensory level	100

Table 6: Disc extrusion vs multiple nerve root involvement

	Single root	Multiple root	Total
Extrusion present	3 (5%)	5 (9%)	8 (14%)
Extrusion absent	44 (76%)	6 (10%)	50 (86%)
Total	47 (81%)	11 (19%)	58 (100%)

In patients with disc protrusion radiculopathy was noted in all patients and it had a very high correlation (p- 0.002) with presence of disc protrusion. Among the various symptoms associated with disc protrusion loss of motor power had best correlation (p-0.046) in predicting the level of disc disease. Sensory loss and areflexia were not significantly related in predicting the level of disc disease. In our study, there is no significant correlation between sensory loss and areflexia. Straight leg raising test was positive in 60% of the cases of disc protrusion and was significantly associated with predicting the presence of disc protrusion (0.027).

Though radiculopathy was present in all cases of disc protrusion only in 60.3% of cases there was radiological evidence of nerve root compressing again stressing the significance of a dynamic MRI. Gilbert J *et al.*,⁹ have noted how the diagnosis of disc protrusion was made in 50.1% of patients in conventional MRI and 73.3% were found to have disc protrusion with open Upright MRI, after a retrospective study in 1468 symptomatic patients, again emphasizing for dynamic MRI. Even though disc protrusion is noted on MRI if no nerve root compression

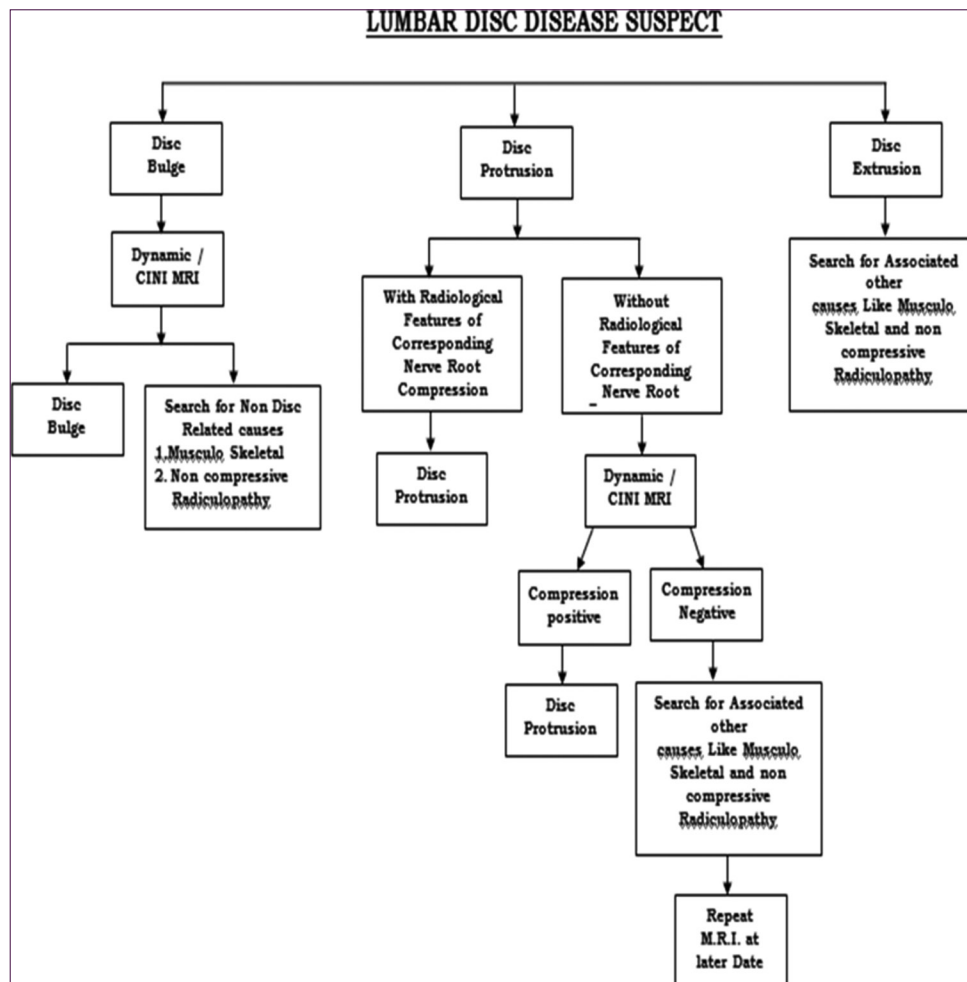


Figure 1: Lumbar disc disease suspect

is noted, other causes of radiculopathy will have to be considered.

Disc extrusion was also associated with radiculopathy along with positive straight leg raising test. In few studies, it has been shown that disc extrusion can have more clinical symptoms and high disability (Dora C *et al.*¹⁰). In our study, 77.1% of the disc extrusion patients are symptomatic, more so with pain (Pfirrmann CW *et al.*¹¹), more than disc bulge and disc protrusion. But based on the clinical features it was unable to predict the level of disc involvement ($p = 0.164$). The reason behind this probably could be because of multiple nerve root involvement associated with disc extrusion. In 62.5% of cases of disc extrusion more than one nerve root was involved. When clinically more than one nerve root involvement is suspected then the chances of having an extruded disc is very high ($p = 0.0042$). Apart from having the multiple nerve root involvement and highly symptomatic patients, the disc extrusion also has high failure rates for conservative treatment and they should be priority candidates for surgery along with patients with, the laterally placed discs and the discs with larger fragments. The proposed algorithm for management of Lumbar disc disease (Figure 1).

CONCLUSION

In a patient with lumbar disc disease clinical features of radiculopathy is highly suggestive of the level of disc disease. Among the features of radiculopathy it is the loss of motor power that is very useful in predicting the level of disc disease. Disc bulge less often presents with radiculopathy. But if radiculopathy is noted in cases of disc bulge, a Dynamic MRI may be needed to look for nerve root compression and hence can influence surgical decision. In lumbar disc disease if single level radiculopathy is noted then, disc protrusion is the most likely disc morphology suspected. Among the clinical features of radiculopathy,

it is loss of motor power which is again highly predictive of level of disc protrusion. In cases of disc protrusion on MRI look for nerve root compression. If it is not observed then Dynamic MRI may be suggested to look for nerve root compression based on which surgical decision can be taken. Disc extrusion presents with radiculopathy but more than one root may be involved. If clinical features are suggestive of more than one root involvement then disc extrusion is more likely on a MRI.

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How to cite this article: Selvaraj R, Narayana GSJ, Ranganathan J, Anandan H. Clinical Correlation of Magnetic Resonance Imaging with Symptom Complex in Prolapsed Intervertebral Disc Disease: A Cross-sectional Study. *Int J Sci Stud* 2017;5(5):261-265.

Source of Support: Nil, **Conflict of Interest:** None declared.