

# Association between clinically diagnosed lumbar intervertebral disc prolapse and magnetic resonance image findings

Md. Habibur Rahman, K. M. Tarikul Islam, Md. Rokibul Islam, Moududul Haque, Haradhon Devnath, Mohammad Afzal Hossain and Kanak Kanti Barua

## Article Info

Department of Neurosurgery, Faculty of Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

### For Correspondence:

K. M. Tarikul Islam  
dr.tarik\_2007@yahoo.com

Received: 2 February 2016  
Accepted: 11 July 2016  
Available Online: 5 September 2016

ISSN: 2224-7750 (Online)  
2074-2908 (Print)

DOI: 10.3329/bsmmuj.v9i3.29459

### Cite this article:

Rahman MH, Islam KMT, Islam MR, Haque M, Devnath H, Hossain MA, Barua KK. Association between clinically diagnosed lumbar intervertebral disc prolapse and magnetic resonance image findings. Bangabandhu Sheikh Mujib Med Univ J. 2016; 9: 146-150.

### Available at:

www.banglajol.info

A Journal of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

## Abstract

There are contradictory reports on the findings of magnetic resonance image (MRI) in lumbar intervertebral disc prolapse. A study was conducted on 54 patients using 3 of 4 clinical criteria (low back pain with radiation down to the lower limbs, radicular pain along specific dermatomes, positive straight leg raising test, presence of neurological symptoms and signs e.g. motor or sensory deficit and MRI of lumbosacral spine of the respondent). Evaluation of MRI of lumbosacral spine was done based on extent of disc prolapse, disc degeneration, nerve root compression neural foramen compromise. The logistic regression analysis between the findings of MRI and the clinical features show that there was a significant association in the neural foramen or lateral recess (Odd's ratio 7.106,  $p < 0.05$ ), the root compression ( $p < 0.01$ ) as well as the disc extrusion ( $p < 0.05$ ). There was no statistical association between clinical levels and other MRI findings like disc protrusion and disc bulge ( $p$  value 0.21 and 0.14, respectively). The strength of agreement between clinical and MRI diagnosis level of disc prolapse was calculated using kappa statistics ( $k$ -value). The test revealed a very good agreement for L3/4 ( $k$ -value = 0.812) and good agreement for L4/5 and L5/S1 level ( $k$ -value 0.75 and 0.75 respectively) between these two procedures, suggesting that level of disc prolapse could be correctly diagnosed without MRI findings. In conclusion, clinically diagnosed levels associate well with MRI levels, but all MRI abnormalities do not have any clinical significance.

## Introduction

One of the commonest causes of low back pain among working people is the lumbar intervertebral disc prolapse.<sup>1</sup> The clinically significant sciatica due to disc prolapse is 4-6%.<sup>2</sup> In 85% of cases, no specific diagnosis can be made. Only 1-3% have lumbar disc herniation.<sup>3</sup>

Lumbar intervertebral disc prolapse can be diagnosed clinically by low back pain and its radiation along the course of the sciatic nerve, commonly called sciatica. Usually, it is a shooting, episodic pain related to movement, and going down the back of the thigh to a varying distance to the posterior or posterolateral aspect of the calf and the foot, the radiating pain is aggravated by coughing, sneezing or straining and relieved by rest (particularly in supine position which reduces the intradiscal pressure). An important feature of disc prolapse is the intermittent exacerbation and remission of varying duration and severity of low back pain. Besides radiating pain, there may also be paraesthesia (tingling or numbness), in the area of distribution of particular nerve root.<sup>4</sup>

The findings identified by the magnetic resonance imaging (MRI) can confirm the clinical suspicions of lumbar intervertebral disc prolapse. Prophylactic or therapeutic intervention should not be done based on MRI abnormal findings in the absence of clinical indicators.<sup>5</sup>

An important finding is the loss of disc height. However, the bulge or the protrusion of the disc bulge does not have any additional significance.<sup>6</sup> The presence of any extrusion of the disc or severe degree nerve compression at one or more sites is associated with the pain at the distal leg.<sup>7</sup>

There is a good correlation between the findings of clinical features and MRI. However, all MRI abnormalities do not correlate with the findings of clinical features. The presence of centrolateral protrusion of the disc and the extrusion with gross neural foramen compromise are associated with the clinical features. Bulging of the disc with compression of thecal sac or central protrusions and extrusions without significant neural foramen compromise are clinically insignificant. The presence of



neural foramen is important in determining the clinical features while the type of disc herniation correlates poorly with the clinical features. When the disc lesions are at multiple levels with the neural foramen compromise, the patient is likely to have neurological deficit.<sup>1</sup>

Various studies have correlated clinical findings with MRI findings and these studies also gave contrasting reports and were inconclusive. Association of many anatomic variations (degeneration of disc, bulging of the disc and spinal stenosis) with symptoms remains speculative. The correlation of physical findings with MRI remains a critical part of the diagnosis of low back pain and radiculopathy. So, we need to study the association between clinically diagnosed lumbar intervertebral disc prolapse and MRI findings and to know about its significance in decision making for treatment and in predicting prognosis.

## Materials and Methods

This observational cross-sectional study was conducted on 54 consecutive patients with a clinical diagnosis of prolapse lumbar intervertebral disc irrespective of age, sex, and occupation who were admitted for surgery at the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University from April 2011 to November 2012. Patients with 3 of 4 clinical criteria were included in this study: Low back pain with radiation down to the lower limbs, radicular pain along specific dermatomes, positive straight leg raising test, the presence of neurological symptoms and signs e.g. motor or sensory deficit and MRI of the lumbosacral spine of the respondent. Exclusion criteria were a)

patients with acute onset of symptoms for <3 weeks, b) radicular symptoms for the first time and c) history of previous lumbar spine surgery. On admission, all the patients were evaluated by taking detailed history thorough general and neurological examination with particular attention to lower limbs. Each patient was evaluated for the distribution of pain and the presence of neurological features. The distribution of pain at the dermatomal level was pointed out.

Evaluation of MRI of the lumbosacral spine including degeneration of the disc, the extent of disc prolapse, nerve root contact/ compre-

ssion, neural foramen compromise, and other findings (hypertrophy of ligamentum flavum or facet joint, spondylolisthesis, stenosis of the canal) were done (Figure 1).

Data was collected by structured questionnaire to collect necessary information. Informed written consent was taken from each participant or guardian before data collection. Data was analyzed by using software SPSS (statistical package for social science), version 16.

## Results

Of the 54 patients, 88.9% were in between 21-60 years. About three-fourth (74.1%) of the patients were male and one-fourth (25.9%) were female giving a male to female ratio of roughly 3:1. Fifteen (27.8%) patients were service holder and 14 (25.9%) patients were day-laborer, housewife and businessman both were 11 (20.4%) in number and student was 3 (5.6%) cases.

Over 80% patients with MRI findings of protrusion or extrusion of disc with nerve root compression had symptomatic levels (95.5% and 81.2% respectively) while 80% of patients with a bulge of disc and nerve root contact/compression had symptomatic levels. Extrusion of the disc with foramen/lateral recess compromise produced symptomatic levels in 100% cases, while foramen/lateral recess compromise in disc bulge and protrusion produced symptomatic levels in some patients (33.3% and 50% respectively) (Table I). When there was no evidence of foramen/lateral recess compromise, these levels were asymptomatic despite the type of herniation of the disc. In fact, the patient with gross extrusion but with central position and not compromising neural foramen were asymptomatic.

MRI findings were analyzed with logistic regression analysis for association of clinical levels for Odd's ratio and clinical significance (Table II). Logistic regression analysis for association between MRI findings and clinical levels show that there was significant association between evidence of neural foramen/lateral recess compromise as seen in MRI and clinical levels (Odd's ratio 7.1,  $p < 0.05$ ); between evidence of root compression seen in MRI and clinical levels ( $p < 0.001$ ) as well as between evidence of disc extrusion seen in MRI and clinical levels ( $p < 0.05$ ). There was no statistically significant association between clinical levels and other MRI findings such as bulging and protrusion of the disc ( $p$  value 0.21 and 0.14 respectively).

The strength of agreement between the clinical and MRI diagnosis of prolapse of the disc was calculated using kappa statistics (k-value) (Table III). The test was found to have a very good agreement for the L3/4 level (k-value = 0.812) and good

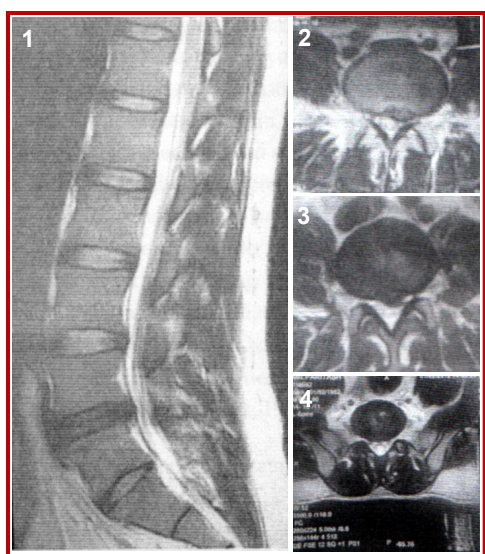


Figure 1: MRI of degenerated disc at L4/5 (1), extruded disc (2), protruded disc (3) and bulge disc (4)

**Table I****Association between the type of disc herniation and clinical levels**

Type of herniation	Neural canal compromise	Symptomatic levels	Asymptomatic levels
Disc bulge	Without neural foramen compromise (TSC)	2	25
	With foramen/lateral recess compromise	4	8
	Nerve root contact/compression	4	1
Disc protrusion	Without neural foramen compromise (TSC)	0	0
	With foramen/lateral recess compromise	7	7
	Nerve root contact/compression	26	6
Disc extrusion	Without neural foramen compromise (TSC)	0	0
	With foramen/lateral recess compromise	1	0
	Nerve root contact/compression	21	1

**Table II****Association between clinical levels and MRI findings**

MRI findings	Odd's ratio	95% CI interval	p value
Disc bulge	3.060	0.532-17.596	0.210
Disc protrusion	5.098	0.586-44.355	0.140
Disc extrusion	28.456	1.506-537.494	0.026
Foramen/lateral recess compromise	7.106	1.191-42.381	0.031
Nerve root contact/compression	33.822	4.780-239.32	0.000

agreement for the L4/5 and L5/S1 level (k-value 0.795 and 0.705 respectively). These suggest that level of prolapse of the disc could be correctly diagnosed without the findings of MRI.

## Discussion

Lumbar disc protrusions are more frequent in middle-aged people from third to the fifth decade of life. The herniation of the lumbar disc is more common at L4/5 and L5/S1. Less than 5% of it occurs at L1/2, L2/3 and L3/4. Fracture of intravertebral disc may occur following injury.<sup>8</sup> The

earliest symptom of the root involvement in a lumbar disc prolapse is radiating pain along the sciatic nerve (sciatica).<sup>4</sup>

The incidence of lumbar disc herniation under 24 years of age is only 1-3.5%.<sup>2,10</sup> In our study, 3.7% of PLID patients were under 20 years of age. It was reported that male patient was 75% and the female patient was 25% which is similar to our study where the male patient was 74.1% and the female patient was 25.9%.<sup>11</sup> In our study, service holders (included government and non-government job) and day-laborer (27.8% and 25.9% respectively) more commonly presented with PLID which is comparable to another study.<sup>12</sup> Professional, housewife and clerical also develop PLID.

According to most literature, the common presentation of lumbar disc herniation was low back pain and sciatica. Low back pain was reported in 99% cases and leg pain/sciatica in 79% cases.<sup>12</sup> In our study, all the cases presented with low back pain and sciatica. Right sciatica was found in 46.3% of cases whereas left sciatica was in 37.0% cases. Bilateral sciatica was present in 16.7% patients which are nearly similar to another study.<sup>13</sup> Right sciatica was in 51.0%, left sciatica in 43% and bilateral sciatica in 6% of the PLID cases.

The presence of weakness in one or both extensor hallucis longus was reported by 42.9% participants, 35% reported the sensation of pin and needles and 37.4% reported numbness<sup>2</sup> and sphincter dysfunction was present in 6.2% cases.<sup>2</sup> In our study, 33% patients reported weakness in extensor hallucis longus and 81.5% presented with tingling sensation/numbness and 7.4% with urinary incontinence. These were probably due to late presentation of patients in our department for surgery.

The positive straight leg raising test means is the involvement of nerve root. This test is usually positive in all levels of herniation (94%).<sup>13</sup> Strongly positive test (under 30°) means that there is more frequently herniation in the lower discs. In our study, over 61% exhibited positive straight leg raising test (>30-80°) and over 11.1% were strongly positive straight leg raising test (<30°).

It was reported that quadriceps weakness was present in 15 (62.5%) cases<sup>14</sup> and weak dorsiflexion of foot in 16 (32.8%) cases, weak ankle-plantar flexion in 1 (1.9%) and weak EHL in 6 (11.43%) cases.<sup>15</sup> In our study, EHL was weak in 63% cases, weak ankle planter-flexion in 31.5% cases, ankle-dorsiflexion in 22.3% cases and knee extensor weakness in 5 (9.3%) cases.

In our study knee jerk was diminished in 5.6% cases and ankle jerk in 50% cases which is nearly similar to another study where diminished knee jerk was present in 4% cases and diminished ankle jerk in 46% cases.<sup>11</sup>

**Table III**

Strength of agreement between clinical and MRI diagnosis levels (n = 54)				
Clinical diagnosis level	MRI diagnosis level		k-value	Strength of agreement
	Yes	No		
<i>For L3/4 disc level</i>				
Yes	5	1	0.812	Very good
No	1	47		
<i>For L4/5 disc level</i>				
Yes	33	1	0.795	Good
No	4	16		
<i>For L5/S1 disc level</i>				
Yes	23	6	0.705	Good
No	2	23		

The different dermatomes were checked to find out the level of prolapse disc after asking about the pain radiation. There is a debate about the sensibility of the patient with lumbar disc herniation. The presence of a reduction in sensibility in such patients varies between 21 and 88%.<sup>16</sup> The present study showed that the sensory disturbance is most common at SI dermatome which corresponds with other studies. Out of 54 patients, 43 (79.6%) patients had the sensory deficit and 11 (20.4%) patients had no sensory deficit. The level of disc herniation was determined on the clinical basis.

In the study of Cheung, the most commonly affected level was found to be the L5/S1 (52%), whereas L4/5 was the second most affected level and L1/2 was the least commonly affected level.<sup>17</sup> In our study, results were similar where most commonly affected levels were L4/5 (83.3%) intervertebral disc, second most were L5/S1 (70.4%) disc followed by L3/4, L2/3 and L1/2 level in 44.4, 22.2 and 13.0% respectively.

It was reported that disc bulge was present in 15%, protrusion in 31.25% and non-contained herniation/extrusion in 44.4%.<sup>17</sup> In our study, disc bulge was found in 38.9%, protrusion in 40.7% and extrusion in 20.4% levels of disc herniation.

The clinical features and the MRI findings of the level of disc prolapse correlate well which might not be considered as essential for the clinical diagnosis. But MRI is mandatory when someone is planned for surgery. Not all the lesions identified in MRI have symptoms. Out of 113 levels of disc lesions, only 65 were symptomatic. However, MRI is a sensitive test for identifying disc lesions but it is not specific. MRI finding with neural foramen compromise and nerve root compression are likely to be more symptomatic than those without neural foramen compromise.

It was reported that a centrolateral disc extrusions, disc protrusions, and disc bulge with neural foramen compromise are more likely to cause symptoms in that order while central disc protrusions and extrusions, as well as disc bulges without foramen compromise, are less likely to produce symptoms. When a nerve root compression is visible on MRI, it is more likely to produce symptoms as in 86.4% (57 out of 66 patients) patients: when only neural foramen compromise was seen, 39.5% patients were symptomatic and without neural foramen compromise only 11.9% patients were symptomatic. This clearly shows that MRI evidence of nerve root compression is more likely to produce symptoms.<sup>1</sup> In our study, MRI-visible nerve root contact/compression produce symptomatic levels in 86.4% (51 out of 59 levels), with foramen/lateral recess compromise produce symptomatic levels in 44.4% and those without neural foramen compromise (TSC) produce symptomatic levels in 7.4% cases, which is almost similar to above study finding.

In the study of Janardhana et al, 15 patients out of 119 had ligament flavum hypertrophy.<sup>18</sup> Thirty four patients with stenosis of the canal, 19 patients with facet joint hypertrophy (1 or more levels), and 5 patients had spondylolisthesis.<sup>1</sup> In our study, 39 patients had canal stenosis, ligamentum flavum hypertrophy found in 22 (40.7%) patients, facets hypertrophy in 33 (61.5%) patients and spondylolisthesis in 6 (11.2%) patients nearly similar to above study.

MRI is a helpful preoperative diagnostic investigation which shows structural changes in the discs, the size and the site of the extrusion or protrusion. However, these images are not useful in predicting neurological deficit and therefore should not be used as an indication for surgery unless there is a strong correlation with the clinical findings.<sup>19</sup> In our study, 34 (63.0%) patients had signs and symptoms of PLID at the level L4/5, 53.7% at L5/S1 and 11.1% cases at L3/4 level; which on MRI was found to be 68.5%, 46.3% and 11.1% respectively, showing good agreement for L4/5 and L5/S1 (k-value 0.795 and 0.705 respectively) and very good agreement for L3/4 level (p value 0.812), between the two modalities of diagnosis in detecting level of disc prolapse. MRI detected herniation at an L2/3 level in 1 case which could not diagnose clinically. So for evaluation of high lumbar disc prolapse, MRI is very essential.

## Conclusion

Clinically diagnosed level of lumbar intervertebral disc prolapse associates well with the MRI findings. But all MRI abnormalities do not have a clinical significance.



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