Correlation between Clinical Features and Magnetic Resonance Imaging Findings in Lumbar Disc Prolapse

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ABSTRACT

INTRODUCTION: Lumbar disc prolapse is one of the most commonly diagnosed abnormalities associated with low back pain. It can be asymptomatic in some but can be symptomatic in others. This study was conducted to correlate the clinical findings and magnetic resonance imaging (MRI) in symptomatic patients with lumbar disc prolapse.

METHOD: Forty one symptomatic patients with lumbar disc prolapse over a period of one year (July 2017-June 2018) were studied regarding demographic details, dermatome, motor straight leg raising test (SLRT). MRI of those symptomatic patients were done to evaluate the level of disc prolapse, type of herniations, neural foramen compromise and nerve root compression. These MRI findings were then correlated with clinical signs and symptoms.

RESULT: Out of 41 patients, 60.95% were male. Mean age of the patients was (36.14 ± 7.70) years with ranges from 21 to 50 years. Among them, 63.41% patients presented with low back pain. Radiculopathy was present in 95.12%. L5 nerve root involvement was most common neurological finding (56.10 %). SLRT was positive in 68.30%. In MRI, there were 78 disc herniations with 58.53% position paracentral and 55.14% disc bulge. Mostly (87.80%) were at the level of L4-L5 and L5-S1 (87.80%). There were statistically significant correlation between MRI findings of disc bulge and neurological signs (p=0.02), neural foramen compromise and neurological deficit (p=0.051), nerve root compression and neurological deficit (p=0.02) and absent ankle jerk (p=0.03). The clinical level atL5-S1 (p=0.003) and MRI level L5-S1 (0.04) had statistically significant correlations.

CONCLUSION: Neurological deficits correlated significantly with MRI findings of neural foraminal compromise, nerve root compression and L5-S1 level lesion. However, bulge, protrusion, extrusion, SLRT and radicular pain did not correlate with neurological deficits.

KEY WORDS: Clinical correlation, Lumbar disc prolapse, Magnetic Resonance Imaging.

INTRODUCTION

The term disc prolapse initially meant a focal extension of nucleus pulposus beyond the margin of the disc.[1] The term herniation of intervertebral disc was synonymous with herniation of the nucleus pulposus.

Various studies have shown that the lifetime prevalence of a major episode of low back pain (LBP) ranges from 60% to 80% but only 10% of these episodes are accompanied by sciatica. Sciatica lasting longer than two weeks is even less common, with a lifetime prevalence of 1.06%[2] LBP is a common problem among adults. Most of these symptoms are short-lived and 80% to 90% resolves within 6 weeks regardless of the type of treatment.[2] Various pathoanatomical

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changes in lumbar disc prolapse can be visualized in magnetic resonance imaging (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.[3] Indications for surgical intervention include severe, intractable pain, pain unresponsive to conservative treatment, and neurological deficit.[4] MRI scans are available in various magnetic field strengths, with 1.5 Tesla being the most commonly used.[5] LBP results from many causes including 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 LBP.[6] Lumbar disc prolapse occurs at L4-L5 and L5-S1 regions in 95% cases.[4]

METHOD

It was a cross-sectional observational study conducted at National Academy of Medical Sciences, National Trauma Center, Kathmandu from July 2017 to June 2018.

All men and women of age group 20-50 years with clinical diagnosis of lumbar disc Prolapse (lower limb radiculopathy not improving clinically with 2 weeks of rest and analgesics) were included after screening in this study after taking consent. LBP without radiculopathy, spine fracture, systemic lumboradicular pain (tumor, infections or inflamatory disease), cauda equina syndrome, prior lumbar surgery, uncontrolled psychiatric disorder, MRI contraindications (permanent pacemaker implanted / claustrophobia) were excluded from the study.

Patients who meet the criteria were enrolled in the study after Institutional Review Board approval letter. Detailed clinical, neurological (dermatomal involvement, motor & sensory examination) and special (SLRT and Femoral stretch test) examinations were done. Symptomatic patients fulfilling inclusion criteria were investigated for MRI of limbo-sacral spine for comparison between clinical and MRI findings.

MRI was done with 5mm slices on sagittal and axial T1W / T2W sequences. MRI findings were reported by consultant radiologists regarding disc degeneration, extent of disc prolapse, position of the herniated disc, neural foramen compromise, nerve root compression and findings related to chronicity (facet joint arthritis, ligamentum flavum hypertrophy, canal stenosis, spondylolisthesis). These findings were recorded and analysed by statistical package for the social sciences (SPSS) version 22 software package.

RESULT

Out of 41 patients, about 60% were male. Mean age was 36.14 years±7.70. The maximum incidence of backache appeared to occur in 3rd to 4th decades of life 70.73%. Among them, 73.18% were heavy workers (83.03% male) and 26.82% were light workers (54.05% male). The study had 34.14% farmers and 17.07% hosewives.

Most of the patient in this study presented with LBP 63.41%. The average duration of back pain was 33.3 weeks±6.14 with minimum of 2 weeks and maximum of 96 weeks. Among them, 56.10% had neurological symptoms, 68.30% had positive SLRT, 56.10% had motor deficit, 73.17% had sensory deficit and 39.02% had neurological deficit of L5 level.

Out of 78 disc herniation levels (41 patients), disc bulge was noticed in 43 levels (19 patients), disc protrusion was noticed in 27 levels (17 patients) and disc extrusion was noticed in 8 levels (5 patients). The incidence of lumbar disc herniation was most commonly seen at L4-L5 level (48.73%) with 20 disc bulge, 14 disc protrusion and 4 disc extrusion; followed by L5-S1 level (25.89%) with 14 disc bulge, 11 disc protrusion and 3 disc extrusion; and L3-L4 level (14.10%) with 8 disc bulge, 2 disc protrusion and 1 disc extrusion. Altogether herniation occurred in L4-L5 and L5-S1 in 87.80% (Figure 1).

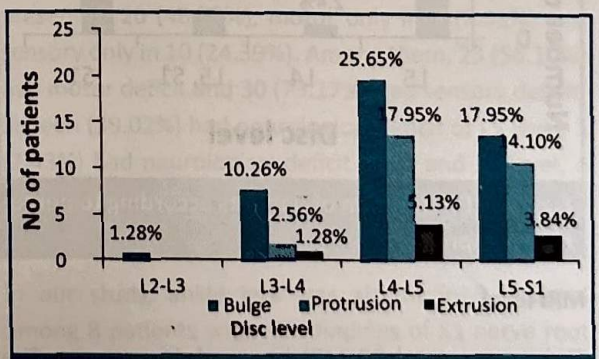

Figure 1: Distribution of patients according to level of herniation

Out of 41 positions of disc herniation, bulge was present in 19 patients (5 central, 14 paracentral), protrusion in 17 patients (3 central, 9 paracentral and 5 central and paracentral) and extrusion in 5 patients (1 central, 1 paracentral and 3 central and paracentral). The paracentral was most common position present in 24 patients (58.53%), central in 9 patients (21.95%), and central and paracentral in 8 patients (19.51%).

Out of 16 patients with neural foramen compromise, 5 patients (4 with protrusion and 1 with bulge) had neural foramen compromise at L4-L5 level, 9 patients (8 with bulge and 1 with extrusion) had neural foramen compromise at L4-L5 and L5-S1 level, and 2 patients (1 with bulge and I with protrusion) had neural foramen compromise at L5-S1 level. Therefore, out of 16 levels of neural foramen compromise, 10 were due to disc bulge, 5 were due to protrusion and 1 was due to extrusion.

Out of 17 patients with nerve root compression, 10 patients (7 with protrusion, 2 with extrusion and 1 with bulge) had nerve root compression at L5 level, 2 patients (2 with protrusion) had nerve root compression at L5 and S1 levels, 4 patients (2 with protrusion,1 with extrusion and 1 with bulge) had nerve root compression at S1 level and 1 patient had nerve root compression at L4 level due to disc extrusion. Therefore, out of 17 levels of nerve root compression, 11 were due to disc protrusion, 4 were due to disc protrusion and 2 were due to disc bulge (Figure 2).

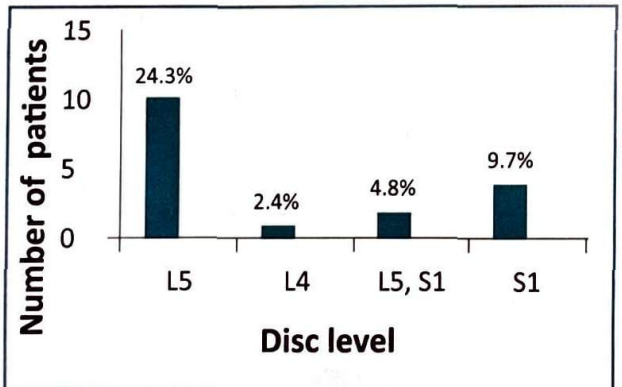

Figure 2: Distribution of patients according to nerve root compression

MRI level

There were total 50 MRI levels of 41 patients. The frequencies were 4, 15, 21 and 1 at L3-L4, L5-S1, L4-L5 and L2-L3 levels respectively. There were 9 patients with two levels in MRI i.e. L4-L5 and L5-S1 level.

Neurological deficit was present in 7 out of 19 patients with disc bulge (p=0.02), 11 out of 17 patients with protrusion (p=0.23) and 4 out of 5 patients with extrusion (p=0.25). Thus the correlation between disc bulge and neurological deficit was statistically significant however the correlation between disc protrusion and extrusion with neurological deficit was not statistically significant (Table 1).

Table 1: Correlation of types of herniation and neurological deficit

Types of herniation		Neurological deficit		p value
		Present	Absent	
Bulge	Present	7	12	0.02
	Absent	16	6	
Protrusion	Present	11	6	0.23
	Absent	11	13	
Extrusion	Present	4	1	0.25
	Absent	19	17	

Out of 16 patients with neural foramen compromise, 15 patients had radicular pain (p=0.74) and 12 had neurological deficit during clinical examination (p=0.051). Thus neurological deficit correlated significantly with neural foramen compromise and did not correlate with radicular pain.

Out of 17 patients with nerve root compression, 14 patients had positive SLRT (p=0.1), 16 patients had radicular pain (p=0.76) and 13 had neurological deficit during examination (p=0.02) as shown in Table 2.

Table 2: Correlation of nerve root compression and observation

Clinical observation		Nerve root compression		p value
		Present	Absent	
SLRT	Present	14	14	0.1
	Negative	3	10	
Radicular Pain	Present	16	22	0.23
	Negative	1	2	
Neurological deficit	Present	13	10	0.02
	Absent	4	14	

Out of 8 patients with MRI showing nerve root compression at S1, 2 had absent ankle reflex (p=0.03, statistically significant). Out of 26 patients with MRI level L5, 23 had clinical level L5 (p=0.003, statistically significant). And out of 18 patients with MRI level S1, 12 had clinical level S1 (p=0.04, statistically significant).

Figure 3: T2W Midsaggital MRI scan of Lumbar spine showing central and right paracentral disc protrusion at L4-L5 level with severe narrowing of right lateral recess and compression of right L5 nerve root and right paracentral disc protrusion at L5-S1 level with moderate narrowing of left lateral recess and compression of right S1 nerve root

Figure 4: T2W axial section of lumbar spine showing right paracentral disc protrusion at L4-L5 with severe right L5 nerve root compression

DISCUSSION

Lumbar disc herniation is one of the common causes of sciatica and LBP[7,8]. Mechanical compression and inflammation of the nerve root by herniated disc is responsible for radicular pain. Stimulation of Sinuvertebral nerve supplying annulus fibrosis and posterior longitudinal ligament is responsible for discogenic back pain[9,10]. MRI is often done routinely for patients with suspected intervertebral disc prolapse, but there remains doubt about clinical relevance of different MRI findings.

We studied 41 patients ranging from 20 to 50 years of age. Patients less than 20 years of age were excluded due to uncommon occurrence of disc herniation in that age group. Similarly patients with more than 50 years were excluded owing to other causes of back and leg pain in that age group. In this study, mean age of the patient was (36.14±7.70) years. Lumbar disc herniation was more common in 3rd and 4th decades (70.73%). It was comparable to the study done by Thapa SS et al which showed mean age to be 36.82±8.57 years with 72% of lumbar disc herniation in 3rd and 4th decades[2].

In the present study, 60.95% were male. Among the 30 workers who were heavy workers, 25 (83.03%) were male which was comparable to the study done by Thapa SS et Al where 27 (84.4%) were male among the 32 patients who were heavy workers[2]. This might be the reason for male predominance seen in our study. In this study, 63.41% patients presented with back pain. The average duration of back pain was 33.36 weeks±6.14. There were 95.12% cases with radicular pain with mean duration OF 9.72 weeks±1.27. This was comparable with study of Janardhana AP et Al[3].

There were 54 different dermatome level distribution of pain in 30 patients (26 level in L5, 21 level in S1 and 7 level in L4). Among them,19 patients had more than one dermatome level distribution of pain (13 patients had L5 and S1 level, 5 patients had L4, L5, S1 level and 1 patient had L4, L5 level). L5 and S1 were the most common dermatome level distribution of pain. In our study SLRT was positive in 28 patients (68.30%).

In our study, 80.48% patients had neurological deficit. Out of which, both motor and sensory deficit were present in 20 (48.78%), motor only in 3 (7.31%) and sensory only in 10 (24.39%). Among them, 23 (56.10%) had motor deficit and 30 (73.17%) had sensory deficit. Sixteen (39.02%) had neurological deficit of L5 level, 1 (2.43%) had neurological deficit at L4 and L5 level, 4 (9.75%) had neurological deficit at L5 and S1 level, and 2 (4.87%) had neurological deficit at S1 level.

In our study, ankle jerk was absent in 3 patients among 8 patients with MRI findings of S1 nerve root compression which was statistically significant (p=0.03) similar to study done by Thapa SS et al.[2]

Among 16 patients with neural foramen compromise, 15 had radicular pain which was statistically not significant (P=0.74) and out of 17 patients with nerve root compression,16 had radicular pain which was statistically not significant (p=0.76) either.

Our study showed that 23 out of 26 patients with MRI level L5 correlated well with clinical level L5. Similarly, 12 out of 18 patients with MRI level S1 had clinical level S1. These findings were similar to study by Janardhana AP et al.[3]

CONCLUSION

Clinical findings correlate well with MRI findings, but all MRI abnormalities need not have a clinical significance. The presence of paracentral disc protrusion with gross neural foramen compromise or nerve root compression are invariably associated with clinical signs and symptoms. Disc bulges with thecal sac compromise or central protrusions and extrusions without significant neural canal compromise are clinically insignificant. The presence of neural foramen compromise is more important in determining the clinical signs and symptoms. The type of disc herniation, protrusions and extrusions, correlates poorly with clinical signs and symptoms. Correlation of clinical and MRI findings are essential for successful selection of patients for surgical management of sciatica. MRI findings can serve as a useful tool when planning surgery due to the accurate depiction of the morphometric features.

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