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Original Article

Comparison Between Clinical Findings and Magnetic Resonance Imaging Findings in Lumbar Prolapsed Intervertebral Disc

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ABSTRACT

Introduction: Lumbar prolapsed intervertebral disc is commonly associated abnormality with lower backache. Disc herniation of same size can be asymptomatic in one patient and agonizing in another patient. Magnetic resonance imaging (MRI) is a gold standard diagnostic investigation for prolapsed intervertebral disc. Despite of high sensitivity sometimes MRI shows abnormal findings even in the asymptomatic individuals indicating a moderate relationship between MRI and symptoms in the patient. The study was conducted to correlate the abnormalities observed on MRI and clinical features of lumbar disc prolapse.

Methodology: A descriptive cross-sectional study was conducted from 20 December 2021 to 15 September 2022. Ethical approval was obtained from the Institutional Review Committee (Reference number: 078/78-009/HG). A convenience sampling method was used. The study consisted of patients with low back pain and radiation to lower extremity or patient with MRI scan of lumbar spine. Clinical and MRI findings were correlated to know the association and significance of MR findings in producing symptoms.

Results: The study included 68 patients with back pain between 18 to 55 years (mean 41± 8.79 years). Neurological symptoms were present in 26 (38.23%) patients. Disc bulge in MRI was noticed in 48 (45.28%), protrusion in 46 (43.39%) and extrusion in 10 (11.32%) levels, most seen at L5-S1 level (66.11%). The clinical level of pain distribution correlated well with the MRI level (Kappa 0.69), but not all disc bulges produced symptoms.

Conclusion: Clinical features and Magnetic resonance imaging findings of disc prolapse had significant correlation similar to other studies done in a similar setting, but all imaging abnormalities may not have a clinical significance.

Keywords: magnetic resonance imaging; intervertebral disc; prolapse; radiculopathy; correlation of data.

INTRODUCTION

Low back pain is experienced by 70 -80% of adults sometime during their lives accounting for loss of productivity in the workforce, prolapsed intervertebral disc being one of the commonest causes.[1,2] Mechanical compression and inflammation of the nerve root by herniated disc is responsible for radicular pain. Neurologically patients may be normal or show features of radiculopathy.[3]

Magnetic resonance imaging (MRI) is done routinely for these patients which is non-invasive, sensitive to disc disease and extension of disc: bulge, protrusion, extrusion or sequestration and effects on cord/foramina compression.[4] Despite high sensitivity of MRI there is still question about whether the modality is acceptably specific or not as sometimes it reveals abnormal findings in absence of clinical signs and symptoms. There is only a moderate correlation between imaging evidence of disc herniation and the presence of symptoms.[5] Therefore, MRI scan should be interpreted with caution.

The objective of this study was to determine the correlation between clinical features and MRI findings in lumbar disc prolapse.

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METHODS

This descriptive cross-sectional study was conducted from 20 December 2021 to 30 August 2022 in the Department of Orthopedics of Bharatpur Hospital, Chitwan, Nepal. Ethical approval was obtained from the Institutional Review Committee (IRC) of the same Institute (Reference number: 078/78-009/HG). The study group consisted of patients between 18 to 55 years of age with low back pain and radiation to lower extremity or patient with MRI scan of lumbar spine coming to the OPD in Department of Orthopaedics. Patients who had back pain with or without neurological deficit secondary to fractures, tumours and infection were not included in the study. A convenience sampling method was used. The sample size was calculated based on the study done by Kim KY et al[6] at Department of Orthopaedic Surgery, University of Ulsan Medical College, Seoul, Korea; the overall accura-

cy of MRI predicting the types of herniated lumbar intervertebral disc was 85%;
Now, the sample size (N) is given by
n =Z2pq /e2
=1.962 x 0.85 x 0.15 / 0.852
=67.79

Where,
n= minimum required sample size
Z= 1.96 at 95% Confidence Interval (CI)
p= prevalence of taken as 85%
q= 1-p
e= margin of error, 10% of prevalence = 10% of 85% = 8.5%

The calculated sample size was 68.

Patients presenting with clinical features of lower limb radiculopathy to the outpatient department of orthopaedics with clinical diagnosis of lumbar disc herniation were included in the study. All patients were clinically evaluated for pain distribution and presence of neurological symptoms and signs. The dermatomal level of pain distribution was noted. Similarly, the dermatomal level for neurological signs and symptoms were also recorded.

All patients meeting inclusion criteria underwent MRI evaluation. The MRI findings on standard sagittal and axial T1W and T2W sequences, were reported by a radiologist regarding level, type and position of disc prolapse, any neural foramen or nerve root compression and findings related to chronicity (facet joint arthritis, ligamentum flavum hypertrophy, canal stenosis, spondylolisthesis). MRI findings analysed were disc degeneration, extent of disc prolapse (normal, bulge, protrusion, extrusion), neural foramen compromise, nerve root compression, and miscellaneous findings (ligamentum flavum hypertrophy, facet joint arthritis, canal stenosis). Disc degeneration was graded from 1 to 5 as per Pfirrmann et al7 Grades 1–3 were considered insignificant and normal. Grades 4 and 5 were considered as abnormal.

Neural foramen compromise was graded as thecal sac compression, neural foramen compromise, nerve root contact, and nerve root compression. Analysis of results were done and clinical findings and MRI findings were correlated to know the association between clinical and MRI findings and significance of MR findings in producing symptoms.
Data was entered in Microsoft excel 2016 and converted it into SPSS (Statistical Package for Social Sciences, version 25) for statistical analysis. For descriptive statistics; percentage, mean, standard deviation, median inter-quartile range, minimum, maximum were calculated along with tabular and graphical presentation were made. For inferential statistics; chi-square test was applied, the significant differences between the MRI findings and clinical observation was done at 95% confidence interval where p-value less than 0.05 was considered statistically significant.

RESULTS

Total 68 patients with lumbar prolapsed intervertebral disc were studied, out of them 33 (48.53%) were male and 35 (51.47%) were female. Age range was from 18 to 55 years, with mean age of 41± 8.79 years. Considering the lifestyle of the patients, 34 (50%) patients were heavy workers and 34 (50%) were light workers. All the patients presented with back pain. The mean duration of back pain was 37.37 ± 15.5 weeks, minimum 10 weeks and maximum 72 weeks.

Neurological symptoms were present in 26 (38.23%) patients. 31 (45.59%) patients have right sided radiculopathy, 33 (48.53%) patients have left sided and 4 (5.88%) have bilateral radiculopathy. The pain distribution was also classified as per the dermatomal level where 20 (29.41%) patients have L5 level, 3 (4.41%) patients have S1 level, 30 (44.12%) patients have both L5 and S1 level. Lumbosacral spine tenderness was present in 63 (92.65%) patients. 21 (30.88%) patients showed features of pelvic list. Straight leg raising test (SLRT) was positive in 63 (92.65%) patients and cross-SLRT was positive in 23 (33.82%) patients. Femoral stretch test was positive in only 3 (4.41%) patients.

Neurological deficits were present in 26 (38.23%) patients. Out of them, 23 (33.82%) patients had motor weakness and 3 (4.41%) patients had sensory deficits. 5 (7.35%) patients have motor weakness of L5 (extensor hallucis longus) and 15 (22.06%) patients have motor weakness of S1 (flexor hallucis longus). Ankle jerk was absent in 3 (4.41%) patients and knee jerk absent in 3 (4.41%) patients. Bowel and bladder involvement was seen in 3 (4.41%) patients only of total 68 patients. After clinical evaluation, 30 (44.12%) patients were diagnosed to have prolapse at L4-L5 level, 34 (50%) patients at L5-S1 level, 4 (5.88%) patients L2-L3 level.

MRI Findings

There were 104-disc herniation levels shown in 68 patients. Bulge was noticed in 48 (45.28%) levels, protrusion was noticed in 46 (43.39%) levels, extrusion was noticed in 10 (11.32%) levels. The incidence of lumbar disc herniation was most commonly seen at L4-L5 level (50%); followed by L5-S1 level (44.12%) and L3-L4 level (5.80%). 68 different position of the disc herniation (protrusion and extrusion) were found. Out of them, 30 (44.12%) were Centro-lateral disc herniation, 22 (32.35%) were central and 16 (23.53%) were far-lateral disc herniation. Out of 33 patients with neural foramen compromise due to disc herniation 20 (29.41%) patients had neurological deficit. Commonly neural foramen compromise was seen at L4- L5 level among 26 (38.2%) patients.
After MRI evaluation, MRI level of disc prolapse were – 19 (27.94%) patients at L4-L5 level, 45 (66.18%) patients at L5-S1 level, 4 (5.88%) patients L2-L3 level.

Correlation of MRI Findings and Clinical observation

In 48 patients with disc bulge 20 had neurological deficit (p-value = 0.367), in 46 patients with protrusion 17 had neurological deficit (p-value = 0.754) and in 10 patients with extrusion 4 had neurological deficit (p-value = 0.901). Thus, the correlation between types of herniation and neurological deficit is statistically not significant (Table 1).

Table 1: Association of type of disc herniation with neurological deficit.

Type of disc herniation		Neurological deficit			p-value
		Yes	No	Total	
Bulge	Yes	20 (41.7%)	28 (58.3%)	48 (100%)	0.367*
	No	6 (30%)	14 (70%)	20 (100%)	
Protrusion	Yes	17 (37%)	29 (63%)	46 (100%)	0.754*
	No	9 (40.9%)	13 (59.1%)	22 (100%)	
Extrusion	Yes	4 (40%)	6 (60%)	10 (100%)	0.901*
	No	22 (37.9%)	36 (62.1%)	58 (100%)	

* Chi-square test; Bold signifies statistical significance at p<0.05

Out of 33 patients with neural foramen compromise, 20 had neurological deficit during clinical examination which is statistically significant (Table 2).

Table 2 : Association of neural foramen compromise with neurological deficit.

Neural foramen compromise	Neurological deficit			p-value
	Yes	No	Total	
Yes	20 (60.6%)	13 (39.4%)	33 (100%)	<0.001*
No	6 (17.1%)	29 (82.9%)	35 (100%)	

* Chi-square test; Bold signifies statistical significance at p<0.05

Out of 33 patients, showing neural foramen compromise, only 3 patients had absent ankle jerk as compared to 3 patients with absent knee jerk among those without neural foramen compromise (Table 3).

Table 3: Association of neural foramen compromise with jerk

Neural foramen compromise	Jerk			
	Absent ankle	Absent knee	Both ankle and knee present	Total
Yes	3 (9.1%)	0	30 (90.9%)	33 (100%)
No	0	3 (8.6%)	32 (91.4%)	35 (100%)

NA: Not Applicable (could not be computed)

After through clinical evaluation, one clinical level and one MRI level was confirmed for same patient. Clinical level involvement and MRI level involvement were found to have good agreement at kappa value 0.690 (Table 4).

Table 4: Agreement of MRI level and Clinical level

Clinical level	MRI level				Kappa value	p-value
	L2 - L3	L4 – L5	L5 – S1	Total		
L2 - L3	4 (100%)	0	0	4 (100%)	0.690	<0.001*
L4 – L5	0	34 (100%)	0	34 (100%)		
L5 – S1	0	11 (36.7%)	19 (63.3%)	30 (100%)		

* Chi-square test; Bold signifies statistical significance at p<0.05

DISCUSSION

In our study, the mean age of the patients was 41 ± 8.79 years. It is comparable to the studies done at similar setups showing mean age of 44.83 years ranging from 20-72 years[1] and in another study mean age of the patient was 36.82 ± 8.57 years ranging from 21 to 50 years[8].

In this study, 33 (48.5%) were male and 35 (51.5%) were female. This is similar to other studies. Among the 34 patients who were heavy workers, 24 (70.5%) were male.[9] This might be the reason for male predominance seen in our study.

All the patients in our study presented with back pain. The average duration of back pain was 37.37 ± 15.5 weeks. This is similar to study done at Kathmandu, Nepal where 57 (100%) patients presented with back pain with average duration 30.54 ± 27.043 weeks.[8]

In this study, there were 100 different dermatomal levels of distribution of pain in 60 patients where 13 patients have L5 level, 7 patients have S1 level, 25 patients have both L5 and S1 level, 15 patients have L4 L5 and S1 dermatomal level of distribution. Similar study presented 74 different dermatomal levels in 41 patients where 35 levels were L5, 34 levels were S1 and 5 levels were L4.[8] Thus L5 and S1 were the most common dermatomal levels distribution of pain. In a study in Pakistan 26% patient had radiculopathy along L5 nerve root, 21 (42%) patients had radiculopathy along S1 root and 13 (26%) patients had radiculopathy along L5 and S1 dermatome,[10] which is comparable to our study.

In this study, Straight Leg Raising Test (SLRT) was positive in 57 patients (83.8%). Comparable results were found in other similar studies: SLRT positive in 87.7% of cases[8]; 94% patient had SLRT positive[10] and 82.5% patients had positive SLRT;[11,16] which is similar to our study.

In this study, 26 patients (38.2%) had neurological deficits. Out of them, 20 patients had motor weakness and 23 patients show sensory deficits. 15 patients (75%) had motor weakness of L5; 5 patients (25%) had motor weakness of S1 whereas 17 patients (73.9%) had sensory deficit of L5, 3 patients (13.1%) had sensory deficit of S1 and 4 patients (17.4%) had sensory deficit of both L5 and S1. Similar neurological findings were noted in other study which showed motor involvement present in 34 (85%) cases and

sensory involvement in 31 (77.5%) cases.[12]

In this study, among 33 patients had MRI finding of neural foramen compromise, ankle jerk was absent in 3 patients and knee jerk in 3 patients so here chi square test was not applicable due to small sample size and no inference could be made but other study calculated the positive predictive value of ankle jerk for PIVD at L5-S1 level was 67-84 % and negative predictive value was 79-84%.[13] According to another study the sensitivity of ankle jerk for PIVD at L5-S1 was 50% and specificity was 60%.[14] Another study also showed the sensitivity of ankle jerk was 90% with 64.3% positive predictive value, while the specificity was 46%.[10]

In this study, 104 disc herniation levels were shown in 68 patients. Bulge was noticed in 48 levels, protrusion was noticed in 46 levels and extrusion was noticed in 10 levels. The incidence of lumbar disc herniation was most commonly seen at L4-L5 level 34 (50%) with; followed by L5-S1 level 30(44.12%) and L3-L4 level 4 (5.8%). Altogether herniation occurred in L4-L5 and L5-S1 in 94.12%. The commonly involved level of lumbar disc prolapse is L4-L5 which is supported by multiple other studies similar to our study: 49.0% cases at L4-L5 and 36.5% at L5-S1 levels;[8] 86% cases at L4-L5 and L5-S1 levels;[15] L4-L5 level (57.5%) and L5-S1 (25%);[11] L4-L5 level in 43 patients (50.6%) followed by L5-S1 level in 40 patients (48.9%).[12]

In this study; out of 48 patients with disc bulge 20 had neurological deficit (p-value = 0.367), out of 46 patients with protrusion 17 had neurological deficit (p-value=0.754) and out of 10 extrusions 4 had neurological deficit (p-value=0.908). Thus, the correlation between types of herniation and neurological deficit is not statistically significant. This is similar to another study which concluded that type of disc herniation (bulge, protrusion or extrusion) correlates poorly with clinical signs and symptoms.[1,17-20]

In this study, out of 34 patients with MRI level L4-L5, 34 patients had clinical level L4-L5 and out of 30 patients with MRI level L5-S1, 19 patients had clinical level L5-S1 which is also statistically significant (kappa-value = 0.691, p-value <0.001); which is similar to another study which found strong correlation between clinical level and MRI level; the kappa value for the statistical significance between the clinical level and the MRI level was 0.8.[1] Similarly, in the another study, in case of L4-L5 level disc herniation, the sensitivity of all clinical features was 92% and positive predictive value was 95.8%, while the specificity was 96% and negative predictive value was 88.46% with chi-square value of 38.78 and p- value of 0.000 and in case of L5-S1 level disc herniation, the sensitivity and specificity of clinical features as a whole were 93.3% and 70% respectively. The positive predictive value was 82.3% with chi-square value of 22.12 and p- value of <0.001.[10,21]

CONCLUSION

Clinical features and Magnetic resonance imaging findings of disc prolapse had significant correlation but all imaging abnormalities do not have a clinical significance. Thus, it is the combination and correlation of the clinical examination findings and MRI findings that is essential for successful selection of patients for surgical management of sciatica.

REFERENCES

1. Janardhana AP, Rajagopal, Rao S, Kamath A. Correlation between clinical features and magnetic resonance imaging findings in lumbar disc prolapse. Indian J Orthop. 2010 Jul;44(3):263-9. [PubMed | Full Text | DOI]
2. Nelson JH, Burks R, Belmont PJ Jr. Incidence and risk factors for lumbar degenerative disc disease in the United States military 1999-2008. Mil Med. 2011 Nov;176(11):1320-4. [PubMed | Full Text | DOI]
3. van Rijn JC, Klemetso N, Reitsma JB, Majoie CB, Hulsmans FJ, Peul WC, Bossuyt PM, Heeten GJ, Stam J. Symptomatic and asymptomatic abnormalities in patients with lumbosacral radicular syndrome: Clinical examination compared with MRI. Clin Neurol Neurosurg. 2006 Sep;108(6):553-7. [PubMed | Full Text | DOI]
4. Taneichi H. Role of MR imaging in the evaluation of low back pain (orthopedic surgeon's view). Semin Musculoskelet Radiol. 2001 Jun;5(2):129-31. [PubMed | Full Text | DOI]
5. Boden SD, Davis DO, Dina TS, Patronas NJ, Wiesel SW. Abnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation. J Bone Joint Surg Am. 1990 Mar;72(3):403-8. [PubMed | Full Text]
6. Kim KY, Kim YT, Lee CS, Kang JS, Kim YJ. Magnetic resonance imaging in the evaluation of the lumbar herniated intervertebral disc. Int Orthop. 1993;17(4):241-4. [PubMed | Full Text | DOI]
7. Pfirrmann CW, Metzdorf A, Zanetti M, Hodler J, Boos N. Magnetic resonance classification of lumbar intervertebral disc degeneration. Spine (Phila Pa 1976). 2001 Sep 1;26(17):1873-8. [PubMed | Full Text | DOI]
8. Thapa SS, Lakhey RB, Sharma P, Pokhrel RK. Correlation between Clinical Features and Magnetic Resonance Imaging Findings in Lumbar Disc Prolapse. J Nepal Health Res Counc. 2016 May;14(33):85-8. [PubMed | Full Text | DOI]
9. Jarvik JG, Hollingworth W, Heagerty PJ, Haynor DR, Boyko EJ, Deyo RA. Three-year incidence of low back pain in an initially asymptomatic cohort: clinical and imaging risk factors. Spine (Phila Pa 1976). 2005 Jul 1;30(13):1541-8; discussion 1549. [PubMed | Full Text | DOI]
10. Rehman L, Khaleeq S, Hussain A, Ghani E, Mushtaq M, Zaman Ku. Correlation between Clinical Features and Magnetic Resonance Imaging findings in patients with Lumbar Disc Herniation. Journal of Postgraduate Medical Institude (JPMI). 2011;21(1):65-70. [Full Text]
11. Kamal F, Quddus MA, Hossain A, Rahman MM, Sarkar RN, Nabi S, Ahmed S, Chowdhury N, Rahman K. Role of magnatic resonance imaging (MRI) in the pre-operative diagnosis of lumbar disc herniation. Journal of Dhaka Medical College. 2009;18(1):8-14. [Full Text | DOI]
12. Younis F, Shahzad R, Rasool F. Correlation of magnetic resonance patterns of lumbar disc disease with clinical symptomatology of patients. Annals 2011;17(1):41-7. [Full Text | DOI]
13. Jhawar BS, Fuchs CS, Colditz GA, Stampfer MJ. Cardiovascular risk factors for physician-diagnosed lumbar disc herniation. Spine J. 2006 Nov-Dec;6(6):684-91. [PubMed | Full Text | DOI]
14. Deyo RA, Rainville J, Kent DL. What can the history and physical examination tell us about low back pain? JAMA. 1992 Aug 12;268(6):760-5. [PubMed | Full Text | DOI]
15. Akbar A, Mahar A. Lumbar disc prolapse: management and outcome analysis of 96 surgically treated patients. JPMA The Journal of the Pakistan Medical Association. 2002;52(2):62-5. [PubMed | Full Text]
16. Majlesi J, Togay H, Unalan H, Toprak S. The sensitivity and specificity of the Slump and the Straight Leg Raising tests in patients with lumbar disc herniation. J Clin Rheumatol. 2008 Apr;14(2):87-91. [PubMed | Full Text | DOI]
17. Beattie P. The relationship between symptoms and abnormal magnetic resonance images of lumbar intervertebral disks. Phys Ther. 1996 Jun;76(6):601-8. [PubMed | Full Text | DOI]

18. Hedge D, Ballal A, Rai HR. A study to correlate the clinical signs and magnetic resonance imaging in lumbar intervertebral disc prolapse Indian journal of applied research. 2015 march;5(3):430-2. [Full Text | DOI]
19. Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic resonance imaging of the lumbar spine in people without back pain. N Engl J Med. 1994 Jul 14;331(2):69-73. [PubMed | Full Text | DOI]
20. Bajpai J, Saini S, Singh R. Clinical correlation of magnetic resonance imaging with symptom complex in prolapsed intervertebral disc disease: A cross-sectional double blind analysis. J Craniovertebr Junction Spine. 2013 Jan;4(1):16-20. [PubMed | Full Text | DOI]
21. Dora C, Wälchli B, Elfering A, Gal I, Weishaupt D, Boos N. The significance of spinal canal dimensions in discriminating symptomatic from asymptomatic disc herniations. Eur Spine J. 2002 Dec;11(6):575-81. [PubMed | Full Text | DOI]