

CORRELATION BETWEEN CLINICAL FEATURES AND MAGNETIC RESONANCE IMAGING FINDINGS IN PATIENTS WITH LUMBAR DISC HERNIATION

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ABSTRACT

Objective: To find out the correlation of clinical features and magnetic resonance imaging (MRI) findings in determining the level of lumbar disc herniation.

Material and Methods: It was an analytic study, which was conducted in the department of Neurosurgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from 1st May 2002 to 1st March 2003. The total number of patients with prolapsed intervertebral disc, selected for this study was fifty. The clinical level of disc herniation was determined and was correlated with MRI findings. For data analysis, SPSS 10 soft ware was used.

Results: In 29 (58%) patients there was right sciatica, while eighteen (36%) had bilateral sciatica. Straight leg raising test was positive in 47 (94%) patients. On MRI, 48 (96%) cases had prolapsed intervertebral discs (PIVD) at L4-L5 and L5-S1 levels and 2 (4%) patients had L3-4 disc herniation. Thirty-eight patients had posterolateral disc herniation and 12 patients had central disc herniation. At L4-L5 level, the sensitivity, specificity, positive predictive value and negative predictive value of all clinical features was 92%, 96%, 95.8% and 88.46% respectively. The chi square value for L4-L5 and L5-S1 was 38.78 ($P=0.000$) and 22.12 ($P=0.000$) respectively, while for multiple level disc herniation, it was 3.42 ($P=0.064$).

Conclusion: Majority of PIVD lie in lower lumbar region. There is excellent correlation between the clinical features and MRI findings in the diagnosis of single level disc herniation but no correlation occurs in case of multiple level disc herniations.

Key Words: Prolapsed intervertebral disc, Clinical diagnosis, MRI.

INTRODUCTION

Low back pain with or without sciatica is a major cause of morbidity through out the world.¹ Lumbar disc herniation is one of the commonest causes of low back pain and sciatica. Lumbar disc herniation leads to inflammation in the nerve roots and dorsal root ganglions, which is induced by nucleus pulposus.² Detailed history and physical examination supplemented by MRI can differentiate herniated lumbar disc from other causes of low back pain and sciatica.¹ Due to higher weight load on the lower lumbar and its connection to the sacrum, there is increased mechanical stress on the corresponding disc. That is why; about 95% of the lumbar intervertebral disc herniations occur in the L4-L5 and L5-S1

regions. MRI can represent morphological and pathological changes of the osteoligamentous and neural components of the lumbar spine.³ Morphological abnormalities demonstrated on MRI do not always reflect low back pain, so these should be interpreted with consideration of full signs, symptoms and other relevant back ground.⁴ The value of clinical presentation in the diagnosis of lower lumbar disc herniation is highly specific, but rather insensitive.⁵ Therefore, clinical correlation is essential to determine the importance of abnormalities on MRI. We selected patients with lumbar disc herniation confirmed with MRI of the lumbar spine to find out the correlation of clinical features and magnetic resonance imaging (MRI) findings in determining the level of lumbar disc herniation.

DECREASE IN PIN PRICK SENSATIONS IN LOWER LIMBS

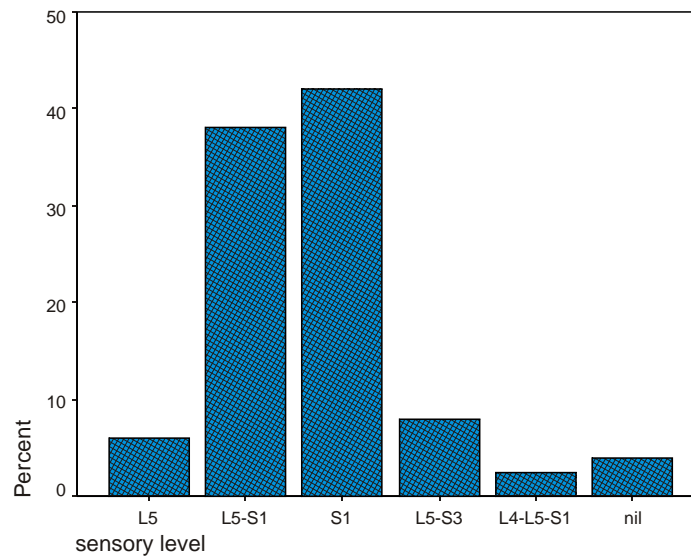


FIGURE NO. 1

MATERIAL AND METHODS

This study was conducted on fifty patients suffering from lumbar intervertebral disc herniation. These patients were selected on the basis of clinical features and MRI findings. It was an analytical, hospital-based study, the duration of which was from 1st May 2002 to 1st March 2003, conducted in the department of Neurosurgery, PIMS, Islamabad. For the collection of information, we used a proforma. This proforma included the information about the identity of patients, clinical features and MRI findings. In MRI location of herniated intervertebral disc, its side, and number of levels and associated spinal stenosis were recorded. We included patients with lumbar disc herniation at all levels, lumbar disc herniation with mild stenosis, multiple level disc herniations and cauda equina syndrome due to lumbar disc herniation. We did not include patients with recurrent lumbar disc herniation, lumbar disc herniation with severe spinal stenosis and disc herniation with spondylolesthesis. The different variables mentioned were sciatica, roots involvement, SLR (straight leg raising), decreased pinprick sensation, ankle jerk and MRI findings for level of lumbar disc herniation, its side and severity. The patients with low back pain and sciatica, having concerned findings, investigated with MRI, showing herniated intervertebral disc were considered as patients of lumbar disc herniation. Both the clinical features and MRI findings were compared and correlated.

STATISTICAL ANALYSIS

The findings were analyzed for mean,

frequency and predictive values. Chi square test was applied, using commercially available software, SPSS 10.

RESULTS

Total fifty patients were studied during the 10 months period. The duration of symptoms was ranging from 2 months to 5 years. The duration of symptoms was less than six months in thirteen patients and while in other thirteen patients it was more than six months. The average duration in female patients was 1.63 years and in male patients, it was 1.7 years. In 29 (58%) patients there was right sciatica, while eighteen (36%) had bilateral sciatica. The distribution of pain along different roots was also recorded. In 13 (26%) patients, there was radiculopathy along L5 root, 21 (42%) patients had radiculopathy along S1 root and 13 (26%) patients had radiculopathy along L5 and S1 roots. In four (8%) patients, there was cauda equina syndrome, presented with bilateral numbness in legs, urinary retention and perianal numbness. Forty-seven (94%) patients had positive straight leg raising (SLR) test. The patients were divided into five groups, based on degree of SLR. In three (6%) patients, the SLR was below 30 degrees, in twelve (24%) patients it was between 30-45 degrees, in fifteen (30%) patients it was between 45-60 degrees. In 17 (34%) patients, the SLR was more than 60 degrees while it was negative in three (6%) patients. We also examined the sensory level in these patients as shown in figure 1. Twenty (40%) patients had only decreased pinprick sensations in S1 dermatome and nineteen (38%) patients had decreased pinprick sensations in L5-S1 dermatome. Four (8%) patients

RESULTS OF ANKLE JERK EXAMINATION

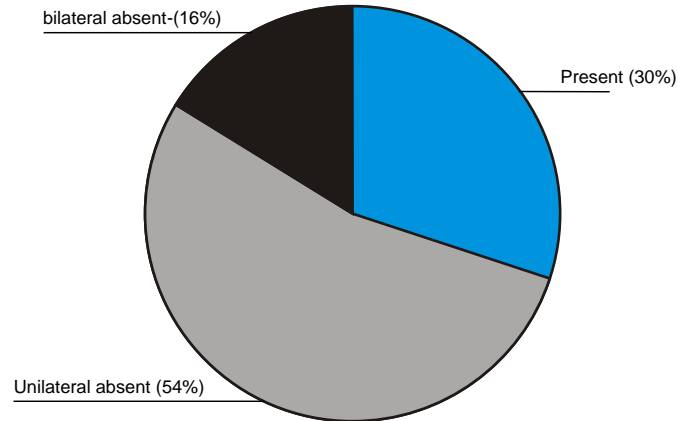


FIGURE NO. 2

had bilateral saddle anesthesia. We also noted the ankle jerk in these patients, which was absent only in 30% of the patients as shown in figure 2. It was absent in 87% of L5-S1 discs. Two patients had right-sided foot drop, both of them had L4-5 disc herniation. Knee jerk was exaggerated in all patients. Two (4%) patients had L3-4 disc herniation but the femoral stretch test was negative.

On MRI, the PIVD was at L4-L5 level in 17 (34%) patients and it was at L5-S1 level in 23 (46%) cases. In eight cases (16%), it was at both L5-S1 and L4-L5 levels. The overall incidence in lower lumbar region was 96%. Regarding side of PIVD, the disc herniation was on right side in 21 (42%) patients, on left side in 17 (34%) patients, and it was central disc herniation in 12 (24%) patients. The level of disc herniation was determined on clinical basis as well as on MRI. These findings were compared and correlated for single level disc like L4-L5 and L5-S1 as shown in table 1 and table 2 respectively and for more than one level as shown in table 3. We found out the sensitivity, specificity and predictive values of clinical features and applied chi square test. 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%. The chi square value was 38.78 with P value of 0.000 as shown in table 1. 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 0.000 as shown in table 2. In case of L4-L5 & L5-S1 levels disc herniations, the sensitivity and specificity of clinical features as a whole were 57.14% and 97.05% respectively. The positive predictive value and negative predictive value were 28.6% and 11.1%

respectively while the chi square value was 3.42 and P value was 0.064 as shown in table 3.

DISCUSSION

Low back pain and sciatica is a very common ailment. The most important symptoms are radiating leg pain and related disabilities. In majority of cases, sciatica is caused by a herniated disc with nerve root compression, but lumbar stenoses and tumours are other possible causes. In this study 50 cases of low back pain and sciatica were studied. In the present study, the unilateral sciatica was present in 94% of patients. According to Richard,⁶ unilateral sciatica was present in 81% of cases and bilateral sciatica was present in 10% of cases. Another study showed left sided sciatica in 81% of patients.⁷

The duration of symptoms may be varied. In case of PIVD, the duration of symptoms is shorter than stenosis. Weber said, the duration of backache could precede the sciatica from 6 to 10 years.⁸ In the present study, the duration of pain was ranging from two months to five years. The mean duration of symptoms in male and female patients was 1.7 years and 1.63 years respectively. The main reason for long duration of symptoms is

CORRELATION BETWEEN CLINICAL FEATURES AND MRI AT L4-L5 LEVEL

Clinical level	MRI level		Total
	L4-L5 Absent	L4-L5 Present	
L4-L5 Absent	24	2	2
L4-L5 Present	1	23	23
Total	25	25	25

Table 1
CHI SQUARE TEST:

Chi square value = 38.78
P value = 0.000

CORRELATION BETWEEN CLINICAL FEATURES AND MRI AT L5-S1 LEVEL

Clinical level	MRI level		Total
	L5-S1 Absent	L5-S1 Present	
L5-S1 Absent	14	2	16
L5-S1 Present	6	28	34
Total	20	30	50

Chi square value = 22.12, P value = 0.000

Table 2

that initially these patients go to non-doctors like quacks etc and so they present late. Some patients with lumbar disc herniation also present with cauda equina syndrome. They may have numbness and weakness in lower limbs along with sphincters involvement and saddle anesthesia. According to the study on 14 patients of cauda equina by Shapiro,⁹ all patients (100 %) presented with bilateral sciatica and bilateral lower limbs weakness. Urinary retention was present in 93% of the patients, nine patients had disc herniation at L4-L5 level and three patients had disc herniation at L5-S1 level. In our study, four (8%) patients presented with cauda equina syndrome. All had numbness and weakness in the lower limbs. All of them had urinary retention with saddle anesthesia. Three (6%) patients had central disc herniation at L4-L5 level and one (2%) patient had central disc herniation at L5-S1 level. According to Richard,⁶ foot drop was present in 8% of the patients with sciatica. In our study there were two (4%) patients presenting with foot drop on right side. Both had PIVD at L4-L5 level.

Among the common signs in lower limbs of patient with PIVD in lumbar region, decreased pinprick sensation is very important. The different dermatomes are checked to find out the level of prolapsed disc after asking about the pain radiation. Pain radiation along L5 root is more reliable in diagnosing level than S1 root, especially when two roots are involved. The neurological picture of high level is unreliable.¹⁰ According to one study, for decreased pin prick sensation in L5 dermatome in case of L4-L5 disc level, the positive predictive value was 76% and negative predictive value was 50%.¹¹ In another study, the sensitivity for sensory loss was 50% and specificity was also 50%.¹² In our study, the sensitivity and specificity of decreased pinprick sensation was 84% and 66.6% respectively. The positive predictive value was 68% and negative predictive value was 91%. Another important sign is ankle jerk, in which S1 root is involved. In case of S1 root compression, the ankle jerk is affected which becomes either weak or absent. According to one study, the positive predictive value of ankle jerk for PIVD at L5-S1 level was 67-84% and

CORRELATION BETWEEN CLINICAL FEATURES AND MRI AT MULTIPLE LEVELS

Clinical level	MRI level		Total
	L4-L5 & L5-S1 Absent	L4-L5 & L5-S1 Present	
L4-L5 & L5-S1 Absent	33	3	36
L4-L5 & L5-S1 Present	10	4	14
Total	43	7	50

Chi square value = 3.42, P value = 0.064

Table 3

negative predictive value was 79-84%.¹³ According to another study, the sensitivity of ankle jerk for PIVD at L5-S1 level was 50% and specificity was 60%.¹⁴ In the present study, the sensitivity of ankle jerk was 90% with 64.3% positive predictive value, while the specificity was 46%. In case of knee jerk, this may be diminished in case of upper lumbar disc herniation. In our study, in one patient, the knee jerk was weak while in other, it was normal. Similarly, the presence of femoral stretch sign helps in the diagnosis of upper lumbar disc herniation.¹⁵ In our patients' femoral stretch sign was absent. Sciatic stretch signs have high correlation with surgical pathology in patients with documented lumbar disc pathology, but have no correlation regarding the location of disc herniation relative to the nerve root.¹⁶ In case of SLR, in which the compressed and inflamed roots are when stretched, produce pain is a very important sciatic stretch sign. In one study,¹⁷ SLR was positive in 86% of cases. In another study,¹⁸ the patients were divided into four groups according to the degree of SLR like below 30 degree, from 30 to 60 degree, above 60 degree and those with negative sign. It was positive in 94% of the patients. Another study shows positive SLR in 90% of the patients.¹⁹ In one study; presented by Lebkowski et al, SLR was positive in 96% of the cases.²⁰ In another study, there were 88.5% cases of positive SLR.²¹ In other studies, there was positive SLR in 98% and 81% of the cases respectively.^{22,23} In a study by Kosteljanetz et al²⁴ it was positive in 95.5% cases. SLR is considered a very important sign in the diagnosis of lumbar disc herniation but its absence does not preclude the presence of lumbar disc herniation.²⁴ Sensitivity of SLR has been reported as 85% and 80% respectively.^{12,19} In these two studies specificity was reported to be 50% and 40%. In the present study, which was conducted on fifty patients, we divided our patients into five groups, those with SLR below 30 degree, 30-45 degree, 45-60 degree, above 60 degree and those with negative SLR. SLR was positive in 94% of these cases. The sensitivity was 92.9% with positive predictive value of 98%, while the specificity was 50%. In

the present study similar observation has been recorded which is in agreement with the previous studies. In case of lumbar disc herniation, after taking history and examining the patient, the next important step is investigating the patient, for which MRI is the investigation of choice. Clear clinical identification of the roots affected and corresponding pathological findings at imaging are the best predictors of successful outcome, so emphasis should be placed on clinical identification of the nerve roots causing the complaints.²⁵ Positive sciatic tension signs and shorter duration of symptoms correlate with large disc herniation.²⁶ MRI should be interpreted with consideration of full clinical signs, symptoms and other relevant back ground.¹² The identification of PIVD level is very important from surgery point of view. As we know, most of the disc herniation occurs in lower lumbar region and there are different studies showing different level of disc herniation. According to one study, in 95 % of cases, the disc herniation occurs at L4-L5 and L5-S1 levels.²⁷ In another study, there were 58.7% disc herniations at L4-L5.²⁸ In one study, done on 160 patients, 90.6% disc herniations were present at single level and 9.4% were at multiple levels, in which 92.4% cases were at L4-L5 and L5-S1 levels.²⁹ According to the study of Akbar et al,¹ there were 86% cases at L4-L5 and L5-S1 levels. In another study, 30 there were 58.7 % discs at L4-L5 level. According to another study,³¹ there were 10.4% cases at L3-L4 level. Another study shows 3.6% cases at L3-L4 level.³² One study,¹⁴ shows 98% cases at L4-L5 and L5-S1 levels. In our study, there were two (4%) disc herniations at L3-L4 level. In 44% of the cases, PIVD was present at L4-L5 level and in 52% of the cases; it was present at L5-S1 level, comprising 96% of the total cases at L4-L5 & L5-S1 levels. Out of these discs, the two level discs were in 18 % of cases. In 21 patients, the PIVD was on right side, in 17 patients it was on left side and in 12 patients, the PIVD was central. Disc degeneration is characterized by progressive changes in the disc cellular and biochemical composition.³³ The degree of disc displacement on MRI has no correlation with any subjective symptoms, nor nerve root enhancement or compression.⁴ According to one study,¹⁶ the level of disc herniation was correctly predicted in 93% of cases with monoradicular pain, by the location of pain, supplemented by neurological signs. We determined the level of disc herniation on clinical basis and the changes on MRI were noted. These clinical findings were correlated with the level of disc herniation on MRI. In case of PIVD at L4-L5 level the sensitivity and specificity of overall clinical features were 92% and 96% respectively with positive predictive value of 95.8% and negative

predictive value of 88.46% while the chi square value was 38.78 with P=0.000. In case of L5-S1 disc herniation, the chi square value was 22.12 with P=0.000 and for multiple level disc herniation, the chi square value was 3.42 with P=0.064. Therefore, there was an excellent correlation of clinical features and MRI findings in case of single level disc herniation but no correlation in case of multiple level disc herniations.

CONCLUSION

The clinical features should be correlated with MRI findings in determining the level of disc herniation. There is excellent correlation between the clinical features and MRI findings in case of single level disc herniation, when it is lying posterolaterally at L4-L5 level or L5-S1 level.

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