

A Study of Clinico-radiological Correlation of Prolapsed Intervertebral Disc in Lumbar Spine

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Abstract: The diagnosis of disc herniation many a times becomes complex because one not only has to correlate clinical symptoms and signs with image findings but also has to determine which of anatomic abnormality is cause of the patient's pain. This study aims to determine the correlation between clinical features (pain distribution, neurological signs, and symptoms) and Magnetic resonance imaging (MRI) findings in lumbar disc prolapse and to know about its significance in decision making for treatment. Prospective study conducted between February 2014 to January 2016 at Department of Orthopedics, Mumbai Port Trust Hospital, and Mumbai. N= 52 patients. All patients selected were examined and their findings noted into pro forma. Details of pain projection in relation to specific dermatomes and muscles were noted. Straight leg raising test was performed. Visual Analogue Scores, Oswestry Disability Index, were clinical parameters used. Plain x rays of lumbosacral spine were taken and MRI spine was done for all patients. Disc herniation of types Protrusion, extrusion and sequestration were recorded by the radiologists using pro forma. All candidates for surgery were evaluated to assess fitness for anesthesia. Surgery was performed under general anesthesia. Maximum incidence of disc herniation was found in 4th and 5th decades (59.61%) with male to female ratio of 2:1. Manual laborer is more commonly affected. Back pain and sciatica are most common symptoms. L4-L5 was the commonest level of disc herniation. Sensory deficit was found to be significantly correlated with surgical findings. With multiple signs of single root compression offending disc herniation could be localized with higher accuracy. MRI scan has accuracy of 92.3% with false negativity of 20%. We found protrusion in 53.84% twenty eight patients, extrusion in sixteen patients (30.76%), sequestration and no disc in four patients each (7.7%) and incidence of far lateral herniation was 8%. Sensory deficit was found to be significantly correlated with surgical findings. Decompression surgeries have good outcome. MRI is the standard imaging modality for detecting disc pathology due to its advantage of lack of radiation, multiplanar imaging capability, excellent spinal soft-tissue contrast and precise localization of intervertebral discs changes MRI is able to demonstrate accurately structural changes in disc, size and site of sequestrum or protrusion. However, these images are not useful in predicting neurological deficit, and therefore should not be used as indication for surgery unless there is strong correlation with the clinical findings. Clinical follow-up demonstrated no significant correlation with MRI images.

Keywords: Intervertebral disc degeneration; Intervertebral disc; Spine; Zygapophyseal joint; MRI of lumbar spine; Far lateral Disc.

INTRODUCTION

Degenerative disc disease is described as clinical condition, without new injury, in which abnormally large deformations are induced by a physiological load at the intervertebral joint [1], despite voluminous literature dealing with every aspect of the problem, our understanding of disc lesion remains minuscule. The diagnosis of the disc herniation many a times becomes complex because one not only

has to correlate clinical symptoms and signs with image findings but also has to determine which of the anatomic abnormality is the cause of the patient's pain [2]. This study aims to determine the correlation between clinical features (pain distribution, neurological signs, and symptoms) and Magnetic resonance imaging (MRI) findings in lumbar disc prolapse and to know about its significance in decision making for treatment.

Aims and Objectives

A clinical and radiological evaluation of patients with prolapsed intervertebral disc and its correlation with surgical findings and laying out objective criterion for undertaking disc surgery

MATERIALS AND METHODS

This a prospective study conducted between February 2014 to January 2016 at department of orthopedics, Mumbai Port Trust Hospital, Mumbai. Study included 52 patients of low back pain with lumbar disc prolapse. Patients with severe structural deformity, Osteoporosis, Instability, Acute fractures or infections, Severe cardiovascular, respiratory diseases, Autoimmune or metabolic disease, Cancer, Previous spinal surgery were excluded from study.

At first visit all patients thus selected were examined and their findings noted into proforma. Historical details such as mode of onset, duration, number of acute attacks and accentuation of stress were also noted, along with occupation and preceding trauma. Details of pain projection in relation to specific dermatomes and muscles were noted. Straight leg raising test was performed using goniometer for accurate quantification. Visual Analogue Scores, Oswestry Disability Index, were the clinical parameters used. Plain x rays of lumbosacral spine were taken and MRI spine was done for all patients. The radiologists recorded the findings using a Performa. Disc herniation of types Protrusion, extrusion and sequestration were recorded. Following MRI confirmation of diagnosis, all candidates for surgery were evaluated to assess fitness for anaesthesia. Surgery was performed under general anaesthesia. The standard approach used in all cases was unilateral interlaminar exposure of intervertebral disc space.

Data analysis was carried out with SPSS software for Windows version 13.0 (SPSS Inc., Chicago, IL, USA). Continuous variables are analysed in terms of mean \pm standard deviation. Chi square test are used to establish data correlation. Standard Student's t-test for paired samples or one-way ANOVA performed for comparing data, as needed. A p-value < 0.05 is considered significant.

RESULTS

In this study maximum incidence of disc herniation was found in 4th and 5th decades (59.61%). Male are more commonly affected with male to female ratio of 2:1. Manual labourer are more commonly affected. Back pain and sciatica are most common symptoms. Straight Leg Raising Test was not significantly correlated with surgical findings. L4-L5 was the commonest level of disc herniation. If strict clinical and diagnostic criteria for lumbar disc herniation were used, the risk of false diagnosis was low. Sensory deficit was found to be significantly

correlated with surgical findings. Other criteria such as muscle wasting, pathological ankle reflex, motor weakness, motor wasting, List is less reliable. Bladder involvement was common in cauda equina lesions due to large disc prolapse. When multiple signs of single root compression were present the offending disc herniation could be localized with higher degree of accuracy. Plain radiography is an unreliable aid in identifying the level of herniation as well as predicting degree of symptomatology. MRI scan was found to have accuracy rate of 92.3% with false negative of 20%. MRI is helpful in identifying the site of sequestered disc, thickened calcified ligamentum flavum and in repeat surgery. In this study, protrusion was found in 53.84 % twenty eight patients, while extrusion in sixteen patients (30.76%), sequestration and no disc was observed in four patients each (7.7%) and incidence of far lateral herniation was found to be 8 %.

DISCUSSION

Low back pain is a common clinical problem that an orthopaedician deals day in and day out. The quest for reliable diagnostic method pre operatively started since 1934, when Mixter and Barr³ described ruptured intervertebral disc. Despite of early popularity of myelography, Ford and Key [4] suggested that even with newer agents such as metrizamide, this investigation fraught with many lacunae.

In later years, Meyer [5] described benefit of CT scan in diagnosing disc herniation disc herniation, following which CT scans became the mainstay of diagnosis in many centres. With the advent of Magnetic resonance imaging, it appeared for the one time that the quest was accomplished. With further studies fallacies of MRI were also noted, leaving us to start from commencement. The clinical methods of diagnosis have virtually been relegated to the background. In addition to this is much ignored fact that all the recent investigation are very expensive and not in the budget at every centre.

In this series an attempt was made to study clinical features and evaluated the role and clinical level diagnosis by correlating it with surgical findings. By using MRI as the main investigation, an effort was made to define its role in diagnosis.

The youngest patient in this study was fourteen year old female and oldest was fifty six year old female. The mean age was 41.03 years. In comparison with Chandra *et al.* [6], this study showed lower age range. The maximum incidence of disc herniation in this series was in 4th and 5th decade which was matched with the previous authors. Spangfort [7] showed a male to female ratio of 2:1 whereas Chandra *et al.* [6] reported 3:1 male to female ratio. In our study male to female ratio was found to be 2:1.

While Chandra *et al.* [6]observed prolapsed intervertebral disc more in middle income group, our study shows most of patients belonged to lower and middle socioeconomic strata. As division was based on the basis of occupation due to non-availability of reliable income statistics, we encountered this difference in our study. Astonishingly, nearly 36.5% patient had profession requiring lifting weights (14 heavy labourers and 5 light labourers). 15 patient 28.8 % gave history of trauma. This is in accordance with various foreign study [8].

We had only three patients with the occupation of driving that was the sharp contrast from the study of Kelsey and Hardy [9].

Inspired by Frymoyer [8] epidemiological observation on correlation severe backache and smoker we inquired about this habit in our patient. 24 patients 46.15% in our study were habitual smokers. However pathogenesis is still unknown. Frymoyer [8]attributed this to decreased blood supply by nicotine to vertebral body while Svelsson[10]believed cigarette smoking causes bronchitis, which stimulate coughing leading to elevated intradiscal pressure.

We observed higher incidences of disc at L4/L5 level as compared to L5/S1 level. Upon comparison with the western literature our study showed similar results, but far higher than a similar Indian study. This is because in the former study multiple level involvements were also studied. However multiple disc in our study had incidence of 7.8%. But we considered only L4/5 and L5/S1 disc in our study.

Study	L4/L5	L5/S1
Spangfort [7]	49.8%	46.9%
Kortelainein [11]	56.8%	40.7%
Vivek Sharma [12]	34.4%	26.7%
Present	57.7%	42.3%

Low back pain and sciatica was the most common presentation in our study (thirty three out of fifty two) 57.62 %, while only twelve patients 23.07% presented with back pain only and seven 13.46% patient presented with only leg pain. This was contrary to western literature Armstrong [13], Young [14] and Alexander [15]reporting backache to be the commonest presentation but in accordance to Indian study by Chandra *et al.* [6] and Sharma and Sankaran. As in our study patients attended our hospital only after failure of several indigenous methods this discrepancy can very well be explained.

In this study, the straight leg raising tests correlated very well with the findings of herniated disc at surgery. The reliability of the test was 92.3% and it compared with values expressed by Spangfort[7].

Although According to our study, 42.9% of cases had L4/5 level that was strongly positive which was less as compared to 56.2% of the cases who were mild positive, 75.0% of the cases who were weakly positive and 50.0% of the cases who were Negative but the difference was not significant. This matched with the observations made by Abdulla [16] and Patrick [17].

However horizontal localization of the herniated disc is not correlated with straight leg raising test. We recommend a larger randomized controlled study to evaluate predictive value of straight leg raising test for the ease of the surgical approach.

Muscle atrophy as a sign specific for localization of disc herniation was found to be not significantly correlated with disc, in our study. We encountered this sign in patients with long standing disc herniation, with involvement of the whole lower limb. Hence role of muscle atrophy in deciding level of herniation is not significant. We have observed this in three of fifty two cases studied. Even in cases of muscle wasting, motor power was well preserved. In order to avoid nerve root tension, patients tends to disuse on moving the affected side which possibly results in atrophy. In presence of severe pain, it's misleading to assess the power of muscle, particularly proximal muscles such as the gluteus medius and gluteus maximus. Thus, explaining higher incidence of extensor hallucislongus weakness in surgically proven L5-S1.

We observed exaggerated knee jerk (two out of fifty two) in patients with evidence of multiple sacral nerve root compression, although statistically correlation was not observed. Despite reviewing literature extensively, this observation could not be explained. Theoretically, an imbalance of muscle power of the posterior thigh muscles (L4-L5) and the quadriceps (L2-L3-L4) could result in exaggeration of knee jerk.

100.0% of the cases with positive sensory deficit had positive surgical finding which was significantly more as compared to 84.0% of the cases with normal sensory deficit. This observation was matched with that by Kortelainen *et al.* [11] Weisse [18]said in a large number of cases only sensory deficit may be identified.

It was found that extensor hallucislongus weakness could localize for L4-L5 herniation in only 50% accurately. Upon adding pain projection, the specificity increased to 66.66% and further jumped to 75% in presence of objective sensory deficit in L5 dermatome, However only three cases showed presence of all three signs of L5 root compression, making us to conclude that particular neurological deficit in isolation gave much less accurate level diagnostic information verses composite sign of particular root compression. This was particularly so when considering L5-s1

herniations, where for accuracy of level diagnosis, multiple sign of S1 root compression, were necessary.

Because in most cases, multiple neurological signs presented together, a statistical correlation of individual neurological signs and localization of disc herniation was not feasible. Multiple signs of root compression viz pain projection, motor and sensory localizing signs were necessary for accurate diagnosis of level particularly with S1 root signs, as large number of L4-L5 herniation also compress the S1 root composite correlated with observations of Kortelainen *et al.* [11].

In our study, plain radiograph was poorly correlated with both level diagnosis and severity of symptoms. Disc space reduction was the most common abnormality on plain skiagram 15.38%, it correlated with the correct level of herniation in only 15.38% of the cases. Plain x ray are useful in ruling out other abnormalities presenting as disc herniation such as lumbar spondylosis, lumbar canal stenosis, spondylolisthesis, tuberculosis of lower lumbar spine ,congenital anomalies, haemangioma, space occupying lesions and transitional vertebrae. The finding of claw spurs and reduced disc space on plain X-ray did not correlated with the degree of symptomatology as also suggested by Frymoyer [8].

In our study, MRI was correlated with surgical findings in 92.3% of cases with false negative in 20%. In one patient MRI showed posterocentral disc at L4-L5 and posterolateral disc at L5-S1, but preoperatively patient had only canal stenosis and foraminal stenosis. While in another patient ligamentary hypertrophy was wrongly reported by MRI. In other patient extruded disc was found to be a far lateral disc on surgically exploring it.

Our study showed a higher incidence at L4-L5 herniation in accordance with Spangfort [7]who showed marginally higher incidence of L4-L5 herniation as compared to L5-S1 herniation. Spangfort[7]also suggested higher incidences of L5-S1 herniation in younger patients and of L4L5 herniation in adolescents.

On MRI, Double level herniation occurred in 25 % of patients which was higher as compared to Chandra *et al.* [6] and Armstrong [13] and Spangfort [7].

More disc height reductions and more number of Osteophytes were seen in L5-S1 level where as more Spinal canal narrowing, lateral recess narrowing , neural foramen compression as well as Facetal hypertrophy and ligamentum hypertrophy seen at L4-L5, that correlated with lumbar canal stenosis in our study. Similar observation was also made by PokhrajSuthar [23].

Both levels were explored in cases where either the imaging modality or clinical findings suggested a double level herniation, We felt exploration at two levels by fenestration did not cause any greater morbidity and it had the additional advantage that in cases with recurrence of severe post-operative back pain one additional doubt factor was eliminated. The same view is also held by Chandra *et al.* [6]. However long term results are still awaited, to conclusively prove our observation.

In this study, protrusion was found in 53.84 % twenty eight patients, while extrusion in sixteen patients (30.76%), sequestration and no disc was observed in four patients each (7.7%) that was in accordance with a similar Indian study by Vivek Sharma *et al.* [12].

The type of prolapse disc was also evaluated and it was found that the incidence of far lateral herniation was 8 %

Study	Incidence of lateral disc
Abdullah AF[19]	3-10%
Siebner HR[20]	4 %
Vivek Sharma [12]	8.9 %
Present study	8%

In terms of Visual Analogue Score and Oswestry Disability Index , significant improvement was seen as VAS fell from 7.04 to 3.67 post operatively and ODI from 63.25 to 37.54.

All patients were made to ambulate on the next day. Few precautions were observed for two weeks e.g. avoidance of Indian style of toilets, forward bending, sitting not more than thirty minutes. Isometric exercises of back were started after two weeks. Analgesics were used for 3-4 days only. Most patients joined there old occupation after six weeks, except the manual labourer who took about 8- 10 weeks after operation. Four patient 7.69% had recurrence of symptoms after six months. One of these patients initially had disc at L4L5, was operated upon and subsequently presented with disc at L5S1 and was re-operated. Other three were maintained on physiotherapy. These patients had persistent mild pain at back, but this pain did not interfered with activity of daily living.

We encountered two wound infections, that were superficial and were promptly managed my antibiotics for 2 weeks. One case of dural rupture was also encountered that was managed with air tight closure of the wound. Post operatively acetazolamide 250 thrice a day was used for 5 days to prevent CSF leak.

The incidence of caudaequina was 9.6% much higher than in western literature (Spangfort [7] 1.2%,

Knudson [21] 2% and Busch 2%) but similar to Indian studies Sharma [22]13% and Chandra6 7%. Our hospital being a tertiary hospital, it could be due to selection bias. Most of these patients (3 out of 5) came to us after severe damage to nerve roots. We agreed with Sankaran and Tandon [22] contention that relief of pain in caudaequina is of grave prognostic significance. All these patients improved after surgery. Sensory deficit improved in two of these patients till six months of follow up.

The negative exploration rate in our study was 7.69%, similar to Spangfort [7]. One patient had canal stenosis with hypertrophic ligamentumflavum reported as disc at L5S1 on MRI other patient had congenitally formed L5 laminae and thickened and inflamed bilateral L5 nerve roots however patient had normal disc at L4L5 and L5S1. In one patient, dural cyst was reported as disc on MRI. In fourth patient had the dura adhered to ligamentumflavum and was reported as Ligamentumflavum hypertrophy

RECOMMENDATIONS

- Decompression surgeries have good outcome.
- MRI is the standard imaging modality for detecting disc pathology due to its advantage of lack of radiation, multiplanar imaging capability, excellent spinal soft-tissue contrast and precise localization of intervertebral discs changes
- MRI must be read thoroughly and precisely.
- MRI is able to demonstrate accurately the structural changes in the disc, the size and the site of the sequestrum or protrusion. However, these images are not useful in predicting neurological deficit, and therefore should not be used as indication for surgery unless there is strong correlation with the clinical findings. Clinical follow-up demonstrated no significant correlation with the MRI images.
- Awareness is needed of this very common problem and proper protective measures can be taken to prevent the disease in early age, like giving proper time for exercise and prolonging life. It is very necessary to keep risk factors like smoking, weight lifting, prolonged driving, psychosocial factors, and accidents away from our life style.

CONCLUSION

When multiple signs of single root compression were present the offending disc herniation could be localized with higher degree of accuracy. Plain radiography is an unreliable aid in identifying the level of herniation as well as predicting degree of symptomatology. MRI scan was found to have accuracy rate of 92.3% with false negative of 20%. MRI is helpful in identifying the site of sequestered disc, thickened calcified ligamentumflavum and in repeat surgery.

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