

A Prospective Study of Spectrum of Lumbar Disk Herniation and Its Surgical Outcome

¹Vishwanath Sidram, ²Chandrakumar PC, ³Raghavendra Bellara

ABSTRACT

Objectives: To study the surgical outcome of lumbar disk herniation and factors influencing the surgical outcome.

Materials and methods: A case series study of 200 patients with herniated lumbar disk were studied in setting of tertiary hospital in the Department of Neurosurgery at Vijayanagara Institute of Medical Sciences, Bellary, Karnataka during the period of June 2013 to January 2015. Among the selected patients, the sociodemographic profile, clinical profile, radiological profile, and the surgical interventions were undertaken and the outcome was noted. The MacNab scale was used to determine the clinical outcome after surgery. All patients were followed for a period 6 months postoperatively for the presence of complications.

Results: Mean age of the patients was 45.63 ± 18.54 years with 61% of males and 39% of them were females. L4-L5 interspace was involved in 138 cases (68.0%), disk was protruded in 54% of the cases, and extruded in 28% of the cases. According to MacNab's criteria, in this study "Excellent" outcome was seen in 146 patients (73%), outcome was "Good" in 45 (22.5%) patients, "Fair" in 7 (3.5%) patients, and "Poor" in 2 cases (1%). Better surgical outcomes were associated with younger patients ($p=0.002$), disk prolapse at the level of L4-L5 ($p<0.001$), extruded and protruded type of disk prolapse ($p=0.034$), and disk prolapse precipitated by lifting inappropriate weight ($p=0.002$).

Conclusion: The outcome of lumbar discectomy depends more on patient's age, level and type of disk prolapse, factors precipitating disk prolapse, and patient selection than on surgical technique.

Keywords: Disk prolapse, Lumbar disk herniation, MacNab's criteria, Surgical outcome.

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¹Professor, ^{2,3}Associate Professor

^{1,2}Department of Neurosurgery, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka, India

³Department of Community Medicine, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka, India

Corresponding Author: Vishwanath Sidram, Professor Department of Neurosurgery, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka, India, e-mail: vsidram@gmail.com

INTRODUCTION

Lumbar disk herniation represents one of the most common problems that a neurosurgeon will be called upon to evaluate. In the modern world, day-by-day, there is rise in lumbar intervertebral disk prolapse requiring medical attention.¹ At some point in any individual life time, 80% of them will develop chronic back conditions.² "Back pain is considered as one of the most unrewarding problems in clinical medicine." Is it correct? There existed several etiologies for the same and most of them do not have an ideal clinical presentation. Only those syndromes associated with neurologic compression of the caudaequina or nerve roots have reasonably well-understood clinical presentation.³

Lumbar disk prolapse constitutes about 1% of cases with back pain.⁴ The main objective of conservative or surgical management is improvement in the functional outcome of the patient. Many approaches have evolved since the introduction of the first surgical method for treatment of ruptured intervertebral disk by Mixter and Barr.⁵ Among the surgical management, laminectomy and discectomy are the common procedures performed for the management of intervertebral disk prolapse.⁶

With this background we aimed at studying the surgical outcomes of lumbar disk herniation by conducting a comparative study between different surgical techniques and also to study the factors affecting the surgical outcome.

OBJECTIVES

- To study the surgical outcome of lumbar disk herniation.
- To study the factors influencing the surgical outcome.

MATERIALS AND METHODS

Study Design and Setting

A case series study of 200 patients with herniated lumbar disk were studied in setting of tertiary hospital in the Department of Neurosurgery at Vijayanagara Institute of Medical Sciences, Bellary, Karnataka, India during the period of June 2013 to January 2015.

Inclusion and Exclusion Criteria

The inclusion criteria were radicular pain and evidence of nerve-root irritation with a positive nerve-root irritation

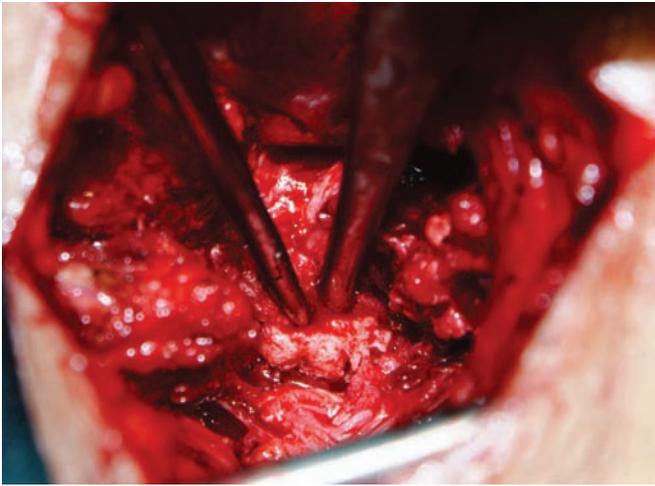


Fig. 1: Intraoperative photograph showing extruded disk compressing L5 nerve root

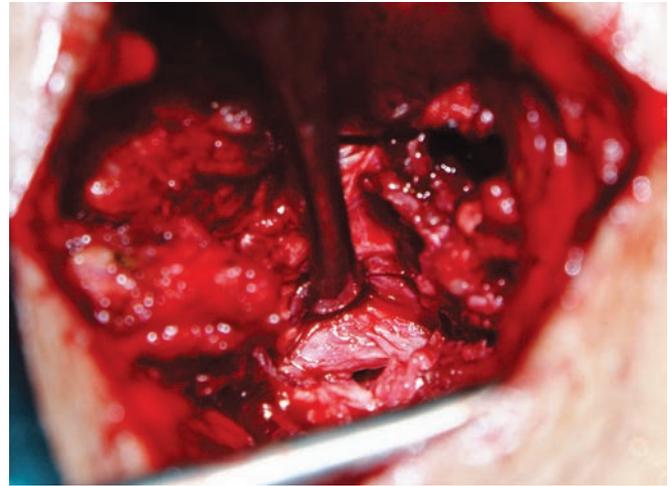


Fig. 2: Intraoperative photograph showing decompressed canal after removing disk

sign or neurological deficit. All were considered surgical candidates with neuroimaging demonstrating herniated disk that was related to their symptoms and persistent symptoms despite nonoperative treatment for at least 6 weeks.

Exclusion criteria were prior lumbar surgery, scoliosis more than 15°, segmental instability, vertebral fractures, spine infection or tumor, inflammatory spondyloarthropathy, pregnancy, comorbid conditions contraindicating surgery, or unwillingness to have surgery within 6 months.

Diagnosis

All patients underwent magnetic resonance imaging (MRI) study of the lumbar spine to assess the level and type of the herniation of the intervertebral disk.

Data Variables

Among the selected patients the sociodemographic profile, clinical profile, radiological profile, and the surgical interventions were undertaken and the outcome was noted. After initial clinical assessment, MRI of the lumbar spine was done in all the patients to assess the position, level, and type of the herniation of the intervertebral disk.

Surgical Procedures

Surgical procedures consisted of laminectomy, hemilaminectomy, and the interlaminar fenestration technique.^{7,8}

In laminectomy and hemilaminectomy (Figs 1 and 2), the whole or half portion of the lamina was removed respectively along with overlying ligaments. In interlaminar fenestration, the lamina was removed partially whenever necessary, and the herniated fragment was removed (Fig. 3) after retracting the nerve roots. The remaining nucleus in the disk space was preserved as



Fig. 3: Disk specimen

much as possible. Free fat grafts were placed over the root and the dura at the end of each procedure to prevent excessive adhesion.⁹⁻¹¹ All the patients were followed up at least up to 6 months postoperatively for the presence of complications and neurological deficits.

Assessment of Clinical Outcome after Surgery

The MacNab scale was used to determine the clinical outcome after surgery.¹² The state of satisfaction was graded as excellent, good, fair, or poor. Excellent result meant that the patient had no complaints and was able to return to full working capacity. Good result indicated that the patient had full working capacity but slight low back and leg pain. Excellent or good were regarded as satisfactory outcome. Fair result indicated that the patient does not have normal working capacity; low back and leg pain was reduced but the patient still required the administration of analgesics. Poor result meant that the degree of pain is unchanged or worse and the patient required regular administration of analgesics.¹³

Statistical Analysis

Appropriate descriptive statistics were used to describe the sociodemographic profile, clinical, radiological profile, and outcome of the patients, and the difference in the rates of outcome was tested using chi-square/Fisher's exact test and p-value of <0.05 was considered to be statistically significant.

Ethical Committee Approval

The study was given ethical approval by Ethical Review Committee of Vijayanagara Institute of Medical Sciences. All ethical requirements, including confidentiality of identity, responses and informed consent, were stringently ensured throughout the project.

RESULTS

A total of 200 cases were included in the study among which nearly two-thirds of them (60%) were in the middle age group (30–49 years), followed by 50 to 59 years (22.5%) and 20 to 29 years (9.5%). Under the extremes of age, 6.5% of them were in the age group ≥60 years and 1.5% of them were in the age group of 1.5%. Mean age of the patients was 45.63 ± 18.54 years with 61% of males and 39% of them were females. Three-fourths of them were below the poverty line (BPL) card holders and the remaining one-fourth of them were above the poverty line (APL) card holders (Table 1).

In more than half of the patients (55%), there was insidious onset of the symptoms and in 35% of them symptoms followed after lifting an inappropriate weight and in another 10% it was followed after trauma and twisting injury (Table 2).

Low back pain (94%), radicular pain (96%), numbness of the limbs (61%), and weakness (47%) were the predominant presenting symptoms and the other less common symptoms were bowel bladder disturbances (11%) and paresthesia (26%) (Table 2).

On clinical examination, straight leg rising test was positive in 91% of the cases, motor deficit was present in 77% of the cases, sensory deficit in 66.5% of cases, and sciatic irritation was observed in 67% of cases. Limitation of spine movement was present in 46% of cases and local tenderness was elicited in 28% of the cases (Table 2).

After initial clinical assessment, MRI of the lumbar spine was done in all the patients to assess the position, level, and type of the herniation of the intervertebral disk. L4-L5 interspace was involved in 138 cases (68.0%) (Fig. 4), L5-S1 in 52 cases (26.0%), L3-L4 in 9 patients (4.5%) (Fig. 5), and upper levels in 3 patients (1.5%). The disk was protruded 54% (Fig. 4) of the cases, extruded in 28% (Fig. 6) of the cases, sequestered in 12% of the cases and no bulge was observed in 6% of the cases (Table 3).

Table 1: Sociodemographic profile of the patients

<i>Sociodemographic profile of the patients (n = 200)</i>		
<i>Variable</i>	<i>Frequency</i>	<i>Percentage</i>
<i>Age group (years)</i>		
10–19	3	1.5
20–29	19	9.5
30–39	54	27.0
40–49	66	33.0
50–59	45	22.5
≥60	13	6.5
Mean ± SD		
<i>Sex</i>		
Male	122	61.0
Female	78	39.0
<i>SES*</i>		
APL	50	25.0
BPL	150	75.0

*Socioeconomic status; APL: Above poverty line card holders; BPL: Below poverty line card holders

Table 2: Clinical profile of the patients

<i>Clinical profile of the patients (n = 200)</i>		
<i>Variable</i>	<i>Frequency</i>	<i>Percentage</i>
<i>Mode of Onset</i>		
Insidious	110	55.0
Lifting inappropriate weight	70	35.0
Trauma	12	6.0
Twisting injury	8	4.0
<i>Symptomatology</i>		
Low back pain	188	94.0
Radicular pain	192	96.0
Numbness	122	61.0
Weakness	94	47.0
Bowel/bladder disturbances	22	11.0
Paraesthesias	52	26.0
<i>Signs</i>		
SLRT (Lasegue test)	182	91.0
Motor deficit	154	77.0
Sensory deficit	133	66.5
Local tenderness	56	28.0
Sciatic irritation	134	67.0
Limitation of spine movement	92	46.0



Fig. 4: An MRI T2 image showing protruded disk at L4-L5 level



Fig. 5: An MRI T2 image showing protruded disk at L3-L4, L4-L5, and L5-S1 levels



Fig. 6: An MRI T2 image showing extruded disk at L4-L5 level

Table 3: Radiological profile of the patients

Radiological profile of the patients (n = 200)		
Variable	Frequency	Percentage
<i>Level</i>		
L2-L3	3	1.5
L3-L4	9	4.5
L4-L5	136	68.0
L5-S1	52	26.0
<i>Type</i>		
Extruded	56	28.0
Protruded	108	54.0
Sequestered	24	12.0
No bulge	12	6.0

Table 4: Surgical intervention undertaken among the patients

Surgical intervention undertaken among the patients		
Procedure	Frequency	Percentage
Laminectomy	74	37.0
Hemilaminectomy	92	46.0
Interlaminar fenestration	22	11.0
Microdiscectomy	12	6.0
Total	200	100.0

Surgical intervention was done in all patients where 92 patients (46%) underwent hemilaminectomy, in 74 patients (37%) laminectomy was performed, interlaminar fenestration was performed in 22 patients (11%), and in the remaining 12 patients (6%) microdiscectomy was done (Table 4).

Table 5: Complications and outcome based on MacNab's criteria

Complications and outcome based on MacNab's criteria (n = 200)		
Variable	Frequency	Percentage
<i>Complications</i>		
Wound infection	5	2.5
CSF leak	2	1.0
Dural tear	4	2.0
Neurological deficits	5	2.5
Urine retention	3	1.5
Discitis	1	0.5
<i>Outcome (MacNab's criteria)</i>		
Excellent	146	73.0
Good	45	22.5
Fair	7	3.5
Poor	2	1.0

According to MacNab's criteria, in this study "Excellent" outcome was seen in 146 patients (73%), outcome was "Good" in 45 (22.5%), "Fair" in 7 (3.5%), and "Poor" in 2 cases (1%). Wound infection (2.5%) and neurological deficits (2.5%) were the common complications followed by dural tear (2%), urine retention (1.5%), and cerebrospinal fluid (CSF) leak (1%) (Table 5).

disk prolapse at the level of L4-L5 had better outcome (excellent 77.9%, good 20.6%) compared with other levels of disk prolapse. Patients with extruded (excellent 75%, good 23.2%) and protruded (excellent 76.9%, good 20.6%) type of disk prolapse had better outcome after surgical intervention compared with other types of disk prolapse. This association between factors precipitating disk prolapse, level, and type of disk prolapse was found to be statistically significant (Table 6).

A statistically significant association was observed between outcome and age of the patient ($p = 0.002$), mode of onset ($p = 0.002$), level ($p < 0.001$), and type of disk prolapse (0.034). As the age of the patient increased more than 60 years, the proportion of patients with excellent (38.5%) and good (30.8%) outcome also decreased when compared to rest of the age groups (Table 6).

All types of surgical intervention had similar outcome, however, patients who underwent microdiscectomy had lesser proportion of patients with excellent (66.7%) and good (25%) outcomes compared with other

Table 6: Factors influencing the outcome among the patients

Variable	MacNab's criteria				p-value
	Excellent n (%)	Good n (%)	Fair n (%)	Poor n (%)	
<i>Factors influencing the outcome among the patients</i>					
<i>Age group (years)</i>					
10–19	2 (66.7)	1 (33.3)	0 (0.0)	0 (0.0)	0.002
20–39	56 (76.7)	16 (21.9)	1 (1.4)	0 (0.0)	
40–60	83 (74.8)	24 (21.6)	3 (2.7)	1 (0.9)	
>60	5 (38.5)	4 (30.8)	3 (23.1)	1 (7.7)	
<i>Mode of onset</i>					
Insidious	70 (63.6)	35 (31.8)	4 (3.6)	1 (0.9)	0.002
Lifting inappropriate weight	63 (90.0)	6 (8.6)	1 (1.4)	0 (0.0)	
Trauma	8 (66.7)	2 (16.7)	1 (8.3)	1 (8.3)	
Twisting injury	5 (62.5)	2 (25.0)	1 (12.5)	0 (0.0)	
<i>Level</i>					
L2-L3	2 (66.7)	0 (0.0)	0 (0.0)	1 (33.3)	<0.001
L3-L4	3 (33.3)	2 (22.2)	3 (33.3)	1 (11.1)	
L4-L5	106 (77.9)	28 (20.6)	2 (1.5)	0 (0.0)	
L5-S1	35 (67.3)	15 (28.8)	2 (3.8)	0 (0.0)	
<i>Type</i>					
Extruded	42 (75.0)	13 (23.2)	1 (1.8)	0 (0.0)	0.034
Protruded	83 (76.9)	22 (20.4)	2 (1.9)	1 (0.9)	
Sequestered	13 (54.2)	8 (33.3)	3 (12.5)	0 (0.0)	
No bulge	8 (66.7)	2 (16.7)	1 (8.3)	1 (8.3)	
<i>Procedure</i>					
Laminectomy	54 (73.0)	17 (23.0)	2 (2.7)	1 (1.4)	0.996
Hemilaminectomy	68 (73.9)	20 (21.7)	3 (3.3)	1 (1.1)	
Interlaminar fenestration	16 (72.7)	5 (22.7)	1 (4.5)	0 (0.0)	
Microdiscectomy	8 (66.7)	3 (25.0)	1 (8.3)	0 (0.0)	

surgeries performed. But this difference in the outcome rates was not statistically significant (Table 6).

DISCUSSION

Management of lumbar disk prolapse has been extensively studied because of its economic impact but the results vary with respect to demographic features, clinical presentations, radiological diagnosis, surgical outcome, and the contributing factors, according to the society and the method of investigation.^{14,15} In this study we intended to report the outcome of series of 200 patients in whom the surgical procedures were performed by a single team.

Mean age of the patients in our study was 45.9 years. Majority of the patient's age group ranged from 20 to 60 years (87%) involving productive life years of an individual. Our study results are in consonance with the study done by Mahmood et al where the mean age of the patients was 46.3%. The age groups mainly affected in other studies and were between 16 and 69 years (the average was 38 years), so it can be concluded that lumbar disk herniation mainly affects working group of the society and the disease affects the financial issues of the involved population.¹⁶

In our study, male to female ratio was 1.56 which similar to other reported series where the ratio was 1.88

in a study done by Yorimitsu⁹ and his colleagues, 2.6 in another study by Akbar and Mahar,¹² and 1.5 in a study done by Mahmood et al¹⁶ and this male preponderance for disk prolapse can be explained by the fact that men are exposed to more severe mechanical stresses compared with women.

In our cases the most common presenting symptom was radicular pain (96%) and axial low back pain (94%) ranked the second. This was compatible with other series^{9,16} wherein the rate of presentation was 93.8 and 98%.

The occurrence of lumbar disk prolapse was highest at L4-L5 (68%) and L5-S1 (26%) levels in our study. Similar frequency of occurrence of involvement of lower lumbar disk was reported in other studies, like Mahmood et al¹⁶ (87.3%) and Brandenburg and Traynelis¹⁷ (90%). This may be explained by the fact that in the upper lumbar spine, extra-foraminal space is proportionally larger than the lower lumbar levels and the increased mobility of lower segments results in earlier degeneration and disk herniation.¹⁸

Our study showed that the most common finding in clinical examination was positive Lasegue [straight leg raising (SLR)] test seen in 91% of cases, motor and sensory deficit was seen in 77 and 66.5% of the cases respectively. Ben-Eliyahu¹⁴ and Mahmood et al¹⁶ reported

that 86 and 73.9% of the patients had a positive SLR test before surgery.

The choice of surgical approach in treating disk prolapse depends on the patient selection. In our study, hemilaminectomy (46%) and laminectomy (37%) were the common surgical procedures done in treating the disk prolapse. The surgical outcome was gauged using MacNab's criteria. In this study, "Excellent" outcome was seen in 146 patients (73%), "Good" in 45 patients (22.5%), "Fair" in 7 patients (3.5%), and "Poor" in 2 patients (1%). Using the same criteria, Mahmood et al¹⁶ also observed similar surgical outcomes where "Excellent" outcome was seen in 71.7% of patients, "Good" in 21.9%, "Fair" in 4.4%, and "Poor" in 2% of the patients. There are both subjective and objective criteria of assessing the surgical outcome of the patients operated for disk prolapse. Different studies adopt different criteria for assessment. However, the review of literature shows that the reported success rate ranges from 50 to 93%. Lakicević¹⁹ reported that good outcome occurred in 73% of his patients and in the other cases the results were fair or poor. Graver et al²⁰ analyzed outcomes of 122 patients suffering from lumbar disk herniation that underwent surgery. This study reports good result for 90% of patients and 6% reoperation. Approximately, 80 to 90% of patients usually obtain good results with traditional hemilaminectomy and discectomy.^{7,21}

In the study, by Akbar and Mahar, 50% of the patients had excellent results, while 40% obtained good results.¹² According to the study by Manish Garg and Sudhir Kumar, good results were obtained in 86% of the cases.²²

In our study we did not find any statistically significant difference in the surgical outcomes with respect to type of surgery ($p=0.996$). In other studies we observed a statistically significant relation between interlaminar fenestration and best surgical outcome.^{16,19} There was no difference in the surgical outcomes with respect to sex of the patients ($p=0.629$). Similar results were observed by Mahmood et al,¹⁶ but in Graver study,²⁰ the outcomes of surgeries on male were better than females.

We found a significant correlation between the age and outcome. In our study, younger patients (<60 year) had more favorable outcome after surgical intervention ($p=0.002$). This finding was inconsonant with the results of study done by Mahmood et al¹⁶ and Ankur Mittal et al.² However, Klein and Garfin¹⁵ showed that there is not any relationship between age and outcomes. In our study, better surgical outcomes were associated with disk prolapse at the level of L4-L5 ($p<0.001$), extruded and protruded type of disk prolapse ($p=0.034$), and disk prolapse precipitated by lifting inappropriate weight ($p=0.002$).

The most common complication in our series was superficial wound infection that occurred in 2.5% of our

patients and resolved completely with antibiotic therapy. Neurological deficit showed in 2.5% of our cases and discitis occurred in 0.5%. Similar complications were observed by Mahmood et al.¹⁶ There was no mortality in our study.

CONCLUSION

The success rate (including excellent and good outcome) in our study was 95.5%. Therefore, surgery can be considered as a safe and useful option, especially in cases intractable to conservative treatments. The outcome of lumbar discectomy depends more on patient's age, level and type of disk prolapse, factors precipitating disk prolapse, and patient selection than on surgical technique.

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