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A Prospective Study of Lumbar Intervertebral Disc Prolapse by Open Lumbar Discectomy

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ABSTRACT

Introduction: Sciatica, a common presenting complaint in routine clinical practice, is often caused by the herniation of the nucleus pulposus within an intervertebral disc. Lumbar intervertebral disc prolapse has traditionally been treated most effectively through surgical interventions. The study aims to investigate the clinical manifestations of lumbosacral intervertebral disc prolapse in patients, evaluate the outcomes of open lumbar discectomy for such cases, and examine the impact of this surgical procedure on pain, vertebral tenderness, and SLRT (Straight Leg Raising Test).
Methodology: This is a prospective observational type of study done from December 2020 till June 2022 and post-operatively all the patients were followed up till September 2022. Sample size was 30 cases were included in the study. This study was conducted in DR. B.R.AMBEDKAR MEDICAL COLLEGE AND HOSPITAL on patients who were diagnosed with lumbosacral intervertebral disc prolapse aged between 30 to 80years of age .After obtaining their written informed consent, data was collected regarding basic demographic details. Pain, Tenderness and Straight leg rising test (SLRT) was used to assess the outcome measures at 1week, 6week and 3months intervals.
Results: Majority of the patients were Male patients (63.33%) female patients (36.67%) in incidence. The mean age of patients was 47.53 years (18 to 60 year), L4 - L5 was the most common disc to herniated. 28 patients (93.33%) out of 30 patients showed significant improvement It was found to be statistically significant with respect to MACNAB score and JOAS score during their Post –op 0weeks, 1week, 3week, 12week.Complications after the surgery were found to be superficial infection in 2 (6.67%) cases, CSF Leak in 1 case (3.3%), post op blood loss (>100 ml) in 20 cases (66.67%).
Conclusion: Hence, Open lumbar discectomy always remains as a gold standard as it has the better visualization of the bulged disc, allows complete removal of the bulged disc and better after removal of the disc material, freeness of the nerve roots can be better visualized.

Key Words: *Intervertebral disc prolapsed, Open lumbar discectomy, SLRT*

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INTRODUCTION

Sciatica, which is often due to the herniation of an intervertebral disc's nucleus pulposus, is a frequently observed symptom among patients consulting in everyday clinical practice, with an annual incidence of 1 to 5% [1-3]. Despite its noticeable clinical impact on only 1-2% of people, lumbar disc disease reveals a much higher prevalence of 30% when examined with MRI [4].

Lumbar intervertebral disc prolapse most commonly affects individuals aged between 30 and 50 years but can also occur in other age groups. Despite efforts towards preventive measures, their success in preventing disc prolapse has been limited. The two predominant treatment options for lumbar intervertebral disc prolapse include:

- Conservative treatment, with epidural steroid analgesia being the most commonly utilized approach, and
- Surgical treatment, where open fenestration lumbar discectomy stands as the gold standard.

Remarkably, about 70% of patients experience symptom resolution through non-surgical treatment [5]. However, conservative management's failure may necessitate surgery in 10% of these patients [6]. Immediate surgery is unequivocally considered for cases with absolute indications, such as progressive neurological deficit and cauda equina syndrome [6-8]. The challenge arises in patients who don't respond to conservative management and whose quality of life is affected by ongoing pain [9, 10]. While surgery is a frequent recourse for such indications, there's a lack of consensus on when to transition from conservative treatment to surgical intervention. Even though non-operative treatment is considered viable for a few weeks due to the self-limited nature of lumbar disc herniation, the exact duration of this "golden period" remains undefined. Furthermore, shared decision-making concerning the patient's preference for or

against surgery often sparks debate regarding the potential consequences of delaying surgery and defining the critical period for surgical intervention.

Despite these debates, surgical management has consistently stood out as the superior treatment option for lumbar intervertebral disc prolapse. Therefore, this study aims to carry out a prospective examination of the surgical management's impact on enhancing the quality of life in lumbar disc prolapse patients within a 3-month period following the initiation of treatment.

OBJECTIVES OF THE STUDY

1) To study the clinical presentations of patients with lumbosacral intervertebral disc prolapsed.
2) To assess the outcome of open lumbar discectomy in lumbar intervertebral disc prolapsed.
3) To study the end result of open lumbar discectomy with respect to pain, vertebral tenderness and SLRT.

METHODOLOGY

Research Design: The study utilized a prospective observational design.
Study Period: The research was conducted from December 2020 through June 2022, with post-operative follow-ups for all patients continuing until September 2022.
Sample Size: The study included a total of 30 cases.

Sampling Criteria:

A) Inclusion Criteria:

- Adults aged between 30 and 80 years who experienced back pain for at least 6 weeks. This group was diverse and included both males and females from various professions, religions, and geographic regions. Participants showed evidence of lumbosacral disc herniation on MRI with or without radiculopathy.
- Cases displaying a progressive neurological deficit despite conservative treatment.

B) Exclusion Criteria:

- Individuals with back pain persisting for less than 6 weeks or without evidence of lumbosacral disc herniation on MRI.
- Asymptomatic individuals with or without evidence of lumbar disc herniation on MRI imaging.
- Cases presenting osseous causes for lumbar canal stenos is on MRI imaging.
- Cases showing signs of lumbar disc degeneration without lumbar disc herniation.
- Cases with cauda equina syndrome.

Data Collection Methods:

- Data was collected using the following methods:
- History obtained through verbal communication.
- Clinical examination.
- Baseline investigations for assessing fitness for surgery.
- X-ray of the lumbosacral spine (anterior and lateral view).
- MRI of the L-S spine.
- X-ray of the chest (AP view).
- Written and informed consent obtained for the surgical procedure.

Outcome measures, including Pain, Tenderness, and Straight Leg Raising Test (SLRT), were assessed at 1 week, 6 weeks, and 12 weeks post-operatively.

Investigations and Evaluation:

All patients underwent a detailed history taking, clinical examination, and systemic examination, coupled with the following investigations:

- X-ray of the lumbosacral spine (anteroposterior and lateral view).
- MRI of the L-S spine.
- Chest x-ray (PA view).
- Routine hematological investigations such as hemoglobin count, bleeding time, clotting time, blood grouping and typing, serology, HIV-1 and 2, HbsAg.
- Urine routine test.
- Other investigations: Serum urea, serum creatinine, random blood sugar, and ECG.

Data Analysis:

The collected data was evaluated using appropriate statistical methods to discern patterns and draw conclusions. This involved comparing the patients' pre-operative and post-operative scores in pain, tenderness, and SLRT at the specified intervals.

RESULTS

Table 1: Distribution of patients according to Age

Age(yrs)	Frequency	Percentage
30-40	8	26.67%
40-50	9	30%
50-60	10	33.33%
60-70	3	10%
Total	**30**	**100%**

Maximum number of patients belongs to the age group of 50-60yrs 10(33.33%), followed by 9 (30%)of patients belongs to the age group of 40-50yrs, 8(26.67%) patients belongs to the age group of 30-40yrs and 3(10%) patients belongs to the 60- 70yrs respectively. Meanageis47.53years±10.57.

Table 2: Distribution of patients according to Gender

Gender	Frequency	Percentage
Male	19	63.33%
Female	11	36.67%
Total	**30**	**100%**

Majority of the patients were males (63.33%) compared to females (36.67%).

Table 3: Distribution of patients according to Occupation

Occupation	Frequency	Percentage
Significant	12	40%
Non significant	18	60%
Total	**30**	**100%**

Majority of the patients had non-significant history with respect to occupation (60%) and remaining 40% of the patients had the significant history with respect to occupation

Table 4: Distribution of patients according to Pre-Op Duration of Pain

Pre-operative Pain Duration	Frequency	Percentage
6-9months	16	53.33%
9-12months	6	20%
>12 months	8	26.67%
Total	**30**	**100%**

Majority of patients had the pain duration for 6-9 months i.e, 16 (53.33%), followed by 8 patients (26.67%) and remaining 6patients (20%) had the pain duration for 9-12 months respectively.

Table 5: Distribution of patients according to Pain

Pre-operative Pain	Frequency	Percentage
B=1, L=0	2	6.66%
B=1, L=1	1	3.33%
B=1,L=2	2	6.66%
B=2,L=0	1	3.33%
B=2,L=1	7	23.33%
B=2,L=2	4	13.3%
B=3,L=3	3	10%
B=3,L=0	1	3.33%
B=3,L=1	4	13.3%
B=3,L=2	3	10%
B=3,L=3	2	6.66%
Total	**30**	**100%**

Low Back pain Scoring-B

None	0	B=0
Occasional mild pain	1	B=1
Frequent mild pain/Occasional severe pain	2	B=2
Frequent or continuous pain	3	B=3

Leg pain with/without Tingling/Numbness scoring-L

None	0	L=0
Occasional mild pain	1	L=1
Frequent mild pain/Occasional Severe pain	2	L=2
Frequent or continuous pain	3	L=3

Majority of the patients (23.33%) had B=2, L=1 pain.

Table 6: Distribution of patients according to Pre-operative Pain side

Pre-operative Pain Side	Frequency	Percentage
Right side	18	60%
Left Side	12	40%
Total	**30**	**100%**

Majority of patients presented with right side pain (60%) and remaining 12 patients (40%) had presented with left side pain.

Table 7: Distribution of patients according to Pre-operative SLRT

Pre-operative SLRT	Frequency	Percentage
<30 degree	7	23.3%
30degree– 70 degree	23	76.7%
Total	**30**	**100%**

Majority of the patients (76.7%) had presented with the 30- 70 degree of SLRT test and remaining 23.3% presented with <30 degree of SLRT Test.

Table 8: Distribution of patients according to Pre-operative Motor deficit

Pre-operative Motor deficit	Frequency	Percentage
Grade5 (Normal)	4	13.33%
Grade4(Slight weakness)	22	73.33%
Grade 0-3 (Marked weakness)	4	13.34%
Total	**30**	**100%**

Majority of the patients (73.33%) presented with Grade 4 (Slight weakness), followed by Grade 5 (Normal) and Grade 0-3 (Marked weakness) 13.34% respectively.

Table 9: Distribution of patients according to Pre-operative Sensory deficit

Pre-operative Sensory deficit	Frequency	Percentage
None	8	26.67%
Slight disturbance	20	66.67%
Marked disturbance	2	6.66%
Total	**30**	**100%**

Majority of the patients presented with slight sensory disturbance (66.67%), followed by none (26.67%) and marked sensory disturbance (6.66%) respectively.

Table 10: Distribution of patients according to Pre-operative Reflexes

Pre-operative Reflexes	Frequency	Percentage
K=0,A=0	27	90%
K=0,A=R	2	6.67%
K=R,A=R	1	3.33%
Total	**30**	**100%**

Reflexes at Knee=K, Ankle=A

Normal Grade II	**0**
Reduced	**1**
Absent	**2**

Majority of the patients (90%) presented with the Normal reflexes (K=0, A=0), followed by 2patients (6.67%) had presented with K=0, A=R and 1 patient (3.33%) had presented with K=R, A=R.

Table 11: Distribution of patients according to Pre-operative Level of disc herniation on MRI

Pre-operative Level	Frequency	Percentage
L3-L4	4	13.33%
L4-L5	22	73.33%
L5-S1	4	13.33%
Total	**30**	**100%**

Majority of the patients presented with the L4-L5 disc herniation (73.33%), followed by L3-L4 and L5-S1disc herniation (13.33%) respectively. Majority of the patients (66.67%) presented with (>100ml) of bloodloss, followed by 33.33% presented with <100ml respectively. Majority of the patients had no CSF leak (96.67%) while remaining 1 patient presented with CSF Leak (3.33%). Majority of the patients had not presented with the infection (93.33%) and remaining 6.67% had presented with the infection (6.67%) respectively. Majority of the patients had 4-6 days of hospital stay (56.67%), followed by 7-9days (33.33%) and >10days (10%) respectively.

Table 12: Distribution of patients based on the MACNAB Score

MACNAB Score	Frequency	Percentage	Pvalue
Post–op 0 week - 1 2	2 28	6.67% 93.33%	0.01
1Week - 1 2 3	1 26 3	3.33% 86.67% 10%	0.01
3 Week -1 2 3	1 4 25	3.33% 13.33% 83.33%	0.01
12Week - 1 2 3	1 1 28	3.33% 3.33% 93.33%	0.01
Total	**30**	**100%**	

(MACNAB Scoring- 1=Poor, 2=Fair, 3=Good, 4=Excellent)

During the Post-op 0 week, maximum number of patients 28 (93.33%) had the MACNAB Score 2 (Fair), during 1week after the surgery maximum number of patients 26 (86.67%) had MACNAB Score 2 (Fair), whereas in the 3weeks after surgery maximum number of patients 25 (83.33%) had MACNAB Score 3 (Good), whereas in the 12week after surgery maximum number of patients 28 (93.33%) had MACNAB Score 3. It was found to be statistically significant with respect to MACNAB score during their Post –op 0week, 1week, 3week, 12week.

Table 13: Distribution of patients based on the JOA Score

JOAS Score	Frequency	Percentage	Pvalue
Post–op0week- 0	1	3.33%	0.01
1	19	63.33%	
2	10	33.33%	
3	3	10%	
1 Week -0	1	3.33%	0.01
1	9	30%	
2	20	66.67%	
3 Week -1	3	10%	0.01
2	27	90%	
12 Week -1	2	6.67%	0.01
2	16	53.33%	
3	12	40%	
Total	**30**	**100%**	

(JOAS Scoring-0=Poor (<49%), 1=Fair (50-74%), 2=Good (75-89%), 3= Excellent (>90%)

Majority of the patients (19) had the fair score during the immediate post-op 0 week, 20 patients had the good score during 1st week post-operatively, 27 patients had the good score during 3rd week post-operatively and 16 patients had the good score, 12 patients had the excellent score during 12 th week post-operatively. It was found to be statistically significant with respect to JOAS score during their Post –op 0weeks, 1weeks, 3weeks, 12weeks.

Table 14: Distribution of patients based on the JOAS Score (12thweek)

JOAS Score	Frequency	Percentage
Excellent	12	40%
Fair	2	6.67%
Good	16	53.33%
Total	**30**	**100%**

Majority of the patients presented with the Good JOAS Score (53.33%), followed by Excellent score (40%) and remaining 6.67% had fair score respectively.

DISCUSSION

Lumbar disc prolapse, a major contributor to disability and impaired work capability in the young working populace, is commonly associated with low back ache. In the early 1900s, Mixter and Barr [11] were the first to diagnose this as the cause of disc prolapse and reported on surgical outcomes of discectomy in patients with low back ache. The outcomes of discectomy surgeries range from 50-89% in terms of effectiveness [12-14], with recurrence rates varying between 6-11% [12, 13 & 15]. This large range suggests that numerous factors influence the success of spine surgeries, spanning from patient selection, to post-operative physiotherapy, to potential changes in occupation.

Surgery without thorough evaluation and imaging may yield poor results. Conservative management, which yields positive outcomes in approximately 80% of cases, is important to consider in line with the natural progression of the disease. Conversely, patients with progressing neurological deficits and poor functional outcomes should not be subjected to conservative management. Patients presenting after prolonged sciatica typically have poorer outcomes.

Diagnostic imaging studies have greatly improved our understanding of the level of disc herniation and preoperative assessment of neural structures. Our study found that males are more prone to stressful activities like heavy weight lifting and prolonged sitting in their daily activities, potentially making them more susceptible to intervertebral disc prolapse. Similar results were found in other studies, with males being predominantly affected [12, 13, 16 & 17].

In our study, the mean age of patients was 47.53 years, ranging from 20 to 70 years. This aligns with findings from Richard Davis and Pappas et al [12], who reported a mean age of 42 years. The young age group (20-40 years), who engage in more work and stressful activities, may be more prone to intervertebral disc prolapse. The maximum amount of movement at the L4-L5 level subjects it to increased stress and repeated trauma, leading to degeneration and resulting in IVDP.

The majority of subjects in our study demonstrated right-sided postero-lateral disc prolapse, thereby involving the right lower limb. This was also found in other studies [17-18].

We employed open disc excision under direct vision, which offers ample exposure for lumbar disc excision with a

smaller incision, lesser morbidity, shorter convalescence, and hence a lesser complication rate. Our study reported a lower incidence of complications compared to others, with 20 cases of post-op blood loss, one case of discitis, one case of post-op CSF leak, and 2 cases of post-op infection.

As for the outcomes of open discectomy, our study revealed fair scores for the majority of patients during the immediate post-operative period (0 week). However, good scores were observed during the 1st, 3rd, and 12th post-operative weeks. These findings were statistically significant, with respect to the JOAS score at post-op 0 weeks, 1 week, 3 week, and 12 weeks.

We adopted the JOAS scoring system to evaluate the outcome of open lumbar discectomy. We found excellent results among 40% of the patients, good results among 53.3%, and fair results among 6.67% of patients. The Japanese Orthopaedic Association low backache score is a valuable tool for evaluating functional outcomes, as both subjective and objective measurements can be clearly recorded after proper evaluation. The same score can be used preoperatively and postoperatively, which is an added advantage. Our results are comparable to results obtained by microdiscectomy studies. Despite microsurgical technique being a minimally invasive approach with a shorter hospital stay, it requires a long learning curve for the surgeon and technically advanced equipment for the procedure. On the other hand, fenestration discectomy is more cost-effective and can be performed in all centers with minimal technical demand.

CONCLUSION

In conclusion, the following points were observed from our study:

- The most common presentation was back pain with radiation to the legs.
- Disc prolapse was more frequently seen in males than in females.
- The age group 30-50 years was more susceptible to disc prolapse.
- Strenuous activity was significantly linked to the risk of disc prolapse.
- The Straight Leg Raise Test (SLRT) was the most reliable sign of nerve root involvement.
- L4-L5 disc prolapse was the most common presentation.

Post-operative assessment using the MACNAB score at different stages (0 week, 1 week, 3 weeks, 12 weeks) showed a statistically significant improvement. At the immediate post-op (0 week), most patients (93.33%) had a fair score, which improved over time with 86.67% achieving a fair score at 1 week, and 83.33% and 93.33% achieving a good score at 3 weeks and 12 weeks respectively.

Additionally, using the Japanese Orthopaedic Association (JOA) Scoring system for follow-up evaluations, we found that most patients had a fair score (19 patients) immediately post-op, which improved to a good score for 20 patients at 1 week, 27 patients at 3 weeks, and 16 patients at 12 weeks post-operatively. At the 12-week mark, 12 patients achieved an excellent score. These findings were statistically significant with respect to JOAS score at each follow-up period.

In terms of complications, superficial infection occurred in 2 cases (6.67%), CSF Leak in 1 case (3.3%), and post-operative blood loss (>100 ml) in 20 cases (66.67%).

In light of these findings, it can be concluded that Open Lumbar Discectomy remains the gold standard for the management of disc prolapse. This is primarily due to its advantages of better visualization of the bulged disc, enabling complete removal of the bulged disc, and allowing better assessment of nerve roots' freedom after removal of the disc material.

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