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Assessment of Pain and Neurological Involvement in Patients with Lumbar Intervertebral Disc Prolapse Who Underwent Fenestration Discectomy

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ABSTRACT

Background: Many factors cause low back pain, but lumbar disc prolapse is a significant cause in adults. It drastically affects the overall quality of life. Treatment for this includes conservative measures and discectomy, primarily fenestration discectomy, less damage to other body parts, quicker recovery time, and improved overall results. Pain relief and neurological recovery are the most important measures of success, and many patients have had good outcomes with this procedure. To evaluate postoperative pain relief and neurological involvement in patients undergoing fenestration discectomy for lumbar disc prolapse.

Methods: This prospective, observational cohort study at Hindu Rao Hospital from June 2019 to June 2021 evaluated fenestration discectomy in thirty patients with magnetic resonance imaging-proven lumbar disc herniation with radiculitis. It focused on clinical outcomes, functional recovery, and complications in the same group of patients for much better reliability in findings.

Results: The study evaluated 30 patients with low back pressure due to disc prolapse, showing that the most commonly affected lumbar disc levels were L4-L5 and L5-S1. Significant improvement has been seen in postoperative recovery functional scores, JOA, and VAS in pain, with great recovery in the first month, which continued to improve up to 6 months.

Conclusion: This research showed significant enhancements in pain and functional status after surgery for lumbar disc prolapse, extending to six months of post-surgical follow-up.

Key-words: Low back pain, Lumbar disc prolapse, Fenestration discectomy, Neurological, Musculoskeletal condition

INTRODUCTION

One of the most debilitating conditions in the world, low back pain affects people of all ages. A prevalent musculoskeletal condition that affects people worldwide is low back pain.

One of the main reasons for low back pain with a significant morbidity rate is lumbar disc prolapse worldwide, primarily affecting young people in the working class. Lumbar intervertebral disc prolapse is a common disorder that substantially affects individuals' quality of life. The displacement of disc material outside the usual confines of the intervertebral disc space often compresses surrounding neural structures, resulting in a range of symptoms, such as regional back pain, radiating leg discomfort (sciatica), sensory abnormalities, & motor dysfunction. This disease places a significant strain on healthcare systems and is among the primary causes of disability worldwide. Conservative and surgical

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treatments have advanced due to the need for efficient treatment modalities [1,2].

The prevalence of lumbar disc prolapse is highest among people in their fourth and fifth decades of life. However, it affects people of all ages worldwide. Age, lifestyle choices, and occupational hazards all increase the risk of disc herniation by degenerating intervertebral discs. In addition to causing physical discomfort, this ailment presents psychological and socioeconomic difficulties, highlighting the significance of prompt diagnosis and treatment [3].

Since the outcome of surgery is dependent on numerous criteria, including a thorough clinical history, Disk prolapse may be differentiated among different causes, such as sciatica and low back pain, with careful patient screening, a physical examination, and relevant radiological investigations [4].

Conservative treatments like medication, physical therapy, and lifestyle changes are frequently used in the early stages of lumbar disc prolapse care. Although a sizable percentage of patients find that these methods help them with their symptoms, some people may need surgery if their symptoms are severe or persistent. A straightforward and efficient treatment for surgical excision from a prolapsed disc that has shown to be a generally safe procedure with favourable results for most patients is the treatment for severe sciatic pain [4]. Discectomy is a standard treatment for lumbar disc prolapse. Although neurologic symptoms and indicators are often considered, despite their generally lower functional value, pain is the leading indicator for lumbar disc surgery. This could be because they appear to be more objective than signals associated with pain. The fenestration technique has been frequently used for years to remove the troublesome disc because it offers certain benefits over the commonly used laminectomy operation [4,5].

By making a small fenestration in the lamina, a fenestration discectomy allows the herniated part of the intervertebral disc to be accessed and removed. Compared to open operations, this treatment is linked to less tissue damage, less postoperative pain, and faster recovery periods. The procedure's primary goals are to relieve pain and decompress the damaged nerve root, but it also attempts to restore neurological function. Therefore, improvements in motor and sensory functioning, reflexes, and general functional abilities are used to gauge the success of this procedure in addition to pain alleviation [6].

To evaluate the results of fenestration discectomy, pain alleviation and neurological recovery must be considered. Standardized techniques such as the Visual Analog Scale (VAS) or the Numeric Pain Rating Scale (NPRS) are frequently used to measure pain, a subjective and complex phenomenon. Conversely, clinical evaluations that concentrate on reflexes, motor strength, and sensory function are used to evaluate neurological results. Patient-reported outcomes, including the Oswestry Disability Index (ODI), offer information on functional gains and general satisfaction in addition to clinical measurements [5,6].

Substantial changes have been made to the lumbar discectomy procedure. Hrudey [7] described restricted disc excision, which involves removing just the ligamentum flavum and, if necessary, a tiny portion cut of the inferior lamina to extract the extruded disc and expose the prolapsed disc area. In 2017, Swamy *et al.* [8] said that the fenestration method of discectomy produced 93.5% good to excellent results, making it an exceptionally satisfactory approach. Compared to laminectomy, it is claimed that the fenestration discectomy approach requires less time, causes less blood loss, has fewer postoperative complications, and preserves spine stability because of the surgery's intrinsic less invasive character.

MATERIALS AND METHODS

Research Design- This study was conducted during the prospective observational cohort study in the Department of Orthopaedics at Hindu Rao Hospital, Malka Ganj, Delhi, from June 2019 to June 2021 for two years. This study design was meant to analyse fenestration discectomy outcomes in patients with lumbar disc herniation. A cohort of patients made prospective observations to collect that information systematically and analyse it based on clinical outcomes, functional parole, and complications that the patients of procedures might endure. The research was performed in one of the tertiary care hospitals; in this case, it was Hindu Rao Hospital, which provided access to a diverse patient population through both the emergency and outpatient departments. The advanced diagnostic facilities, including MR imaging at the hospital, set the basis for the patient's inclusion as they could accurately

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identify the lumbar disc herniation and its radiculitis. Patients with MRI confirmation of lumbar disc herniation in whom clinical symptoms and signs of radiculitis, such as pain along the nerve path, sensory abnormalities, or motor deficits, were considered the populations in this study. The inclusion criterion ensured a homogeneous group of individuals affected directly by the condition under investigation which would have increased the reliability of findings. Therefore, the total number of patients included in the present study is 30. The sample size calculation was based on a previous study by Dr. Mohan Kumar et al., who reported very good or fair results in 96.6% of patients undergoing fenestration discectomy. The minimum requirement of sample-size calculation could be computed using the following formula:

$$N \geq (p(1-p))/(ME/z\alpha)2$$

Where:

- ✓ p= Proportion of patients with excellent or fair outcomes (0.966)
- ✓ ME= Margin of error (6.5%)
- ✓ zα= Z-value for a 5% level of significance (1.96)

Thus, the research supports the statistical prerequisites in achieving validity and accuracy in the parameter. Patients were recruited consecutively to the facility at the time of presentation and meeting the inclusion criteria. Data collected uniformly included demographic details, clinical signs and symptoms of the diseases, MRI findings, and post-surgery outcomes. These patients have been followed up to account for functional recovery and symptom resolution over time. Prospective cohort design offered real-time data capture whilst minimizing recall bias. Observational methodology ensured clinical practice was never changed for research purposes and maintained external validity. This study sought to provide proof of fenestration discectomy as a productive and safer management method of lumbar disc herniation to enrich clinical orthopaedics.

Inclusion Criteria

- Age-20-65 years
- Lumbar disc herniation with evidence of exiting nerve root compression in MRI with symptoms of radiculopathy.
- Clinical examination confirmed with MRI finding
- Back pain with radicular pain of more than 6 weeks duration.
- Failure to respond to non-operative treatment.

Exclusion Criteria

- Back pain for less than 6 weeks duration.
- Those without evidence of lumbar disc herniation on MRI.
- Osseous cause for lumbar canal stenosis on MRI, e.g. vertebral fractures.
- Signs of lumbar disc degeneration without lumbar disc herniation on MRI.
- Presence of other associated spinal pathologies.
- Those who have had previous discectomies.
- Lack of consent.
- Spondylolisthesis > Grade 1
- Radiological evidence of facet joint arthritis.
- Prior lumbar spine surgery

Statistical Analysis- The categorical variables were described in numbers and percentages (%), while continuous variables were expressed as mean±SD and median values. The Kolmogorov-Smirnov test was applied to check for normality in data. Paired t-tests/Wilcoxon Test were used to compare quantitative variables in non-normally distributed data sets collected pre- and post-observations. We considered $p<0.05$ to be statistically significant. Data used for analysis were entered on an MS EXCEL spreadsheet and analysed through Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

Table 1 gives the distribution information to patients according to age and sex. The much-studied thirty patients-33.33% were aged 51-60 years. The next group, 30%, consisted of patients between 41 and 50. Next were those aged between 31 and 40, making up 20% of patients. The minor proportion of adults ≥61 years is 10%, and the one that includes those millions is only 6.67%, comprising patients younger than 30 years. This distribution also translates to 56.67% male patients and 43.33% female patients with a male-to-female ratio of 1.3:1. This entails that among the demographic data, it is pronounced that middle-aged and older adults of this group are the ones most affected by the weighting toward men.

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Table 1: Patient Demographics and Gender Distribution

Age groups	Frequency	Percentage (%)	Sex	No of cases	Percentage (%)
<30	2	6.67	Male	17	56.67
31-40	6	20	Female	13	43.33
41-50	9	30			
51-60	10	33.33			
>61	3	10			
Total	30	100	Total	30	100

Table 2 illustrates the level of inter-vertebral disc prolapse with the radicular pain pattern and associated neurological symptoms in 30 studied patients. The highest frequency of disc prolapse was noted in patients with an L4-L5 level comprising 46.67% of the total sample, followed by L5-S1 (33.33%), L3-L4 (13.33%), and the lowest at L2-L3 (6.67%). Radicular pain was present in 43.33% of the patients on the left side, in 36.67% on the right, and in 20%, pain was bilateral. All patients demonstrated some evidence of neurological involvement (100%) in the form of signs of nerve tension. Motor deficits were seen in 50 patients (sensor deficits in 36.67%), while combined motor and sensory involvement was noted in 30 other patients. Notably, none of the patients suffered from bladder or bowel dysfunctions. The analysis above reveals L4-L5 and L5-S1 to be among the most frequently affected disc levels, with a marked neurological and radicular pain presentation.

Table 2: Comprehensive Analysis of Disc Prolapse and Associated Symptoms

Category	Subcategory	No of cases	Percentage (%)
Level of Disc Prolapse	L2-L3	2	6.67
	L3-L4	4	13.33
	L4-L5	14	46.67
	L5-S1	10	33.33
	Total	30	100
Side of Radicular Pain	Left	13	43.33
	Right	11	36.67
	Bilateral	6	20
	Total	30	100
Neurological involvement	Nerve tension signs	30	100
	Motor	15	50
	Sensory	11	36.67
	Both Motor and Sensory	9	30
	Bladder and Bowel	0	0

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Table 3 depicts mean and standard deviation values for JOA and VAS scores pre-operated and post-operative. For the JOA score, which measures functional outcomes, statistically significant changes occur from a pre-operative mean of 16.67±1.99 to 22.9±1.67 at 2 weeks and further increase to 24.7±1.64 at 1-month post-operation, with p<0.01. Similarly, VAS goes from a pre-operative mean of 7.8±1.10 to 3.6±0.93 at 2 weeks post-operation and 2.4±0.85 at 1-month post-operation, reflecting a reduction in pain intensity. At 6 months post-operation, the VAS scores drop to 1.2±0.89, indicating permanence of improved pain management. The changes in both scores are statistically significant, with p<0.01, indicating positive outcomes post-surgery.

Table 3: mean±SD of vas and JOA score pre-operatively and postoperatively

Score Type	N	Time Point	Mean±SD	p-value
JOA Score	30	Pre-Op	16.67±1.99	<0.01
JOA Score	30	2 Weeks Post-Op	22.9±1.67	<0.01
JOA Score	30	1 Month Post-Op	24.7±1.64	
VAS Score	30	Pre-Op	7.8±1.10	<0.01
VAS Score	30	2 Weeks Post-Op	3.6±0.93	<0.01
VAS Score	30	1 Month Post-Op	2.4±0.85	
VAS Score	30	6 Months Post-Op	1.2±0.89	

Fig. 1 shows that the mean preoperative visual analog scale score in patients before the present study was 7.8, while the mean VAS scores postoperatively at 2 weeks, 1 month, and 6 months were recorded to be 3.6, 2.4, and 1.2, respectively.

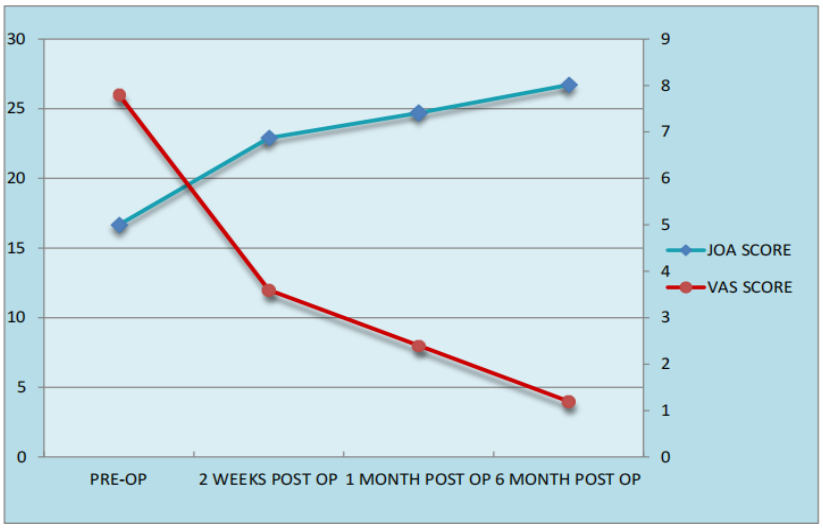

Fig. 1: Double line diagram showing the trend of JOA and VAS scores

DISCUSSION

One of the most frequent causes of back pain is a herniated lumbar disc. Discectomy offers quick relief from radicular and back discomfort. A study aimed to evaluate the results of discectomy, the gold standard treatment for treating LDH. The patients demonstrated excellent functional results. The most frequent first symptoms were numbness or discomfort in the right leg. The mODI score indicated that the patients had significantly improved clinically after surgery [9].

Fenestration discectomy is the most frequent spine surgery procedure for lumbar disc herniation symptoms. Both open and microscopic methods can be used. A study compared the functional outcome, back and leg discomfort, hospital stay, recovery to routine activities, cost, repetition, and therapy for recurrent disc

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herniation, including reoperation between the results of fenestration microdiscectomy and open fenestration discectomy. The use of microscopes within fenestration discectomy to treat symptomatic lumbar disc herniation showed similar results of open fenestration for leg pain alleviation and nerve root decompression, together with the further advantages of decreased back pain and shorter hospital stays, along with an early return to daily activities. The drawback of using a microscope is that it can be more expensive. If a microscope were used during the initial surgery for recurrent patients, the procedure would be less invasive; nonetheless, there was no appreciable change in the frequency of recurrence or reoperation using a microscope after four years of follow-up [10].

A study evaluated the effectiveness of utilizing conventional interlaminar fenestration discectomy (IFD) in association with Transforaminal endoscopic lumbar discectomy (TELD) to treat lumbar disc herniation (LDH). As TELD and traditional IFD were equally effective in treating LDH, TELD offered several benefits. The duration of bed rest, hospital stay, and intraoperative bleeding were all reduced. For the treatment of LDH, it can be regarded as a safe and efficient surgical approach [11].

Numerous publications have shown positive outcomes for individuals after discectomy of lumbar disc herniation (LDH) in terms of low back pain (LBP). A study used a comprehensive visual analogue scale (VAS) unilaterally in an observational trial to identify LBP's precise features and location before and after discectomy for LDH. When the patient's afflicted side's LBP improves while moving, nerve root decompression after discectomy has relieved radicular LBP. Additionally, while sitting, the disc & endplate may experience more significant stress and pressure, which might be reflected in residual LBP [12].

Low back pain and long-term post-discectomy degenerative disc degeneration are well-known conditions, but they lack patient-centred classification and measurement. To ascertain the prevalence of recurrent back pain after discectomy and patient-reported outcomes (PROs), prospective longitudinal research and systematic review were conducted. They stated that 6% reoperation was necessary for a disc herniation of the same level. 15–25% of people may have recurrent lower back pain for two years, depending on the level of discomfort that is considered clinically severe, which results in lower PROs one and two years after surgery [13].

A study aimed to assess the clinical as well as radiologic findings related to pain relief along with postoperative recovery among those who had bilateral lumbar discectomy. They stated that discectomy significantly reduces postoperative & follow-up radicular pain in individuals with lumbar disc herniation. Postoperative pain alleviation was influenced by age, body mass index, para-spinal muscular diameter, neurological claudication, and pain from instability. A rapid decrease in an Oswestry Disability Index (ODI) score was linked to higher disc height. It is advised that future research use more significant sample numbers [14].

A study compared the long-term results of open fenestration discectomy (OFD) combined with percutaneous endoscopic lumbar discectomy (PELD). Regarding LDH, PELD and OFD offer satisfactory clinical results. On the other hand, PELD is better than OFD at reducing low back discomfort, maintaining segmental stability, and delaying disc degeneration [15].

Table 4 reveals the success of discectomy in treating lumbar disc herniation (LDH), with studies indicating considerable improvement in functional outcome measures and reduction of postoperative and post-discharge radicular pain (Yılmaz *et al.* [9]; Tabibkhooei *et al.* [14]). Reduced low back pain on movement after surgery indicates effective decompression at nerve roots (Takahashi *et al.* [12]). However, a small percentage of reoperations (6%) and recurrent low back pain affecting 15-25% of patients within 2 years make patient-reported outcomes lower (PRO), which indicates the need for careful clinical evaluation and follow-up (Parker *et al.* [13]). These Things emphasize the significance of discectomy while showing how it failed.

Table 4: Effectiveness and Outcomes of Discectomy for Lumbar Disc Herniation

Authors	Findings
Yılmaz *et al.* [9]	The patients with discectomy of LDH demonstrated excellent functional results.
Takahashi *et al.* [12]	When the patient's lower back pain on the afflicted side improves while moving, nerve root decompression after discectomy has relieved radicular LBP.

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Parker *et al.* [13]	The study states that for 6%, reoperation was necessary for a disc herniation of the same level. 15–25% of people may have recurrent low back pain for two years, depending on the level of discomfort that is considered clinically severe, which results in lower PROs at one and two years after surgery
Tabibkhooei *et al.* [14]	They stated that discectomy significantly reduces postoperative & follow-up radicular pain in individuals with lumbar disc herniation.

CONCLUSIONS

This study concluded that functional outcomes and pain have significantly improved after lumbar disc prolapse surgery. The scores in the JOA and VAS demonstrated a marked improvement with significantly decreased pain and better functional mobility post-operation. Improvements were maintained at 6 months, indicating that the surgery is effective in managing lumbar disc prolapse and symptoms related to it. Out of the thirty patients analyzed demographically, the age group of 51-60 with a percentage of 33.33 was more populated with a male-female ratio of 1.3:1, which reflected a male predominance. Typical levels of disc prolapse were found to be L4-L5 (46.67%) and L5-S1 (33.33%); the most common radicular pain seen was left side (43.33%). All patients exhibited neurological signs with nerve tension, motor deficits at 50% and sensory at 36.67%. JOA showed an excellent improvement from 16.67 pre-operatively to 24.7 at one-month post-operation, while VAS fell from 7.8 to 1.2 at 6 months, reflecting the reduction of pain and functional recovery. The study revealed surgical intervention's effectiveness in reducing pain, improving motor functions, and managing radicular symptoms.

CONTRIBUTION OF AUTHORS

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