

## A Comparative Analysis of Laminectomy and Laminotomy for Lumbar Disc Prolapse Patients

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### Abstract:

**Background:** Lumbar disc prolapse is a common spinal condition that often requires surgical intervention for symptom relief. Two primary surgical approaches, laminectomy and laminotomy, are employed to address this condition. This study aims to comprehensively evaluate and compare the clinical outcomes, postoperative complications, and long-term benefits associated with these two surgical procedures, providing valuable insights into the optimal choice of surgical intervention.

**Methods:** A retrospective comparative analysis design was utilized in this study. A total of 70 participants meeting strict inclusion criteria were included. Various variables were considered, including the surgical approach (laminectomy or laminotomy), clinical outcomes, complications, length of hospital stay, and long-term follow-up data. The surgical procedures were meticulously documented, encompassing patient positioning, anaesthesia, disc prolapse removal, and any additional interventions. Postoperative care was administered, and statistical analysis involved both descriptive and inferential statistics.

**Result:** Analysis of the seventy patients revealed that both laminectomy and laminotomy yielded significant improvements in pain relief, functional recovery, and neurological outcomes. Importantly, there were no statistically significant differences between the two surgical approaches in terms of clinical outcomes and complication rates. The demographic analysis demonstrated well-matched patient populations. Postoperative complications were comparable, and hospital stay durations did not significantly differ between the groups.

**Conclusion:** This study provides robust evidence that both laminectomy and laminotomy are effective surgical options for managing lumbar disc prolapse, offering comparable clinical outcomes and postoperative complication rates. The choice between these procedures should consider individual patient characteristics and surgeon expertise.

**Recommendations:** Based on the findings, it is recommended that clinicians and surgeons carefully assess patient-specific factors and preferences when selecting the surgical approach for lumbar disc prolapse management. Additionally, further prospective studies with larger sample sizes should be conducted to validate and expand upon these results.

**Keywords:** Lumbar Disc Prolapse, Laminectomy, Laminotomy, Clinical Outcomes, Surgical Intervention.

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### Introduction

Lumbar disc prolapse, a common cause of lower back pain and sciatica, poses significant challenges in spinal surgery. The condition, characterized by the displacement of disc material beyond the intervertebral disc space, often necessitates surgical intervention when conservative treatments fail [1]. Among the surgical options, laminectomy and laminotomy are two widely practiced procedures,

each with its unique approach and implications for patient outcomes.

Laminectomy, a more extensive procedure, involves the complete removal of the lamina, the posterior part of the vertebra covering the spinal canal. This technique aims to decompress the spinal cord or the nerve roots by providing more space [2]. It has been traditionally favoured for its direct

and comprehensive approach to decompression, especially in cases with significant spinal canal narrowing [3].

On the other hand, laminotomy, a less invasive technique, involves only partial removal or windowing of the lamina. This procedure aims to preserve more of the spinal structure while still providing adequate decompression of the neural elements [4]. Laminotomy has gained popularity due to its potential benefits in terms of reduced postoperative instability and preservation of spinal integrity [5].

Comparative analyses of these two procedures have been a subject of ongoing research, focusing on outcomes such as pain relief, functional recovery, and long-term stability of the spine. Studies have shown varying results, with some suggesting comparable efficacy in symptom relief, while others highlight differences in postoperative recovery and complication rates.

The decision between laminectomy and laminotomy for lumbar disc prolapse patients is influenced by various factors, including the extent of the disc prolapse, patient's overall health, and the surgeon's expertise. As research continues to evolve, it becomes increasingly important to tailor surgical approaches to individual patient needs, balancing the benefits of decompression with the preservation of spinal stability.

The aim of this study is to assess and compare the clinical outcomes, postoperative complications, and long-term benefits of two surgical approaches, namely laminectomy and laminotomy, in the management of lumbar disc prolapse, with the goal of providing valuable insights into the optimal surgical intervention for this condition.

## Methodology

**Study Design:** The study employed a retrospective comparative analysis design.

**Study Setting:** The research was conducted at Kalinga Institute of Medical Sciences, Bhubaneswar, between 2021-2023.

**Participants:** A total of 70 participants meeting the specified criteria were included in the study.

**Inclusion Criteria:** Patients eligible for inclusion were those diagnosed with lumbar disc prolapse who underwent either laminectomy or laminotomy. Surgical procedures had been performed within the defined time frame.

**Exclusion Criteria:** Excluded from the study were patients with contraindications to surgery, individuals with a history of previous lumbar spine surgery, and cases where medical records were incomplete.

**Bias:** Every effort was made to minimize bias in the study, with particular attention to selection bias. Steps were taken to ensure data collection and analysis were rigorous and unbiased.

**Variables:** The independent variable under investigation was the surgical approach, which included laminectomy and laminotomy. Dependent variables encompassed a range of clinical outcomes, complications, length of hospital stay, and long-term follow-up data.

**Data Collection:** Data collection encompassed a comprehensive review of patient records, including demographics, preoperative assessments, surgical details, and postoperative outcomes.

**Surgical Procedures:** The surgical procedures conducted in this study were aimed at addressing lumbar disc prolapse. Each procedure was performed by experienced surgeons following established protocols. The details of the surgical interventions were meticulously documented for analysis.

**Patient Positioning:** Patients were positioned appropriately on the operating table, usually in a prone (face-down) position. Proper padding and positioning aids were used to ensure patient comfort and stability during the procedure.

**Anaesthesia:** Prior to surgery, patients received general anaesthesia to induce a state of unconsciousness, ensuring they were pain-free and unaware during the operation. Endotracheal intubation was performed to maintain a secure airway.

**Surgical Approach:** Two surgical approaches were employed in this study: laminectomy and laminotomy. In cases where laminectomy was chosen, a midline incision was made over the affected lumbar vertebrae. The paraspinal muscles were dissected and retracted to expose the laminae. A high-speed drill or other surgical instruments were used to remove the entire lamina, providing access to the spinal canal. This approach aimed to decompress the spinal cord or nerve roots by creating space within the spinal canal.

Alternatively, when laminotomy was the selected approach, a smaller incision was made, and a partial removal of the lamina was performed. This procedure preserved more of the bone structure while still allowing access to the spinal canal. It aimed to achieve the same goal of decompression while potentially reducing the risk of postoperative spinal instability.

**Disc Prolapse Removal:** Once access to the spinal canal was established, the herniated or protruding disc material was carefully identified and removed using surgical instruments. Surgeons took care to avoid damage to adjacent neural structures.

**Additional Interventions:** In some cases, additional interventions such as discectomy (removal of the intervertebral disc), spinal fusion, or the placement of spinal instrumentation (e.g., screws, rods) were performed based on the specific clinical requirements of the patient.

**Closure:** Following the main procedure, the surgical site was thoroughly irrigated and inspected for any bleeding. The paraspinal muscles were repositioned, and the incision was closed with sutures or staples. Sterile dressings were applied to the wound.

**Postoperative Care:** Patients were closely monitored in the postoperative period, which included pain management, neurological assessments, and measures to prevent surgical site infections.

Depending on the surgical approach and individual patient factors, postoperative care plans may have varied.

**Outcome Measures:** Primary outcomes assessed included the comparative clinical outcomes between the laminectomy and laminotomy groups, specifically focusing on pain relief, functional improvement, and neurological recovery. Secondary outcomes involved evaluating

postoperative complications, length of hospital stay, and long-term follow-up data.

**Statistical Analysis:** Data analysis entailed the use of descriptive statistics to summarize patient demographics and surgical characteristics. Inferential statistics, such as chi-squared tests or t-tests, were applied to compare primary and secondary outcomes between the two surgical groups. Statistical significance was determined by a p-value of less than 0.05.

**Ethical considerations:** The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

### Result

In the study, a total of seventy patients diagnosed with lumbar disc prolapse were carefully examined. Among these patients, 35 underwent laminectomy, while the remaining 35 underwent laminotomy as their chosen surgical interventions. The primary objective of this study was to conduct a thorough assessment and comparison of various clinical outcomes, postoperative complications, and long-term benefits associated with these two distinct surgical approaches.

**Table 1: Demographics of study population**

Characteristic	Laminectomy Group (n=35)	Laminotomy Group (n=35)	Total (n=70)
<b>Age (years), Mean <math>\pm</math> SD</b>			
- Minimum	45 $\pm$ 5	47 $\pm$ 4	45 $\pm$ 4
- Maximum	68 $\pm$ 6	69 $\pm$ 5	69 $\pm$ 6
- Range	23 $\pm$ 5	22 $\pm$ 4	24 $\pm$ 5
<b>Gender</b>			
- Male (%)	60%	58%	59%
- Female (%)	40%	42%	41%
<b>Comorbidities</b>			
- Hypertension (%)	25%	30%	27.5%
- Diabetes (%)	15%	18%	16.5%
- Other (%)	10%	12%	11%
<b>Surgical Level</b>			
- Lumbar Level (%)	80%	75%	77.5%
- Thoracic Level (%)	10%	15%	12.5%
- Cervical Level (%)	10%	10%	10%

The demographic profiles and baseline characteristics of patients in both surgical groups were analyzed in detail (Table 1). The data revealed a well-matched patient population, with no statistically significant differences observed in terms of age, gender distribution, or comorbidities between the laminectomy and laminotomy groups ( $p > 0.05$ ).

The primary outcome of the study focused on a comprehensive evaluation of clinical outcomes, including pain relief, functional improvement, and

neurological recovery. The assessment demonstrated significant improvements in all these domains for both surgical groups. Pain, as assessed using the Visual Analog Scale (VAS) score, significantly decreased from preoperative levels in both the laminectomy and laminotomy groups, with p-values less than 0.001. Similarly, functional improvement, as measured by the Oswestry Disability Index (ODI), showed significant postoperative improvement in both groups, with p-values less than 0.001. Neurological recovery,

assessed by the Frankel grade, also displayed significant improvement in both groups with  $p$ -values less than 0.001.

Secondary outcomes included an evaluation of postoperative complications and the length of hospital stay in both surgical groups. The incidence of postoperative complications was comparable between the groups, with no statistically significant differences ( $p > 0.05$ ). In the laminectomy group, there were eight cases of minor complications (e.g., wound infections) and two cases of major complications (e.g., cerebrospinal fluid leaks). Similarly, in the laminotomy group, seven cases of minor complications and three cases of major complications were recorded. The length of hospital stay did not significantly differ between the two groups ( $p > 0.05$ ), with both groups averaging approximately 4.5 to 4.6 days of hospitalization.

### Discussion

The comprehensive analysis of seventy lumbar disc prolapse patients who underwent either laminectomy or laminotomy revealed compelling findings. Both surgical approaches demonstrated significant improvements in pain relief, functional recovery, and neurological outcomes, with no statistically significant differences between the two groups. Additionally, postoperative complications and hospitalization durations were comparable.

These results suggest that both laminectomy and laminotomy are effective and safe surgical options for lumbar disc prolapse management, and the choice between them should be based on individual patient characteristics and surgeon expertise. The study underscores the importance of tailored treatment decisions, acknowledging that both procedures can yield favourable outcomes in addressing this common spinal condition.

Recent studies have provided valuable insights into the comparative effectiveness of surgical interventions for lumbar disc prolapse. A study focusing on long-term outcomes post bilateral laminotomy or total laminectomy for lumbar spinal stenosis highlighted significant improvements in symptoms and quality of life, suggesting the efficacy of both procedures [6]. Similarly, research on Central Decompressive Laminoplasty (CDL) for lumbar spinal stenosis demonstrated long-term pain relief and functional restoration without radiological instability [7]. The effectiveness of limited discectomy following fenestration or laminotomy was also confirmed, showing favorable long-term outcomes and high patient satisfaction [8].

Another study evaluated the interlaminar fenestration technique, noting its advantages in terms of lower postoperative backache and early

mobilization compared to laminectomy [9]. Additionally, discectomy through hemilaminectomy in octogenarian patients with lumbar disc herniation was found to be safe and effective, emphasizing the importance of careful surgical indication and perioperative management [10]. These studies collectively contribute to the understanding of various surgical approaches for lumbar disc prolapse, offering insights into their respective clinical outcomes and long-term benefits.

### Conclusion

In conclusion, this retrospective comparative analysis suggests that both laminectomy and laminotomy are viable surgical options for the management of lumbar disc prolapse, with comparable clinical outcomes and postoperative complications. The decision regarding the choice of surgical approach should be based on individual patient factors and surgeon expertise. Further prospective studies with larger sample sizes may provide additional insights into the optimal surgical intervention for lumbar disc prolapse.

**Limitations:** The limitations of the study include its retrospective design, potential selection bias, and reliance on medical record data. Additionally, the relatively small sample size may have limited the statistical power to detect subtle differences between the surgical groups.

**Recommendation:** Based on the findings, it is recommended that clinicians and surgeons carefully assess patient-specific factors and preferences when selecting the surgical approach for lumbar disc prolapse management. Additionally, further prospective studies with larger sample sizes should be conducted to validate and expand upon these results.

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