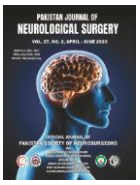

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Original Article

Unilateral Laminotomy vs. Conventional Laminectomy: Which is Better for Degenerative Lumbar Spinal Stenosis?

Muhammad Jazib Ijaz[1], Yasir Shehzad[2], Soban Sarwar Gondal[3], Muhammad Ammad-ul-Haq[1] Fraz Mehmood[1], Nadeem Akhtar[3], Eesha Yaqoob[4], Saad Javed[1]

Department of Neurosurgeries, [1]Holy Family Hospital Rawalpindi, [2]Rawal Institute of Health Sciences Islamabad, [3]DHQ Hospital Rawalpindi, and [4]Department of Public Health, Health Services Academy, Islamabad – Pakistan

ABSTRACT

Objectives: To compare the outcomes of conventional laminectomy and unilateral laminotomy for lumbar spinal stenosis.

Materials and Methods: The results of our research were compared between unilateral laminotomy (Group A) and conventional laminectomy (Group B) for lumbar spinal stenosis using a sample of 60 cases (30 in each group) selected through non-probability convenient sampling. We calculated the sample size using OPENEPI and analyzed the data with SPSS 26.0. For qualitative and quantitative data.

Results: Mean age of participants was 49.7 years in both groups, The sample consisted of 37 male and 23 female participants made up the patient population. Dural tears (5%), progressive neurological deficit (0%), and surgical site infections (1%), among other postoperative complications, were all treated with antibiotics based on culture and sensitivity.

Conclusion: Bilateral decompression via unilateral laminotomy is a less invasive alternative to conventional laminectomy for lumbar spinal stenosis, with significantly improved pain scores and minimized hospital stay. This technique offers appropriate decompression of neuronal components at the affected level with no increased risk of complications.

Keywords: Degenerative, Spinal Stenosis, Unilateral Laminotomy, Conventional Laminectomy

Corresponding Author: Saad Javed
Holy Family Hospital, Rawalpindi Medical University; WFNS GNC Secretariat Team
Email ID: saad.javed@rmur.edu.pk

Date of Submission: 03-03-2023
Date of Revision: 31-05-2023
Date of Acceptance: 02-06-2023
Date of Online Publishing: 30-06-2023
Date of Print: 30-06-2023

DOI: 10.36552/pjns.v27i2.855

INTRODUCTION

Degenerative lumbar spinal stenosis (DLSS) is the main reason for neurologic symptoms and radicular pain. Perhaps the most common is axial back pain, which affects up to 80% of adults at least once during their lifetime and is one of the

most prevalent causes of doctor visits in the US.[1,2] Back pain affects 15 to 20% of adults in one year.[3] Therefore, it should come as no surprise that back pain is the most frequent and costly source of work-related disability among individuals under the age of 45 in terms of workers' compensation and related medical costs.[4,5] Axial back pain, which is localized to the spine and its associated soft tissues without pain radiation into the lower extremities, is due to derangement of the facet joints, the intervertebral discs, the ligaments, the vertebral periosteum, and the spinal nerve roots, blood vessels, and paravertebral musculature and fascia that surround it.[6] Although axial back pain may be attributed to specific causes such as systemic disease, infection, or injury; typically, the pain is nonspecific and cannot be attributed to a single anatomic source. Even though back pain is extremely common and results in many physician visits, fortunately, most patients have a resolution of acute exacerbation of back pain within 8 weeks of onset.[3] When evaluating a patient with back pain, the physician must identify those with pain due to serious conditions such as tumors, infection, neurologic injury, visceral disease, or systemic disease so that appropriate treatment of these pathologies may be rendered. The physician must tailor the treatment for each patient, to avoid unnecessary surgery and return the patient to normal function as quickly as possible. The first line of treatment of acute axial back pain in patients without clinical or radiographic "red flags' ' or neurologic deficits consists of continued activity, nonsteroidal anti-inflammatory drugs, and reassurance. Physical therapy, activity modification, and very early injections can also be helpful.

Surgical treatment of axial back pain is reserved for those patients, who have failed nonoperative treatment, and typically, this includes a spinal fusion with or without instrumentation, and more recently, total disc arthroplasty (TDA) or dynamic stabilization. Radiculopathy is common in degenerative conditions affecting the spine. Radiculopathy is due to impairment in nerve conduction in the axons of a spinal nerve or its roots due to compression or ischemia of the affected nerve root. Surgery may be required if nonoperative treatment options are ineffective in alleviating the symptoms. Myelopathy, progressive neurologic deficit, and cauda equina syndrome symptoms are the main justifications for surgical treatment of radicular pain.[7,8,9]

Bilateral decompression via unilateral laminotomy (BDUL) is a minimally invasive surgical technique that has shown promising results in the treatment of DLSS, but there is a lack of comparative studies with conventional laminectomy. The purpose of this research is to compare the outcomes and complications of BDUL and conventional laminectomy for single-level DLSS. The findings of this study will provide valuable information for clinicians to make informed decisions regarding the most effective and safe surgical treatment for patients with DLSS. Our study aims to compare the outcomes of unilateral laminotomy (Group A) and conventional laminectomy (Group B) in the management of lumbar spinal stenosis.

MATERIALS AND METHODS

The sample was divided into two groups. For Group A, Bilateral decompression via unilateral laminotomy (over-the-top technique) was used while for Group B, Conventional laminectomy was employed.

Study Design & Setting

A comparative interventional study was designed in which we will compare the two treatment modalities in terms of their outcomes. The study was conducted for 6 months at two tertiary care university hospitals in Rawalpindi.

Sample Size

We calculated the sample size using OPENEPI software,[10] with a confidence interval of 95% and 80% power of the test. Based on our calculations, we included a total of 60 cases, with 30 cases in each group.

Sampling Technique

We used a non-probability convenient sampling technique to select our participants.

Table 1: Gender And Age (Years).

		A	B	P-Value
Gender	Male	17 (56%)	20 (66.7%)	0.426
	Female	13 (33%)	10 (33.3%)	
Age		48.13 ± 11.927	52.23 ± 12.80	0.204

Table 2: Surgical Time (Mins) And Hospital Stay (Days).

	A	B	P-Value
Surgical Time	96.35 ± 15.196	72.50 ± 16.015	0.001*
Hospital Stay	1.27 ± 0.450	2.07 ± 0.691	0.001*

*Significant Result

Inclusion Criteria:

The inclusion criteria for the study encompassed patients who met the following conditions: they had degenerative lumbar spinal stenosis and had not responded to conservative management, requiring surgical intervention. These patients experienced backache with a visual analog scale (VAS) score higher than 5. They had one-level central stenosis that necessitated decompression. Additionally, the patients fell within an age range of 30 to 80 years and had a confirmed diagnosis of single-level spinal stenosis through magnetic resonance imaging (MRI).

Exclusion Criteria:

The study had specific exclusion criteria to identify patients who were not suitable for inclusion. Patients with a history of spinal surgery in the past, as well as those with infections or malignancies, were excluded. Furthermore, patients requiring additional segmental fusion surgery were not included. Individuals with rapidly progressive neurological deficits, such as severe worsening of their neurological symptoms, were also excluded. Patients who were unable to cooperate in completing the questionnaire due to conditions such as dementia or stroke were not considered for the study. Additionally, individuals with underlying neuromuscular disorders were excluded from the research. These exclusion criteria were put in place to ensure a specific patient population for the study on degenerative lumbar spinal stenosis and surgical management.

Data Collection

The research included patients of age 30-80 years of either gender with verified lumbar spinal stenosis and a pain level of greater than 5 on the Visual Analogue Score (VAS 0 – 10), with 0 indicating "No pain" and 10 indicating "Worst possible pain,". All patients who met the inclusion criteria signed a written informed consent form. Patients with a history of prior spine surgery, severe trauma, or backache caused by a condition other than single-level degenerative lumbar spinal stenosis were not included in the research. All patients' Visual Analogue Score (VAS) scores were recorded at the time of presentation. The procedure time was included in the surgical data. The length of hospitalization and postsurgical complications were among the clinical outcomes. The pain was assessed using the visual analog scale (VAS) at 0, 3rd, 7th, 14th day, and 1 month after surgery.

Data Analysis

The collected data was entered and analyzed using SPSS 26.0 (Statistical Package for the Social Sciences). Quantitative variables, such as the age and weight of the patients, were represented in the ± S.D. Qualitative variables, such as the

gender of the patients, and the presence or absence of complications (pain, limited mobilization), were represented in frequencies and percentages. We used the Chi-Square test to observe associations between qualitative variables, and a t-test to compare the means of quantitative data.

RESULTS

Age of the Patients

Total 60 patients were included in this study. The patient's average age was (49.7) years, with the lowest and highest ages being 30 and 80 years, respectively. The average age of the group A patients in this study was (48.13 ± 11.927) years, whereas the average age of group B patients was (52.23 ± 12.803) years. There was no significant difference in age between the two groups (p-value 0.204).

Gender Distribution

The male patients in our research were 37; with 17 from Group A and 20 from Group B, and the female patients were 23, with 13 from Group A and 10 from Group B, as indicated in Table 1.

Surgical Time and Hospital Stay

Table 2 compares two groups, Group A and Group B, with respect to two different variables: surgical time and hospital stay. The values reported in the table are the mean values (Average values) of these variables, along with their standard deviations (SD) and the p-values associated with the statistical tests performed. For the variable "surgical time", the mean value for Group A was 96.35 minutes, with a standard deviation of 15.196 minutes, while for Group B

Table 3: Post-Op Surgical Complication.

		%	Group A	Group B	P-value
Post Op Surgical Complications	No Complications	93.3%	27 (91%)	29 (96.66%)	0.495
	CSF Leak	5%	2 (6.66%)	1 (3.33%)	
	Surgical Site Infections	1%	1 (3.33%)	0 (0%)	
	Progressive Neurological Deficit	0%	0 (0%)	0 (0%)	
Post Op Surgical Complications			0.133 ± 0.434	0.033 ± 0.182	0.250

the mean value was 72.50 minutes, with a standard deviation of 16.015 minutes. The p-value of 0.001 suggests that this difference in means is statistically significant, meaning that it is unlikely to have occurred by chance. For the variable "hospital stay", the mean value for Group A was 1.27 days, with a standard deviation of 0.450 days, while for Group B the mean value was 2.07 days, with a standard deviation of 0.691 days. The p-value of 0.001 suggests that this difference in means is also statistically significant.

Postoperative Complications

Postoperative complications included dural tears (**5%**), progressive neurological deficit (**0%**), and surgical site infections **(1%).** Dural tears (repaired primarily) and surgical site infections were treated by intravenous antibiotics according to culture and sensitivity. Table 3 compares post-operative surgical complications between two groups, A and B. The groups had similar rates of no complications and surgical site infections, with slightly more CSF leaks in Group B. The mean number of complications per patient was numerically different but not statistically significant. The small sample size limits the conclusions that can be drawn.

Comparison of Pain Ratings on VAS

At the mean pre-and postoperative (0, 3, 7, 14, and 1 month) VAS ratings for low back pain, there were significant improvements in outcomes in Table 4.

Table 4: Pre and Post-Operative Pain Comparison Between Two Groups.

VAS Ratings	Group A	Group B	P-Value
Pre. Op	8.766 ± 0.817	8.700 ± 0.794	0.750
Day 0	5.866 ± 1.716	7.2 ± 0.886	0.004*
Day3	4.400 ± 0.813	5.666 ± 1.061	0.005*
Day7	2.500 ± 0.682	4.066 ± 1.112	0.003*
Day14	1.466 ± 0.8193	4.966 ± 1.188	0.001*
I Month	1.000 ± 1.050	2.366 ± 1.607	0.001*

*Significant Result

The table displays VAS ratings for pain levels in Group A and Group B at various time points after surgery, along with associated p-values. The ratings were significantly different between the two groups on all post-operative days (0, 3, 7, 14, and 1 month), with Group A consistently reporting lower pain levels than Group B. These findings may be important for optimizing pain management strategies in postoperative care.

DISCUSSION

Over the past few decades, several treatment options for lumbar spinal stenosis. Surgical failures following conventional laminectomy are frequently reported; these failures are typically attributed to postoperative iatrogenic spinal instability. Bilateral laminotomies and particularly unilateral laminotomies for bilateral decompression have been introduced in recent years. Different studies have reported success rates of 68%, 85%, 87%, 88%, and 94% for the unilateral approach in cases of bilateral decompression.[6,11,12,13,14.]

Due to the removal of the posterior elements, such as the spinous process, interspinous ligament, and supraspinous ligament, the traditional laminectomy has the advantage of providing a large working area and providing good visibility. The removal of posterior spinal elements and a significant amount of facetectomy are required for traditional decompression. As a result, the procedure could lead to postoperative instability and the need for spinal fusion, which is linked to more comorbid conditions in older patients. In open decompression, high rates of reoperation ranged from 11% to 30%, according to Mariconda et al.[15]

The posterior ligamentous complex, which stabilizes lumbar motion and serves as a tension

band, is preserved with unilateral laminotomy bilateral decompression over classic laminectomy. Minimally invasive surgical techniques may result in less muscle splitting while leaving the midline tissues intact, resulting in less postoperative discomfort.[16] The "over the top'' procedure preserves the contralateral side's facet joints and neural arch, reducing postoperative instability and preventing substantial damage to the neural structures. 113 patients who underwent "over the top" surgery were studied by Ulrich NH et al,[13] for their clinical outcomes, and it was found that the procedure produced better results. The smaller operational space and potential for an extended procedure time due to the technical difficulty are drawbacks of bilateral decompression via unilateral laminotomy. In addition, if an unintended durotomy takes place, a full laminectomy might be required to accurately identify and treat a dural defect.[11] For mild to moderate stenosis; Postacchini et al. suggested bilateral decompression via unilateral laminotomy, whereas laminectomy was preferred for severe stenosis or spondylolisthesis.[17] The surgical decision-making is influenced by the extent of the stenosis,[18] concurrent medical conditions[19,] and segmental mobility before surgery[20].

Another important aim of surgery for the "over the top" method was the appropriate decompression of the nerve components. Contrary to our results, Thomé et al,[6] discovered that bilateral laminotomy was associated with less adequate decompression than bilateral laminotomy, albeit with a minor difference. This finding could imply that the unilateral approach to bilateral decompression via unilateral laminotomy provides a poor view of the contralateral recess. Moisi et al,[21] stated that the bilateral decompression via unilateral laminotomy technique might enable greater imaging of the contralateral recess. According to Miyazaki et al,[22] the average % facet joint preservation was much lower with traditional decompression surgery than with minimally invasive techniques. On the approach side, microscopic "over the top" preserved 60 – 83 percent of the facet joints, but on the contralateral side, > 90 percent of the facet joint was preserved. The conventional technique, on the other hand, preserved around 40% of the facet.[23] As a result of the good preservation of the facet joint, we believe that this minimally invasive surgical approach can lower the risk of postoperative spinal instability.

Lower back pain is the most common cause of disability in older patients across the world. One of the most prevalent causes of this illness is degenerative lumbar spinal stenosis. Raffo and Lauerman[3] found decompressive surgery is better than conservative management for symptomatic lumbar spinal stenosis patients.[24] Morbidity and complication rates following surgery were greater in older patients compared to younger individuals in recent studies,[25,1] owing to a range of medical comorbidities.

The average age of the patients in this study was (49.7) years, with the lowest and highest ages being 30 and 80 years, respectively. The average age of the group A patients in this study was (48.13 ± 11.927) years, whereas the average age of group B patients was (52.23 ± 12.803) years, and all of them had single-level lumbar spinal stenosis. Some patients had medical comorbidities; patients tolerated the surgical treatment well. Katz et al,[15] discovered that older individuals with medical comorbidity and functional handicap may be less concerned about decompression therapy. In the elderly, "over the top" leads to smaller skin incisions, which aid wound healing and reduce the risk of wound complications. Minimally invasive surgery can also help to prevent blood loss.[13] Older people have fewer options for compensatory cardiovascular and pulmonary mechanisms because aging reduces contractility and increases the stiffness of the left ventricle,[27] These changes may make it difficult for the patient to tolerate substantial

volume shifts, which might result in life-threatening problems in the elderly.

The mean score for pain at presentation was 8.7660.817 overall. In the present investigation, the mean pain score at 1 month was 1.0001.050 for the bilateral decompression via unilateral approach group and 2.3661.607 for the classic laminectomy group. According to statistics, the group that underwent unilateral bilateral decompression experienced significantly less pain than the group that underwent classic laminectomy, with a p-value of 0.001. In both groups, postoperative low back and leg pain VAS scores decreased in comparison to the preoperative state, according to research by O. Yaman et al,[28]. At postoperative 1, 6, and 12 months, low back pain VAS scores were lower. Results from Liu et al's, two-year follow-up study revealed that the group that underwent bilateral decompression via a unilateral approach had a lower atrophy rate of multifidus cross-sectional areas and a postoperative VAS of low back pain than the group that underwent conventional laminectomy.[29]

The total complication rate in our study was 6.66% including dural tears (5%), progressive neurological deficit (0%), and surgical site infections (1.6%). Dural tears were repaired primarily and surgical site infections were treated by intravenous antibiotics according to culture and sensitivity.

Dural tears were the most prevalent form of complication with the "over the top" procedure. The unilateral method may need significant dural sac retraction in the opposite lateral spinal canal, increasing the risk of dural rupture or nerve damage. In our study, dural tears occurred in three individuals (5%) that were repaired primarily. An absorbable suture was applied in a watertight method to seal the paraspinal muscles and surrounding fascia in two layers. Two patients were advised to lie flat in a prone position for 72 hours following surgery and experienced no CSF leak or headaches. The rate of dural tears was comparable to that seen in the prior research. According to Sidhu et al,[13] the microsurgical "over the top" method had a 0% to 18% rate of dural tears. Transfeldt et al, found that open surgical decompression had a procedural complication rate of 42%.[30] The use of angled instruments to generate additional room for decompression of the contralateral side might help to lessen the incidence and severity of dural rents. To prevent CSF leaking, the dural tears must be properly sutured as soon as possible.

CONCLUSION

Our findings suggest that the "Unilateral laminotomy: A less invasive solution for lumbar spinal stenosis" can be used as a less invasive alternative to conventional laminectomy for symptomatic lumbar spinal stenosis, allowing appropriate decompression of neuronal components at the affected level. A comparative interventional study comparing "conventional laminectomy" and "over-the-top technique" in patients with degenerative lumbar spinal stenosis found that conventional laminectomy was faster. In our study, bilateral decompression via unilateral approach resulted in significantly less postoperative back pain and a shorter hospital stay than conventional laminectomy in patients with lumbar spinal stenosis, with no increased risk of complications.

LIMITATIONS

There are a few limitations to our research. To begin with, our study included only a small number of patients from a single center. Second, this surgical technique's indications were limited to lumbar spinal stenosis. More research with larger samples and longer follow-up periods is required to confirm the current findings.

RECOMMENDATIONS

"A less invasive option to traditional laminectomy for symptomatic lumbar spinal stenosis is bilateral decompression via unilateral laminotomy-over the top technique". To confirm our findings and examine the technique's indications in other spinal conditions, additional studies with larger samples and longer follow-up times are required. On a case-by-case basis, surgeons should evaluate the advantages and disadvantages of each technique and adjust their strategy as necessary.

Ethical Requirements

Approved by the Institutional Review Board (IRB) Rawalpindi Medical University. Written informed consent was also taken from the study participants.

Funding

N/A.

ACKNOWLEDGMENTS

We want to acknowledge the patients and their families for their support.

REFERENCES

1. Phan K, Mobbs RJ. Minimally invasive versus open laminectomy for lumbar stenosis: a systematic review and meta-analysis. Spine. 2020; 41 (2): E91-100.
2. Finneran MM, Naik A, Hawkins JC, Nardone EM. Minimally invasive bilateral decompressive lumbar laminectomy with the unilateral approach: patient series. JNS: Case Lessons, 2022; 3 (7).
3. Raffo CS, Lauerman WC. Predicting morbidity and mortality of lumbar spine arthrodesis in patients in their ninth decade. Spine, 2018; 31 (1): 99-103.
4. Dabasia H, Rahim N, Marshall R. Neurogenic claudication without spinal stenosis arising as a result of lumbar epidural varices. The Journal of bone and joint surgery. British Volume, 2021; 94 (9): 1292-4.
5. Lv B, Sun S, Wang H, Xiao L, Xu T, Ji P, Yuan J, Ding H, Xie J, Meng N, Zhang L. Clinical Efficacy and Rehabilitation of Microscopic "Over the Top" for Bilateral Decompression in Degenerative Lumbar Stenosis: A Retrospective Study. Bio Med Research International, 2020; 2020.
6. Thomé C, Zevgaridis D, Leheta O, Bäzner H, Pöckler-Schöniger C, Wöhrle J, Schmiedek P. Outcome after less-invasive decompression of lumbar spinal stenosis: a randomized comparison of unilateral laminotomy, bilateral laminotomy, and laminectomy. Journal of Neurosurgery: Spine, 2005; 3 (2): 129-41.
7. Hua W, Chen C, Feng X, Ke W, Wang B, Li S, Wang K, Zeng X, Wu X, Zhang Y, Liao Z. Clinical outcomes of uniportal and biportal lumbar endoscopic unilateral laminotomy for bilateral decompression in patients with lumbar spinal stenosis: A retrospective pair-matched case-control study. World Neurosurgery, 2022 Jan. 29.
8. Johnsson KE, Rosen I, Uden A. The natural course of lumbar spinal stenosis. Clinical Orthopaedics and Related Research, 1992; (279): 82-6.
9. Haig AJ, Geisser ME, Tong HC, Yamakawa KS, Quint DJ, Hoff JT, Chiodo A, Miner JA, Phalke VV. Electromyographic and magnetic resonance imaging to predict lumbar stenosis, low-back pain, and no back symptoms. JBJS. 2017; 89 (2): 358-66.
10. Dean AG, Sullivan KM, Soe MM. OpenEpi: Open Source Epidemiologic Statistics for Public Health, Version. www.OpenEpi.com.2013
11. Postacchini F. Surgical management of lumbar spinal stenosis. Spine (Phila Pa 1976), 1999; 24: 1043–104.
12. Haddadi K, Ganjeh Qazvini HR. Outcome after surgery of lumbar spinal stenosis: a randomized comparison of bilateral laminotomy, trumpet laminectomy, and conventional laminectomy. Frontiers in Surgery, 2020; 8; 3: 19.
13. Radcliff KE, Kepler CK, Jakoi A, Sidhu GS, Rihn J, Vaccaro AR, Albert TJ, Hilibrand AS. Adjacent segment disease in the lumbar spine following different treatment interventions. The Spine Journal, 2017; 13 (10): 1339-49.
14. Puzzilli F, Gazzeri R, Galarza M, Neroni M, Panagiotopoulos K, Bolognini A, Callovini G, Agrillo U, Alfieri A. Interspinous spacer decompression (X-STOP) for lumbar spinal stenosis and degenerative

disk disease: a multicenter study with a minimum 3-year follow-up. Clinical Neurology and Neurosurgery, 2019; 124: 166-74.
15. Mariconda M, Lotti G, Fava R, Midolo R, Longo C, Milano C. Quantitative ultrasound measurements of the calcaneus in the prediction of lumbar spine degeneration. European Spine Journal, 2019; 13 (4): 346-53.
16. Ulrich NH, Burgstaller JM, Gravestock I, Pichierri G, Wertli MM, Steurer J, Farshad M, Porchet F. Outcome of unilateral versus standard open midline approach for bilateral decompression in lumbar spinal stenosis: is "over the top" really better? A Swiss prospective multicenter cohort study. Journal of Neurosurgery: Spine, 2019; 31 (2): 236-45.
17. Bono CM, Postacchini Lee CK. Critical analysis of trends in fusion for degenerative disc disease over the past 20 years: influence of technique on fusion rate and clinical outcome. Spine. 2021 Feb. 15; 29 (4): 455-63.
18. Škoro I, Stančić M, Kovačević M, Đurić KS. Long-Term Results and Efficacy of Laminectomy with fusion versus young laminoplasty for the treatment of degenerative spinal stenosis. World Neurosurgery, 2020; 89: 387-92.
19. Splendiani A, Perri M, Grattacaso G, Di Tunno V, Marsecano C, Panebianco L, Gennarelli A, Felli V, Varrassi M, Barile A, Di Cesare E. Magnetic resonance imaging (MRI) of the lumbar spine with dedicated G-scan machine in the upright position: a retrospective study and our experience in 10 years with 4305 patients. La Radiologia Medica. 2020; 121 (1): 38-44.
20. Young S, Veerapen R, O'Laoire SA. Relief of lumbar canal stenosis using multilevel subarticular fenestrations as an alternative to wide laminectomy: a preliminary report. Neurosurgery, 1988; 23 (5): 628-33.
21. Shah M, Moisi, Kolb B, Yilmaz E, Halalmeh DR, Moisi MD. Comparison of lumbar laminectomy alone, lumbar laminectomy and fusion, stand-alone anterior lumbar interbody fusion, and stand-alone lateral lumbar interbody fusion for treatment of lumbar spinal stenosis: a review of the literature. Cureus, 2019; 11 (9).
22. Miyazaki M, Kodera R, Yoshiiwa T, Kawano M, Kaku N, Tsumura H. Prevalence and distribution of thoracic and lumbar compressive lesions in cervical spondylotic myelopathy. Asian Spine Journal, 2020; 9 (2): 218.
23. Madsen R, Jensen TS, Pope M, Sørensen JS, Bendix T. The effect of body position and axial load on spinal canal morphology: an MRI study of central spinal stenosis. Spine, 2018; 33 (1): 61-7.
24. Ko S, Oh T. Comparison of bilateral decompression via unilateral laminotomy and conventional laminectomy for single-level degenerative lumbar spinal stenosis regarding low back pain, functional outcome, and quality of life-A Randomized Controlled, Prospective Trial. Journal of Orthopaedic Surgery and Research, 2019; 14 (1): 1-7.
25. Overdevest GM, Jacobs W, Vleggeert-Lankamp C, Thomé C, Gunzburg R, Peul W. Effectiveness of posterior decompression techniques compared with conventional laminectomy for lumbar stenosis. Cochrane Database of Systematic Reviews. 2020 (3).
26. Genevay S, Atlas SJ, Katz JN. Variation in eligibility criteria from studies of radiculopathy due to a herniated disc and of neurogenic claudication due to lumbar spinal stenosis: a structured literature review. Spine, 2018; 35 (7): 803.
27. Anwar T, Rehman MA, Ahmad UT, Anwer A, Wahab A, Tariq QT. Comparing Mean Post-Operative Back Pain Score between Hemilaminectomy and Conventional Laminectomy in Patients of Lumbar Stenosis. Pakistan JNS. 2021; 25 (2): 207-14.
28. Patel C, Yaman, Truumees E, Gitlin J, Herkowitz H. Symptomatic spinal stenosis adjacent to a previous lumbar fusion. The Spine Journal, 2022; 2: 54S.
29. Dohzono S, Toyoda H, Matsumura A, Terai H,

Suzuki A, Nakamura H. Clinical and radiological outcomes after microscopic bilateral decompression via a unilateral approach for degenerative lumbar disease: minimum 5-year follow-up. Asian Spine Journal, 2017; 11 (2): 285.

30. Schwender JD, Casnellie MT, Perra JH, Transfeldt EE, Pinto MR, Denis F, Garvey TA, Polly DW, Mehbod AA, Dykes DC, Winter RB. Perioperative complications in revision anterior lumbar spine surgery: incidence and risk factors. Spine, 2009; 34 (1):8 7-90.

Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.
Financial Relationships: None.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Jazib Ijaz, Yasir Shehzad & Saad Javed	1. Study design and methodology.
2.	Soban Sarwar Gondal, Muhammad Ammad-ul-Haq. Fraz Mehmood & Eesha Yaqoob	2. Paper writing.
3.	Soban Sarwar Gondal Muhammad Ammad-ul-Haq & Fraz Mehmood	3. Data collection and calculations.
4.	Eesha Yaqoob & Saad Javed	4. Analysis of data and interpretation of results.
5.	Saad Javed & Eesha Yaqoob	5. Literature review and referencing.
6.	Yasir Shehzad, Nadeem Akhtar & Saad Javed	6. Editing and quality insurer.