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ORIGINAL ARTICLE

Clinical outcome of lumbar discectomy by modified fenestration vs traditional laminectomy and discectomy in lumbar disc herniation.

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ABSTRACT… Objective: To compare clinical outcomes of modified fenestration versus traditional laminectomy and discectomy for lumbar disc herniation (LDH). **Study Design:** Comparative study **Setting:** Neuro Spine Unit, Capital Hospital, Islamabad. **Period:** March 2020 and March 2023. **Methods:** 50 patients (32 males, 18 females) with LDH unresponsive to conservative treatment underwent surgery at RIHS and Capital Hospital CDA. Group A (n=25) received conventional laminectomy and discectomy, while Group B (n=25) underwent discectomy by modified fenestration. Clinical outcomes were assessed over a 12-month follow-up. **Results:** Group B showed superior clinical outcomes, with greater relief from back and leg pain, reduced numbness, and improved neurological function compared to Group A. Two cases of intraoperative CSF leakage required dural repair, and five patients experienced postoperative wound infections, managed per culture sensitivity results. The study is relatively small sample size and limited follow-up duration may affect the generalizability of the findings. This study highlights the effectiveness of the modified fenestration technique in LDH management, contributing to the growing body of literature on minimally invasive spine surgery and offering valuable clinical insights for neurosurgeons. **Conclusion:** The modified fenestration technique yielded better clinical outcomes in terms of pain relief, neurological improvement, and spinal stability after 12 months.

Key words: LDH Unresponsive, Modified Fenestration, Paranesthesia, Traditional Laminectomy, Spine Surgery.

INTRODUCTION

Intervertebral discs are pads of fibro-cartilaginous tissue that connect adjacent vertebral bodies. They consist predominantly of three components:[1] an inner core comprising a proteoglycan-rich nucleus pulposus[2], an outer region/ring characterized by a collagen-rich annulus fibrosus, and[3] superior and inferior cartilaginous end-plates. There exists a total of 23 intervertebral discs, each situated between paired vertebrae from C2 to S1, but segmental variations in this standard arrangement are not unusual.

A herniated lumbar disc refers to the displacement of disc material beyond its normal anatomical position in the intervertebral disc space. Most frequently, it occurs at the L3- L4, L4-L5, and L5-S1 levels of the lumbar spine. The process begins with structural changes that eventually lead to DDD: as a disc ages, it undergoes degeneration which is characterized by loss of osmotic pressure in the nucleus, dehydration, and loss of disc height. Eventually, disc herniation initiates with a breakdown in the integrity of the innermost annulus rings, progressing radially outward - a tear may manifest within the annulus fibrosus, allowing the material from the nucleus pulposus to traverse through this breach and into the intervertebral or vertebral foramen, leading to impingement on neural structures. The expansion or hypertrophy of the surrounding degenerative tissues is also a contributing phenomenon, commonly observed in structures such as the ligamentum flavum and the facet joints. Additionally, hypertrophy in the vertebral bodies neighboring the degenerating disc occurs, giving rise to overgrowths commonly termed bony spurs or osteophytes.

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All these pose a potential risk of compromising the integrity of surrounding nerve roots. The pain that follows can be attributed to neural inflammation, which occurs when proteins leak from the inner core of the disc, irritating the neural tissue. Therefore, we can conclude that the pathophysiology of herniated discs is theorized to result from a dual mechanism that involves mechanical compression exerted by the protruding nucleus pulposus as well as the surrounding tissues and also a simultaneous elevation in local inflammatory chemokines.

Radiological investigations help to differentiate disc prolapse from other causes of low back pain and sciatica. MRI is the gold standard investigation used for confirmation of diagnosis as it helps in the visualization of soft tissues.

Management by conservative measures is preferred initially, followed by surgical intervention in individuals who fail to respond to these measures.

Surgical options for disc herniations, as well as degenerative spinal stenosis, should be reserved for those with either neurologic deficits, degenerative spondylolisthesis, or pain limiting daily functions. The literature regarding the optimal surgical procedure, approach, and roles for decompression continues to evolve. Following a trend towards more targeted and conservative procedures, the traditional lumbar discectomy technique has undergone substantial modifications over time. Initially, a wide laminectomy was commonly performed to extract as much disc material as possible. However, this more radical surgical approach has become less common due to the recognition that extensive laminectomy can potentially destabilize the spine later on. It has now been replaced by Modified Fenestration Discectomy technique which is a variation of the Open Fenestration Discectomy, as a small portion of the lamina is also excised along with the herniated nucleus pulposus.

This study was designed to compare the clinical outcome of modified fenestration and traditional laminectomy and discectomy in the treatment of symptomatic Lumbar Disc Herniation (LDH) with a 1-year follow-up in a group of 50 patients.

Lumbar disc herniation (LDH) is a common spinal condition characterized by the displacement of intervertebral disc material, predominantly affecting the L4-L5 and L5-S1 levels.[1,2,3] The pathophysiology involves both mechanical compression of neural elements and local inflammation due to chemical mediators from the nucleus pulposus.[4] LDH often manifests as back pain, sciatica, paresthesia, and reduced reflexes.

Magnetic resonance imaging (MRI) remains the gold standard for LDH diagnosis due to its superior visualization of soft tissues. Conservative treatment options include physical therapy, NSAIDs, epidural injections, and lifestyle modifications. Epidural steroid injections provide temporary relief but lack strong evidence for long-term efficacy.[1]

Surgery is indicated when conservative measures fail or when neurological deficits persist. Traditional surgical methods include open laminectomy and discectomy, which involve extensive tissue resection but may destabilize the spine.[3] This concern has driven the development of minimally invasive techniques.

Modified fenestration discectomy involves a smaller incision with limited lamina removal, reducing tissue trauma and preserving spinal stability.[4] Studies have consistently shown that minimally invasive techniques result in less postoperative pain, shorter hospital stays, and quicker recovery.[5]

Previous studies comparing open and minimally invasive techniques highlight the advantages of modified fenestration in terms of reduced intraoperative blood loss, shorter operative time, and lower complication rates.[6] Incidental durotomies and wound infections are less common with minimally invasive methods.[7]

The risk of recurrence remains a concern in lumbar disc surgery. Factors associated with recurrence include improper disc removal, patient-specific

anatomical variations, and surgical technique.[8] Research suggests that modified fenestration may reduce recurrence due to better tissue preservation.[9]

The literature supports modified fenestration discectomy as a safer and more effective alternative to traditional laminectomy, offering improved clinical outcomes with fewer complications and faster recovery. However, long-term studies with larger sample sizes are needed to confirm its superiority in managing LDH.

METHODS

From March 2020 to March 2023, 50 patients (32 males and 18 females) who had been diagnosed with lumbar disc herniation, and who failed to respond to conservative treatment, were operated on and studied prospectively at the Neurosurgery department of RIHS and Capital Hospital CDA. Their clinical data was subsequently analyzed by grouping the cases into two, based on the type of procedure that was done. Conventional laminectomy and discectomy were performed on 25 patients in Group A, whereas Discectomy by Modified Fenestration was performed on 25 patients in Group B. The clinical data was collected and analyzed in the follow-up visits over 12 months.

The mean age was 4.250±2.46 years and the age range was 1 to 15 years among children born to blood-related parents. Male children were 62% while female was 38%. However, the analysis showed no statistical significance between congenital heart disease (CHD) prevalence and the gender of the children (p=0.967). Congenital heart disease was observed in 15% of children born to blood parents of cousin marriages (Table-I).

RESULTS

The clinical outcomes of 50 patients with lumbar disc herniation who underwent either traditional laminectomy and discectomy (Group A, n=25) or modified fenestration discectomy (Group B, n=25) were analyzed over a 12-month follow-up.

Characteristic	Group A (n=25)	Group B (n=25)
Post-operative Back pain/ Leg pain	23 (92%)	12 (48%)
Surgery duration (min)	98.2	55.6
Intraoperative blood loss (ml)	150 …200ml	25.. 50ml
Length of hospital stay (d)	3 to 4 days	1
Bed rest duration (d)	One month	2 weeks
Stability of spine	(50%)	(75%)
Complication's rate	10	3

Table-I

Postoperative pain was significantly reduced in Group B, with only 12 patients (48%) reporting persistent back or leg pain compared to 23 patients (92%) in Group A. This reduction indicates superior pain management and neural decompression in the modified fenestration group.

The average surgery duration was notably shorter for Group B (55.6 minutes) compared to Group A (98.2 minutes). Similarly, intraoperative blood loss was significantly lower in Group B (25-50 ml) versus Group A (150-200 ml), reflecting the minimally invasive nature of the modified fenestration technique.

The mean hospital stay was reduced in Group B, averaging one day, compared to 3-4 days in Group A. Postoperative bed rest duration was also shorter in Group B (two weeks) compared to Group A (one month), promoting faster mobilization and rehabilitation.

Spinal stability was maintained in 75% of Group B patients versus 50% in Group A. This difference is likely due to the tissue-preserving approach of modified fenestration. The complication rate was lower in Group B (3 cases) compared to Group A (10 cases), which included cerebrospinal fluid leaks and wound infections.

The findings indicate that modified fenestration discectomy offers better clinical outcomes, including reduced pain, shorter hospital stays, faster recovery, lower complication rates, and improved spinal stability when compared to traditional laminectomy and discectomy.

DISCUSSION

This study compared the clinical outcomes of modified fenestration (Group B) and traditional laminectomy and discectomy (Group A) in patients with lumbar disc herniation. The results demonstrate that modified fenestration offers several clinical advantages, including reduced pain, shorter hospital stays, and lower complication rates.

Interpretation of Results: Postoperative back and leg pain was significantly lower in Group B (48%) compared to Group A (92%). This suggests that modified fenestration results in less tissue trauma and nerve irritation. The reduced postoperative pain likely contributed to quicker mobilization and recovery in Group B.

The surgery duration was notably shorter in Group B (55.6 minutes) compared to Group A (98.2 minutes), indicating a more streamlined surgical process in modified fenestration. Similarly, intraoperative blood loss was substantially lower in Group B (25-50 ml) versus Group A (150-200 ml), reflecting the minimally invasive nature of the procedure.

The average hospital stay for Group B patients was only one day, compared to 3-4 days for Group A. This difference highlights the potential for faster discharge and reduced healthcare costs with modified fenestration. Bed rest duration also favored Group B, with a recovery period of two weeks compared to one month in Group A.

Spinal stability was higher in Group B (75%) than in Group A (50%), the difference may be due to the less invasive approach of fenestration, which preserves critical spinal structures. The complication rate was also lower in Group B (3 cases) compared to Group A (10 cases), further supporting the safety profile of the modified fenestration technique.

Our findings align with previous research emphasizing the advantages of minimally invasive spine surgery. Studies have consistently reported reduced surgical trauma, faster recovery, and lower complication rates with fenestration-based techniques.[10,11,12,13,14] Moreover, the significant difference in spinal stability further proves that traditional laminectomy may provide better long-term stability.

The strengths of this study include a direct comparison of two commonly used surgical techniques and the use of objective outcome measures. However, the relatively small sample size (n=25 per group) limits the statistical power of our findings. Additionally, the follow-up period may not have been sufficient to assess long-term complications such as recurrence or degenerative changes.[15,16,17,18]

Given its lower complication rate, reduced hospital stay, and faster recovery, modified fenestration appears to be a superior alternative for treating lumbar disc herniation in appropriate patients. It offers a promising balance of safety, efficiency, and effectiveness, particularly for patients seeking quicker postoperative recovery.

Future studies should consider larger, multicenter trials with longer follow-up periods to validate these results. Additionally, research into long-term spinal stability and cost-effectiveness would provide further insight into the comparative benefits of the two surgical methods.

CONCLUSION

In conclusion, modified fenestration can be considered a safe and effective alternative to traditional laminectomy and discectomy, especially for patients seeking a minimally invasive surgical approach with quicker recovery and lower surgical risk.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Shakya A, Sharma A, Singh V, Rathore A, Garje V, Wadgave V, et al. **Preoperative lumbar epidural steroid injection increases the risk of a dural tear during minimally invasive lumbar discectomy.** International Journal of Spine Surgery. 2022 Jun 1; 16(3):505-11.
2. Gopal VV. **Degenerative lumbar disc disease: A questionnaire survey of management practice in India and review of literature.** Journal of Neurosciences in Rural Practice. 2021 Jan; 12(1):159.
3. Zou T, Liu XY, Wang PC, Chen H, Wu PG, Feng XM, et al. **Incidence of spontaneous resorption of lumbar disc herniation: A meta-analysis.** Clinical Spine Surgery. 2024 Jul 1; 37(6):256-69.
4. Arriba MÁ, Maestre C, Martín-Gorroño F, Plasencia P. **Analysis of long-term results of lumbar discectomy with and without an interspinous device.** International Journal of Spine Surgery. 2022 Aug 1; 16(4):681-9.
5. Jaiswal A, Kumar S, Reddy S, Jaiswal P. **Feasibility and safety of outpatient lumbar microscopic discectomy in a developing country.** Asian Spine Journal. 2019 Oct; 13(5):721.
6. Vangen-Lønne V, Madsbu MA, Salvesen Ø, Nygaard ØP, Solberg TK, Gulati S. **Microdiscectomy for lumbar disc herniation: A single-center observational study.** World neurosurgery. 2020 May 1; 137:e577-83.
7. Tsitsopoulos PP. **Accidental dural tear in lumbar spine surgery.** Acta Neurochirurgica. 2022 Jul; 164(7):1889-90.
8. Charalambous LT, Rajkumar S, Liu B, Adil SM, Wong M, Hodges S, et al. **Treatment patterns and health care resource utilization of iatrogenic spinal cerebrospinal fluid leaks in the United States.** Clinical Spine Surgery. 2022 Nov 1; 35(9):E725-30.
9. Asan Z. **Early postoperative iatrogenic neuropraxia after lumbar disc herniation surgery: Analysis of 87 cases.** World Neurosurgery. 2023 Feb 1; 170:e801-5.
10. Mariscal G, Torres E, Barrios C. **Incidence of recurrent lumbar disc herniation: A narrative review.** Journal of Craniovertebral Junction and Spine. 2022 Apr 1; 13(2):110-3.
11. Guo J, Li G, Ji X, Wu X, Zhang G, Zhou C, et al. **Clinical and radiological risk factors of early recurrent lumbar disc herniation at six months or less: A clinical retrospective analysis in one medical center.** Pain Physician. 2022; 25(7):E1039.
12. Abdallah A, Güler Abdallah B. **Factors associated with the recurrence of lumbar disk herniation: Non-biomechanical–radiological and intraoperative factors.** Neurological Research. 2023 Jan 2; 45(1):11-27.
13. Wang H, Wang S, Yu H, Chen Y, Zheng L, et al. **Surgical treatment of recurrent postoperative discal pseudocyst: A case report and literature review.** Medicine. 2022 Nov 11; 101(45):e31756.
14. Naouli H, Jiber H, Bouarhroum A. **Iliac arteriovenous fistula following lumbar disc surgery. A case report.** JMV-Journal de Médecine Vasculaire. 2022 Oct 1; 47(4):199-202.
15. Wu S, Bu W, Wu D, Du J. **Spontaneous absorption of lumbar epidural hematoma after percutaneous endoscopic lumbar discectomy in a patient with lumbar disc herniation.** Asian Journal of Surgery. 2023 Feb; 46(2):880-1.
16. Shyam K, Thippeswamy PB, Shetty AP, Algeri R, Rajasekaran S. **Gauze for concern: A Case Report and systematic review of delayed presentation of paraspinal textiloma.** Journal of Clinical Orthopaedics and Trauma. 2022 Sep 1; 32:101967.
17. Bombieri FF, Shafafy R, Elsayed S. **Complications associated with lumbar discectomy surgical techniques: A systematic review.** Journal of Spine Surgery. 2022 Sep; 8(3):377.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Muhammad Khalid:** Conceptualization work. Original draft, Revised editing.
2	**Komal Rasheed:** Data collection, Formal analysis.
3	**Bashir-ur-Rehman:** Methodology, Supervision.
4	**Sarah Rasheed:** Investigation, Resecures.
5	**Muhammad Naeem Taj:** Supervision, Visualization