

Long-Term Clinical Outcomes in Patients Undergoing Microscopic Lumbar Discectomy by Fenestration- An Analysis of 1000 Cases

Md. Ruhul Kuddus^a, Shamiul Alam Siddique^b, Robert Ahmed Khan^c, Hafiz Asif Raihan^d, Asifur Rahman^a, Moshir Rahman^f, Md. Hasanur Rahman^g, Prof. Sukriti Das^h, Dr. Ferdousi Tabassumⁱ

^aAssistant Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.

^bAssistant Professor, Department of Neurosurgery, Mymensingh Medical College, Mymensingh, Bangladesh.

^cSenior Clinical Fellow, Department of Neurosurgery, Imperial College Healthcare, NHS Trust, London, United Kingdom.

^dAssistant Registrar, Department of Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh.

^eAssociate Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.

^fAssociate Professor, Department of Neurosurgery, Holy Family Red Crescent Medical College, Dhaka, Bangladesh

^gPhase-B Resident, Department of Neurosurgery, Dhaka Medical College, Dhaka, Bangladesh.

^hProfessor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.

ⁱAssistant Professor, Department of Ophthalmology, Bashundhara Ad-Din Medical College & Hospital, Dhaka, Bangladesh.

KEYWORDS ABSTRACT

Microscopic lumbar discectomy, fenestration, clinical outcome

Background: The first reports of lumbar discectomy for PLID date back to the 1920s. In the USA, this is the most often performed surgical spine operation. Although there is a wide variety of published data showing generally satisfactory surgical outcomes, the success rate for lumbar discectomy falls between 49% and 90%. Follow-up studies investigating the clinical results of lumbar discectomy by fenestration are uncommon in our nation. As neurosurgeons, we refer to it as the ABC of neurosurgery. Although some refer to it as the "bread and butter" of neurosurgeries, this procedure is crucial for neurosurgeons. **Objective:** The aim of the study was to investigate the long-term outcome of microscopic fenestration & discectomy and relevant factors associated with clinical outcome. **Methods:** The retrospective study was conducted in the department of neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from March 2018 to February 2024. A total of 1000 patients (Min and Max follow-up was done by 6 months and 72 months respectively) were included in the analysis. Patients who underwent Microscopic lumbar discectomy by fenestration were evaluated retrospectively, using the Modified Oswestry disability index (ODI; 0-20 minimal, 21-40 moderate, > 41 severe disability) and the Stauffer-Coventry criteria (excellent, 'good', 'fair', 'poor') to measure clinical outcomes. **Results:** This observational cross-sectional study was conducted in the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. A total of 1000 apparent patients were included in the study. Most of the 360(36.0%) patients were within the age group of 35-44 years. The mean±SD age of the patients was 38.6±1.3 years. Most of the patients 720(72.00%) were male and 280(28.00%) patients were female. The mean onset of preoperative pain was 9.6±3.3 months. Follow-up period was 39.6±3.2

months. At final follow-up, patients were rated as 'excellent' 777(77.7%), 'good' 173(17.3%), 'fair' 30(3.0%) and 'poor' 10(1.0%) using the Stauffer-Coventry criteria. Heavy manual work, heavy weight, uncontrolled diabetic and elderly were significantly associated with unsatisfactory outcomes. **Conclusion:** The long-term outcome of Microscopic lumbar discectomy by fenestration was satisfactory in the majority of patients. Heavy manual work, Heavy weight, elderly were negative predictors of a good clinical outcome.

INTRODUCTION

One of the most significant causes of low back pain and a prevalent issue in neurosurgery and orthopedics is lumbar disc herniation, which can manifest as either low back pain, leg discomfort (radicular pain), or both. The management of lumbar disc herniation ranges from conservative measures involving various modalities to surgical measures involving multiple surgical procedures ranging from very invasive to less invasive [1-4].

The results of minimally invasive lumbar disc herniation procedures should be comparable to those of traditional procedures, but with less soft tissue damage, less blood loss, and an earlier rate of patient recovery. The goal of these minimally invasive surgical procedures for treating lumbar disc herniation was to reduce soft tissue injury and increase early patient recovery with optimal outcomes. This was achieved by the use of a microscope or endoscope with numerous variations [5-7].

Lumbar discectomy as a treatment for herniated lumbar intervertebral discs was first reported in the 1920s. In the USA, this is the most often performed surgical spine operation [8]. Although there is a wide variety of published data showing generally satisfactory surgical outcomes, the success rate for lumbar discectomy falls between 49% and 90% [9,10]. The diversity observed in the clinical outcome highlights the significance of precisely identifying preoperative factors that may predict the outcome after lumbar discectomy. Research suggests that long-term follow-up following a discectomy typically results in a less favorable clinical outcome [9, 11-12]. Numerous less invasive surgical methods for lumbar discectomy, including percutaneous lumbar discectomy, chemonucleolysis, percutaneous laser disc decompression, and microendoscopic discectomy, have been made possible by advancements in spine surgery and microsurgery. These procedures are less appealing than more conventional methods since the gadgets are quite pricey and have limited indications. In order to treat disc herniation, a significant number of lumbar discectomies are carried out each year in the USA and Europe [8, 13–15]. The most typical procedure for treating lumbar disc herniation is still open discectomy.

It is uncommon to find long-term follow-up studies that examine the clinical results of lumbar discectomy by fenestration. The current study examined the long-term (> 6-year) consequences of discectomy as well as the pertinent variables linked to the surgical result.

METHODOLOGY

The retrospective study was conducted in the department of neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from March 2018 to September 2023. A total of 1000 patient (mean follow-up, 28 months) were included in the analysis. Patients who underwent Microscopic lumbar discectomy by fenestration were evaluated retrospectively, using the Modified Oswestry disability index (ODI; 0-20 minimal, 21-40 moderate, > 41 severe disability) and the Stauffer-Coventry criteria ('excellent', 'good', 'fair', 'poor') to measure clinical outcomes. Inclusion criteria were radicular pain or numbness in the lower extremity attributable

to the disc level; unrelieved symptoms after ≥ 6 weeks' conservative treatment (including bed rest, nonsteroidal anti-inflammatory drugs or physical therapy); Preoperative imaging clearly demonstrating lumbar disc herniation that could lead to clinical symptoms. Patients who underwent laminectomy, hemilaminectomy or presented with concomitant spinal pathologies were excluded from the study. And patients who were not willing to give consent were excluded. Purposive sampling was done according to the availability of the patients who fulfilled the selection criteria. Face to face interview was done to collect data with a semi-structured questionnaire. After collection, the data were checked and cleaned, followed by editing, compiling, coding, and categorizing according to the objectives and variables to detect errors and to maintain consistency, relevancy and quality control. Statistical evaluation of the results used to be obtained via the use of a window-based computer software program devised with Statistical Packages for Social Sciences (SPSS-24).

RESULTS

This observational cross-sectional study was conducted in the Department of neurosurgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. This study was conducted among the radicular pain or numbness in the lower extremity attributable to the disc level; unrelieved symptoms after ≥ 6 weeks' conservative treatment (including bed rest, nonsteroidal anti-inflammatory drugs or physical therapy); Preoperative imaging clearly demonstrating lumbar disc herniation that could lead to clinical symptoms lumbar discectomy by fenestration in adults individuals attending the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, after fulfilling the exclusion and inclusion criteria by purposive sampling method. A total of 1000 apparent patients were included in the study

Table I: Stauffer–Coventry criteria [16] used to determine clinical outcome for patients undergoing lumbar discectomy

Result	Criteria
Excellent	Complete relief ($> 90\%$) of pain in the back and lower extremity, returned to previous activities
Good	Relief of most ($>70\% - 90\%$) of pain in the back & lower extremity, able to return to accustomed employment, physical activities not limited or slightly limited and analgesic medications used infrequently or not used.
Fair	Partial relief ($> 30\% - 70\%$) of pain in the back and lower extremity, able to return to accustomed employment with limitations or to lighter work, physical activities definitely limited and mild analgesic medications used frequently
Poor	Little or no relief ($0 - 30\%$) of pain in the back or lower extremity, or pain worse than before operation, disabled for work, Physical activities greatly limited and strong analgesic medications used regularly.

Table II: Distribution of the patients according to age (n = 1000)

Age group (Years)	n=1000	%
≤24	43	4.3
25-34	163	16.3
35-44	360	36.0
45-54	328	32.8
55-64	75	7.5
≥65	31	3.1
Total	1000	100.0
Mean±SD	38.6±1.3	

Table II shows that, most of the 360(36.0%) patients were within the age group of 35-44 years. The mean±SD age of the patients was 38.6±1.3 years.

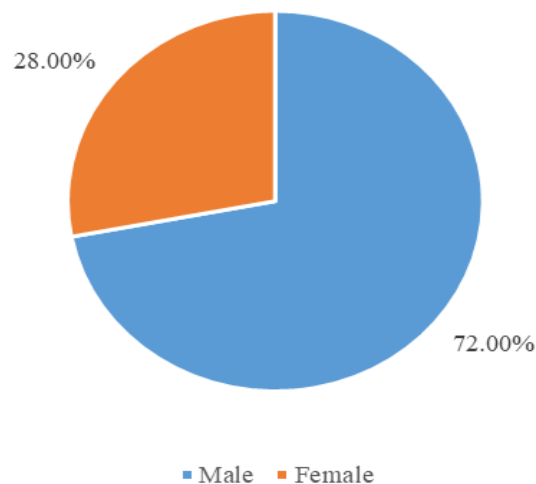


Figure I: Distribution of the patients according to sex (n=1000)

Figure I show that most of the patients 720(72.00%) were male and 280(28.00%) patients were female.

Table III: Distribution of the patients according to onset of preoperative pain and follow-up period (n = 1000)

	n=1000	%
Onset of preoperative pain (Months)		
≤12	77	7.7
13-22	457	45.7
23-32	343	34.3
33-42	123	12.3
43-52	0	0
53-62	0	0
Mean±SD	9.6±3.3	
Follow-up period (Months)		
12-23	200	20.0
24-35	457	45.7

36–48	299	29.9
≥49	44	4.4
Mean±SD	39.6±3.2	
Total	1000	100.0

Table III shows that, the mean onset of preoperative pain was 21.6±5.3 months and the mean follow-up period was 28.6±3.2 months.

Table IV: Distribution of the patients according to requiring reoperation (n = 1000)

Reasons for reoperation	n=40	%
Recurrent disc herniation at the same level	12	1.2
Recurrent contralateral disc herniation at the same level	10	1.0
Recurrent adjacent lower-level ipsilateral disc herniation	7	0.7
Post operative Discitis	11	1.1
Total	40	4.0

Table IV shows that, reasons for reoperation were recurrent disc herniation at the same level 12(30%), recurrent contralateral disc herniation at the same level 10(1.0%), recurrent adjacent level ipsilateral disc herniation 7(0.7%) and Post operative Discitis 11(1.1%).

Table V: Distribution of the patients according to the level of disability in reoperated patient (n=40)

Level of disability (ODI score)	n=40	%
0-20 (minimal)	38	3.8
21-40 (moderate)	2	0.2
> 41 (severe)	0	0.0
Mean±SD	11.8 ± 4.3	
Total	40	100

Table V shows that, at last follow-up, the mean ± SD of ODI scoring was applied by reoperation of these 40 patients was 11.8 ± 4.3

Table VII: Distribution of the patients according to complication (n = 1000)

Complication	n=40	%
Discitis	6	0.6
Recurrence	19	1.9
Development of G-I Listhesis	3	0.3
Unintentional durotomy	11	1.1
Postoperative foot-drop	1	0.1
Total	0.4	100

Table VII shows that, Discitis occurred in 6(0.6%) patients, Recurrence occurred in 19(1.9%) patients, Development of G-I Listhesis occurred in case of 3(0.3%) patients and Unintentional durotomy 11(1.1%) and Postoperative foot-drop 1(0.1%).

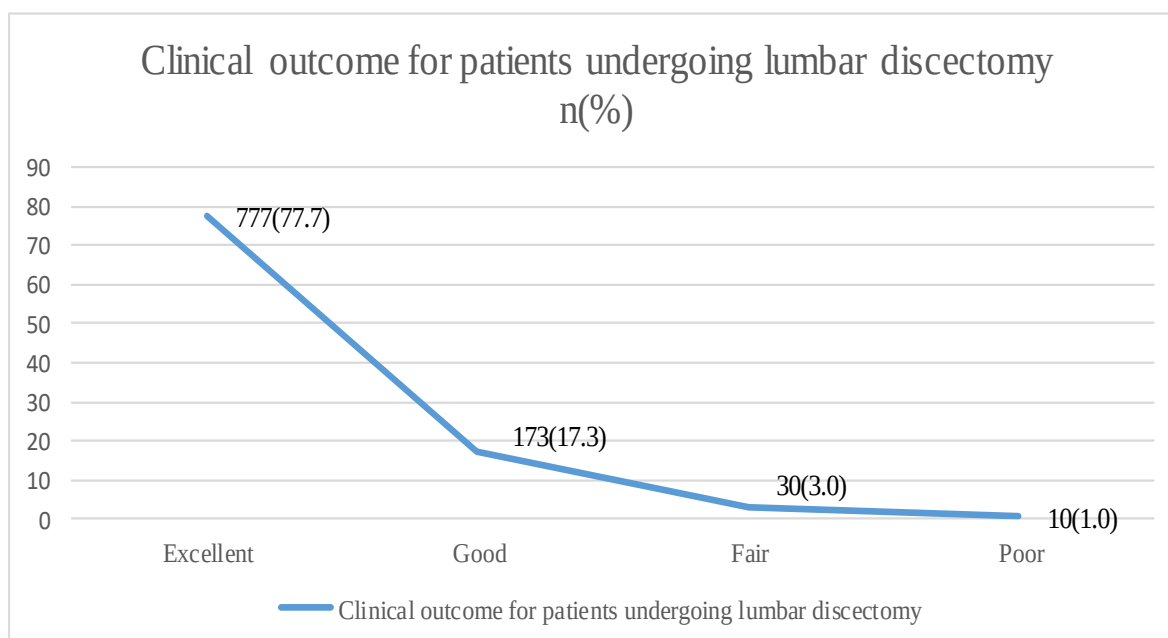


Figure III: Distribution of the patients according to Stauffer–Coventry criteria used to determine clinical outcome for patients undergoing lumbar discectomy (n = 1000)

Figure III shows that, at final follow-up outcome, patients were rated as 'excellent' 777(77.7%), 'good' 173(17.3%), 'fair' 30(3.0%) and 'poor' 10(1.0%) using the Stauffer-Coventry criteria.

DISCUSSION

Although lumbar discectomy is still the most common surgery for disc herniation, the clinical outcome of the procedure is difficult to evaluate definitively. The cross-sectional observational study was conducted in the Department of neurosurgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from March 2018 to September 2023. A total of 1000 patients were included in the study.

In this study, most of the 360(36.0%) patients were within the age group of 35 - 44 years. The mean±SD age of the patients was 38.6±1.3 years. Most of the patients 820(82.00%) were male and 280(28.00%) patients were female. The mean onset of preoperative pain was 34.6±5.3 months. Follow-up period was 39.6±3.2 months. In another study, in 60 patients 37 (61.7%) were men and 23 (38.3%) were women, with a mean operative age of 38 years (range 21 – 64 years). The mean onset of preoperative pain was 56 months (range 2 – 116 months), and the mean follow-up period was 214 months (range 183 – 249 months). [16] reasons for reoperation were recurrent disc herniation at the same level 12(30%), recurrent contralateral disc herniation at the same level 10(25%), recurrent adjacent level ipsilateral disc herniation 7(17.50) and Post operative Discitis 11(27.50). In another study, six patients required repeat back surgery, giving a reoperation rate of 10%. Reasons for reoperation were recurrent disc herniation at the same level (n = 3), recurrent contralateral disc herniation at the same level (n = 1), and recurrent adjacent lower-level ipsilateral disc herniation (n = 2). Repeat operation was performed at a mean of 4.6 years (range 2 months to 14 years) after the first discectomy. At last follow-up, the mean ± SD ODI score of these six patients was 10.8 ± 4.6 compared with 11.3 ± 5.3 in the other 54 patients;

there was no significant difference between the reoperation group and patients undergoing a single operation. [16]

At final follow-up outcome, patients were rated as 'excellent' 777(77.7%), 'good' 173(17.3%), 'fair' 30(3.0%) and 'poor' 10(1.0%) using the Stauffer-Coventry criteria. In another study, according to the Stauffer–Coventry criteria. On the other study, 44 (73.3%) patients were considered to have had a satisfactory outcome and 16 (26.7%) an unsatisfactory outcome, following discectomy. [17] As reported elsewhere preoperative occupational workload is known to influence surgical outcome and residual symptoms significantly, with patients engaged in heavy manual work having significantly more functional disability compared with those engaged in light or medium-strenuous work. [18] Heavy work increases flexion–extension and torsional movements of the lumbar spine, increasing load and shear forces on the spine that could lead to facet joint injury and disc degeneration. Some studies have reported no obvious relationship between occupational workload and clinical outcome; however, this may be related to different approaches to classifying workload and quantifying outcome. [19] Several factors have been reported as predictive of a successful outcome following lumbar discectomy, including: male sex; age < 41 years old; duration of sciatica <7 months; no previous lumbar surgery. [20] It has also been shown that surgical outcome is unsatisfactory in patients with preoperative leg pain associated with lumbar disc herniation for > 8 months, due to the fact that patients were unable to return to their previous work status. [21] The duration of severe preoperative symptoms in the present study had a significant impact on clinical outcome; a long duration of symptoms resulted in more severe nerve root lesions and poorer outcomes than a short duration of symptoms.

Microscopic lumbar discectomy via fenestration is a widely used surgical technique for treating lumbar disc herniation. Long-term studies have generally reported favorable outcomes for patients undergoing this procedure. In a study with an average follow-up of 17.9 years, 60 patients who underwent discectomy by interlaminar fenestration were evaluated using the Oswestry Disability Index (ODI) and the modified Stauffer-Coventry criteria. The results indicated satisfactory long-term outcomes for the majority of patients. [22] However, factors such as heavy manual work, smoking, and prolonged preoperative symptoms were identified as negative predictors of clinical success. Another study compared percutaneous endoscopic lumbar discectomy (PELD) with open fenestration discectomy (OFD) over a follow-up period exceeding five years. The findings suggested that both procedures provided acceptable clinical outcomes for lumbar disc herniation. Notably, PELD was associated with greater improvements in low back pain relief, delayed disc degeneration, and better maintenance of segmental stability compared to OFD. [23] Additionally, a study comparing conventional lumbar fenestration discectomy and minimally invasive lumbar discectomy reported that both techniques yielded comparable results at short-term follow-up. However, minimally invasive discectomy showed statistically significant improvements in Japanese Orthopedic Association (JOA) scores, visual analog scale (VAS) scores, and Roland-Morris scores at two years postoperatively. The differences, though statistically significant, may not be clinically substantial. [24]

Overall, these studies suggest that microscopic lumbar discectomy via fenestration offers satisfactory long-term outcomes for patients with lumbar disc herniation. Nonetheless, patient-specific factors and surgical techniques can influence the success rates, and minimally invasive approaches may provide additional benefits in terms of recovery and long-term function.

CONCLUSION

Though the Lumbar discectomy is Most common neurospine procedure, and outcome is excellent. Obviously, there is no systematic follow-up of the patient undergone this surgery specially in Bangladesh. It is a very time demanding study that could be undertaken in large scale to assess the outcome of this surgery.

REFERENCE:

1. Love JG. Root pain resulting from intraspinal protrusion of vertebral discs: diagnosis and treatment. *J Bone Joint Surg.* 1939; 19:776–80.
2. Caspar W. A new surgical procedure for lumbar disc herniation causing less tissue damage through a microsurgical approach. *Adv Neurosurg.* 1977; 4:152.
3. Williams RW. Micro lumbar disectomy: a conservative surgical approach to the virgin herniated lumbar disc. *Spine.* 1978; 3:17582.
4. Mixter WJ, Barr JS. Rupture of intervertebral disc with involvement of spinal canal. *N Engl J Med.* 1934; 211:210–5.
5. Yasargil MG. Microsurgical operation for herniated disc. In: Wullenweber R, Brock M, Hamer J, Klinger M, Spoerri O, editors. *Advances in Neurosurgery.* Berlin: Springer-Verlag; 1977. p. 81.
6. Tullberg T, Isacson J, Weidenhielm L. Does microscopic removal of lumbar disc herniation lead to better results than the standard procedure? Results of a one-year randomized study. *Spine.* 1993; 18:24–7.
7. Lagarrigue J, Chaynes P. Comparative study of disk surgery with or without microscopy. A prospective study of 80 cases. *Neu-rochirurgie.* 1994; 40:116–20.
8. Deyo RA, Weinstein JN: Low back pain. *N Engl J Med* 2001; 344: 363 – 370.
9. Findlay GF, Hall BI, Musa BS, et al: A 10-year follow-up of the outcome of lumbar microdiscectomy. *Spine (Phila Pa 1976)* 1998; 23:1168 – 1171.
10. Lavyne MH, Bilsky MH: Epidural steroids, postoperative morbidity, and recovery in patients undergoing microsurgical lumbar discectomy. *J Neurosurg* 1992, 77: 90 – 95.
11. Loupasis GA, Stamos K, Katonis PG, et al: Seven- to 20-year outcome of lumbar discectomy. *Spine (Phila Pa 1976)* 1999; 24: 2313– 2317.
12. Davis RA: A long-term outcome analysis of 984 surgically treated herniated lumbar discs. *J Neurosurg* 1994; 80: 415 – 421.
13. HES Online: Primary Diagnosis: 3 Character Tables. London: The Health and Social Care Information Centre (available at: <http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=203>).
14. Health Council of the Netherlands: Management of the Lumbosacral Radicular Syndrome (Sciatica). The Hague: Health Council of the Netherlands, 1999.
15. Deyo RA, Mirza SK: The case for restraint in spinal surgery: does quality management have a role to play? *Eur Spine J* 2009; 18(suppl 3): S331 – S337.
16. Stauffer RN, Coventry MB: Anterior interbody lumbar spine fusion. Analysis of Mayo Clinic series. *J Bone Joint Surg Am* 1972; 54: 756 – 768.
17. Shi J, Wang Y, Zhou F, Zhang H, Yang H. Long-term clinical outcomes in patients undergoing lumbar discectomy by fenestration. *Journal of International Medical Research.* 2012 Dec;40(6):2355-61.
18. Wankhade UG, Umashankar MK, Reddy BJ. Functional outcome of lumbar discectomy by fenestration technique in Lumbar disc prolapse–return to work and relief of pain. *Journal of clinical and diagnostic research: JCDR.* 2016 Mar;10(3):RC09.

19. Hamawandi SA, Sulaiman II, Al-Humairi AK. Open fenestration discectomy versus microscopic fenestration discectomy for lumbar disc herniation: a randomized controlled trial. *BMC musculoskeletal disorders*. 2020 Dec; 21:1-1.
 20. Wilson CA, Roffey DM, Chow D, Alkherayf F, Wai EK. A systematic review of preoperative predictors for postoperative clinical outcomes following lumbar discectomy. *The Spine Journal*. 2016 Nov 1;16(11):1413-22.
 21. Nygaard ØP, Kloster R, Solberg T. Duration of leg pain as a predictor of outcome after surgery for lumbar disc herniation: a prospective cohort study with 1-year follows up. *Journal of Neurosurgery: Spine*. 2000 Apr 1;92(2):131-4.
 22. Yang H, Wang YW, Liu J, Lee A, Shi JH, Xu YZ, Tang T, Ebraheim N. 68. Long-term Outcomes of Lumbar Discectomy by Fenestration: A 15-year Follow-up Study. *The Spine Journal*. 2007 Sep 1;7(5):34S.
 23. Li T, Zhang J, Ding Z, Jiang Q, Ding Y. Percutaneous endoscopic lumbar discectomy versus open fenestration discectomy for lumbar disc herniation: a retrospective propensity score-matched study with more than 5 years of follow-up. *Journal of Orthopaedic Surgery and Research*. 2024 Nov 13;19(1):753.
 24. Majeed SA, Vikraman CS, Mathew V. Comparison of outcomes between conventional lumbar fenestration discectomy and minimally invasive lumbar discectomy: an observational study with a minimum 2-year follow-up. *Journal of orthopaedic surgery and Research*. 2013 Dec; 8:1-5.
-