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Full-Endoscopic Interlaminar Lumbar Discectomy in 100 Consecutive Cases: Operative-Time Trends, Durotomy, and Early Same-Level Reoperation

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Full-Endoscopic Interlaminar Lumbar Discectomy in 100 Consecutive Cases: Operative-Time Trends, Durotomy, and Early Same-Level Reoperation

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ABSTRACT

Objective: To describe complications, early repeat surgery for same-level recurrent radicular symptoms with an MRI-confirmed fragment, and operative-time trends during one surgeon's initial experience with full-endoscopic interlaminar lumbar discectomy.

Methods: This retrospective, single-center series included 100 consecutive patients treated from April 2024 to April 2025, with at least 12 months of follow-up. Early same-level repeat surgery was recorded when recurrent radicular pain followed at least 2 symptom-free weeks and MRI showed a same-level fragment. Operative times in the first and last 30 cases were compared.

Results: Mean age was 45.0 ± 12.4 years, and 63 procedures were at L5–S1. Seven patients (7.0%) underwent repeat surgery for early same-level symptoms with an MRI-confirmed fragment, detected 2 weeks to 4 months after surgery. No wound infection or drainage, CSF fistula/leak, or new neurological deficit was documented. Mean VAS was 8.0 before surgery and 2.0 at 12 hours; mean ODI was 74% and 16%, respectively. All patients mobilized on the day of surgery and were discharged within 24 hours. Durotomy occurred in 6/12 patients with prior surgery and 1/88 without ($p < 0.001$). Mean operative time decreased from 140.4 ± 15.0 minutes in the first 30 cases to 45.5 ± 9.0 minutes in the last 30 ($p < 0.001$); no durotomy occurred in the last 30.

Conclusion: Operative time declined. Prior surgery was associated with more durotomies. Seven patients underwent early repeat surgery; without a comparator, the findings do not establish superiority over microdiscectomy.

Keywords: full-endoscopic discectomy; lumbar disc herniation; interlaminar approach; operative-time trend; incidental durotomy; repeat surgery; revision surgery

Introduction

Lumbar disc herniation is a common cause of radicular pain and may require surgery when symptoms persist despite conservative treatment or when progressive neurological deficit develops. Conventional microdiscectomy remains an established surgical treatment, while full-endoscopic techniques provide an alternative for appropriately selected patients [1–3].

The interlaminar route is particularly relevant to selected L5–S1 herniations, where the interlaminar corridor can provide direct access to the disc and neural structures. Comparative studies and systematic reviews report broadly similar clinical outcomes between endoscopic and microsurgical discectomy, although the approaches, patient selection, and outcome definitions vary across studies [1–3,11–13].

Endoscopic lumbar discectomy requires adaptation to a restricted visual field, fluoroscopic orientation, and specialized instrument handling. Prior studies and pooled analyses describe learning curves in which operative efficiency changes with accumulated experience; the number of cases associated with proficiency varies by approach, surgeon background, and the metric used [4,7–9,14]. Revision surgery presents additional technical challenges because scar tissue and altered tissue planes can make dissection less predictable and increase the risk of dural injury [6,10].

This study describes the first 100 consecutive full-endoscopic interlaminar lumbar discectomies performed by one surgeon, focusing on operative-time trends, durotomy, early same-level repeat surgery for recurrent symptoms with an MRI-visible fragment, early pain and disability scores, and same-day mobilization and discharge. Events are also described according to prior lumbar surgery.

Materials and Methods

Study Design and Patient Population

This retrospective observational study included 100 consecutive patients who underwent full-endoscopic interlaminar lumbar discectomy between April 2024 and April 2025 at a single tertiary referral center. All patients completed at least 12 months of postoperative follow-up. All procedures were performed by the same surgeon during the early phase of endoscopic practice. The study was conducted in accordance with institutional ethical standards. Ethical approval was obtained from the Sakarya University Faculty of Medicine, Health Sciences Scientific Research Ethics Committee (application no. 433; document no. E-43012747-050.04-590433; approval document date: 21 May 2026). Because of the retrospective design and anonymized data analysis, the requirement for written informed consent was waived by the ethics committee.

Inclusion and Exclusion Criteria

Patients were included if they had symptomatic single-level lumbar disc herniation, radicular pain resistant to at least 6 weeks of conservative treatment, and imaging findings concordant with symptoms. Spinal instability, infection, tumor, multilevel stenosis requiring open decompression, and inadequate follow-up were exclusion criteria. Previous lumbar surgery was not an exclusion criterion; 12 patients had a prior lumbar operation and 88 underwent primary surgery.

Surgical Technique

All procedures were performed under general anesthesia with the patient in the prone position. A 9-mm-diameter monoportal full-endoscopic system with a 30-degree viewing angle was used. The interlaminar level was selected from concordant clinical and imaging findings. Under continuous endoscopic visualization, the interlaminar corridor was used to access the epidural space. The herniated material was identified, mobilized, and removed, and decompression of the affected nerve root was confirmed by endoscopic inspection. Neural structures were protected

and epidural manipulation was minimized. In revision cases, scarred tissue was dissected cautiously because normal tissue planes could be obscured. Intraoperative durotomies were recorded, and postoperative records were reviewed for cerebrospinal fluid fistula and new neurological deficit. No routine fusion or stabilization procedure was performed.

Outcome Measures and Learning Curve Assessment

Outcomes included VAS (0–10) and ODI (0–100%), measured 24 hours before surgery and 12 hours after surgery; same-day mobilization; discharge within 24 hours; incidental durotomy; cerebrospinal fluid fistula; new neurological deficit; early same-level repeat surgery for recurrent radicular symptoms with an MRI-confirmed fragment; and operative time. A repeat operation was recorded when recurrent radicular pain followed at least 2 weeks without symptoms and follow-up MRI showed a same-level disc fragment. The seven events were detected between postoperative week 2 and month 4, and all were treated with repeat surgery. Operative-time trends were assessed exploratorily by comparing the first 30 cases with the last 30 cases; this grouped comparison was not used to estimate a formal proficiency threshold. Durotomy and repeat surgery were additionally described by prior lumbar surgery status.

Statistical Analysis

Analyses were performed using SPSS version 30 (IBM Corp., Armonk, NY, USA). Continuous variables are reported as mean ± standard deviation and categorical variables as number and percentage. VAS and ODI are reported as means at the prespecified time points; standard deviations and paired patient-level data were unavailable, so no inferential comparison was performed. Between-group comparisons of categorical outcomes used Fisher's exact test; normally distributed continuous variables were compared using the independent-samples t test. Tests were two-sided, with $p < 0.05$ considered statistically significant. Because only seven durotomies and seven repeat operations occurred, subgroup findings are interpreted cautiously.

Results

Patient Characteristics

The cohort comprised 100 patients (mean age, 45.0 ± 12.4 years); 37 procedures were performed at L4–L5 and 63 at L5–S1. Twelve patients (12.0%) had a history of lumbar surgery. All patients completed at least 12 months of postoperative follow-up. Baseline characteristics by operated level are summarized in Table 1.

Neurological Outcomes

Radiculopathy was present preoperatively in all patients. Preoperative motor deficit was recorded in 10 patients: 4 at L4–L5 and 6 at L5–S1. At the last recorded assessment, six patients had persistent preoperative dorsiflexion weakness and four had persistent preoperative sphincter dysfunction; no new postoperative neurological deficit was recorded. Mean VAS was 8.0/10 24 hours before surgery and 2.0/10 12 hours after surgery. Mean ODI was 74% 24 hours before surgery and 16% 12 hours after surgery. All 100 patients mobilized on the day of surgery and were discharged within 24 hours. Preoperative neurological findings are shown in Table 2.

Recurrence and Complications

Early same-level repeat surgery for recurrent radicular symptoms with an MRI-confirmed fragment occurred in 7/100 patients (7.0%). A repeat operation was recorded when recurrent radicular pain followed at least 2 symptom-free weeks and follow-up MRI showed a same-level disc fragment. Events were detected between postoperative week 2 and month 4, and all seven patients underwent repeat surgery. One of the 12 patients with prior lumbar surgery had an event (8.3%), compared with 6/88 primary cases (6.8%; Fisher's exact $p = 1.000$). No surgical-site infection, wound drainage, or CSF fistula/leak was documented, and no new postoperative neurological deficit was recorded.

Operative-Time Trend During Initial Experience

Mean operative time decreased across the sequential case series, from 140.4 ± 15.0 minutes in the first 30 cases to 45.5 ± 9.0 minutes in the last 30 cases ($p < 0.001$), a 67.6% reduction in group means. No durotomy occurred in the final 30 cases. Because case-level complication chronology was unavailable for all events, overall complication rates by case block could not be estimated. The available summaries support an early-to-late reduction in operative time but do not permit a case-by-case curve or a formal CUSUM proficiency threshold. The comparison is summarized in Table 6 and Figure 1.

Discussion

This consecutive 100-patient series describes the initial experience of one surgeon with full-endoscopic interlaminar lumbar discectomy. The principal findings were a substantial reduction in mean operative time between the first and last 30 cases, seven repeat operations for early same-level recurrent symptoms with an MRI-visible fragment, and a marked concentration of durotomy among patients with prior lumbar surgery. No surgical-site infection, wound drainage, or CSF fistula/leak was documented, and all patients mobilized on the day of surgery and left hospital within 24 hours. These findings describe feasibility and early practice patterns; the retrospective design and lack of a concurrent comparator do not establish that this approach is safer or more effective than microdiscectomy.

The 67.6% decrease in mean operative time is consistent with the technical adaptation reported in prior endoscopic discectomy learning-curve studies. A systematic review and individual-participant meta-analysis found that learning curves differ by procedure, surgeon experience, and outcome definition [4]. Earlier interlaminar and percutaneous endoscopic series similarly reported changes in operative efficiency over sequential cases [7–9,14]. The present comparison is deliberately limited to the first and last 30 cases: without patient-level times and an analysis such as CUSUM, it cannot identify the case at which proficiency was achieved. Case mix and procedure complexity may also have changed over time.

Durotomy occurred in six of 12 patients with prior lumbar surgery (50.0%) and one of 88 patients without prior surgery (1.1%). The association is clinically plausible because revision dissection can involve scarred epidural planes and less distinct tissue boundaries; prior spine-surgery complication reviews and studies discuss dural injury and operative risk factors in this context [5,6,10]. However, the revision subgroup contains only 12 patients, and this single-surgeon series cannot separate the effect of prior surgery from case sequence, anatomy, or other confounders.

The data support careful counseling and operative planning, but not a causal estimate of risk. No surgical-site infection, wound drainage, CSF fistula/leak, nerve-root injury, or new neurological deficit was documented in the cohort, including after the seven durotomies. In the BMJ randomized trial, wound infection occurred in 0/171 patients after transforaminal endoscopic discectomy and 3/249 (1%) after open microdiscectomy; cerebrospinal fluid leakage occurred in 0 and 2 patients (<1%), respectively [2]. The absence of infection or CSF leakage in the present series is a favorable descriptive observation, but the cohort size, different endoscopic route, patient selection, and lack of a concurrent comparator preclude a claim of lower risk than microdiscectomy.

Seven patients (7.0%) underwent repeat surgery for early same-level recurrent radicular symptoms with an MRI-confirmed fragment. Events were detected between postoperative week 2 and month 4, after a minimum 2-week symptom-free interval. Because this interval is short, early residual material cannot be reliably distinguished from a new recurrence; the outcome is therefore best interpreted as repeat surgery for early same-level symptoms and an MRI-visible fragment. One event occurred among 12 patients with previous lumbar surgery and six among 88 primary cases; Fisher's exact test did not identify a difference ($p = 1.000$), but these small groups do not support an equivalence conclusion. In the multicenter BMJ randomized trial, one-year repeat-surgery rates were 5.3% after transforaminal endoscopic discectomy and 5.6% after open microdiscectomy [2]. The observed 7.0% in the present series is numerically within a similar range, but this is contextual comparison only: the route, patient selection, recurrence definition, and follow-up framework differ, and the present study had no concurrent control group. Systematic reviews likewise pool heterogeneous endoscopic and microscopic techniques and outcome definitions [3,13].

The observed same-day mobilization and discharge within 24 hours are relevant practical outcomes for this cohort. The BMJ randomized trial also reported earlier mobilization and frequent same-day discharge after transforaminal endoscopic surgery than after open discectomy [2]. Because the current series had no control group and discharge criteria were not compared, the findings show that a short postoperative pathway was achieved in these patients; they do not establish that the endoscopic procedure caused earlier discharge or reduced resource use. The interlaminar route is an established option for selected L5–S1 herniations, while approach selection should account for anatomy and herniation location [1,11,12].

VAS and ODI improved between the measurement obtained 24 hours before surgery and the measurement obtained 12 hours after surgery. These very early postoperative scores are useful as an immediate symptom snapshot, but they should not be interpreted as durable pain relief or functional recovery. The ODI is ordinarily used to assess disability over a longer interval, and a score measured 12 hours after surgery may be influenced by perioperative analgesia, anesthesia, and restricted early activity. Future follow-up should include prespecified later assessments and paired patient-level data. No between-time inferential test is presented here.

This study has limitations. It was retrospective, single-center, and performed by one surgeon, with no contemporaneous microsurgical comparison. The first-versus-last 30-case analysis is a grouped comparison rather than a case-by-case learning-curve model; case mix may have changed over the series. The small numbers of durotomy and reoperation events make subgroup estimates imprecise. Follow-up of at least 12 months may not capture later recurrence. VAS and ODI were assessed only at the stated immediate time points in the available dataset, so longer-term patient-reported outcomes cannot be inferred. The operational definition captured early same-level reherniation after a minimum 2-week symptom-free interval; retrospective records did not permit independent adjudication of residual versus recurrent fragments. Prospective work

should use standardized outcome time points, prespecified recurrence criteria, and comparison groups.

Conclusion

In this single-surgeon series, mean operative time was lower in the last 30 than in the first 30 cases. Early same-level repeat surgery for recurrent radicular symptoms with an MRI-confirmed fragment occurred in 7.0% of patients. Durotomy occurred in 6/12 patients with prior lumbar surgery and 1/88 without prior surgery; this association warrants cautious interpretation. No surgical-site infection, wound drainage, or CSF fistula/leak was documented, and no new neurological deficit occurred. Mean VAS was 8.0/10 24 hours before surgery and 2.0/10 12 hours after surgery; mean ODI was 74% and 16%, respectively, at those time points. All patients mobilized on the day of surgery and were discharged within 24 hours. These early observations do not establish long-term outcome or superiority over microdiscectomy.

Declarations

Human Ethics and Consent to Participate declarations

This study was approved by the Sakarya University Faculty of Medicine, Health Sciences Scientific Research Ethics Committee (application no. 433; document no. E-43012747-050.04-590433; approval document date: 21 May 2026). Because of the retrospective design and anonymized data analysis, the requirement for written informed consent was waived by the ethics committee.

Consent for publication

Not applicable; only aggregate data are reported, with no individually identifiable patient information or images.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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References

1. Ruetten S, Komp M, Merk H, Godolias G. Full-endoscopic interlaminar and transforaminal lumbar discectomy versus conventional microsurgical technique: a prospective, randomized, controlled study. Spine (Phila Pa 1976). 2008;33(9):931–939. doi:10.1097/BRS.0b013e31816c8af7.

2. Gadjradj PS, Rubinstein SM, Peul WC, Depauw PR, Vleggeert-Lankamp CL, Seiger A, et al. Full endoscopic versus open discectomy for sciatica: randomised controlled non-inferiority trial. BMJ. 2022;376:e065846. doi:10.1136/bmj-2021-065846.

3. Barber SM, Nakhla J, Konakondla S, Fridley JS, Oyelese AA, Gokaslan ZL, et al. Outcomes of endoscopic discectomy compared with open microdiscectomy and tubular microdiscectomy for lumbar disc herniations: a meta-analysis. J Neurosurg Spine. 2019;31(6):802–815. doi:10.3171/2019.6.SPINE19532.

4. Koh CH, Booker J, Choi D, Khan DZ, Horsfall HL, Sayal P, et al. Learning curve of endoscopic lumbar discectomy: a systematic review and meta-analysis of individual participant and aggregated data. Global Spine J. 2025;15(2):1435–1444. doi:10.1177/21925682241289901.

5. Shriver MF, Xie JJ, Tye EY, Rosenbaum BP, Kshettry VR, Benzel EC, et al. Lumbar microdiscectomy complication rates: a systematic review and meta-analysis. Neurosurg Focus. 2015;39(4):E6. doi:10.3171/2015.7.FOCUS15281.

6. Ju CI, Lee SM. Complications and management of endoscopic spinal surgery. Neurospine. 2023;20(1):56–77. doi:10.14245/ns.2346226.113.

7. Son S, Ahn Y, Lee SG, Kim WK. Learning curve of percutaneous endoscopic interlaminar lumbar discectomy versus open lumbar microdiscectomy at the L5–S1 level. PLoS One. 2020;15(7):e0236296. doi:10.1371/journal.pone.0236296.

8. Xu H, Liu H, Liu G, et al. Learning curve of full-endoscopic technique through interlaminar approach for L5/S1 disk herniations. Cell Biochem Biophys. 2014;70(2):1069–1074. doi:10.1007/s12013-014-0024-3.

9. Ahn Y, Lee S, Son S, Kim H. Learning curve for interlaminar endoscopic lumbar discectomy: a systematic review. World Neurosurg. 2021;150:93–100. doi:10.1016/j.wneu.2021.03.128.

10. Baker GA, Casha S, Shenouda E, et al. Risk factors for unintended durotomy during spine surgery: a multivariate analysis. Spine J. 2012;12(2):121–126. doi:10.1016/j.spinee.2012.01.012.

11. Nie H, Zeng J, Song Y, et al. Percutaneous endoscopic lumbar discectomy for L5–S1 disc herniation via an interlaminar approach versus a transforaminal approach: a prospective randomized controlled study with 2-year follow-up. Spine. 2016;41 Suppl 19:B30–B37. doi:10.1097/BRS.0000000000001810.

12. Kotheeranurak V, Liawrungrueang W, Quillo-Olvera J, et al. Full-endoscopic lumbar discectomy approach selection: a systematic review and proposed algorithm. Spine (Phila Pa 1976). 2023;48(8):534–544. doi:10.1097/BRS.0000000000004589.

13. Yang CC, Chen CM, Lin MH, Huang WC, Lee MH, Kim JS, et al. Complications of full-endoscopic lumbar discectomy versus open lumbar microdiscectomy: a systematic review and meta-analysis. World Neurosurg. 2022;168:333–348. doi:10.1016/j.wneu.2022.06.023.

14. Wang H, Huang B, Li C, et al. Learning curve for percutaneous endoscopic lumbar discectomy depending on the surgeon's training level of minimally invasive spine surgery. Clin Neurol Neurosurg. 2013;115(10):1987–1991. doi:10.1016/j.clineuro.2013.06.008.

Tables

Table 1. Comparison According to L4–L5 and L5–S1 Levels

Parameters	L4–L5 (n=37)	L5–S1 (n=63)	p Value
Sex (Female, n %)	25 (67.6%)	23 (36.5%)	0.003
Sex (Male, n %)	12 (32.4%)	40 (63.5%)	
BMI (kg/m², Mean ± SD)	26.4 ± 3.3	27.1 ± 3.3	0.31
Diabetes (DM, n %)	2 (5.4%)	6 (9.5%)	0.47
Hypertension (HT, n %)	6 (16.2%)	12 (19.0%)	0.72

Table 2. Preoperative Neurological Status According to L4–L5 and L5–S1 Levels

Preoperative Clinical Findings	L4–L5 (n=37)	L5–S1 (n=63)
Radiculopathy (Right)	19 (51.4%)	40 (63.5%)
Radiculopathy (Left)	18 (48.6%)	23 (36.5%)
Motor deficit (overall)	4 (10.8%)	6 (9.5%)
Dorsiflexion Weakness	4 (10.8%)	2 (3.2%)
Sphincter Dysfunction/Incontinence	2 (5.4%)	2 (3.2%)

Note: Preoperative motor deficit was recorded in 10 patients overall (4 at L4–L5 and 6 at L5–S1). Dorsiflexion weakness and sphincter dysfunction are also shown as specific findings and may overlap; they should not be summed as mutually exclusive categories.

Table 3. Postoperative Outcomes and Complications by Operated Level

Postoperative Findings and Complications	**L4–L5 (n=37)**	**L5–S1 (n=63)**
Early same-level repeat surgery (MRI fragment)	2 (5.4%)	5 (7.9%)
Dural Tear (Durotomy)	5 (13.5%)	2 (3.2%)
Wound infection/drainage	0 (0.0%)	0 (0.0%)
CSF fistula/leak	0 (0.0%)	0 (0.0%)
New Neurological Deficit	0 (0.0%)	0 (0.0%)
Persistent Postoperative Dorsiflexion Weakness	4 (10.8%)	2 (3.2%)
Persistent Postoperative Incontinence	2 (5.4%)	2 (3.2%)

Table 4. Durotomy According to Prior Lumbar Surgery

Prior lumbar surgery	**Patients, n**	**Durotomy, n (%)**	**No durotomy, n (%)**	**p value**
Yes	12	6 (50.0%)	6 (50.0%)	<0.001
No	88	1 (1.1%)	87 (98.9%)	

Fisher’s exact test; the observed association does not establish causality.

Table 5. Early Same-Level Repeat Surgery According to Prior Lumbar Surgery

Prior lumbar surgery	**Patients, n**	**Repeat surgery, n (%)**	**No repeat surgery, n (%)**	**p value**
Yes	12	1 (8.3%)	11 (91.7%)	1.000
No	88	6 (6.8%)	82 (93.2%)	

Fisher's exact test. The subgroup rates are descriptive and do not establish equivalence between groups.

Table 6. Operative-Time Comparison Between Early and Late Cases

Case block	**n**	**Mean operative time, minutes (mean ± SD)**
First 30 cases	30	140.4 ± 15.0
Last 30 cases	30	45.5 ± 9.0
Between-group comparison	—	$p < 0.001$

Figures

Figure 1. Mean operative time for the first 30 and last 30 consecutive cases. Bars represent group means; error bars represent standard deviations.

