



SPINAL ANESTHESIA FOR UNILATERAL BIPORTAL ENDOSCOPIC LUMBAR DECOMPRESSION IN PATIENTS WITH SIGNIFICANT COMORBIDITIES: FEASIBILITY AND EARLY OUTCOMES

© Gardashkhan Karırmzada¹, © Demet Evleksiz¹, © Adem Doğan², © Mehmet Can Ezgü³, © Mehmet İlker Özer⁴, © İlker Solmaz⁵

¹Hitit University Çorum Erol Olçok Training and Research Hospital, Clinic of Neurosurgery, Çorum, Türkiye

²Şehitkamil State Hospital, Clinic of Neurosurgery, Gaziantep, Türkiye

³University of Health Sciences Türkiye, Gülhane Training and Research Hospital, Clinic of Neurosurgery, Ankara, Türkiye

⁴University of Health Sciences Türkiye, Sincan Training and Research Hospital, Clinic of Neurosurgery, Ankara, Türkiye

⁵Private Clinic, Clinic of Neurosurgery, Ankara, Türkiye

ABSTRACT

Objective: The objective of this study is to evaluate the feasibility, perioperative safety, and early clinical outcomes of unilateral biportal endoscopic lumbar decompression (UBELD) performed under spinal anesthesia in carefully selected patients.

Materials and Methods: A retrospective review was conducted on patients who underwent UBELD under spinal anesthesia between April 2024 and June 2025. Cases from two different centers were included in the study. The primary outcome was the successful completion of surgery under spinal anesthesia without conversion to general anesthesia. Secondary outcomes included anesthesia-related adverse events, operative time, surgical complications, and changes in visual analog scale (VAS) scores for back and leg pain and in Oswestry disability index (ODI) scores.

Results: The mean operative time was 71.5±18.9 minutes. Mild intravenous sedation was required in 10 patients (45.5%). Transient hypotension was observed in five patients (22.7%), bradycardia in two patients (9.1%), and postoperative nausea in four patients (18.2%). Complications included an incidental dural tear, a postoperative spinal epidural hematoma requiring surgical evacuation, and transient urinary retention, each in one patient. Back pain VAS decreased from 7.27±1.76 preoperatively to 2.64±0.85, corresponding to a mean improvement of 4.64 points [95% confidence interval (CI), 3.89-5.38; p<0.001]. Leg pain VAS decreased from 8.50±1.50 to 2.18±0.85, with a mean improvement of 6.32 points (95% CI, 5.66-6.98; p<0.001). ODI decreased from 65.41±14.78 to 13.64±7.29, corresponding to a mean improvement of 51.77 points (95% CI, 44.38-59.16; p<0.001).

Conclusion: In our study, we observed that UBELD could be performed under spinal anesthesia in a small, carefully selected group of American Society of Anesthesiologists III-IV patients, and we completed all procedures without switching to general anesthesia. Our findings should not be interpreted as evidence that spinal anesthesia is safer than general anesthesia, but rather as evidence of the feasibility of spinal anesthesia in selected patients.

Keywords: Biportal endoscopic surgery, spinal anesthesia, minimally invasive, spinal endoscopy, awake surgery

INTRODUCTION

Degenerative spinal disorders are among the leading causes of pain, disability, and reduced quality of life in the elderly population^(1,2). In degenerative conditions such as lumbar stenosis and lumbar disc herniation, the first-line treatment is conservative^(3,4). Surgical decompression is indicated for patients whose symptoms persist despite medical treatment and physical therapy, or who have progressive neurological deficits⁽⁴⁻⁶⁾. As in all subspecialties of surgery, minimally invasive approaches have now become a routine part of spinal surgery⁽⁷⁾. Among the popular minimally invasive approaches, unilateral biportal endoscopic (UBE) surgery accelerates the postoperative

recovery process by reducing damage to the paraspinal muscles and bone⁽⁸⁾. Thanks to early mobilization, minimal postoperative pain, and the wide range of maneuverability it provides to the surgeon, the frequency of routine use of minimally invasive approaches is increasing^(9,10).

Worldwide, UBE lumbar decompression (UBELD) procedures are generally performed routinely under general anesthesia^(8,11,12). Some patients with degenerative spinal conditions are elderly and have comorbidities, which put them at high risk for anesthesia-related complications. For this group of patients with cardiac, pulmonary, and neurological problems, spinal anesthesia is an important alternative for avoiding complications associated with general anesthesia^(13,14).

Address for Correspondence: Gardashkhan Karırmzada, Hitit University Çorum Erol Olçok Training and Research Hospital, Clinic of Neurosurgery, Çorum, Türkiye

E-mail: kerim_zade@outlook.com

ORCID ID: orcid.org/0000-0002-4897-4758

Received: 06.08.2026 **Accepted:** 23.09.2026 **Publication Date:** 14.10.2026

Cite this article as: Karırmzada G, Evleksiz D, Doğan A, Ezgü MC, Özer Mİ, Solmaz İ. Spinal anesthesia for unilateral biportal endoscopic lumbar decompression in patients with significant comorbidities: feasibility and early outcomes. J Turk Spinal Surg. 2026;37(4):176-184



Spinal/epidural anesthesia is gaining increasing attention in lumbar spine surgery for patients with serious comorbidities^(14,15). It has been used for years in cases operated on using a microsurgical approach, and extensive case series evaluating its safety and outcomes have been reported⁽¹³⁾. However, evidence regarding the use of spinal anesthesia during UBELD is limited, particularly in the elderly and high-risk patient groups. There are very few studies in the literature that specifically evaluate the feasibility and perioperative safety of spinal anesthesia for UBELD in high-risk patients⁽¹⁶⁾.

Although the number of studies is limited, previous studies have reported that UBELD can be performed under spinal or local anesthesia in conscious, elderly patients with high-risk medical conditions. In this study, we aimed to report on the feasibility of intrathecal spinal anesthesia, early clinical outcomes, and perioperative events in carefully selected American Society of Anesthesiologists (ASA) III-IV patients.

MATERIALS AND METHODS

This retrospective multicenter study was conducted after obtaining approval for the multicenter study from the Hitit University Faculty of Medicine Institutional Ethics Committee (approval no: 2025-124, date: 03.06.2025). The study was conducted in accordance with the principles of the Declaration of Helsinki. Patients who underwent UBELD surgery under spinal anesthesia at two different centers approved by the ethics committee between April 2024 and June 2025 were analyzed retrospectively. The study included adult patients classified as ASA III or IV who underwent UBELD under spinal anesthesia and had at least three months of postoperative follow-up and patients aged 18 years and older. Patients who underwent UBELD due to spinal infection, tumor, or traumatic pathology, as well as those with incomplete medical records or inadequate follow-up, were excluded from the study. A total of 22 patients met the inclusion criteria and were included in the final analysis. The cases included in the study do not encompass all UBELD procedures performed under spinal anesthesia. The study includes selected cases that met the inclusion criteria. All patients first underwent routine preoperative cardiac, neurological, and pulmonary evaluations and were approved for general anesthesia with an ASA III or IV score. In UBELD cases, the decision to administer spinal anesthesia was made by the anesthesia team in the operating room. When making this decision, the team evaluated the appropriateness of the procedure in consultation with the surgical team, taking into account factors such as the anticipated duration of surgery, the complexity of the procedure, the number of levels to be operated on, and the level of cooperation expected from the patient.

The primary endpoint was procedural feasibility, defined as completion of UBELD under spinal anesthesia without conversion to general anesthesia. Secondary endpoints included operative time, anesthesia-related adverse events (hypotension,

bradycardia, vasopressor use, postoperative nausea, additional local anesthetic requirements, and conversion to general anesthesia), length of hospital stay, and surgical complications. The overall available postoperative follow-up duration was recorded separately and was not used as the time point for the standardized clinical outcome analysis. Clinical relevance was additionally evaluated using previously established minimum clinically important difference (MCID) thresholds for lumbar spine surgery: an improvement of ≥ 1.2 points for back pain visual analog scale (VAS), ≥ 1.6 points for leg pain VAS, and ≥ 12.8 points for Oswestry disability index (ODI)⁽¹⁷⁾.

Anesthesia Technique

Spinal anesthesia was administered while the patient was in a sitting position. Following skin preparation and sterile draping, a 25-gauge Quincke spinal needle was inserted into the L3-L4 or L4-L5 intervertebral space using a midline approach. After confirming the free flow of clear cerebrospinal fluid, 12.5 mg (2.5 mL) of 0.5% hyperbaric bupivacaine was injected intrathecally. The patients were then placed in the supine position, and the sensory block was assessed using a needle-prick test. Before the patients were placed in the prone position and surgery was initiated, a sensory block level extending to T10 or higher was confirmed. Hemodynamic parameters were recorded at regular intervals, and when hypotension or bradycardia occurred, they were treated according to routine anesthetic practices. The duration of the sensory block and the time to block resolution were not recorded.

In cases where the patient's prolonged immobility in the prone position causes position-related discomfort and psychological distress, sedoanalgesia was administered to ensure that this situation did not adversely affect surgical conditions. For this purpose, a combination of midazolam and fentanyl was chosen. Sedation was individually titrated to preserve spontaneous ventilation and airway reflexes. Electrocardiography, non-invasive blood pressure, and peripheral oxygen saturation were monitored throughout the procedure.

Antithrombotic Therapy Management

In the management of patients on antithrombotic therapy, aspirin was not discontinued prior to surgery; clopidogrel was discontinued 5 days before surgery; and apixaban was discontinued 72 hours before surgery. Once clopidogrel and apixaban were discontinued, enoxaparin bridge therapy was initiated, and the final preoperative dose of enoxaparin was administered 12 hours before spinal anesthesia. 24 hours after surgery, patients resumed their regular antithrombotic therapy.

Surgical Technique

All surgeries were performed under spinal anesthesia using a UBE technique (Figures 1-3). Skin incisions and triangulation were standardized by modifying a previously defined method to accommodate the patient's anatomical characteristics and the surgeon's ergonomic needs⁽¹⁸⁾. Irrigation was provided by gravity from a saline bag positioned at a height of 1.7 meters.

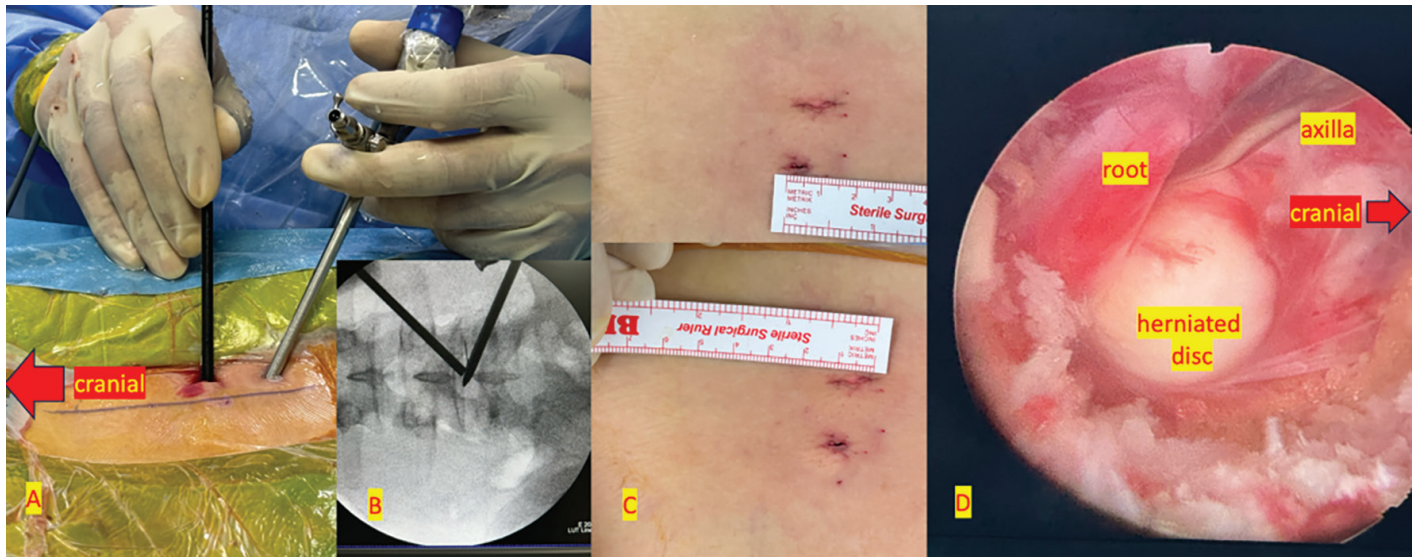


Figure 1. Surgical setup and portal configuration for unilateral biportal endoscopic lumbar decompression under spinal anesthesia. (A) Unilateral biportal endoscopic approach to a right L4-5 lumbar disc herniation. Two portals were established, the endoscope was handled with the surgeon's left hand. The cranial direction is indicated by the red arrow. (B) Intraoperative fluoroscopic view illustrating the triangulation of the viewing and working portals toward the target surgical level. (C) Postoperative small skin incisions used for the viewing and working portals. (D) Endoscopic view showing the decompressed nerve root and the herniated disc fragment before discectomy

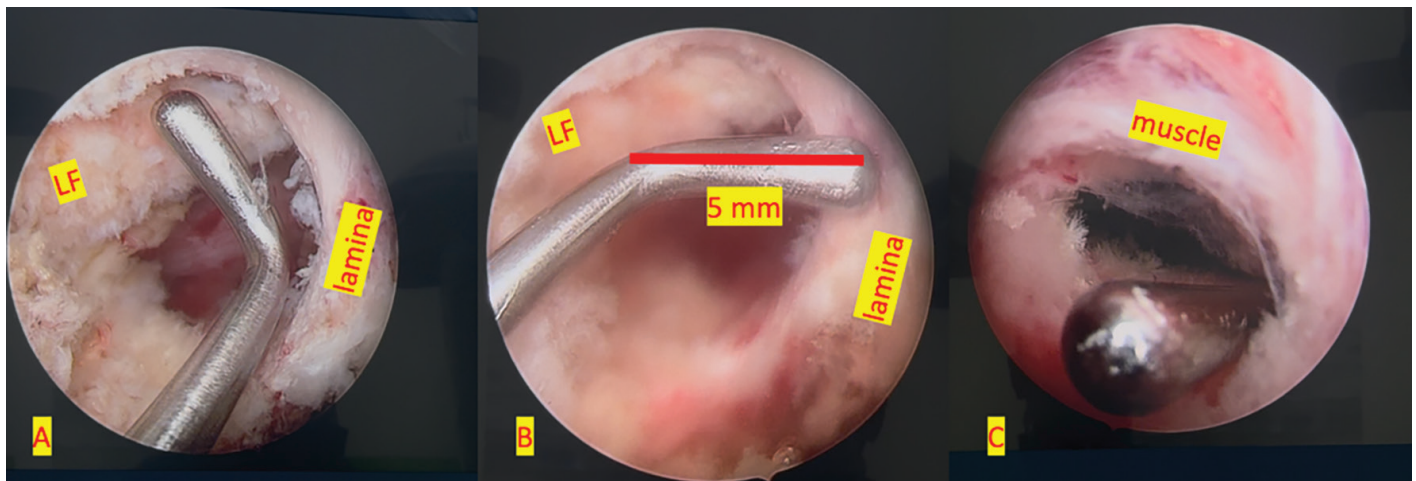


Figure 2. Right-sided L4-L5 key-hole unilateral biportal endoscopic lumbar discectomy performed using a 30° endoscope. (A, B) Endoscopic views demonstrating the key-hole laminotomy. A 5x5 mm bony window (5 mm verticalx5 mm horizontal) was created using a high-speed drill. The ligamentum flavum (LF) was preserved during drilling, and the subsequent flavectomy window was smaller than the laminotomy window. Following flavectomy, discectomy was performed through this limited exposure while preserving the surrounding osseous structures. (C) Endoscopic view at the completion of surgery after cessation of irrigation. The paraspinal muscles returned spontaneously to their anatomical position, and the working portal collapsed spontaneously, demonstrating the muscle-sparing and bone-preserving nature of UBELD. UBELD: Unilateral biportal endoscopic lumbar decompression

A manual pump was used intermittently as needed to improve visual clarity. Irrigation pressure was not measured directly. Potential clinical manifestations associated with increased irrigation pressure were monitored indirectly by observing headaches, an increase in systolic blood pressure, hemorrhages in the epidural space, and pulsations in the dural sac. In cases where two-level decompression was performed, a three-portal configuration was used. In left-sided approaches, to ensure unidirectional (viewing portal -> working portal)

irrigation flow, the caudal level was decompressed first. When proceeding to the cranial level, the initial viewing portal was dilated and reused as the working portal, and an additional portal was created to reestablish the viewing-working portal configuration. In right-sided approaches, the sequence was reversed: the cranial level was treated first, followed by the caudal level. In cases where bilateral decompression was performed, decompression on the contralateral side was performed using a unilateral sublaminar approach.

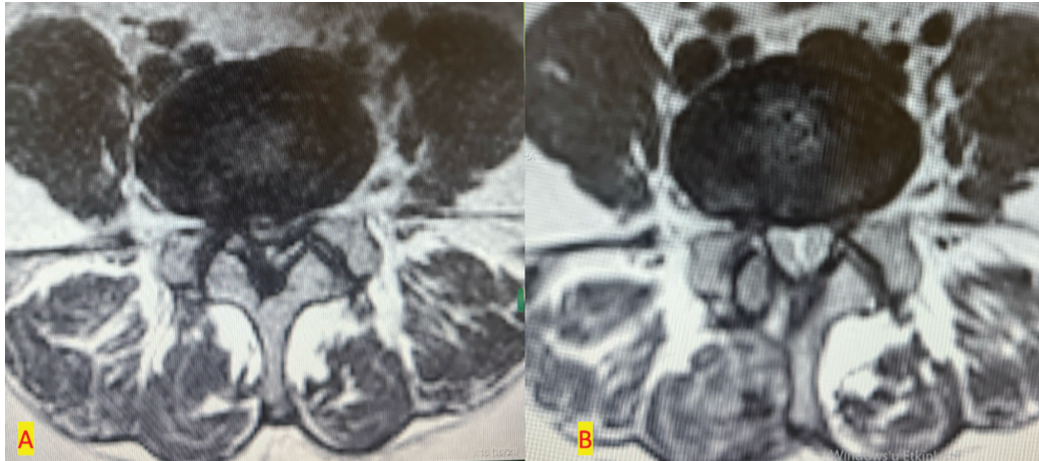


Figure 3. Right-sided UBELD for L4-L5 lumbar spinal stenosis using a 30° endoscope. (A) Preoperative axial T2-weighted MRI demonstrating severe central canal stenosis with compression of the thecal sac and bilateral lateral recess stenosis. (B) Six-month postoperative axial T2-weighted MRI demonstrating adequate decompression of the central canal and bilateral lateral recesses following a right-sided approach. The patient's preoperative symptoms resolved completely, and no evidence of fatty degeneration was observed in the paraspinal muscles on the operated (right) side, indicating preservation of the paraspinal musculature. UBELD: Unilateral biportal endoscopic lumbar decompression, MRI: Magnetic resonance imaging

Statistical Analysis

IBM SPSS Statistics software version 28.0.1.0 (IBM, SPSS, Chicago, Illinois, USA) was used for the statistical analysis of this study data. Numerical variables of patient data were expressed as mean $\pm$ standard deviation, whereas categorical variables are summarized as frequencies and percentages. The distribution of continuous variables was assessed using the Shapiro-Wilk test. Changes in normally distributed paired variables were analyzed using the paired-samples t-test, while non-normally distributed paired variables were compared using the Wilcoxon signed-rank test. All statistical tests were two-tailed, and a p-value <0.05 was considered statistically significant. For each clinical outcome, the magnitude of improvement was calculated as the preoperative score minus the 3-month postoperative score and is reported with its 95% confidence interval (CI). The proportion of patients achieving the predefined MCID threshold was calculated for each outcome and reported as number and percentage.

RESULTS

The mean age of the patients included in the study was 66.7 ± 8.8 years (range, 55-80 years). Seven patients (31.8%) were male and 15 (68.2%) were female. Eighteen patients (81.8%) were classified as ASA III, and four patients (18.2%) were classified as ASA IV. A high burden of systemic comorbidities was observed in the study population. Thirteen patients (59.1%) had hypertension, 14 patients (63.6%) had coronary artery disease, 10 patients (45.5%) had diabetes mellitus, 7 patients (31.8%) had cardiac arrhythmia, 4 patients (18.2%) had a rheumatological disease, 5 patients (22.7%) had a history of previous stroke, 2 patients (9.1%) had Parkinson's disease, and 2 patients (9.1%) had myasthenia gravis. Most patients were receiving

antithrombotic therapy prior to surgery. The mean overall available postoperative follow-up was 7.3 ± 2.7 months, whereas clinical outcome measures were evaluated at the predefined 3-month assessment point. Detailed baseline characteristics are summarized in Table 1. The mean operative time in the study was 71.5 ± 18.9 minutes. Mild intravenous sedation was required in 10 patients (45.5%) during spinal anesthesia, and additional paraspinal local anesthetic infiltration was required in 2 patients (9.1%). Transient hypotension was observed in 5 patients (22.7%), while bradycardia developed in 2 patients (9.1%). Atropine and ephedrine were administered to 2 (9.1%) and 5 (22.7%) patients, respectively. Postoperative nausea was observed in 4 patients (18.2%). Perioperative findings are summarized in Table 2. Clinical outcomes improved at the 3-month assessment. Back pain VAS decreased from 7.27 ± 1.76 preoperatively to 2.64 ± 0.85 , corresponding to a mean improvement of 4.64 points (95% CI, 3.89-5.38; $p < 0.001$). Leg pain VAS decreased from 8.50 ± 1.50 to 2.18 ± 0.85 , with a mean improvement of 6.32 points (95% CI, 5.66-6.98; $p < 0.001$). ODI decreased from 65.41 ± 14.78 to 13.64 ± 7.29 , corresponding to a mean improvement of 51.77 points (95% CI, 44.38-59.16; $p < 0.001$). The MCID threshold was reached by all 22 patients (100%) for both back and leg pain VAS and by 21 patients (95.5%) for ODI (Table 3).

All patients successfully underwent UBELD under spinal anesthesia. Of the patients included in the study, 10 (45.5%) underwent surgery for lumbar disc herniation, while 12 (54.5%) underwent surgery for lumbar stenosis. Among the patients who underwent surgery for disc herniation, eight received single-level UBELD, and two received two-level UBELD. Nine patients operated on for stenosis underwent single-level UBELD, while three patients underwent two-level UBELD. A total of 27 levels were treated. The most commonly treated level was L4-5 ($n=15$,

Table 1. Baseline demographic and clinical characteristics of patients undergoing unilateral biportal endoscopic lumbar decompression under spinal anesthesia

Variable	Overall (n=22)
Age (years), mean $\pm$ SD	66.7 $\pm$ 8.8
Sex, n (%)	
Female	15 (68.2%)
Male	7 (31.8%)
ASA, n (%)	
ASA III	18 (81.8%)
ASA IV	4 (18.2%)
Hypertension, n (%)	13 (59.1%)
Diabetes mellitus, n (%)	10 (45.5%)
Coronary artery disease, n (%)	14 (63.6%)
Cardiac arrhythmia, n (%)	7 (31.8%)
Previous stroke, n (%)	5 (22.7%)
Myasthenia gravis, n (%)	2 (9.1%)
Rheumatologic disease, n (%)	4 (18.2%)
Parkinson disease, n (%)	2 (9.1%)
Antithrombotic therapy, n (%)	
None	4 (18.2%)
Aspirin	9 (40.9%)
Clopidogrel (plavix)	7 (31.8%)
Apixaban (eliquis)	2 (9.1%)
Overall available postoperative follow-up (months), mean $\pm$ SD	7.3 $\pm$ 2.7

Data are presented as mean $\pm$ standard deviation (SD) for continuous variables and number (%) for categorical variables. ASA: American Society of Anesthesiologists

Table 2. Operative and perioperative characteristics

Variable	Overall (n=22)
Operative characteristics	
Operative time (min), mean $\pm$ SD	71.5 $\pm$ 18.9
Hospital stay (hours), mean $\pm$ SD	22.9 $\pm$ 6.0
Approach, n (%)	
Left-sided	17 (77.3%)
Right-sided	5 (22.7%)
Pathology	
Disc herniation	10 (45.5%)
Spinal stenosis	12 (54.5%)
Single level 17	
Two levels 5	
Total levels: 27	
Anesthesia-related events	
Mild intravenous sedation required, n (%)	10 (45.5%)
Additional local anesthetic infiltration, n (%)	2 (9.1%)
Hypotension, n (%)	5 (22.7%)
Bradycardia, n (%)	2 (9.1%)
Atropine administration, n (%)	2 (9.1%)
Ephedrine administration, n (%)	5 (22.7%)
Postoperative nausea, n (%)	4 (18.2%)

Data are presented as mean $\pm$ standard deviation (SD) for continuous variables and number (%) for categorical variables

Table 3. Clinical outcomes following unilateral biportal endoscopic lumbar decompression

Variable	Preoperative	3-month follow-up	Mean improvement (95% CI)	MCID achieved, n (%)	p-value
Back pain VAS	7.27±1.76	2.64±0.85	4.64 (3.89-5.38)	22 (100%)	<0.001*
Leg pain VAS	8.50±1.50	2.18±0.85	6.32 (5.66-6.98)	22 (100%)	<0.001*
ODI	65.41±14.78	13.64±7.29	51.77 (44.38-59.16)	21 (95.5%)	<0.001*

Data are presented as mean ± standard deviation. Improvement was calculated as the preoperative score minus the 3-month postoperative score. MCID was defined as an improvement of ≥1.2 points for back pain VAS, ≥1.6 points for leg pain VAS, and ≥12.8 points for ODI, based on previously established thresholds for lumbar spine surgery. *: Wilcoxon signed-rank test, ^: Paired samples t-test, VAS: Visual analog scale, ODI: Oswestry disability index, CI: Confidence interval, MCID: Minimum clinically important difference

55.6%), followed by L5-S1 (n=6, 22.2%), L3-4 (n=3, 11.1%), L2-3 (n=2, 7.4%), and L1-2 (n=1, 3.7%). The operative descriptive data for the cases included in the study are presented in Table 4. Complications were observed in three patients (13.6%). One patient (4.5%) developed a dural tear, which was repaired with a sponge graft. One patient (4.5%) developed a postoperative epidural hematoma; the patient, who had severe radicular pain, underwent a second UBE procedure to evacuate the hematoma. One patient (4.5%) developed urinary retention 12 hours postoperatively. Since the patient also had concomitant prostatic hypertrophy, he was referred to urology and monitored with a urinary catheter. He returned to normal 10 days later (Table 5). In the third postoperative month, one patient (4.5%) underwent a transforaminal steroid injection due to epidural fibrosis. Subsequently, endoscopic adhesiolysis was performed because pain relief was insufficient.

DISCUSSION

Our study evaluates the feasibility of performing UBE lumbar surgery under spinal anesthesia in patients with high perioperative anesthesia risk due to comorbid conditions and in elderly patients. Our results demonstrate the feasibility of spinal anesthesia for UBELD in ASA III-IV patients with serious comorbidities. In all cases included in the study, UBELD was completed without switching to general anesthesia. The early follow-up results for the patients are encouraging. The successful management of anesthesia-related side effects, combined with the procedure's sustainability and reproducibility, demonstrates that spinal anesthesia is a suitable option for UBELD in selected patients. Along with advances in healthcare and the resulting increase in

life expectancy, the global rise in the elderly patient population has also affected the average age of patients undergoing spinal surgery, and the increasing prevalence of comorbidities in these cases is making procedures increasingly complex⁽¹⁹⁾. In these cases, cardiovascular diseases, diabetes mellitus, neurovascular diseases, chronic rheumatological diseases, and pulmonary disorders have significantly increased the risks associated with perioperative general anesthesia⁽²⁰⁾. General anesthesia is the standard protocol in spinal surgery, and the majority of procedures are performed under general anesthesia. However, in high-risk patient groups, it can lead to adverse outcomes such as hemodynamic fluctuations, pulmonary complications, and the need for intensive care. For example, in one study, the major and minor complications of minimally invasive surgery were analyzed in 21 patients over the age of 80, and it was found that there was a mortality rate of 9.5% due to pulmonary embolism and sepsis⁽⁷⁾. In the study in question, postoperative confusion was observed in 5 patients (24%), liver failure in 1 patient (5%), and transient hypoxia in 2 patients (10%). In a meta-analysis evaluating 7.820 cases and including 38 studies, awake spinal anesthesia was compared with general anesthesia in spinal surgery. It was found that the rates of overall complications, postoperative retention, nausea, and vomiting were statistically significantly higher in the group that received general anesthesia⁽²¹⁾. In another study involving 438 high-risk patients, when patients who underwent surgery under spinal anesthesia were compared with those under general anesthesia, the general anesthesia group was found to have a longer recovery time, greater postoperative analgesic requirements, a longer time spent in the operating room, and a higher overall complication rate⁽²⁰⁾.

Table 4. The operative descriptive data of patients

Subgroup	n	Operative time, min	IV sedation, n (%)	Additional local anesthesia, n (%)	Hypotension, n (%)	Bradycardia, n (%)	Nausea, n (%)
Disc herniation	10	62.5±12.5	4 (40)	1 (10.0)	3 (30)	1 (10)	3 (30)
Spinal stenosis	12	79±20.4	6 (50)	1 (8.3)	2 (16.6)	1 (8.3)	1 (8.3)
Single-level	17	64±11.1	8 (47.1)	2 (11.8)	2 (11.8)	2 (11.8)	3 (17.6)
Two-level	5	97±17.9	2 (40)	0	3 (60)	0	1 (20)
Unilateral decompression	8	62±13.2	3 (37.5)	0	3 (37.5)	1 (12.5)	3 (37.5)
Bilateral decompression	14	76.9±19.8	7 (50)	2 (14.3)	2 (14.3)	1 (7.1)	1 (7.1)

IV: Intravenous

Table 5. Perioperative complications and reinterventions

Variable	Overall (n=22)
Overall perioperative or postoperative adverse events, n (%)	
No complication	19 (86.4%)
Dural tear	1 (4.5%)
Epidural hematoma	1 (4.5%)
Transient urinary retention	1 (4.5%)
Reinterventions, n (%)	
No reintervention	20 (90.9%)
Pain management intervention (algology)	1* (4.5%)
Endoscopic revision surgery	2 (9.1%)
*: One patient underwent both pain management intervention and subsequent endoscopic revision	

Although there is no absolute contraindication for general anesthesia in patients with an ASA score of III-IV, the presence of coronary artery disease or cardiac arrhythmia alone does not determine the choice of anesthetic technique. Particularly in patients with limited cardiovascular reserve, the choice between spinal and general anesthesia should be made on a case-by-case basis. The findings of our study reflect a carefully selected patient group and should not be generalized to all patients with serious systemic disease. Therefore, selecting the appropriate anesthetic method is essential for high-risk spinal surgery cases. As demonstrated in our study, there is a growing need to identify alternative anesthesia strategies for selected patient groups.

Lumbar surgery under awake spinal anesthesia is considered a safe method when performed on appropriately selected patients^(15,22). It has been reported to reduce operative time, length of hospital stay, intraoperative blood loss, postoperative nausea and vomiting, and the need for analgesics^(15,23). Unlike traditional microsurgery, UBE involves continuous saline irrigation throughout the endoscopic procedure; this requires the patient to remain in the prone position without moving for an extended period of time, making it essential to ensure the patient's comfort. Studies on the use of spinal anesthesia during UBE surgery are still limited. However, there are extensive case series evaluating the use of spinal anesthesia, epidural anesthesia, and local anesthesia in monoportal spinal endoscopic surgery⁽²⁴⁻²⁷⁾. In fact, local anesthesia has now become the standard practice in monoportal lumbar disc surgery⁽²⁷⁻³⁰⁾. There are a few studies in the literature reporting that UBELD has been performed under sedation and local anesthesia in elderly and high-risk patients^(16,30). At the same time, studies evaluating cases in which UBELD was administered with epidural and spinal anesthesia are quite rare⁽¹⁶⁾. A distinctive feature of our study is that it includes a selected patient group, employs a multidisciplinary approach to patient selection, and focuses on the spinal anesthesia protocol and perioperative outcomes. However, since the study lacks a control group receiving general or local anesthesia, it is

difficult to assess the superiority or safety of spinal anesthesia compared to other methods.

There are concerns among spinal surgeons regarding the use of spinal anesthesia with UBELD. One of these concerns is that the UBELD surgery may take longer than a traditional approach, during which the sensory block may wear off. Another cause for concern is the potential for disorientation and neural injury due to patient movement during the procedure. Another cause for concern is the possibility that, during spinal anesthesia, an increase in epidural pressure may lead to the flow of irrigation fluid from the site of the dural puncture into the intracranial space, resulting in increased intracranial pressure and a corresponding rise in related complications^(16,30-32). Because the increase in epidural pressure, along with the rise in the level of anesthesia and the risk of causing respiratory depression in the patient, was a cause for concern for us, we were undecided about performing UBELD under spinal anesthesia for an extended period^(30,32). During our planning session with the anesthesia team, to minimize this risk, we positioned the operating table at an approximate vertical tilt 15-20 degrees and used hyperbaric agents to prevent an increase in the level of anesthesia.

In our cases, the saline bags were positioned at a height of 1.7 m to provide gravity-driven irrigation. Except in situations where we have difficulty controlling bleeding due to significant deterioration in visual clarity, we try to complete the surgery without using a manual pump whenever possible to avoid increasing epidural pressure. In the 3 cases where we were required to use a manual pump, albeit rarely to prevent a loss of visual clarity due to bleeding, the patients reported pain in the back of their necks. In this situation, we interpreted the neck pain as a possible clinical warning sign temporarily associated with excessive irrigation pressure. To immediately reduce the irrigation pressure, we extended the fascial incision in the working canal to facilitate the outflow of fluid and paused the irrigation. The patient's neck pain gradually subsided, and the surgery was successfully completed without any further adverse events. No postoperative neck stiffness was observed. This finding has been reported in previous studies involving UBELD performed under sedation and local anesthesia. The authors noted that they paused irrigation, interpreting this as a form of "self-monitoring" of increased epidural pressure⁽³⁰⁾.

In our study, perioperative complications were observed in three patients (13.6%). One patient (4.5%) developed a dural tear. One patient (4.5%) developed a postoperative epidural hematoma. In this patient, the preoperative platelet count, international normalized ratio, and activated partial thromboplastin time were normal. In this case, where the patient was taking aspirin, aspirin administration had not been discontinued during the preoperative period. Six hours after surgery, the patient developed radicular pain without motor deficits. A lumbar magnetic resonance imaging scan performed 10 hours after surgery revealed a spinal epidural hematoma at the surgical site. Since no motor deficits were observed, the patient was closely monitored. Because the pain persisted, a surgical

drainage procedure was performed 24 hours after the initial surgery. The patient was subsequently discharged without any neurological deficits or radicular pain. In one patient (4.5%), urinary retention developed 12 hours after surgery. This patient had benign prostatic hypertrophy. The patient was referred to urology. A urinary catheter was inserted. The patient returned to normal with medical treatment. Although neuraxial anesthesia may have contributed to the urinary retention, the underlying prostate disease and other perioperative factors preclude attributing this event specifically to spinal anesthesia.

When the observed adverse events were evaluated based on their timing and possible mechanisms, the dural tear was determined to be a surgical complication that developed during the procedure. The epidural hematoma, however, developed in the decompression site rather than at the site of the neuraxial puncture and was therefore not specifically attributed to spinal anesthesia. Postoperative urinary retention was considered a multifactorial adverse event due to the patient's preexisting benign prostatic hyperplasia; however, the contribution of spinal anesthesia to this should not be overlooked. In one case, recurrent radicular pain developed one month after surgery, followed by a transforaminal epidural steroid injection due to epidural fibrosis and subsequent endoscopic adhesiolysis. Since this event was not related to the anesthetic technique, it was classified as a delayed postoperative reintervention rather than a perioperative complication. However, the small size of the case series and the absence of a control group do not allow for the exclusion of anesthesia-related complications.

Patient selection is critical for the successful implementation of UBELD under spinal anesthesia. In our opinion, patients scheduled for single- or two-level decompression, for whom the surgical procedure is not expected to be lengthy, and who are able to cooperate are the most suitable candidates. Conversely, we have concerns about administering spinal anesthesia to patients with severe anxiety, those who cannot tolerate the prone position, and those for whom a prolonged surgical procedure is anticipated. Therefore, to optimize perioperative outcomes, we believe that careful preoperative planning between the surgeon and the anesthesiologist is necessary, taking into account the patient's compliance, cognitive status, and social communication skills. In our study, the careful selection of patients played a significant role in the successful completion of procedures under spinal anesthesia without the need to switch to general anesthesia.

Study Limitations

This study has some limitations. The retrospective design of the study poses a risk of selection bias. The sample size is relatively small and consists of a selected group of patients. The fact that the study population included heterogeneous groups and that the groups were small prevented meaningful statistical comparisons from being made. This is not a randomized controlled trial, and there is no control group. Finally, all

procedures were performed by surgeons with four years of UBELD experience who had already completed the learning curve. These findings may not be directly generalizable to centers that are in the early stages of the learning process and have no prior UBELD experience. Another limitation of the study is that the duration of the sensory block and the recovery time were not recorded. The fact that irrigation and epidural pressure were not measured directly is also among the study's limitations.

CONCLUSION

In our study, we observed that UBELD could be performed under spinal anesthesia in a small group of carefully selected ASA III-IV patients, and we completed all procedures without switching to general anesthesia. Perioperative or postoperative adverse events occurred in three patients (13.6%) in this study; however, we believe these were not directly related to spinal anesthesia. In one patient, re-intervention was required 1 month after surgery due to epidural fibrosis. At the three-month follow-up, significant improvements were observed in terms of pain and disability. Our findings should not be interpreted as evidence that spinal anesthesia is safer than general anesthesia, but rather as evidence that spinal anesthesia is feasible in selected patients. The results should not be generalized to all ASA III-IV patients. Although our preliminary findings are encouraging, larger, prospective, and comparative studies are needed to determine the safety and feasibility of routine use of spinal anesthesia in endoscopic lumbar spine surgery for elderly patients and those with high ASA scores.

Ethics

Ethics Committee Approval: This retrospective multicenter study was conducted after obtaining approval for the multicenter study from the Hitit University Faculty of Medicine Institutional Ethics Committee (approval no: 2025-124, date: 03.06.2025).

Informed Consent: Patients who underwent UBELD surgery under spinal anesthesia at two different centers approved by the ethics committee between April 2024 and June 2025 were analyzed retrospectively.

Footnotes

Authorship Contributions

Surgical and Medical Practices: G.K., D.E., M.İ.Ö., Concept: G.K., İ.S., Design: D.E., M.C.E., İ.S., Data Collection or Processing: D.E., A.D., M.C.E., M.İ.Ö., Analysis or Interpretation: A.D., İ.S., Literature Search: D.E., Writing: G.K., D.E., M.C.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

- Atalay B, Gadraj PS, Sommer FS, Wright D, Rawanduzy C, Ghogawala Z, et al. Natural history of degenerative spondylolisthesis: a systematic review and meta-analysis. *World Neurosurg.* 2023;176:e634-43.
- Tuncer C, Kılıç RT, Uludağ V, Kurtuluş A, Kılıç G, Taşkesen A, et al. Evaluation of pain functional limitation and sleep quality in patients with chronic low back pain. *Türk Nöroşir Derg.* 2025;35:7-13.
- Jacobs WC, van Tulder M, Arts M, Rubinstein SM, van Middelkoop M, Ostelo R, et al. Surgery versus conservative management of sciatica due to a lumbar herniated disc: a systematic review. *Eur Spine J.* 2011;20:513-22.
- Grasso G, Canseco JA, Minetos PD, Vaccaro AR. Surgery versus conservative treatment for symptomatic lumbar disk herniation: a never-ending story. *World Neurosurg.* 2020;141:521-2.
- Özer Mİ, Demirtaş OK, Çulcu Z, Sözer A, Solmaz İ. Transforaminal epidural injection in failed back surgery after UBE. *J Turk Spinal Surg.* 2025;36:181-4.
- Durmaz MO, Ezgü MC, Kaplan A, Doğan A. Recurrent lumbar disk herniations: the efficacy of re-operation. *J Turk Spinal Surg.* 2023;34:87-93.
- Vasilikos I, Fistouris P, Krüger MT, Scholz C, Kogias E, Roelz R, et al. How safe is minimally invasive transforaminal lumbar interbody fusion for octogenarians?: A perioperative complication analysis. *World Neurosurg.* 2020;139:e754-60.
- Demirtaş OK, Özer Mİ. Unilateral biportal endoscopic discectomy for lumbar disc herniation: learning curve analysis with CUSUM analysis and clinical outcomes. *Clin Neurol Neurosurg.* 2025;249:108755.
- Santipas B, Kim JS, Mekariya K, Choi JYS, Cho SK. Beyond the microscope: is endoscopic discectomy the next gold standard for lumbar disc herniation? *Neurospine.* 2026;23:61-79.
- Ozer MI, Gurses ME, Ulku G, Demirtas OK. Comparison of microsurgical and biportal endoscopic approach in lumbar lateral recess stenosis surgery: single center retrospective analysis. *Turk Neurosurg.* 2025;35:862-70.
- Demirtaş OK, Kertmen H, Dolgun H, Solmaz İ, Özer Mİ, Abbasoğlu B, et al. Evaluation of a 3D simulation model for unilateral biportal endoscopic lumbar discectomy: a validity study in residency training. *World Neurosurg.* 2026;208:124887.
- Merter A, Özyıldırım M. Comparison of 0-degree and 30-degree endoscopes in unilateral biportal endoscopic decompression for lumbar spinal stenosis: which preserves the facet joint better? *J Orthop Surg.* 2025;33:10225536251386150.
- Früh A, Weber CF, Jelgersma C, Hecht N, Vajkoczy P, Wessels L. Systematic review and meta-analysis of spinal versus general anesthesia in decompressive surgeries of the lumbar spine. *Brain Spine.* 2024;4:104116.
- Khattab MFM, Sykes DAW, Abd-El-Barr MM, Waguia R, Montaser A, Ghamry SE, et al. Spine surgery under awake spinal anesthesia: an Egyptian experience during the COVID-19 pandemic. *Neurosurg Focus.* 2021;51:E6.
- Mohi Eldin MM, Salah-Eldin Hassan Abdelaaty A, Youssef O, Abdulkawy AA, Eltoukhy M. Awake lumbar spine surgery performed under spinal versus conventional anesthesia. *Surg Neurol Int.* 2024;15:388.
- Kang TH, Kim WJ, Lee JH. Efficacy of the erector spinae plane block with sedation for unilateral biportal endoscopic spine surgery and comparison with other anesthetic methods. *Acta Neurochir (Wien).* 2023;165:2651-63.
- Copay AG, Glassman SD, Subach BR, Berven S, Schuler TC, Carreon LY. Minimum clinically important difference in lumbar spine surgery patients: a choice of methods using the Oswestry disability index, medical outcomes study questionnaire short form 36, and pain scales. *Spine J.* 2008;8:968-74.
- Özer Mİ, Demirtaş OK. Comparison of lumbar microdiscectomy and unilateral biportal endoscopic discectomy outcomes: a single-center experience. *J Neurosurg Spine.* 2024;40:351-8.
- Fehlings MG, Tetreault L, Nater A, Choma T, Harrop J, Mroz T, et al. The aging of the global population: the changing epidemiology of disease and spinal disorders. *Neurosurgery.* 2015;77:S1-5.
- Finsterwald M, Muster M, Farshad M, Saporito A, Brada M, Aguirre JA. Spinal versus general anesthesia for lumbar spine surgery in high risk patients: perioperative hemodynamic stability, complications and costs. *J Clin Anesth.* 2018;46:3-7.
- Rajjoub R, Ghaith AK, El-Hajj VG, Rios-Zermano J, De Biase G, Atallah E, et al. Comparative outcomes of awake spine surgery under spinal versus general anesthesia: a comprehensive systematic review and meta-analysis. *Eur Spine J.* 2024;33:985-1000.
- Boddeti U, Polavarapu H, Patel S, Choudhary A, Langbein J, Nusraty S, et al. Current status of awake spine surgery: a bibliometric analysis. *World Neurosurg.* 2024;187:194-201.e2.
- Ononogbu-Uche FC, Tchoumi C, Stubbs NM, Sharma A, Gardocki RJ, Sharan A, et al.; Awake Spine Research Group. Reconsidering anesthesia in lumbar surgery: an umbrella review of awake versus general anesthesia. *J Clin Med.* 2025;14:8335.
- Zhang L, Zhang Y, Li P, Hu B, Liu G, Zhu M, et al. The optimal effective concentration of spinal anesthesia for L5/S1 disc herniation: a retrospective cohort study. *BMC Musculoskelet Disord.* 2024;25:774.
- Liu G, Zhao J, Yuan L, Shi F, Zhang L. Spinal anesthesia for L5-S1 interlaminar endoscopic lumbar discectomy: a retrospective study. *BMC Musculoskelet Disord.* 2023;24:818.
- Zheng B, Guo C, Xu S, Li H, Wu Y, Liu H. Anesthesia methods for full-endoscopic lumbar discectomy: a review. *Front Med (Lausanne).* 2023;10:1193311.
- Watanabe S, Kitahara T, Ohshima T, Soeda S, Nakajima D, Takeuchi M, et al. Transforaminal full-endoscopic lumbar foraminotomy under local anesthesia for adjacent segment foraminal stenosis after lumbar fusion: clinical and radiological outcomes. *Int J Spine Surg.* 2026;20:407-13.
- Xu BS, Wei SS, Li WY, Yang Q, Zhang KH, Guan BG, et al. Anesthetic complications of extensive spinal nerve block and total spinal anesthesia during percutaneous endoscopic spinal surgery under local anesthesia. *Eur Spine J.* 2026.
- Wu T, Liu D, Meng F, Lu JH, Chen YF, Fan Z. Awake unilateral biportal endoscopic decompression under local anesthesia for degenerative lumbar spinal stenosis in the elderly: a feasibility study with technique note. *Clin Interv Aging.* 2024;19:41-50.
- Choi G, Kang HY, Modi HN, Prada N, Nicolau RJ, Joh JY, et al. Risk of developing seizure after percutaneous endoscopic lumbar discectomy. *J Spinal Disord Tech.* 2011;24:83-92.
- Tan H, Liu Y, Li G, Yu L, Sun H, Zhu B, et al. Unilateral biportal endoscopic decompression for degenerative lumbar spinal stenosis under local anesthesia in elderly patients with medical comorbidities. *Orthop Surg.* 2025;17:2362-70.