

Full endoscopic lumbar discectomy

Full [endoscopic lumbar discectomy](#) (FELD) is a [Minimally Invasive Spine Surgery](#) for [lumbar discectomy](#).

Technique

During the procedure, the surgeon inserts the endoscope through a small tube into the spinal canal, allowing them to see the herniated disc and surrounding structures on a monitor. Specialized instruments are then used through the endoscope to remove the herniated portion of the disc, relieving pressure on the spinal nerves and alleviating symptoms such as back pain, leg pain, and numbness or weakness in the legs.

FELD offers several potential advantages over traditional open surgery, including smaller incisions, less disruption to surrounding tissues, reduced risk of complications, shorter recovery time, and potentially faster return to normal activities. However, not all patients are suitable candidates for FELD, and the decision to undergo this procedure should be made in consultation with a qualified spine surgeon after a thorough evaluation of the individual's condition.

The technical development has caused a reintroduction of endoscopic techniques directed towards degenerative spine disease. The spinal canal is reached through an inter-laminar or transforaminal access. In comparison with open surgery the percutaneous transforaminal access seems especially advantageous for the removal of paramedian and/or foraminal herniated disc material. However, careful patient selection is required, as the restricted manoeuvrability and working zone of the endoscope and patient specific pathoanatomy in some cases will disfavour endoscopy ¹⁾

Since [Kambin](#) experimentally induced [arthroscopy](#) to treat herniated nucleus pulposus, [percutaneous endoscopic lumbar discectomy](#) (PELD) has been developed.

Unilateral [biportal endoscopic surgery](#) is being increasingly adopted as a minimally invasive technique.

The purpose of the study was to introduce a novel surgical technique for lateral recess and same-level foraminal decompression by the contralateral inclinatory approach with unilateral biportal endoscopy(CIA-UBE) at the lumbar level.

Methods: Between January 2020 and February 2022, 10 patients suffering from lateral recess and same-level foraminal stenosis at the lumbar level underwent UBE surgery by contralateral inclinatory approach (CIA-UBE). Magnetic resonance imaging (MRI) scans were examined after surgery to measure the cross-sectional area (CSA) of the spinal canal (CSA-SC), the CSA of the intervertebral foramen (CSA-IVF), and the CSA of the facet joint (CSA-FJ). Postoperative radiologic images using computed tomography (CT) were obtained to investigate the existence of facet joint violation. Clinical outcomes were assessed using Oswestry Disability Index (ODI) scores and visual analogue scale (VAS)

scores for buttock and radicular pain.

Results: Ten levels were decompressed, and the mean age of the patients was 56.92 ± 13.26 years. The mean follow-up period was 7.60 ± 4.47 months. The average operative time was 85.14 ± 25.65 min. Postoperative CT and MRI revealed ideal neural decompression of the treated segments in all patients. CSA-IVF and CSA-FJ improved significantly, indicating good foraminal and lateral recess decompression with less damage to facet joints. Preoperative VAS and ODI scores improved significantly after surgery.

Conclusion: CIA-UBE may be an effective surgical treatment of the lateral recess and same-level foraminal stenosis at the lumbar level, which provides successful surgical decompression for traversing and exiting nerve roots with a better operative view and easier surgical manipulation. This approach may also help to maximize the preservation of the facet joint ²⁾.

Unilateral bi-portal [endoscopic spine surgery](#) (UBE) for the treatment of [lumbar spinal diseases](#) has achieved favorable results. In a [systematic review](#), Lin et al., summarized the technical nuances, surgical outcomes, and complications of UBE.

A systematic review of the literature published up to June 2018 was performed. Published studies related to UBE were identified through searching the PubMed database. The outcomes measured included operative time, hospital stay, complications, [visual analogue scale](#) (VAS), [Oswestry disability index](#) (ODI), and the [Macnab criteria](#).

A total of 556 patients and 679 levels were collected from the selected 11 studies. The mean follow-up was 15.2 months, the mean operative time was 81.3 minutes, and the mean length of hospital stay was 4.4 days. The mean overall complication rate was 6.7% (ranging from 0% to 13.8%). The mean VAS score for leg pain decreased from preoperative 7.9 to 1.9 at final follow-up visit and the mean VAS score for back pain decreased from 5.7 to 1.8. The mean ODI significantly improved from preoperative 63.7 to 18.6 at the final follow-up. The average satisfied outcome (excellent/good; based on Macnab criteria) was 84.3% (range, 75.35-95%). There were similar results between UBE for the treatment of lumbar disc herniation and stenosis, including operative time, length of hospital stay, complications, and satisfaction rate.

Although the existing studies are limited to small size cohorts and short-term follow-up, based on the given preliminary results and experiences of current studies, UBE may be a feasible option for lumbar spinal surgery ³⁾.

In 2016 Hwa Eum et al., performed a unilateral [laminotomy](#) with bilateral [foraminotomy](#) using a unilateral biportal endoscopic system in patients with single-level lumbar stenosis. The authors enrolled only patients who underwent follow-up for longer than 12 months after percutaneous biportal endoscopic decompression (PBED). Fifty-eight patients were enrolled in this study. This approach was based on 2 portals: one portal was used for continuous irrigation and endoscopic viewing and the other portal was used to manipulate the instruments used in the decompression procedures. Clinical parameters such as the Oswestry Disability Index (ODI), [Macnab criteria](#), and postoperative complications were analyzed.

Neural decompression was effectively performed in all enrolled patients. The mean ODI was

significantly lower after PBED. Of 58 patients, 47 (81.0%) had a good or excellent result according to the Macnab criteria. Postoperative ODI and visual analog scale scores were significantly improved compared with preoperative values.

From a surgical point of view, percutaneous biportal endoscopy is very similar to microscopic spinal surgery, permitting good visualization of the contralateral sublamina and medial foraminal areas. The authors suggest that the PBED, which is a minimally invasive procedure, is an alternative treatment option for degenerative lumbar stenosis ⁴⁾

The stenosing foramen of L5-S1 by several degenerative diseases is one of the challenging areas on surgical approaching because of the deeper depth and steep slope in the lumbosacral junction. The floating view using unilateral biportal endoscopic spine surgery rather than docking into the Kambin's zone can make the foraminal structures seen panoramically and permit dynamic handling of various instruments without destroying the facet joint and causing iatrogenic instability. Fine discrimination of structural margins in helps of the higher magnification and gentle manipulation of neural structures just as in open spine surgery could be guaranteed using floating technique from the target structures. Selective decompression with preserving innocent structures including facet joints could relieve foraminal lesions at the L5-S1 and decrease the necessity of fusion surgery caused by wider decompression and iatrogenic instability ⁵⁾.

Choi et al., provided an introduction of this technique followed by a description of the surgical anatomy with discussion on its indications and advantages. In particular, tricks to avoid complications are also presented.

Effective circumferential and focal decompression were achieved in most cases without damage to the spinal structural integrity with preservation of muscular and ligamentous attachments. The biportal endoscopic spinal surgery (BESS) may be safely used as an alternative minimally invasive procedure for [lumbar spinal stenosis](#) ⁶⁾.

Biportal [endoscopic spine surgery](#) (BESS) with addressing on 2–3 cm apart from the [pedicle](#) could approach the L5–S1 without disturbing by the alar wing and freely handling of a scope with various angles in floating technique ⁷⁾. Safe manipulation of neural structures could be guaranteed in helps of the higher magnification and very closed proximity to the lesions. Friendly handling of various instruments used in open spine surgery could make the performances comfort and learning curve shorter.

Indications

Percutaneous Endoscopic [Lumbar Discectomy](#) refers to an essentially intradiscal procedure indicated primarily for contained disc herniations, although some small “non contained” fragments may be treatable. ⁸⁾

No large randomized study has been done to compare the technique to the accepted standard, open [lumbar discectomy](#) (with or without microscope).

In 1975 the Japanese orthopedic surgeon Sadahisa Hijikata described [percutaneous discectomy](#) for the first time, which was a further minimally invasive surgical technique. Further variants of minimally invasive surgical procedures, such as percutaneous laser discectomy in 1986 and percutaneous endoscopic microdiscectomy in 1997, were also introduced; however, open discectomy, especially [microdiscectomy](#) remains the therapeutic gold standard for [lumbar disc herniation](#) ⁹⁾.

Although [open lumbar discectomy](#) is a gold standard surgical technique for [lumbar disc herniation](#) (LDH), surgery-induced tissue injury may actually become a source of postsurgical pain. Percutaneous [endoscopic lumbar discectomy](#) (PELD) is introduced as a minimally invasive spinal technique for LDH.

Yeung developed rigid working channel endoscope for percutaneous [endoscopic lumbar discectomy](#) (PELD) ¹⁰⁾.

Advantages

The advantage of a percutaneous endoscopic discectomy is that the disc is approached posterolaterally through the triangle of Kambin without the need for bone or facet resection thus preserving spinal stability. There is less damage to muscular and ligamentous structures allowing for faster rehabilitation, shorter hospital stay, and earlier return to function ¹¹⁾. Although many studies have shown the efficacy of PELD with good clinical outcome, the percutaneous approach poses challenges to surgeons and the PELD, the learning curve is usually perceived to be steep. Major complications such as nerve root injury, dural tear, haematoma, visceral injury, vascular injury, and infection may occur, possibly resulting from lack of skilled surgical techniques during the learning period ¹²⁾.

Most of the literature describes these endoscopic procedures using specialized uniportal multichannel endoscopes. However, a single portal limits the motion of the instruments and obscures visualization of the operating field. To overcome this limitation, Eun et al. propose a new technique that utilizes two portals to access the spinal canal. The biportal endoscopic lumbar decompression (BELD) technique uses two portals to treat difficult lumbar disk herniations and also lumbar spinal stenoses.

Seventeen patients were treated with BELD for 11 lumbar disk herniations and 6 lumbar spinal stenoses. Preoperative back and leg visual analog scale (VAS-B and VAS-L, respectively) scores and the Oswestry Disability Index (ODI) were recorded and compared with corresponding values on final follow-up. Results There was an average follow-up of 14 months. For the disk herniation group, preoperative VAS-L (7.8750 ± 1.24) and ODI (51.73 ± 18.57) was significantly different from follow-up postoperative VAS-L (0.87 ± 0.64 , $p = 0.000$) and ODI (9.37 ± 4.83 , $p = 0.001$). For the stenosis group, preoperative VAS-B (6.17 ± 1.94), VAS-L (7.83 ± 1.47), and ODI (63.27 ± 7.67) were significantly different from follow-up postoperative values (2.5 ± 1.04 , $p = 0.022$; 2.00 ± 1.67 , $p = 0.001$; 24.00 ± 6.45 , $p = 0.000$, respectively). One patient underwent revision microdiscectomy for incomplete decompression.

BELD can achieve a similar decompression effect as microdiscectomy and unilateral laminotomy for bilateral decompression with a smaller incision than tubular discectomy ¹³⁾.

Interlaminar endoscopic lumbar discectomy

[Interlaminar endoscopic lumbar discectomy.](#)

Transforaminal endoscopic lumbar discectomy

see [Transforaminal endoscopic lumbar discectomy.](#)

Disadvantages

Although percutaneous endoscopic lumbar discectomy (PELD) is an effective treatment for herniated discs, its application in a disc with extensive migration is still challenging.

Risk factors of poor outcome

[Prolapsed disc](#), higher [disc degeneration](#), higher lumbar level, and longer [preoperative](#) symptom duration were possibly associated with unsatisfactory surgical [outcomes](#) (poor/fair [MacNab scale score](#)). The outside-in technique might be superior to the inside-out technique. Older age and [alcohol](#) use might be associated with a higher re-operation rate ¹⁴⁾.

Case series

[Percutaneous Endoscopic Lumbar Discectomy Case Series.](#)

Case report

A 32-year-old man suffered from radicular pain at the L5 dermatome due to the down migrated soft LDH at the L4-5 level. The PELD was performed to remove the ruptured fragments, yielding a complete decompression of the L5 nerve root. Four years later, he visited the clinic because of right leg radiating pain along the S1 dermatome. An MRI scan revealed the LDH at the L5-S1 level. The PELD with foraminoplasty was also performed successfully at the L5-S1 level. Two months after the second PELD, he visited the clinic again because of severe pain along the left L4 dermatome; consequently, the PELD was also performed at the L3-4 level without any complications. A 34-year-old man presented with radiating pain in the back and both legs at the L5 dermatome. The MR images show a disc extrusion at the L4-5. The patient underwent the PELD at the L4-5 via the left approach. After the PELD, the back and leg pain both improved. One year later, the patient suffered from severe pain in the back and the left anterior thigh. The MR images show a left paramedian LDH at the L2-3. After the PELD was performed at the L2-3, the pain was relieved. The final MR images show no signs of any aggravated degeneration of the intervertebral discs or the facet joints at all of the treated levels.

When multiple episodes of LDH occur in a patient's life span, PELD could be considered as an

alternative good technique to treat LDH in each step by preserving normal anatomic structures¹⁵⁾.

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