Unilateral Biportal Endoscopy: A Modern Shift in Endoscopic Spine Surgery Techniques

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Abstract:

Minimally invasive spine surgery (MISS) has undergone a paradigm shift with the advent of unilateral biportal endoscopy (UBE), a technique that marries the principles of conventional open spine surgery with modern endoscopic innovation. At our centre, we recently initiated a UBE spine surgery programme to expand our minimally invasive capabilities. In our initial experience, ten patients underwent successful UBE procedures, including discectomy, unilateral laminectomy for bilateral decompression (ULBD), and transforaminal lumbar interbody fusion (TLIF). Patients demonstrated excellent clinical outcomes, with minimal blood loss, early mobilisation, and short hospital stays. Two illustrative cases highlight the efficacy of UBE in both elective and emergency settings. The first involved a patient with degenerative disc disease managed with UBE-TLIF, while the second showcased urgent decompression for cauda equina syndrome due to a large disc herniation. Our early results affirm the safety, versatility, and effectiveness of the UBE technique in managing diverse lumbar pathologies with minimal morbidity and rapid recovery.

Key words: Unilateral Biportal Endoscopy, Discectomy, Transforaminal Lumbar Interbody Fusion, Radiculopathy, Endoscopic Discectomy.

Introduction

Endoscopic spine surgery is evolving rapidly, offering patients less invasive options with faster recovery and excellent outcomes.[1-4] In recent years, unilateral biportal endoscopy (UBE) has emerged as a prominent technique in addressing lumbar degenerative diseases and other spinal pathologies. It is widely acknowledged for its advantages, including a wide surgical field, greater operative flexibility, minimal tissue damage, efficient neural decompression, and faster postoperative recovery.[5-10] At our centre, we have recently embraced this cutting-edge technique by initiating our endoscopic spine surgery program, with a focus on UBE spine surgery.

Within a short span, we have successfully performed ten endoscopic spine procedures, showcasing our growing proficiency and commitment to minimally invasive solutions (Table 1).

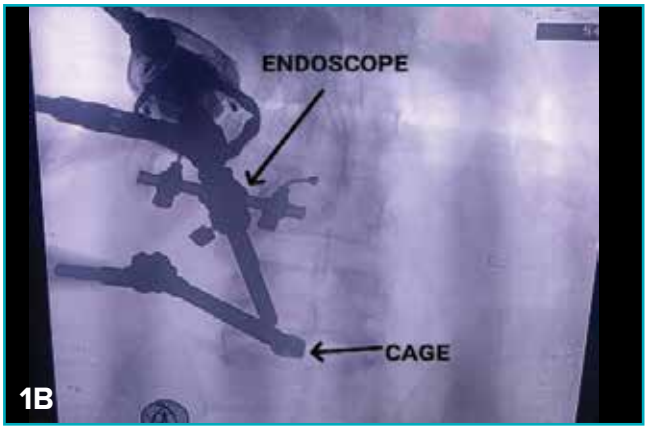
Unilateral biportal endoscopy (UBE) - Procedures	Number of cases
UBE-Transforaminal lumbar interbody fusion (TLIF)	1
UBE-Discectomy	6
UBE-Unilateral laminectomy for bilateral decompression (ULBD)	3
Total	10

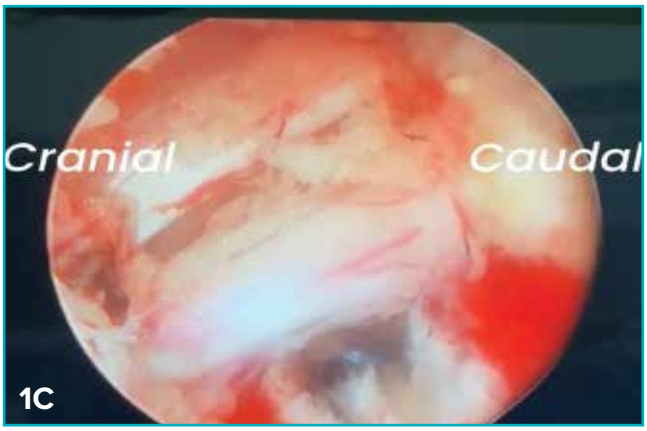
Table 1: Overview of unilateral biportal endoscopy (UBE) procedures performed.

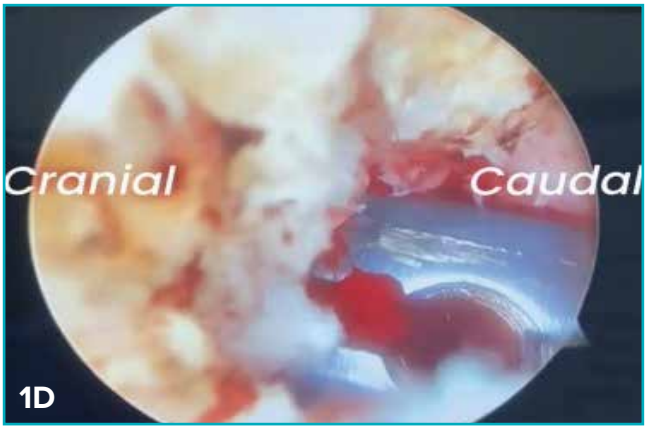
All patients experienced smooth post-operative recovery, with minimal blood loss, early mobilisation, and excellent clinical outcomes. This success reflects the promising future of UBE as a safe, effective, and patient-friendly technique for managing various spinal pathologies.

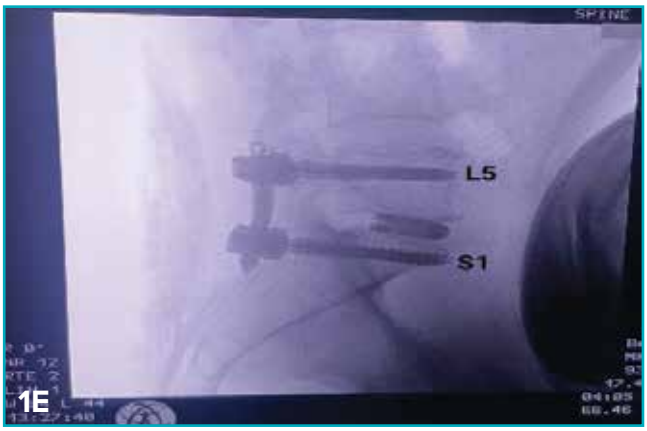
Case Report: 1

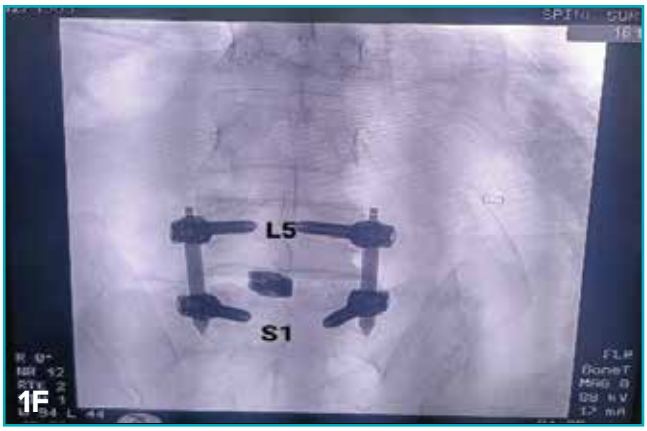
A 47-year-old male presented to our spine department with complaints of severe lower back pain for the past several months. The pain was progressive, aggravated by activity, and unrelieved by conservative measures such as physiotherapy, analgesics, and rest. Neurological examination was intact, with no motor or sensory deficits. The straight leg raise test was negative bilaterally. There were no signs of bladder or bowel involvement. Magnetic resonance imaging (MRI) of the lumbosacral spine revealed degenerative disc disease at the L5-S1 level with Modic changes, reduced disc height, and endplate irregularity. A UBE-transforaminal lumbar interbody fusion (TLIF) was planned and successfully performed at L5-S1 (Figure 1A-G). The patient was mobilised on the same day of surgery. He reported immediate relief from pre-operative back pain, and there were no neurological deficits post-operatively. Blood loss was minimal, and there were no intraoperative complications. The patient was discharged the next day in a stable condition, with appropriate pain management and post-operative instructions.

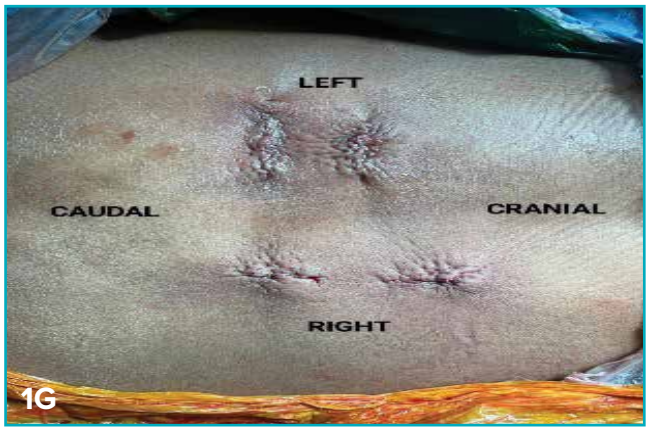












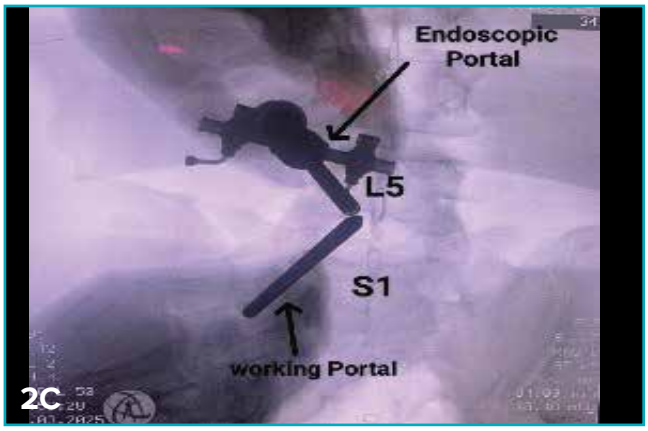
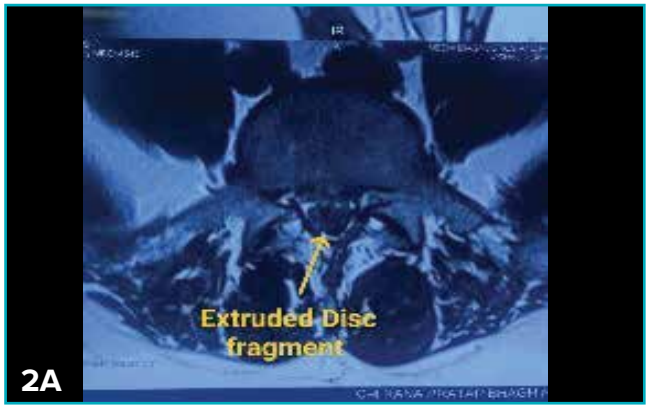


Figure 1 (A-G): Intraoperative and postoperative images of unilateral biportal endoscopy- transforaminal lumbar interbody fusion (UBE-TLIF) at L5–S1 in Case 1.
(A) Preoperative sagittal magnetic resonance imaging (MRI) showing degenerative disc disease with reduced disc height and Modic changes; (B) Axial MRI showing central and foraminal stenosis; (C) Intraoperative endoscopic view showing decompression and disc space preparation; (D) Insertion of interbody cage under endoscopic guidance; (E) Final construct with pedicle screw placement seen on intraoperative fluoroscopy; (F) Immediate postoperative X-ray showing appropriate hardware placement; (G) Postoperative sagittal MRI confirming adequate decompression and cage positioning.

Case Report: 2

A 36-year-old male presented to the emergency department with severe lower back pain, bilateral lower limb radiculopathy, perineal numbness, and acute-onset urinary retention. The symptoms had developed progressively over 24–36 hours. MRI of the lumbosacral spine revealed a large, extruded disc at L5-S1 level, causing severe central canal stenosis with compression of the cauda equina. An urgent UBE decompression at L5-S1 was performed under general anaesthesia (Figure 2A-G). On postoperative day (POD) 1, the patient reported improvement in perineal numbness. Voluntary bladder control began to return, and the urinary catheter was removed. The patient was discharged on POD 2 in a stable condition with improving neurological signs. At the two-week follow-up, the patient had near-complete resolution of radicular pain, normal bladder function, and significant improvement in saddle sensation. He resumed independent daily activities without support.



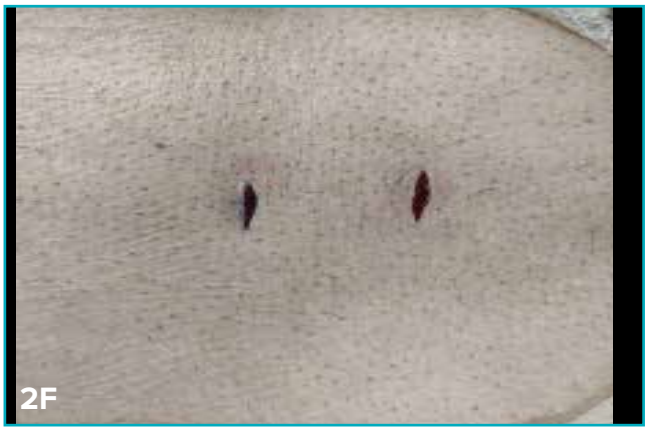


Figure 2 (A-G): Imaging and intraoperative visuals of emergency unilateral biportal endoscopy (UBE) decompression in Case 2 with cauda equina syndrome.
(A) Preoperative sagittal magnetic resonance imaging (MRI) showing a large extruded L5–S1 disc causing severe central canal stenosis; (B) Axial MRI highlighting nerve root compression and cauda equina crowding; (C) Endoscopic image showing herniated disc fragment; (D) Removal of disc material under direct visualisation; (E) Decompressed thecal sac and nerve roots visible endoscopically; (F) Postoperative axial MRI demonstrating relieved compression; (G) Postoperative sagittal MRI confirming decompression of the thecal sac.

Discussion

Our initial experience with UBE spine surgery at a single centre has shown promising results across a variety of lumbar pathologies. In our series of ten cases—including UBE discectomy, ULBD, and TLIF—patients demonstrated excellent clinical outcomes, minimal post-operative pain, early mobilisation, and short hospital stays. The UBE technique provided clear visualisation, effective decompression, and preservation of surrounding anatomical structures, supporting its role as a safe, versatile, and minimally invasive alternative to conventional spine surgery (Table 2).[11-16] With continued experience and refinement, UBE is poised to become an integral part of modern spinal care. As we continue to expand our expertise, we believe UBE will play a central role in transforming the landscape of spine surgery (Figure 3A-C)

Key Advantages of UBE Spine Surgery		
1	Minimally invasive	Smaller incisions and minimal tissue disruption reduce post-operative pain and hospital stay.
2	Wider field of view	The biportal technique offers excellent visualisation of neural structures
3	Faster recovery	Patients mobilise early and return to routine activities sooner than with conventional surgery.
4	Versatile applications	Suitable for discectomy, decompression, and selected fusion procedures.
5	Preservation of anatomy	Less trauma to muscle and bone compared to open surgery, preserving spinal integrity

Table 2: Five key advantages of unilateral biportal endoscopy (UBE) endoscopic spine surgery.

Figure 3 (A-C): Schematic representation of key advantages of unilateral biportal endoscopy (UBE).
(A) Minimal invasiveness with small incisions and muscle-sparing approach; (B) Enhanced visualisation due to dual portal technique allowing better access to pathology; (C) Versatile application enabling discectomy, decompression, and fusion with faster recovery and preservation of spinal anatomy

Conclusion

UBE signifies a modern leap in minimally invasive spine surgery. By combining the familiarity of open surgical instruments with the precision of endoscopic visualisation, UBE offers a versatile, muscle-sparing, and effective method for treating a wide range of spinal disorders. Its cost-effectiveness and adaptability make it particularly valuable in resource-limited settings, offering high-quality care without prohibitive expenses. UBE is set to define the future of spinal decompression and possibly fusion techniques. Structured training and ongoing research will be essential to realise its full potential and refine its scope of application.

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