Unilateral Biportal Endoscopic Posterior Cervical Foraminotomy (UBE-PCF): An Affordable, Motion-Preserving Alternative to Anterior Cervical Discectomy and Fusion for Cervical Radiculopathy — A Case Report with Review of Comparative Evidence

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Abstract

Background: Anterior cervical discectomy and fusion (ACDF) continues to be the proven gold standard in managing cervical radiculopathy due to foraminal stenosis, albeit with some limitations such as adjacent-segment degeneration, expense, infection risk from implants, and limitations in bilateral conditions. The purpose of our study is to report the indications, operative technique, and initial clinical and radiographic results of the unilateral biportal endoscopic posterior cervical foraminotomy (UBE-PCF) in managing unilateral cervical radiculopathy at one level and compare the outcome with published data on PCF vs ACDF.

Materials and Methods: Case report with descriptive approach was done in a 37-year-old male suffering from right-sided foraminal radiculopathy between C6-C7 level which was unresponsive to the conservative therapy and was treated by UBE-PCF in the prone reverse Trendelenburg position with two-port endoscope technique in the region of C6-C7 level. The clinical, imaging, intraoperative details, and postoperative details like wound healing, CT, and clinical follow-up at 1 month and 3 months were documented. Literature review with focused approach in PubMed/Google Scholar (2011-2025) with the keywords "posterior cervical foraminotomy," "unilateral biportal endoscopic," "ACDF," and "cervical radiculopathy" was done.

Results: The patient achieved complete resolution of radicular arm pain, uneventful wound healing with two small linear scars, and full painless cervical range of motion by 3 months, with return to occupational activity by 1 month. Postoperative CT confirmed adequate foraminal decompression without iatrogenic instability. Comparative literature indicates equivalent clinical success between ACDF and PCF, a lower overall complication rate for PCF (4%) than ACDF (7%), comparable reoperation rates, and preliminary evidence of cost-effectiveness favoring PCF.

Conclusion: UBE-PCF is a technically feasible, safe, motion-preserving, and cost-conscious alternative to ACDF in appropriately selected patients with unilateral foraminal cervical radiculopathy. This index case supports incorporation of the technique into routine practice, pending validation through larger prospective case series with longer follow-up.

Keywords: Unilateral biportal endoscopy; posterior cervical foraminotomy; cervical radiculopathy; anterior cervical discectomy and fusion; motion preservation; minimally invasive spine surgery.

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Introduction

Spine surgery is usually performed because of cervical radiculopathy caused by degenerative osteophyte formation, disc-osteophyte complexes and foraminal stenosis. ACDF is traditionally viewed as the gold standard procedure for treating this disease because of its minimal operative time, blood loss, soft tissue dissection, and direct access to uncovertebral osteophytes via an anterior approach. Decompression and stabilization are provided due to the distraction of the disc space and interbody fusion, resulting in reduction of axial neck pain and irritation of nerve roots. Yet, ACDF also has some drawbacks – adjacent segment degeneration, cost and infection risk associated with implants, and resource constraints, especially if both sides of the spinal column are affected (1,13).

Posterior approach for cervical radiculopathy is a technique that preceded fusion surgeries; keyhole laminoforaminotomy became widely used thanks to Scoville et al. in the middle of the twentieth century, being an innovative motion-sparing technique not associated with any morbidity linked to the anterior approach (16,17). Advancements in minimally invasive and endoscopic surgery techniques made possible progressive improvement of the posterior approach: open microscopic posterior cervical foraminotomy (PCF), tubular and percutaneous full-endoscopic PCFs and finally the most recent technique – unilateral biportal endoscopy (UBE) (17). The latter technique utilizes two separate portals for visualization and instrumentation, initially designed for lumbar decompression surgeries and later adapted for cervical interventions, allowing for wide-angle view, continuous irrigation with saline and use of standard surgical instrumentation through small skin incisions (5,6,19).

Comparative literature demonstrates that both techniques result in similar clinical success rates, while PCF appears to offer improved segmental kinematics and a more favorable adverse event profile, along with weaker data in favor of cost-effectiveness of the posterior technique (1–3,10–12). Due to absence of permanently placed implants, the UBE-PCF procedure can be especially appealing for use in low-resource areas and in patients concerned about the costs and risks associated with fusion surgery.

The goal of this paper is to demonstrate the indications, position and detailed surgical procedure of UBE-PCF technique utilized in a case study patient; to present early clinical, radiographic and wound healing results of this procedure; and to analyze these results within the scope of comparative literature review on PCF vs. ACDF procedures, and outcomes of UBE procedure specifically, in order to evaluate whether UBE-PCF procedure provides an alternative option for motion preservation in selected patients with cervical radiculopathy.

Materials and Methods

This is a case report which is descriptive in nature and single institution and is prepared as the first case of a prospective case series from the Department of Orthopaedics (Spine Unit), Saveetha Medical College and Hospital, Chennai under the aegis of Madras Orthopaedic Society. The index operation was carried out by the presenting surgeon under the supervision of a fellow trained minimally invasive spine surgeon (FMISS, Korea). Informed consent for surgery, photography and academic presentations was obtained from the patient and patient identifiers were stripped off from all figures.

The inclusion criteria for UBE-PCF procedure would be patients with symptoms of unilateral radiculopathy at one or two levels secondary to foraminal disc-osteophyte complex or foraminal stenosis who were resistant to a minimum of six weeks of nonoperative treatment with analgesics, physiotherapy, cervical traction and/or epidural or selective nerve-root blocks, having Spurling test positive corresponding to the dermatomic level and with foraminal compromise on MRI/CT scans. The exclusion criteria would be patients with myelopathic symptoms such as positive Hoffmann sign, Lhermitte sign or cord signal changes.

Preoperative Assessment

Preoperative work-up comprised a detailed history and neurological examination (motor power, sensory examination, deep tendon reflexes, and provocative tests), plain anteroposterior and lateral cervical radiographs, and MRI of the cervical spine (axial and sagittal T2-weighted sequences) supplemented by CT where bony foraminal stenosis was suspected.

Surgical Technique

The patient was positioned prone under general endotracheal anesthesia, with the operating table tilted 10°–20° in reverse Trendelenburg and the neck placed in slight flexion so that the surgical field lay parallel to the floor. Under fluoroscopic guidance, two skin portals approximately 2 cm apart were marked over the C6–C7 interlaminar region — one designated as the endoscopic viewing portal and the other as the working portal. Sequential soft-tissue dilation was performed down to the lamina, and a continuous saline inflow–outflow irrigation system was established to maintain a clear working cavity and provide tamponade hemostasis. A 30° endoscope was introduced through the viewing portal while a high-speed burr, Kerrisonrongeurs, curettes, and nerve hooks/probes were introduced through the working portal. A partial laminotomy of the inferior lamina

of C6 and the superior lamina of C7 was performed, followed by identification of the ligamentumflavum and a medial (approximately one-third to one-half) facetectomy that deliberately preserved the majority of the facet joint and capsule. The exiting nerve root and lateral dura were then identified and decompressed circumferentially within the foramen; where present, extruded disc fragments were removed under direct endoscopic vision. Meticulous hemostasis was achieved with a radiofrequency probe, and the two portal incisions were closed with two to three interrupted sutures each.

Postoperative Protocol and Outcome Assessment

Postoperatively, patients were mobilized on the same or following day, and a soft cervical collar was used for comfort only. Outcome parameters recorded included the immediate postoperative wound appearance, postoperative CT to confirm the adequacy of foraminal decompression and integrity of the facet/lamina, and clinical follow-up at 2 weeks, 1 month, and 3 months for pain relief, neurological status, cervical range of motion, wound cosmesis, and any complication (dural tear, neurological deterioration, infection, or C5 palsy).

Literature Review Methodology

A targeted and non-systematic search was carried out using Pubmed and Google Scholar databases between 2011 and 2025 using various combinations of the key words “posterior cervical foraminotomy,” “unilateral biportal endoscopic,” “anterior cervical discectomy and fusion,” and “cervical radiculopathy.” Comparative studies, systematic reviews, and meta-analyses which included the rate of complications, revision surgery, and clinical outcome parameters such as Neck Disability Index (NDI) and visual analogue scale (VAS), along with costs for PCF versus ACDF, and UBE-PCF in particular, were included.

Results

The index case was that of a 37-year-old male, working in a garment manufacturing unit, complaining of pain in the posterior part of the neck extending to the right upper limb in the area innervated by the trapezius muscle, lateral upper arm, and first three fingers for 5 months. His neurological examination revealed full muscle strength (5/5) in biceps, triceps, handgrip, and shoulder abductors without any sensory loss. There was a preservation of deep tendon reflexes on both sides, Spurling sign was positive on the right side, and Hoffman and Lhermitte signs were negative, ruling out myelopathic lesion. Cervical MRI showed right-sided foraminal stenosis at C6-7 level.

Table: 1. Demographic and clinical profile of the index case

Parameter	Finding
Age / Sex	37 years / Male
Occupation	Garment-factory worker
Duration of symptoms	5 months
Presenting complaint	Posterior neck pain radiating to right trapezius, lateral upper arm, and 1st–3rd fingers
Level and side	Right C6–7 (C7 dermatome distribution)
Prior treatment	Conservative management (analgesics/physiotherapy) — inadequate relief

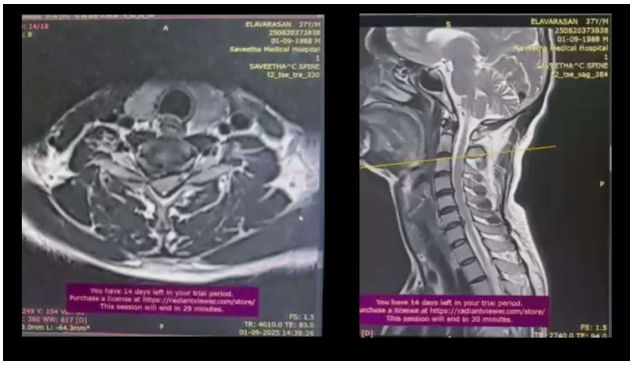

Figure 2: Radiological findings

Table 2. Preoperative neurological examination

Test / Domain	Right side	Comment
Biceps / Triceps / Hand-grip power	5/5 each	No motor deficit
Shoulder abduction	Full, free	No deficit

Sensory examination	Intact	No dermatomal loss
Biceps / Triceps reflex	++ / ++	Normal, symmetrical
Spurling test	Positive	Reproduced radicular pain
Hoffmann sign	Negative	No myelopathy
Lhermitte sign	Negative	No myelopathy

Table 3. Intraoperative technique summary

Step	Description
Position	Prone; table in 10°–20° reverse Trendelenburg; neck slightly flexed, surgical field parallel to floor
Portals	Two portals (viewing + working), ~2 cm apart, centered over C6–C7 junction under fluoroscopy
Access	Sequential dilation to lamina; continuous saline irrigation for visualization and hemostasis
Bone work	Partial laminotomy of inferior C6 / superior C7 lamina; medial (1/3–1/2) facetectomy with facet/capsule preservation
Neural decompression	Circumferential foraminal decompression of exiting nerve root; discectomy where fragment present
Hemostasis / Closure	Radiofrequency probe hemostasis; 2–3 interrupted sutures per 8-mm portal

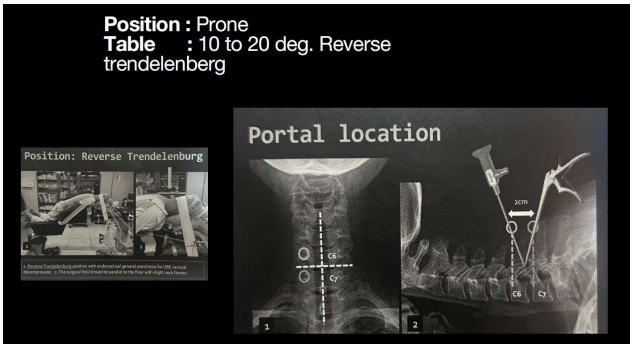

Figure 2: Position and portal location

Table 4. Postoperative course and follow-up

Time point	Finding	Complications
Immediate postoperative	Two clean sutured portal wounds; no drain required	None
Postoperative CT	Adequate foraminal decompression; preserved facet/lamina integrity, no instability	None
1 month	Well-healed scars; painless neck posture; returned to occupational duties	None
3 months	Full, painless cervical flexion–extension and rotation; matured linear scars	None

Table :5. Benchmarking against published comparative literature (ACDF vs. PCF/UBE-PCF)

Parameter	ACDF	PCF / UBE-PCF
Overall complication rate	~7%	~4% (1,13)
Reoperation rate	Comparable / 3.5–4% in pooled series	Comparable / 5–6% in pooled series (1,10,11)
Clinical success (VAS/NDI improvement)	Equivalent to PCF	Equivalent to ACDF; significant reduction in VAS-neck, VAS-arm, NDI on meta-analysis of 558 UBE-/full-endoscopic PCF patients (7)
Motion preservation	Fusion — segment immobilized	Preserved; may reduce adjacent-segment

		stress (1,13)
Implant requirement / cost	Plate, screws, cage/graft — higher cost	No implant — weak evidence of greater cost-effectiveness (1)

In this index case, no dural tear, neurological deterioration, postoperative C5 palsy, or wound infection occurred. The clinical trajectory — early return of function, cosmetically acceptable scars, and radiologically confirmed adequate decompression without destabilization — is concordant with the outcome ranges reported for PCF and UBE-PCF in the comparative literature summarized in Table 5.

Discussion

This particular case demonstrates the reliability and feasibility of UBE-PCF as a procedure for treating unilateral foraminal cervical radiculopathy with a rapid recovery of symptoms and functions with the use of two small skin incisions without the use of any implants. Open keyhole laminoforaminotomy, first introduced by Scoville and later confirmed through several other case studies, has been successful in 90–95% of the cases where carefully chosen patients had foraminal soft disc herniation or bony stenosis (16,17). The development of the procedure in the direction of minimally invasive endoscopy has been targeted at maintaining such success rate with less paraspinal muscle damage, blood loss, and recovery period (5,6,8,9,12,17).

Posterior Non-Fusion Technique: Biomechanically, the advantage of a non-fusion technique lies in sparing the facet joint and capsule when performing foraminal decompression and is claimed by some authors to minimize stress transmission to adjacent motion segments in comparison with fusion procedures. Recent systematic reviews and meta-analysis comparing the results of minimally invasive posterior cervical foraminotomy (MI-PCF) with anterior cervical discectomy and fusion (ACDF) and cervical disc arthroplasty did not show any significant difference in operation time, duration of hospitalization, complication rate, and number of reoperations between MI-PCF and ACDF, however, MI-PCF showed more favorable complication rate than arthroplasty. A guest editorial, which summarized the most recent high quality evidence, demonstrated that ACDF and PCF have similar success rates, that PCF better preserves cervical mobility and decreases adjacent segmental stress, that the complication rates of these operations are low but different (ACDF 7% versus PCF 4%) and that there is weak evidence for favoring the cost-effectiveness of PCF (1).

In terms of UBE, a 2024 systematic review and meta-analysis of 558 patients (390 patients undergoing UBE-PCF and 168 full-endoscopic PCF) across ten retrospective studies indicated significant improvement in NDI, VAS-neck, and VAS-arm scores after UBE-PCF, establishing its clinical effectiveness (7). The results from comparative single-center studies comparing full-endoscopic PCF with biportal endoscopic PCF have shown similar short-term clinical outcomes from the use of these two techniques, with the biportal approach being favorable due to more familiar instruments used during this procedure compared with the full-endoscopic one (8,9). Modifications of the UBE-PCF technique, such as inclined and sliding approach to treat multilevel or two-level adjacent foraminal disease, and piezosurgery as an additional surgical tool to control bony dissection, have widened the application of UBE-PCF (5,6,19).

The aspect of resource utilization, therefore, makes the absence of interbody cage, plate, and screws in UBE-PCF even more pertinent in a clinical setting like ours where issues related to cost of implants and insurance may form an important limiting factor in cases of bilateral/multilevel foraminal disease where multi-level fusion may have been needed. The affordability factor, along with the advantage of motion preservation and low risk of complications, constitutes the primary basis for the recommendation of UBE-PCF over ACDF.

There are some limitations with this case report because of its single-illustrative nature. The number of participants is equal to one (n = 1), and it makes statistical analyses impossible. No outcome measures such as VAS and NDI scores have been collected prospectively at each visit; the patient's status was evaluated through clinical examination, visualization of the wound and CT findings after surgery. The period of observation was equal to 3 months only, so it was impossible to make conclusions regarding adjacent segment mechanics or decompression stability in the long run. It is known that endoscopic spine surgery has its learning curve, and early cases cannot be extrapolated onto those of other doctors (17). All these problems will be resolved during the next study.

Conclusion

Unilateral biportal endoscopic posterior cervical foraminotomy represents a technically sound, safe, and motion-preserving option for the treatment of unilateral foraminal cervical radiculopathy among select patients. In the present case, the surgery provided complete relief of symptoms, successful wound closure, and adequate decompression without destabilization according to imaging, which is analogous to the results seen in other studies comparing PCF and ACDF and in studies on UBE-PCF. Considering the lack of use of implants and favorable complication profile, as well as preliminary cost-effectiveness compared to fusion, UBE-PCF should be considered a potential and affordable substitute for ACDF, especially in developing

countries and patients for whom implants are either too risky or expensive.

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