



Review Article

Perspective: Cervical laminoforaminotomy (CLF) is safer than anterior cervical discectomy/fusion (ACDF) for lateral cervical disease

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ABSTRACT

Background: The literature documents that laminoforaminotomy (CLF), whether performed open, minimally invasively, or microendoscopically, is safer than anterior cervical discectomy/fusion (ACDF) for lateral cervical disease.

Methods: ACDF for lateral cervical disc disease and/or spondylosis exposes patients to multiple major surgical risk factors not encountered with CLF. These include; carotid artery or jugular vein injuries, esophageal tears, dysphagia, recurrent laryngeal nerve injuries, tracheal injuries, and dysphagia. CLF also exposes patients to lower rates of vertebral artery injury, dural tears (DT)/cerebrospinal fluid fistulas, instability warranting fusion, adjacent segment disease (ASD), plus cord and/or nerve root injuries.

Results: Further, CLF vs. ACDF for lateral cervical pathology offer reduced tissue damage, operative time, estimated blood loss (EBL), length of stay (LOS), and cost.

Conclusion: CLFs, whether performed open, minimally invasively, or microendoscopically, offer greater safety, major pros with few cons, and decreased costs vs. ACDF for lateral cervical disease.

Keywords: Cervical Laminoforaminotomy (CLF), Safety; Reduced Cost, Disc Disease; Spondylosis; Lateral Recess Stenosis, Reduced Morbidity, Preservation Stability, Lack of Fusion; Anterior Cervical Discectomy/Fusion (ACDF)

INTRODUCTION

Cervical laminoforaminotomy (CLF), whether performed open, minimally invasively (MI), or microendoscopically (ME) for lateral/foraminal cervical disc disease, are safer than anterior cervical discectomy/fusion (ACDF) [Table 1].^[1-17] Notably, ACDF risks uniquely include, carotid artery or jugular vein injuries, esophageal tears, dysphagia, tracheal injuries, and recurrent laryngeal nerve injuries not posed by CLF. Further, CLF vs. ACDF offer marked reductions in the frequency of vertebral artery injuries, cord/nerve root deficits, spinal instability, dural tears (DT), tissue damage, operative time, estimated blood loss (EBL), adjacent segment disease, length of stay, and cost.

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Table 1: Minimally Invasive, Microendoscopic, or Open Cervical Laminoforaminotomy with/without Microdisectomy vs. Anterior Cervical Disectomy/Fusion (ACDF) for Lateral Disease.

Author [Ref] Journal Date	Study Design	Review	Review	Review	Conclusions
Adamson ^[1] J Neurosurg 2001	Outcomes of MELF 100 Unilateral Rad MR- Documented Disc/Spondylosis	Compared Open LF vs ACDF +/- Fusion Sitting Position EGO 97-RetW	AE 1 RetW Not Baseline 2 RetW Sedentary: Pain/ Pares 2 Occasion Pares/ Numb	AE 2 DT 1 Wound Inf No Deaths	MELF Safe/Effective Unilat C Rad CLD/ForSt
Epstein ^[4] Surg Neurol 2002	CLF Advantages Avoid Instability + Fusion ACDF Limited Morbidity	Unilat Rad Bilateral Disease LAM vs LOP	Carefully Select Pts MR/CT Critical to Success	Eval Pathology for CLE, LAM, LOP	Carefully Select Pts CLF Stringent MR/CT Findings
Winder ^[11] Can J Neurol Sci, 2011	MTPF C Rad Probable Advantages Vs. Open CLF < Tissue Damage < EBL, < Pain <<LOS	Open CLF Likely > Pain Rx > LOS	MTPF to CLF Compar AE Rates Compar	1999-2009 107 Pts 65 Open CLF 42 MTPF	Compar OR Times and AE for Both MTPF For MTPF < EBL <Pain < LOS
Mansfield ^[7] Neurosurg Focus 2014	One Level ACDF vs. CLF (MI) 101 Pts C Rad Over 3 yrs	Avg Cost ACDF \$8192 vs CLF \$4320	Avg cost ACDF 89% Higher vs. CLF	Cost of Surgical Implants for ACDF	Similar Outcomes Recommend CLF C Rad
Skovrlj ^[9] Spine J 2014	AE, Outcomes, Fusion Required MICLF with/without Microdisectomy	70 Pts C Rad 95 Levels Imp VAS Postop Neck/ Arm NDI	F/O 0 Avg 32.1 mos 3 (4.3%) AE: 1 DT 1 Clot 1 > Rad 0 Reop	<u>5/70 Pts Reop</u> <u>(8 Levels)</u> Avg 44.4 mos- 5 Same vs 3 ASD	Low 1.1% Rate/yr Reop to Fuse Low Reop Rate/yr for ASD 0.9%/yr
Church ^[3] Surg Neurol Int 2014	Safety Efficacy CLF C Rad Soft Disc- Osteophyte <u>1085 Pts 1999-2009</u> <u>338 Interviews</u>	CLF 1990-2009 MR F/O Mean 10 yrs	90% Report Imp Pain Imp Weak 93% RetW	AE 3.3% Reop-6.2% Recurrent Rad Soft Discs Better Results vs. Osteophyte	CLF Few AE Rad Soft Disc Better Prognosis vs. Osteophytes Exc Procedure for ForSt
Epstein ^[5] Surg Neurol Int 2015	Open CLF Safe/Effective Decompression Excision Soft Disc or ForSt for Rad	<u>Pros/< AE vs</u> <u>ACDF:</u> <Trachea, <Esopha-gus, RLN, Carotid, Instability	Pros Open CLF Over MIS CLF < DT < Infection < Neural Injury	Open CLF vs MI CLF >TechnicalChallenge	<u>Cons MI CLF</u> << Sight of View, < Work Space, >Morbidity Lost Art Open CLF
Yilmaz ^[13] Turk J Med Sci, 2016	KH CLF Success Treat C Rad Lateral Foraminal Soft Disc/ForSt <u>83 Pts Pros: ExC</u> Exposure Root, Keep Stability/ROM Avoid Fusion, Shorter LOS	Eval Surgery AE Outcomes Odom's Criteria Pros and Cons KH	51 (61.5%) Soft Discs 23 (38.5%) Osteophyte F/O 6 mos	66 Exc (79.5%) 13 Good (15.7%) 3 Fair (3.6%) 1 Poor (1.2%)	Rad Imp 79 (95%) AE in 2 Pts 1 DT 1 Wrong Level Concluded Low AE Rate

(Contd...)

Table 1: (Continued).

Author [Ref] Journal Date	Study Design	Review	Review	Review	Conclusions
Liu^[6] Orthop Surg 2016	Compare ACDF Vs. Open CLF For C Rad-PubMed Embase Databases	3 RCT 7 RCoS <u>Avg AE 7%</u> ACDF 4% CLF	Avg reop 4% ACDF 6% CLF In 2 years	Similar Outcomes AE Events Reop Rates	CLF No Instability Preserved ROM Lower Avg Cost CLF + Less ASD
Yolas^[14] J Craniovertebr Junction Spine 2016	35 Pts C Rad Disc/ForSt CLF (No ACDF) vs Exc Results LCF Using KH	KH LF 2010-15 Avg Age 46.4 (34-66) 19 M 16 F	10 at C56 18 at C67 2 at C34 2 at C45 1 at C7T1 1 at C56/67 1 at C45/56	14/35 Osteophyte + 21 Soft Disc	31/35-88.5% Resolved Rad 4 Neck Pain No Instability No Fusions
Yoo^[15] Korean J Neurotrauma 2017	<u>Lateral Soft Disc vs.</u> <u>ForSt Pros CLF vs.</u> <u>ACDF</u> 47 Pts Rad 2004-2012 27 Discs/20 ForSt <u>Overall Success 91.5%</u>	Odom's Criteria CLF Disc <u>92.6% Exc</u> <u>7.4% Good</u> ForSt 55% Exc, <u>25%</u> <u>Good</u>	< Extent MFAC/ FOR CLF for Soft Disc-32.1% vs. ForSt 48.8%	13 CC Postop Neck Pain 2 mos No Instability Flex/Ext X-rays 2 AE	CLF with MFAC/FOR Better Outcomes Soft Disc vs. ForSt
Ament^[2] Surg Neurol Int 2018	Compare Costs Rx C Rad ACDF vs. CLF vs. CPM	Database Analysis PubMed Medline Embase	Similar Reop Rates CLF 2% CPM 9.8% ACDF 2-8% Outcomes	Sig Higher Direct Costs 1 yr ACDF \$131,951 PER QALY	Sig Lower \$79,856 Cost for CLF/CPM per QALY CLF/CPM Safe More Cost-Effective vs. ACDF
Sahai^[8] Spine 2019	Outcomes + AE MI CLF Unilateral C Rad vs. ACDF 14 Studies 1216 Pts	Databases Pubmed CINAHL Plus Scopus	Avg Age 51.57 Followed Avg 30 mos Same Reop + AE Rates	MI CLF Sig Better Results on VAS-Arm Scores vs. ACDF	Similar MI CLF Imp VAS-Neck and NDI vs. ACDF, Most AE Transient Root Injury, Inf, DT
Srikantha^[10] J Craniovertebr Junction Spine 2021	<u>MI CLF</u> 7 Years: 2013-20 <u>vs. ACDF vs. CDR</u> Advantages No Fusion Preserves Motion Reduced AE Faster RetW	Advantage Motion Preserved For Lateral Disc ForSt	Outcome Measures ODI VAS	No Major AE No Reop F/O 1- 3 yrs Sig Benefit VAS/ODI	Conclusion MI CLF Effective for C Rad/CLD Careful Patient Selection
Zou^[17] Neurosurg Rev 2022	MI CLF vs. ACDF for C Rad Meta-Analysis 7 Studies 1175 Pts	Databases PubMed Embase Cochrane Scopus NDI+VAS Scores	Avg Age 48.9 Males 53.5%	Sig Less LOS But Similar AE Reop Rate VAS Arm + Neck NDI Scores	Avg Cost MI CLF Lower vs. ACDF Use in Select Patients
Yao^[12] Medicine (Baltimore), 2022	Learning Curve Posterior Percutaneous Endoscopic (PPE) CLF	64 Pts Outcomes VAS, JOA, NDI McNab Criteria	Radiology Disc Ht C2-C7 Cobb Angle ROM F/O 12-24 mos	Outcomes Sig Clinical Imp Both Similar Radiology Outcomes Surgery Exc/Good 82.8%	Trend Decreased OR Time with More Cases <u>26th Case Required for</u> <u>Learning Curve Eval</u>

(Contd...)

Table 1: (Continued).

Author [Ref] Journal Date	Study Design	Review	Review	Review	Conclusions
Zeitouni ^[16] World Neurosurg 2023	MELF vs. ACDF 42 Pts Dx C4 Rad 21 MELF 21 ACDF	Outcomes LOS, LOSurg, VAS, RR, RetW, NP MR vs ESI	MELF Sig Dec LOS, LOSurg vs. ACDF <u>VAS Same Imp</u> <u>Both Groups</u>	No Major AE-MELF No Reop at Index or Adjacent Levels	Conclusion Effective Rx MELF Similar Outcomes to ACDF but MELF < LOS, < LOSurg

ME=Microendoscopic, C=Cervical, LF=Laminoforaminotomy, MELF=Microendoscopic Laminoforaminotomy, Rad=Radiculopathy, ACDF=Anterior Cervical Discectomy/Fusion, LOS=Length of Stay, LOSurg=Length of Surgery, Reop=Reoperations, RR=Reoperation Rate, VAS=Visual Analog Scale, NP=Neck Pain, RetW=Time to Return to Work, Dx=Diagnosis, ESI=Epidural Steroid Injections, Sig=Significantly, Dec=Decreased, AE=Adverse Events, MI-Minimally Invasive, CDR=Cervical Disc Replacement/Arthroplasty, ForSt=Foraminal Stenosis, CLD=Lateral Disc, ODI=Oswestry Disability Index, yrs=Years, F/O=Follow-up, Imp=Improved, Weak=Weakness, EGO=Excellent/Good Outcomes, Pares=Paresthesias DT=Dural Tears, Inf=Infection, MTPF=Microscopic Tubular Assisted Posterior Cervical Laminoforaminotomy, Surg=Surgery, OR=Operating Room, EBL=Estimated Blood Loss, Rx=Treatment, Compar=Comparable, Exc=Excellent, MFAC/FOR=Medial Facetectomy/Foraminotomy, mos=Months, Flex/Ext=Flexion/Extension X=-rays, Pts=Patients, CSM=Cervical Spondylotic Myelopathy, PPE=Posterior Percutaneous Endoscopic, JOA Scores=Japanese Orthopedic Association, NDI=Neck Disability Index, Ht=Height, ROM=Range of Motion, Eval=Evaluation, LAM=Laminectomy, LOP=Laminoplasty, RLN=Recurrent Laryngeal Nerve, OPLL=Ossification Posterior Longitudinal Ligament, OYL=Ossification Yellow Ligament, IONM=Intraoperative Neural Monitoring, Neuro=Neurological, Spondy=Spondylosis, KH=Keyhole, Scope=Microscope, Avg=Average, M=Males, F=Females, Cervical Posterior Microdiscectomy=CPM, QALY=Quality-Adjusted Life Year, RCT=Randomized Controlled Studies, RCoS=Retrospective Comparative Studies, ROM=Rangel of Motion, ASD=Adjacent Segment Disease, vs=versus

Pros with Few Cons for Open Cervical Laminoforaminotomy (CLF) vs. ACDF for Lateral Cervical Disc/Spondylosis

Several studies emphasized the multiple pros without significant cons for performing open CLF vs. predominantly ACDF for addressing lateral cervical disc disease/spondylosis [Table 1].^[3-5] In 2002, Epstein cited the various benefits of open CLF over ACDF for addressing lateral/foraminal cervical disc disease or spondylosis [Table 1].^[4] Church *et al.* (2014) subsequently confirmed the safety/efficacy of 338 open CLF for lateral cervical disease; results showed an overall 3.3% incidence of perioperative adverse events (AE) and 6.2% frequency of the need for repeated surgery to address recurrent radiculopathy [Table 1].^[3] Again, in 2015, Epstein further confirmed the pros and limited cons of performing open CLF vs. ACDF for lateral cervical pathology; open CLF avoided carotid artery and jugular vein injuries, dysphagia esophageal, tracheal, and recurrent laryngeal nerve (RLN) injuries [Table 1].^[5] Further, they contributed to lower frequencies of vertebral artery injuries, intraoperative dural tears (DT)/cerebrospinal fluid (CSF) leaks, infections, instability requiring fusion (i.e., the AE attributed to instrumentation/failure), and cord/root injuries.

Good/Excellent Postoperative Outcomes with Limited Adverse Events for Open CLF

Three studies documented good/excellent postoperative outcomes with limited reports of adverse events following open CLF [Table 1].^[13-15] Yilmaz (2016) *et al.* found that performing 83 open CLF to address posterolateral soft discs or foraminal stenosis resulted in 66 excellent and 13 good

outcomes (Odom's Criteria); additionally, 79 (95%) showed improvement in postoperative radicular complaints, with just two adverse events (i.e., AE: 1 dural tear, and one wrong level surgery) [Table 1].^[13] Further pros for CLF included; better operative exposure to limit perioperative neural injuries, a shortened LOS, and greater preservation of stability (i.e., avoidance of fusion). Performing 35 open keyhole (KH) CLF to address 21 lateral/foraminal soft discs and 14 with foraminal osteophytes, Yolas *et al.* (2016) documented an 88.5% incidence of good/excellent outcomes with no instances of postoperative instability [Table 1].^[14] When Yoo *et al.* (2017) evaluated the overall outcomes for 27 patients undergoing open CLF for soft disc herniations vs. 20 for lateral/foraminal stenosis, they found both groups exhibited 92.6% excellent and 7.4% good outcomes (Odom's Criteria), with better results recorded for those with soft discs [Table 1].^[15]

Microscopic Tubular Assisted Posterior Cervical Laminoforaminotomy (MTPF) vs. Open CLF

Winder *et al.* (2011) compared the results for MTPF (42 patients) vs. open CLF (65 patients) for patients with lateral cervical disease; although both groups sustained comparable perioperative AE, and operating room times, MTPF reduced tissue damage, intraoperative blood loss, postoperative pain, and LOS [Table 1].^[11]

Results for Minimally Invasive CLF (MICLF) vs. ACDF for Lateral Cervical Discs/Osteophytes

Three studies described better outcome scores and reduced length of stay (LOS) for MICLF over ACDF [Table 1].^[8,10,17]

Sahai *et al.*, (2019) compared outcomes for MICLF vs. ACDF for 1216 patients from 14 studies; although patients from both groups demonstrated comparable perioperative adverse events, reoperation rates, and similar Visual Analog Scores (VAS) - Neck and Neck Disability Scores (NDI), those undergoing MICLF had better VAS-Arm Scores. [Table 1].^[8] Comparing MICLF vs. ACDF vs. cervical disc arthroplasty (CDR), Srikantha *et al.* (2021) found MICLF proved a more effective operation for carefully selected patients [Table 1].^[10] In Zou *et al.* (2022) meta-analysis of 1175 patients undergoing MICLF vs. ACDF for lateral cervical disease, MICLF patients demonstrated significant reductions in LOS but comparable frequencies of perioperative adverse events, reoperation rates, and similar outcomes [Table 1].^[17]

Success of Microendoscopic Laminoforaminotomy (MELF) for Lateral Cervical Disease

Two series showed that MELF were safe and effective, with MELF and ACDF yielding comparable results when addressing lateral cervical disease [Table 1].^[1,16] Adamson *et al.* (2001) evaluated the outcomes of 100 MELF performed for unilateral cervical radiculopathy; 97 were able to return to work, with only 2 experiencing intraoperative durotomies and one wound infection [Table 1].^[1] For unilateral C4 radiculopathy, Zeitouni *et al.* (2023) found that 21 patients undergoing MELF vs. 21 having ACDF demonstrated comparable outcomes (VAS Scores), length of stay (LOS), duration of surgery, time to return to work, incidence of perioperative AE, reoperation rates, and incidence of adjacent segment disease (ASD) warranting surgery [Table 1].^[16]

Learning Curve for Percutaneous Endoscopic CLF (PPE CLF) Procedures Requires Performing the First 26 of the 64 Cases

Yao *et al.* (2022) determined that the learning curve for PPE CLF procedures occurred after the first 26 of 64 cases (i.e., before surgeons showed a “trend” for decreased operating room time and greater “proficiency”); this further correlated with an overall 82.8% incidence of good/excellent outcomes for the 65 patients at 12-24 postoperative months [Table 1].^[14]

Lower Cost for Open CLF, Posterior Cervical Foraminotomy/Cervical Posterior Microdiscectomy (PCF/CPM) or MICLF vs. ACDF for Unilateral Cervical Radiculopathy

Three studies demonstrated reduced costs for variants of CLF (i.e., open CLF, PCF/CPM, MICLF) vs. ACDF when addressing lateral cervical pathology [Table 1].^[2,6,7] For 101 patients, Mansfield *et al.* (2014) compared the 3-year perioperative costs for 1-level ACDF vs. MICLF; average

ACDF (largely implants) cost \$8192 vs. \$4320 for MICLF, but outcomes were comparable for both groups [Table 1].^[7] Two years following open CLF vs. ACDF, Liu *et al.* (2016) documented comparable postoperative AE (4% vs. 7%) and reoperation rates (6% vs. 4%), but CLF cost less [Table 1].^[6] In 2018, Ament *et al.* documented reduced costs for performing PCF/CPM vs. ACDF to treat unilateral radiculopathy; direct costs were markedly greater for ACDF at one year (\$131,951 per Quality-Adjusted Life Year) vs. a reduced \$79,856 cost for PCF/CPM. [Table 1].^[2] Of note, both groups demonstrated comparable reoperation rates and quality of outcomes.

Rare Postoperative Instability and Adjacent Segment Disease After Minimally Invasive Cervical Laminoforaminotomy (MICLF) With/Without Microdiscectomy

Over an average of 44.4 postoperative months, Skovrlj *et al.* showed that 5 of 70 total patients undergoing MICLF required additional surgery at eight levels (i.e., five at the index surgical level and 3 for new adjacent level disease); summarized, this meant that only 1.1% of patients undergoing MICLF required fusions per year, with another 0.9% warranting surgery for ASD/year [Table 1].^[9] Additionally, postoperative adverse events were rare, with just 3 (4.3%) occurring out of 70 patients undergoing MICLF (i.e., at 95 levels) over 2.5 postoperative years; AE included one dural tear, one wound hematoma, and one increase in radiculopathy.

CONCLUSION

CLF and its’ minimally invasive, microendoscopic, and microdiscectomy variants offer greater safety, major pros with few cons, and decreased costs vs. ACDF for patients with lateral/foraminal cervical disc disease and/or spondylosis [Table 1].^[1-17]

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

Patient’s consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Adamson TE. Microendoscopic posterior cervical laminoforaminotomy for unilateral radiculopathy: Results of a new technique in 100 cases. *J Neurosurg* 2001;95:51-7.
2. Ament JD, Kaarnati T, Kulabya E, Kim KD, Jackson JP. Treatment of cervical radiculopathy: A review of the evolution and economics. *Surg Neurol Int* 2018;9:35.
3. Church EW, Halpern CH, Faught RW, Balmuri U, Attiah MA, Hayden S, *et al.* Cervical laminoforaminotomy for radiculopathy: Symptomatic and functional outcomes in a large cohort with long-term follow-up. *Surg Neurol Int* 2014;5:S536-43.
4. Epstein NE. A review of laminoforaminotomy for the management of lateral and foraminal cervical disc herniations or spurs. *Surg Neurol* 2002;57:226-33; discussion 233-4.
5. Epstein NE. Open laminoforaminotomy: A lost art? *Surg Neurol Int* 2015;6:S600-7.
6. Liu WJ, Hu L, Chou PH, Wang JW, Kan WS. Comparison of anterior cervical discectomy and fusion versus posterior cervical foraminotomy in the treatment of cervical radiculopathy: A systematic review. *Orthop Surg* 2016;8:425-31.
7. Mansfield HE, Canar WJ, Gerard CS, O'Toole JE. Single-level anterior cervical discectomy and fusion versus minimally invasive posterior cervical foraminotomy for patients with cervical radiculopathy: a cost analysis. *Neurosurg Focus* 2014;37:E9.
8. Sahai N, Changoor S, Dunn CJ, Sinha K, Hwang KS, Faloon M, *et al.* Minimally invasive posterior cervical foraminotomy as an alternative to anterior cervical discectomy and fusion for unilateral cervical radiculopathy: A systematic review and meta-analysis. *Spine (Phila Pa 1976)* 2019;44:1731-9.
9. Skovrlj B, Gologorsky Y, Haque R, Fessler RB, Qureshi SA. Complications, outcomes, and need for fusion after minimally invasive posterior cervical foraminotomy and microdiscectomy. *Spine J* 2014;14:2405-11.
10. Srikantha U, Hari A, Lokanath YK. Minimally invasive cervical laminoforaminotomy - Technique and outcomes. *J Craniovertebr Junction Spine* 2021;12:361-7.
11. Winder MJ, Thomas KC. Minimally invasive versus open approach for cervical laminoforaminotomy. *Can J Neurol Sci* 2011;38:262-7.
12. Yao R, Yan M, Liang Q, Wang H, Liu Z, Li F, *et al.* Clinical efficacy and learning curve of posterior percutaneous endoscopic cervical laminoforaminotomy for patients with cervical spondylotic radiculopathy. *Medicine (Baltimore)* 2022;101:e30401.
13. Yilmaz H, Erturk AR, Karatus A, Atci IB, Yurt A. Posterior laminoforaminotomy in the treatment of lateral cervical herniated disc and foraminal stenosis. *Turk J Med Sci* 2016;46:424-9.
14. Yolas C, Ozdemir NG, Okay HO, Kanat A, Senol M, Atci IB, *et al.* Cervical disc hernia operations through posterior laminoforaminotomy. *J Craniovertebr Junction Spine* 2016;7:91-5.
15. Yoo HJ, Park HJ, Seong YH, Roh SW. Comparison of surgical results between soft ruptured disc and foraminal stenosis patients in posterior cervical laminoforaminotomy. *Korean J Neurotrauma* 2017;13:124-9.
16. Zeitouni D, Pfortmiller D, Monk SH, Franklin D, Cowan D, Tenorio I, *et al.* Microendoscopic posterior cervical laminoforaminotomy for C4 radiculopathy. *World Neurosurg* 2023;180:e729-32.
17. Zou T, Wang PC, Chen H, Feng XM, Sun HH. Minimally invasive posterior cervical foraminotomy. *Neurosurg Rev* 2022;45:3609-18.

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