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Case Report

Posterior endoscopic cervical discectomy with partial pediculotomy for management of highly down-migrated cervical disc herniation: A case report

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ABSTRACT

Background: Highly migrated cervical disc herniations are rare, and the optimal surgical approach remains uncertain. When located in the median or paramedian position, anterior cervical discectomy and fusion or anterior cervical corpectomy and fusion are preferentially selected, whereas posterior approaches are often considered for cases with radiculopathy.

Case Description: A 40-year-old woman presented with right C6 radicular symptoms without any specific triggering event. She initially experienced symptom relief through medication and an ultrasound-guided nerve block 4 years previously. The symptoms recurred 2 months before presentation and did not improve with conservative treatment. Magnetic resonance imaging revealed a paramedian herniation on the right side, migrating downward from the C5/6-disc level to the inferior border of the pedicle. Posterior endoscopic cervical discectomy (PECD) with partial pediculotomy was performed under general anesthesia with transcranial motor-evoked potential monitoring. The operative time was 56 min. The patient experienced immediate symptom relief, mobilized 3 h postoperatively, and was discharged the following day.

Conclusion: PECD with partial pediculotomy is a minimally invasive and effective option for treating highly down-migrated cervical disc herniation, offering reduced tissue disruption, faster recovery, and excellent clinical outcomes.

Keywords: Endoscopic posterior cervical discectomy, Highly migrated cervical disc herniation, Partial pediculotomy

INTRODUCTION

Highly migrated cervical discectomy is an exceedingly rare condition.[10] Notwithstanding occasional reports of herniated discs migrating to the caudal region, most cases involve disc fragments located in the median or paramedian regions of the spinal canal, causing cervical myelopathy or radiculopathy.[1,6,9,10] Highly migrated cervical discectomy, in which the herniated fragment descends from the original disc level, presents additional challenges due to limited access

and visualization using conventional approaches. Surgical intervention is necessary in patients who are unresponsive to conservative treatment. Because spinal cord and nerve root compression typically originate from the anterior aspect, anterior approaches such as anterior cervical discectomy and fusion (ACDF) or anterior cervical corpectomy and fusion (ACCF) are commonly reported.[6,9,10,11]

ACDF and ACCF are primarily indicated in cases where the herniated disc is located in the median or paramedian regions of the spinal canal and causes symptoms of cervical myelopathy.[11] In contrast, posterior approaches are often more appropriate for cases in which the herniation is located in the paramedian or lateral regions, and the patient presents with radiculopathy.[6,7,10] However, ACDF and ACCF are associated with risks such as dysphagia and hoarseness of voice, as well as implant-related complications, including adjacent-segment degeneration and pseudoarthrosis at the operative level.[11] The overall complication rate of anterior cervical surgery ranges from 13.2% to 19.3%.[3] In cases in which sequestrated disc fragments are positioned behind the posterior wall of the vertebral body, ACCF may be considered to achieve complete removal of the herniated material. Despite its effectiveness, ACCF is more invasive and sacrifices an additional normal disc segment compared to ACDF, which can result in reduced cervical motion and an increased risk of complications.[11] In this report, we present a case of highly migrated cervical disc herniation with radiculopathy caused by a paramedian herniation. Posterior endoscopic cervical discectomy (PECD) with partial pediculotomy enabled the removal of the herniated fragment located anterior to the dura. This report details the surgical techniques and outcomes of this minimally invasive approach.

CASE DESCRIPTION

A 40-year-old woman first presented to our hospital 4 years prior with pain and numbness in the right C6 dermatome of the upper limb without a specific triggering event. Initial treatment, including medication and ultrasound-guided right C6 selective nerve root block, provided symptom relief. However, her symptoms recurred 2 months before the current presentation; despite treatment with nonsteroidal anti-inflammatory drugs, mirogabalin, and tramadol-acetaminophen combination (Tramacet), she experienced no improvement. The patient was subsequently admitted to a nearby hospital, where she received 2 weeks of bed rest and additional treatment; however, her symptoms remained unchanged. Subsequently, the patient returned to our hospital. On neurological examination, she presented with pain and numbness in the right C6 dermatome and a positive Spurling test. Muscle strength in the biceps and wrist extensors was approximately grade 4, according to manual muscle testing. The deep tendon reflexes were diminished, whereas the Hoffmann reflex was negative. Magnetic resonance imaging (MRI) revealed a paramedian herniation on the right side that migrated downward from the C5/6-disc level to the inferior border of the C6 vertebral pedicle [Figures 1a and b]. We repeated the ultrasound-guided right C6 selective nerve root block, which provided minimal symptom relief. Consequently, we decided to perform PECD with partial pediculotomy.

Surgical setting

Under general anesthesia, the patient was positioned prone on a four-point frame with transcranial motor-evoked potential (Tc-MEP) monitoring. The head was elevated, and the cervical spine and knees were slightly flexed. A horseshoe-shaped headrest, rather than a Mayfield clamp, was used, and the face was protected with a sponge. The surgical level was confirmed using C-arm fluoroscopy.

To ensure the safety of the surgery, intraoperative monitoring was performed using Tc-MEP and free-run electromyography.

Normal saline irrigation was performed using a gravity drip system from an IV pole positioned 2 m high without the assistance of an irrigation pump [Figure 2].

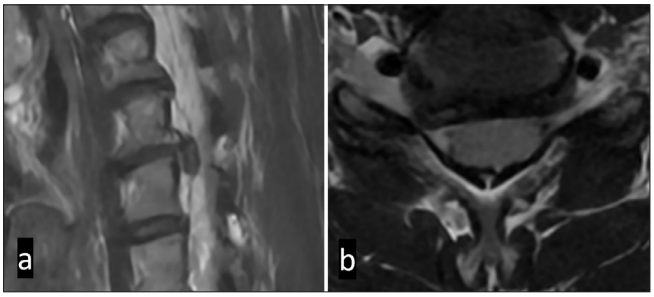
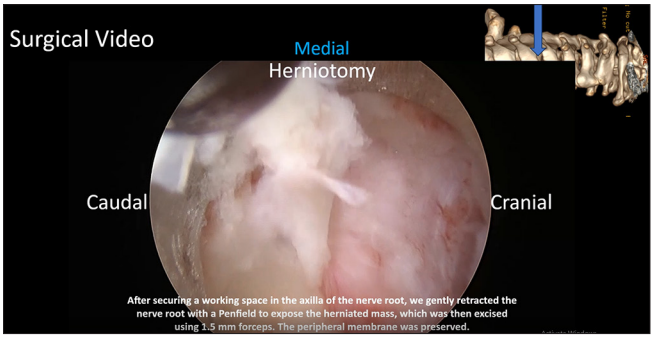


Figure 1: Preoperative cervical magnetic resonance imaging (MRI). (a) Sagittal T2-weighted MRI shows a herniated disc that has migrated downward from the C5/6 disc level to the inferior border of the C6 pedicle. (b) Axial T2-weighted MRI shows that the herniated disc is located in the right paramedian region, causing compression of the nerve root.



Video 1: Intraoperative visualization of patient positioning and endoscopic decompression technique.

SURGICAL INSTRUMENTS

A lumbar endoscope (VERTEBRIS®, Richard Wolf GmbH, Knittlingen, Germany; 165 mm length, 7 mm outer diameter, 4 mm working channel, 25° angled camera) was used for the cervical procedure, along with a bevel-type sheath with a 7.5-mm outer diameter, cut at a 70° angle. A pair of 1.5-mm herniotomy forceps was utilized for herniation removal; bone removal was performed using a high-speed drill fitted with a 3.5-mm coarse diamond ball tip (Primado2 Long®, NSK, Tokyo, Japan).

Surgical procedure

After establishing a sterile field with waterproof drapes, the surgical level was confirmed using lateral-view fluoroscopy. An 8-mm vertical skin and fascial incision was made 1–1.5 cm lateral to the midline. A dilator was introduced, followed by a bevel-type sheath and endoscope.

Upon endoscope insertion, the soft tissue was removed to reveal the V-point (the intersection of the upper and lower laminae with the articular process),[12] a key anatomical landmark. After confirming orientation, drilling exposed the apex of the inferior articular process to the superior articular process. The ventral cortical bone of the superior articular process was thinned and carefully removed using a Penfield dissector to prevent nerve root compression; any remaining bony edges were excised using a Kerrison Rongeur.

Figure 2: Patient positioning and intraoperative monitoring setup. Under general anesthesia, the patient was placed prone on a four-point frame with transcranial motor evoked potential monitoring. The head was elevated, with the cervical spine and knees slightly flexed. A horseshoe-shaped headrest was used instead of a Mayfield clamp, and the face was protected with a sponge. The surgical level was verified using Carm fluoroscopy. Normal saline irrigation was performed using a gravity drip system from an IV pole positioned 2 m high without the assistance of an irrigation pump.

For bleeding from vessels accompanying the nerve, hemostasis was achieved by compressing the bleeding point with a bipolar instrument (TriggerFlex®, Elliquence LLC, Baldwin, NY, USA), followed by brief thermal coagulation.

After removing the superior articular process from the upper margin of the pedicle, partial excision of the upper and medial aspects of the pedicle allowed access to the down-migrated herniation. A working space was created in the axilla of the nerve root, allowing gentle retraction of the nerve root with a Penfield dissector to expose the herniated mass, which was removed using 1.5-mm forceps. The peripheral membrane was preserved.

Hemostasis was meticulously managed upon endoscope withdrawal, and a drain was not routinely placed. The subcutaneous layer was closed using 3–0 absorbable sutures in a buried manner, and the skin was covered with Steri-Strips, rendering suture removal unnecessary. As demonstrated in Video 1, this endoscopic technique enabled clear visualization of the herniated fragment and precise decompression with minimal tissue disruption.

Postoperative clinical course

The patient experienced remarkable postoperative relief from radicular pain. Mobilization was initiated without a cervical collar 3 h after surgery, and the patient was discharged the following day.

Postoperative computed tomography (CT)

Postoperative imaging [Figure 3] confirmed sufficient decompression of the intervertebral foramen. The 3D reconstruction [Figure 3a] provides a comprehensive view of the expanded foramen. The sagittal CT image [Figure 3b] clearly depicts the extent of the partial pedicle resection, while the axial CT scan [Figure 3c] demonstrates adequate neural decompression at the operative site.

Postoperative MRI

Postoperative MRI showed complete removal of the herniated disc with adequate decompression [Figures 4a and b].

DISCUSSION

Highly migrated cervical disc herniations are rare; selecting an optimal surgical approach remains a challenge because of the variability in herniation characteristics and associated symptoms.[10] The various reported cases of highly migrated cervical disc herniation, showing a range of surgical techniques and outcomes, are summarized in Table 1. Although anterior approaches such as ACDF and ACCF are commonly used for median and paramedian herniations, they are associated

Figure 3: Postoperative computed tomography (CT) images. (a) Three-dimensional (3D) CT reconstruction showing an expanded intervertebral foramen. (b) Sagittal CT image demonstrating partial pedicle resection. (c) Axial CT image showing the decompressed neural foramen and resection site.

Table 1: Overview of studies on migrated cervical disc herniation.

Author (year)	Cases	Location	Procedure	Outcomes
Manabe *et al.* (1986)[6]	22	Not specified	Anterior or posterior	Good
Raynor *et al.* (1997)[9]	16	Not specified	ACDF using intraoperative ultrasonography	14 improved, 2 did not.
Srinivasan *et al.* (2011)[10]	8	C4-C7 (single or multiple levels)	Anterior corpectomy or dorsal laminectomy	Improved in most cases; one deteriorated after refusing surgery
Choi *et al.* (2011)[2]	1	C5/6-C6/7	ACDF with transcorporeal herniotomy	Good
Wang *et al.* (2017)[11]	32	C2/3 in 1 case, C3/4 in 8 cases, C4/5in 10 cases, C5/6 in 11cases C6/7 in 2 cases.	ACDF (27 cases), ACCF (5 cases)	Transient dysphagia in 40.7% (ACDF) and 60% (ACCF)
Qiao *et al.* (2019)[8]	1	C3/4	Full-endoscopic anterior transcorporeal discectomy	Good
Ou *et al.* (2023)[7]	1	C4/5-C5/6	PECD with retrocorporeal technique and hemilaminectomy	Good

PECD: Posterior endoscopic cervical discectomy, ACDF: Anterior cervical discectomy and fusion, ACCF: Anterior cervical corpectomy and fusion

with specific risks, including structural and functional complications such as adjacent-segment degeneration and pseudoarthrosis.[3,11] In addition, ACCF has higher complication rates due to its invasiveness and the need to sacrifice additional motion segments.[11]

In the present case, conservative treatments, including medication and ultrasound-guided nerve root block, initially provided symptom relief. However, when her symptoms recurred, the patient underwent 2 weeks of bed rest and additional conservative therapy at another hospital for pain management. Despite these efforts, her symptoms persisted, necessitating surgical intervention. Although bed rest is sometimes used for pain management in cervical disc herniation, the current evidence suggests that prolonged bed rest is generally ineffective and may delay recovery. Thus, early mobilization and active pain management are typically more effective in reducing symptoms and improving function.

Given these considerations, minimally invasive techniques such as PECD and anterior endoscopic cervical discectomy have been reported in isolated cases with promising results.[2,7,8] These approaches minimize tissue disruption while providing effective decompression. For instance, Qiao *et al*. and Ou *et al*. reported good clinical outcomes without complications using full-endoscopic techniques; the retrocorporeal technique and hemilaminectomy approach used by Ou *et al*. demonstrated

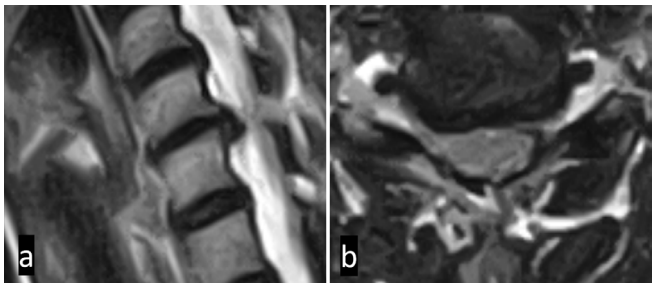


Figure 4: Postoperative cervical magnetic resonance imaging (MRI). (a) Sagittal T2-weighted MRI shows the complete removal of the herniated fragment. (b) Axial T2-weighted MRI shows sufficient nerve root decompression.

specific utility for herniated fragments in the posterior region.[7,8] These findings highlight the potential of minimally invasive methods to treat highly migrated cervical disc herniations with reduced complication rates.

In this case, we performed PECD with partial pediculotomy to treat a paramedian highly down-migrated cervical disc herniation at the C5/6 level. Preoperative CT imaging confirmed the absence of calcification or ossification in the herniated fragment. This allowed for the safe and effective removal of the soft herniated fragment using partial pediculotomy. However, if calcification or ossification had been present, partial vertebrotomy, in addition to partial pediculotomy would have been considered to remove the fragment without spinal cord retraction safely. This preoperative planning ensured that the most appropriate surgical strategy could be selected based on the characteristics of the herniated disc.[4]

This approach provided direct visualization and precise removal of the herniated fragment located anterior to the dura while minimizing damage to the surrounding tissues. To further enhance surgical safety, intraoperative Tc-MEP monitoring was employed due to the paramedian position of the herniated fragment, which was in close proximity to the spinal cord. Although Tc-MEP is not routinely used in endoscopic procedures for radiculopathy, it was deemed necessary in this case to minimize the risk of neurological injury during manipulation near the dura.

The patient experienced immediate symptom relief, mobilized 3 h after surgery, and resumed her daily activities the next day, emphasizing the rapid recovery enabled by this minimally invasive technique. Compared with traditional anterior approaches, PECD offers a less disruptive alternative with a reduced risk of complications.[4,5] In addition, it expands the surgical options for highly migrated cervical disc herniations, particularly paramedian or lateral herniations, by providing a minimally invasive solution.

This report underscores the importance of tailoring surgical strategies to the specific characteristics of herniation and the clinical presentation of the patient. Although PECD shows clear advantages, its limitations must also be considered. Central or highly medial herniations may require ACDF or ACCF to achieve adequate decompression. Furthermore, this technique requires a high level of expertise in endoscopic surgery to ensure its safety and effectiveness.[7,8] Future studies involving larger case series are necessary to validate the efficacy and safety of PECD in highly migrated cervical disc herniations.

CONCLUSION

PECD with a partial pediculotomy offers significant advantages over traditional surgical methods. These benefits include smaller incisions, reduced tissue disruption, enhanced surgical safety due to continuous saline irrigation, and faster recovery times. These advantages make it a highly effective and low-risk surgical option for the treatment of highly down-migrated cervical disc herniations.

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REFERENCES

1. Carvi y Nievas MN, Hoellerhage HG. Unusual sequestered disc fragments simulating spinal tumors and other space-occupying lesions. Clinical article. J Neurosurg Spine 2009;11:42-8.
2. Choi KC, Ahn Y, Lee CD, Lee SH. Combined anterior approach with transcorporeal herniotomy for a huge migrated cervical disc herniation. Korean J Spine 2011;8:292-4.
3. Epstein NE. A review of complication rates for anterior cervical diskectomy and fusion (ACDF). Surg Neurol Int 2019;10:100.
4. Kim HS, Wu PH, Lee YJ, Kim DH, Kim JY, Lee JH, *et al*. Reprint of: Safe route for cervical approach: Partial pediculotomy, partial vertebrotomy approach for posterior endoscopic cervical foraminotomy and discectomy. World Neurosurg 2021;145:621-30.
5. Kim HS, Wu PH, Tze-Chun Lau E, Jang IT. Narrative review of uniportal posterior endoscopic cervical foraminotomy. World Neurosurg 2024;181:148-53.
6. Manabe S, Tateishi A. Epidural migration of extruded cervical disc and its surgical treatment. Spine (Phila Pa 1976) 1986;11:873-8.
7. Ou SW, Lee JH, Chen CM, Lin YH. How I do it? Posterior full-endoscopic cervical discectomy with retrocorporeal technique and hemilaminectomy for highly migrated cervical disk herniation. Acta Neurochir (Wien) 2023;165:159-63.

8. Qiao Y, Liao WB, Du Q, Ao J, Cai YQ, Kong WJ, *et al*. Percutaneous full-endoscopic anterior transcorporeal diskectomy for massive migrated cervical disk herniation treatment: Case report and review of the literature. World Neurosurg 2019;132:47-52.
9. Raynor RB. Intraoperative ultrasound for immediate evaluation of anterior cervical decompression and discectomy. Spine (Phila Pa 1976) 1997;22:389-95.
10. Srinivasan US, Kumar GS, Mahesha KB. Posterior epidural migration of sequestrated cervical disc fragment: Case series. Asian Spine J 2011;5:220-7.
11. Wang Y, Qian Y, Wang J, Zhu M, Wang J, Teng H. Anterior discectomy could still be an alternative to corpectomy in highly migrated cervical disc herniation. Br J Neurosurg 2017;31:709-13.
12. Zhong G, Feng F, Su X, Chen X, Zhao J, Shen H, *et al*. Minimally invasive full-endoscopic posterior cervical foraminotomy and discectomy: Introducing a simple and useful localization technique of the "V" Point. Orthop Surg 2022;14:2625-32.

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