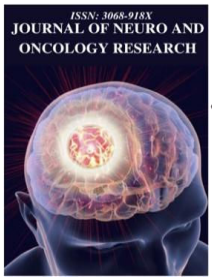


ISSN: 3068-918X
Journal of Neuro and Oncology Research

ATHENAEUM SCIENTIFIC PUBLISHERS

Research Article

Anterior Approach to Craniovertebral Junction Lesions: Experience with the Transcervical Approach

Eiji Abe[1,2*], Kensaku Makino[1,2], Takeshi Hara[1,2], Hirokazu Iwamuro[1,2], Hidetoshi Nojiri[1,3], Yukoh Ohara[1,2], Akihide Kondo[1,2]

[1]Spine and Spinal Cord Center, Juntendo University Hospital, Japan
[2]Department of Neurosurgery, Juntendo University Hospital, Japan
[3]Department of Orthopedics, Juntendo University Hospital, Japan

***Correspondence author:** Eiji Abe, Spine and Spinal Cord Center and Department of Neurosurgery, Juntendo University Hospital IPB Building 4F, 3-3-11, Hongo, Bunkyo-Ku, Tokyo 113-0033, Japan; Email: eijiabe@juntendo.ac.jp

Citation: Abe E, et al. Anterior Approach to Craniovertebral Junction Lesions: Experience with the Transcervical Approach. J Neuro Onco Res. 2025;5(3):1-9.

https://doi.org/10.46889/JNOR.2025.5306

Received Date: 24-10-2025

Accepted Date: 24-11-2025

Published Date: 30-11-2025

Abstract

Objective: Posterior decompression with occipitocervical fixation is generally effective for various pathologies at the Craniovertebral Junction (CVJ). However, in some cases, anterior decompression is required. Anterior decompression at the CVJ is technically demanding. Traditionally, the transoral approach has been considered the gold standard, but it has limitations due to the deep and narrow surgical field and is associated with a high risk of complications. To overcome these challenges, endoscopic techniques have been explored because of their minimal invasiveness and improved access to deep regions. Three types of endoscopic approaches have been reported: transoral, transnasal and transcervical. Among them, the endoscopic transcervical approach utilizes a familiar corridor for spine surgeons. We retrospectively analyzed our experience with this approach.

Methods: Fifteen patients who underwent surgery using the endoscopic transcervical approach were retrospectively reviewed. Patients with ventral CVJ compression and symptoms such as myelopathy or brainstem dysfunction were retrospectively reviewed. Evaluated parameters included operative time, blood loss, complications, postoperative symptoms, follow-up duration and recurrence or reoperation.

Results: All patients showed neurological improvement without any major complications. One patient had intraoperative blood loss over 400 ml. No recurrences or reoperations were observed during a mean follow-up of 36.7 months.

Conclusion: The endoscopic transcervical approach offers several advantages for anterior CVJ lesions. It provides a favorable alternative to other anterior routes, allowing spine surgeons to operate through a familiar corridor for safe decompression and, when necessary, stabilization.

Keywords: Craniovertebral Junction; Anterior Decompression; Endoscopic Spine Surgery; Odontoid Process; Basilar Invagination

Abbreviations

CVJ: Craniovertebral Junction; CT: Computed Tomography; MRI: Magnetic Resonance Imaging

Introduction

The Craniovertebral Junction (CVJ) has a complex anatomical structure within the cervical spine and decompression surgery in this region is generally considered technically demanding. Historically, the transoral approach has been regarded as the gold standard surgical method for ventral CVJ lesions. However, in recent years, other minimally invasive techniques have also been attempted in clinical practice [1-9]. Among these, endoscopic surgery has shown particular advantages in this challenging anatomical area. In particular, the endoscopic transcervical approach has proven to be a highly useful method. In this study, we describe its characteristics and compare it with other approaches.

Materials and Methods

1. Indications

This approach is generally indicated for pathologies involving anterior compression of the spinal cord or brainstem. Odontoid pannus (pseudotumors) typically enlarge in the presence of CVJ instability or mechanical overload and may recur even after anterior decompression. When posterior decompression and fixation do not result in reduction of the pseudotumor, a transcervical odontoidectomy becomes a suitable option. In cases of bony compression, such as basilar impression, transcervical odontoidectomy is also indicated when symptoms persist despite posterior decompression and fixation. Additionally, anteriorly compressive lesions that do not require fixation can be treated with this approach. In cases requiring fixation where posterior fixation was difficult for some reason, this approach was used to perform anterior fixation.

2. Surgical Procedure

Under general anesthesia with nasotracheal intubation, the patient is placed in the supine position. The head is fixed using a Mayfield head clamp. Although intraoperative orientation can be confirmed using biplanar fluoroscopy, a navigation system based on intraoperative CT imaging is extremely useful. The navigation reference frame is attached to the arm of head clamp. Both lateral fluoroscopy and the navigation system can be used simultaneously. A transverse skin incision is made on the right anterior neck based on preoperative radiographs, considering the planned angle of the endoscope. As with a conventional open anterior cervical approach, the anterior surface of C2 and base of the odontoid process is exposed. A single-port endoscope is then inserted. Anterior decompression by odontoidectomy can be performed. In a case that fixation was performed, the same approach was used to access the anterior surface of C2 and the METRx system was inserted. A posterior fusion at C1/2 was augmented with autologous bone grafting at the same time [6].

3. Outcome Measures

The evaluation included operation time, estimated blood loss, presence of perioperative complications, postoperative complaints, follow-up duration and recurrence or need for reoperation. Postoperative complaints were categorized as worsened, unchanged or improved compared to the preoperative condition, based on the attending physician's medical records.

4. Illustrative Cases

Case of Pannus (Case 10 in Table 1)

A 79-year-old man had experienced numbness in both upper limbs for five years. His symptoms gradually worsened, eventually involving both upper and lower extremities. After that, his condition rapidly worsened about one month prior to presentation and he became unable to walk, prompting him to visit our hospital. Imaging studies revealed osteophyte and pannus formation posterior to the odontoid process. Severe spinal cord compression was also observed. He had the uncontrollable severe DM. No evidence of instability was identified (Fig. 1). Anterior decompression was successfully achieved by partial odontoidectomy using the endoscopic transcervical approach (Fig. 1). Postoperatively, the patient's ability to walk improved.

Case of Anterior Fixation (Case 15 in Table 1)

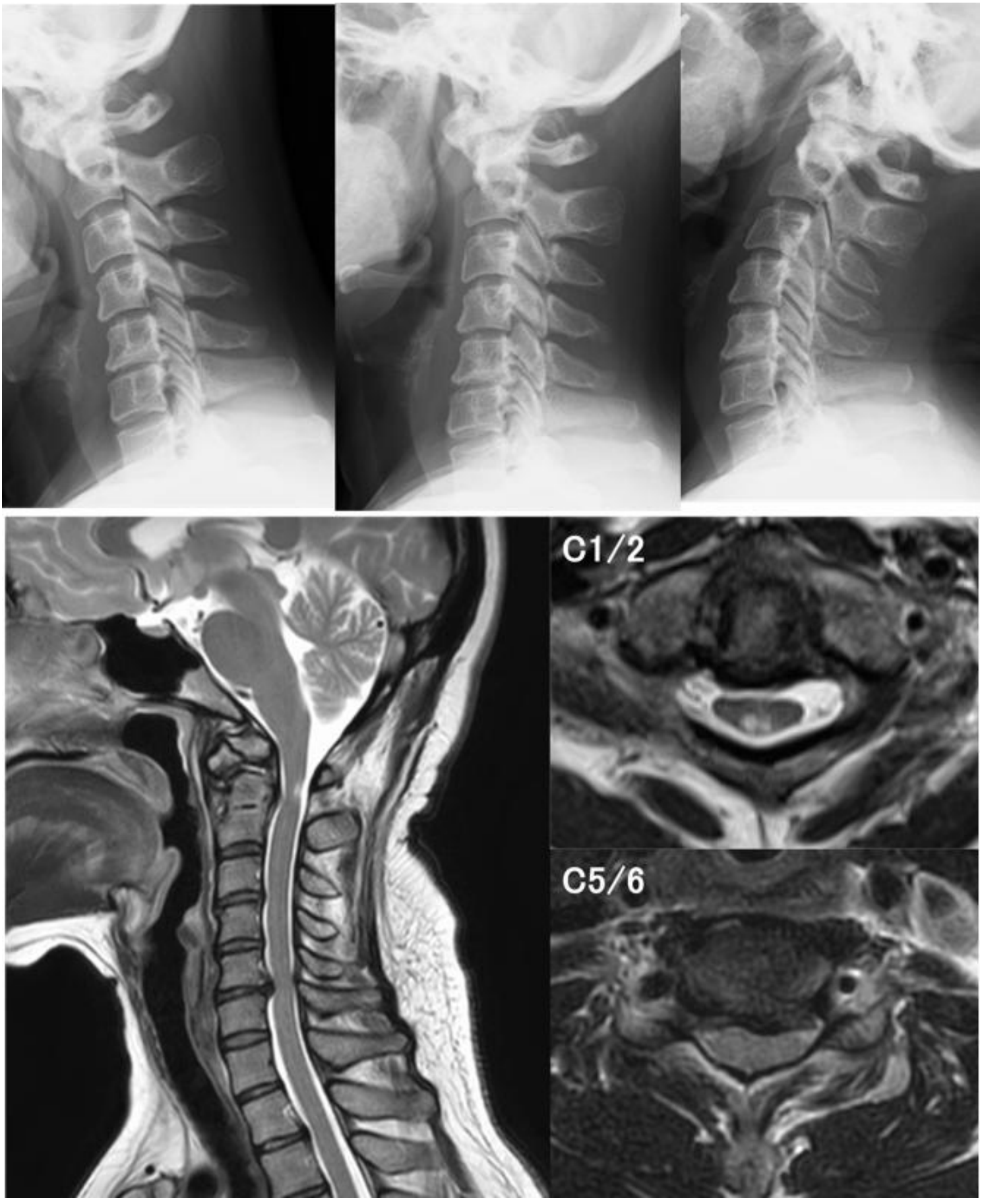
A 52-year-old woman presented with numbness initially affecting both upper extremities. The symptoms gradually progressed, resulting in numbness in both upper and lower extremities, along with gait disturbance. She visited our hospital after experiencing worsening numbness in all four extremities during both neck flexion and extension. Imaging studies revealed os odontoideum and instability at C1/2, as well as spinal canal stenosis at the C5/6 level due to disc bulging and bony spur. A high-riding vertebral artery was also identified (Fig. 2). The patient underwent Anterior Cervical Discectomy and Fusion (ACDF) at C5/6, along with odontoid screw placement and C1/2 transarticular screw fixation using the endoscopic transcervical approach (Fig. 2). Postoperative rehabilitation was performed and the patient showed symptomatic improvement, regaining the ability to walk.

Case of Anterior Decompression (Case 14 in Table 1)

A 62-year-old woman had sustained a C2 fracture in a traffic accident at the age of 14. Posterior fixation surgery was performed at that time, wiring and autologous bone grafting, followed by bone union and she remained independent in daily life thereafter. She had been followed up for a long time after surgery. During this period, she began to feel numbness in both upper extremities during neck flexion and gradually developed clumsiness of the hands. These symptoms prompted her to visit our hospital. Imaging studies revealed that although the old fracture site had achieved bony union. The occipital bone and the bone graft had

fused. Fusion between C2 and the graft was also present but. A posterior bony protrusion at the fracture site was compressing the spinal cord during neck flexion (Fig. 3). Anterior decompression was performed using the endoscopic uniportal transcervical approach (Fig. 3). After surgery and rehabilitation, the patient's activities of daily living improved.

Figure 1: Case of pannus (Case 10 in Table 1). A: Lateral cervical radiographs in flexion (left) and extension (right). No obvious instability was observed; B: Sagittal CT showing osteophyte at inferior tip of clivus; C: Sagittal T2-weighted MRI showing pannus formation is observed posterior to the odontoid process at the same level; D: Intraoperative fluoroscopic image showing transodontoid access for decompression; E: Postoperative CT confirming successful decompression. A drainage tube is confirmed.


C1/2
C5/6

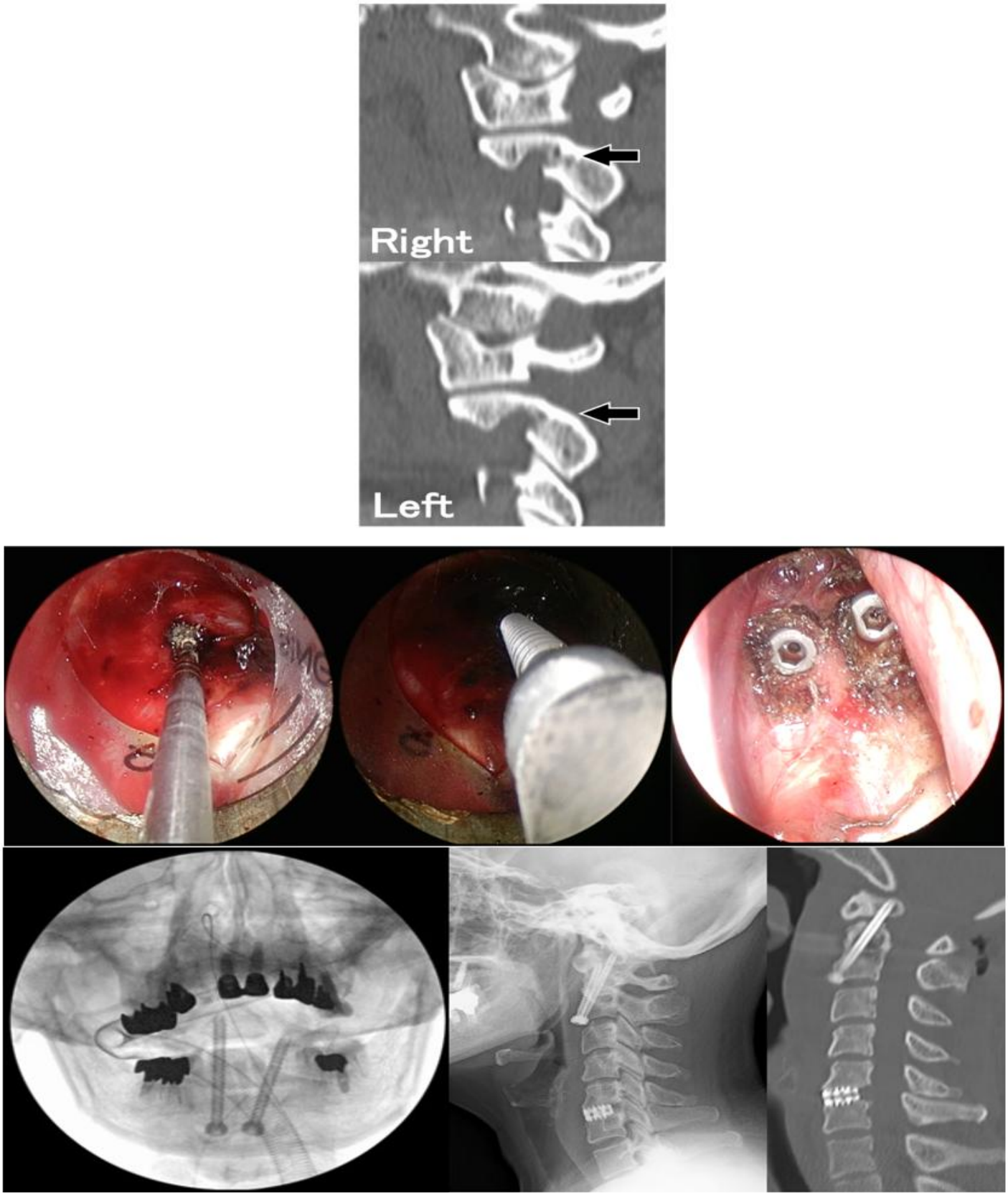


Figure 2: Case of anterior fixation (Case 15 in Table 1). A: Lateral cervical radiographs in flexion (left), neutral (center) and extension (right). The patient had os odontoideum with C1/2 instability; B: Sagittal and axial T2-weighted MRI showing a high-intensity intramedullary signal at the C1/2 level. Spinal cord compression at C5/6 due to an anterior bony spur and disc protrusion is also noted; C: Sagittal CT image showing bilateral high-riding vertebral arteries; D: Intraoperative findings Using navigation and lateral fluoroscopy, a drill hole was created from the anterior surface of C2 for screw placement (left). A

guidewire was used for screw insertion (center). Insertion of the odontoid and left C1/2 transarticular screws was completed (right); E: Intraoperative fluoroscopic image (left), postoperative lateral X-ray (center) and sagittal CT (right). An odontoid screw and a left-sided transarticular screw were placed. ACDF was performed at C5/6.

Figure 3: Case of anterior decompression (Case 14 in Table 1). A: Preoperative sagittal myelography images in the neutral position (left) and in flexion (right). A bony edge compressing the spinal cord is clearly observed during flexion; B: Postoperative sagittal CT image showing that the compressive lesion was successfully removed.

Case	Age (Year)	Sex	Pathology	Operation Time (Min)	Blood Loss	Follow Up (Months)	Fixation
1	72	man	BI	300	small	52	OCF
2	39	woman	BI	343	small	46	OCF
3	78	man	Pannus	205	small	46	OCF
4	71	woman	BI	220	small	38	OCF
5	71	man	Pannus	93	small	38	OCF
6	77	woman	BI	220	small	36	OCF
7	77	woman	Pannus	106	small	33	OCF
8	64	woman	BI	138	small	32	OCF
9	59	man	BI	134	small	28	OCF
10	79	man	Pannus	170	small	28	none
11	53	man	BI	189	small	26 death	none
12	81	man	Pannus	164	small	15	none
13	78	woman	BI	205	420 ml	6	none
14	62	woman	bony edge	80	small	3	OCF
15	52	woman	instability	225	85 ml	63	OCF
BI: Basilar Impression, OCF: Occipitocervical Fixation							

Table 1: Our case series.

Results

A total of 15 patients underwent surgery using the endoscopic uniportal transcervical approach (Table 1). Case 1-12 were reported in a previous paper [10]. The underlying conditions included Basilar Impression (BI) in 8 cases, pannus in 5 cases, bony edge in 1 case and instability in 1 case. There were 7 male and 8 female patients. Among them, BI cases included 3 males and 5 females, pannus cases included 4 males and 1 female and both the bony edge and instability cases were female. The mean age was 65.7 years (range, 39-81 years). The mean operative time was 193.7 minutes overall, with an average of 218.6 minutes for BI and 147.6 minutes for pannus cases.

Except for one case, intraoperative blood loss was small. The mean follow-up period was 36.7 months (range, 3-63 months). No cases of recurrence or reoperation were observed during the follow-up period. One patient was lost to follow-up due to sudden unexpected death, which was presumed to be caused by a cardiac event. No major complications-such as death or new permanent neurological deficits were observed. In all cases, postoperative improvement in symptoms related to myelopathy and brainstem dysfunction was achieved.

Discussion

The open transoral approach has traditionally been considered the standard method for accessing anterior lesions of the CVJ [1]. However, its deep surgical field and narrow access make it technically demanding. It also carries risks such as contamination from oral flora, wound dehiscence, voice changes, tongue edema, prolonged intubation, tracheostomy and restricted oral intake [11]. To address these issues, endoscopic approaches have been developed. Currently, three main endoscopic routes to the CVJ are reported: transoral, transnasal and transcervical-our study focuses on the latter.

The endoscopic transoral approach was first described by Frempong-Boadu, et al., in 2002 in seven adult cases [4]. Qiuhang, et al., later reported decompression without posterior fixation via this route, emphasizing its direct access to C1 and the odontoid, which is superior to transnasal [5]. This approach suits vertically long lesions from the clivus to below C2 but does not eliminate the risk of contamination or postoperative oral intake restriction [1,5,7]. Angled endoscopes may reduce soft palate injury and invasiveness, but complications like infection and dysphagia remain similar to the open method [5,7,13,14].

The transnasal approach, originally developed by skull base surgeons, utilizes natural anatomical cavities and standard instruments. However, lateral access is limited by the Eustachian tubes and inferior access by nasopalatine and palatine lines making exposure below C2 difficult [2,3,7]. Similar to the transoral approach, it often requires removal of the anterior arch of C1, which may compromise stability. Still, avoiding soft palate/pharyngeal wall incision likely reduces dysphagia and oral intake problems.

The transcervical approach was first described by Wolinsky et al., who used the METRx system [6]. It avoids oral mucosa, permits access to basilar impressions from below and generally does not require C1 anterior arch removal. Ruetten et al., later reported a fully endoscopic odontoidectomy via this route [8]. This technique offers a broad working space, though limited superiorly by the mandible and inferiorly by the chest. Use of an oblique-viewing endoscope maintains a wide view. Expected complications are similar to anterior cervical surgery, but endoscopes are thinner and impose less tissue pressure [6,12]. Bone drilling can be stabilized by anchoring the outer sheath, reducing slippage risk. This approach allows tailored decompression based on pathology [9]. In some basilar impressions, total odontoidectomy may be necessary, but not always. Preserving portions of the odontoid and C1 arch may help prevent future C1/2 instability. The uniportal system provides a clear, irrigated surgical field, minimizing thermal damage. Anterior fixation is also feasible with tools like METRx. While our series observed no complications, further cases are needed to validate safety and efficacy.

Although a direct comparison of the three approaches is not possible, each has advantages. Selection should consider lesion location and pathology. In this context, the transcervical approach may be particularly suitable for spine surgeons. Compared to transoral and transnasal approaches, it provides a familiar corridor, reduces contamination risk and allows anterior fixation when needed. While the transnasal route benefits some skull base pathologies, its limited access to C2 is a drawback. The transcervical approach generally avoids C1 arch resection, helping preserve stability. Therefore, for ventral CVJ lesions requiring odontoid or anterior C2 access, it may offer the best balance of safety, reach and versatility.

Conclusion

The endoscopic transcervical approach offers several advantages for ventral CVJ lesions. This approach allows for decompression and, when necessary, fixation. It has the potential to become a standard anterior approach to the CVJ performed by spine surgeons. However, further accumulation of clinical experience is necessary.

Conflict of Interest Statement

The authors declare that they have no conflicts of interest to disclose.

Informed Consent Statement

Informed consent was obtained from the participant involved in this study.

Authors' Contributions

All authors have contributed equally to this work and have reviewed and approved the final manuscript for publication.

Financial Disclosure

No financial support was received for the writing, editing, approval or publication of this manuscript.

Consent for Publication

Informed consent for publication was obtained from the patient involved in this report.

Ethical Statement

This project was exempt from IRB review as it did not qualify as human subject research under federal regulations.

References

1. Kanavel AB. Bullet located between the atlas and the base of the skull: technique for removal through the mouth. Surg Clin Chicago. 1917;1:361-6.

2. Kassam AB, Snyderman C, Gardner P, Carrau R, Spiro R. The expanded endonasal approach: a fully endoscopic transnasal approach and resection of the odontoid process. Neurosurgery. 2005;57(Suppl 1):213-4.
3. Fong S, DuPlessis SJ. Minimally invasive anterior approach to upper cervical spine: surgical technique. J Spinal Disord Tech. 2005;18(4):321-5.
4. Frempong-Boadu AK, Faunce WA, Fessler RG. Endoscopically assisted transoral-transpharyngeal approach to the craniovertebral junction. Neurosurgery. 2002;51(Suppl 1):S60-6.
5. Qiuhang Z, Feng K, Bo Y, Hongchuan G, Mingchu L, Ge C, et al. Transoral endoscopic odontoidectomy to decompress the cervicomedullary junction. Spine (Phila Pa 1976). 2013;38:E901-6.
6. Wolinsky J, Sciubba DM, Suk I, Gokaslan ZL. Endoscopic image-guided odontoidectomy for decompression of basilar invagination via a standard anterior cervical approach. J Neurosurg Spine. 2007;6(2):184-91.
7. Dlouhy BJ, Dahdaleh NS, Menezes AH. Evolution of transoral approaches, endoscopic endonasal approaches and reduction strategies for craniovertebral junction pathology: a treatment algorithm update. Neurosurg Focus. 2015;38:E8.
8. Ruetten S, Hahn P, Oezdemir S, et al. Full-endoscopic uniportal odontoidectomy and decompression of the anterior cervicomedullary junction using the retropharyngeal approach. Spine (Phila Pa 1976). 2018;43:E911-8.
9. Ohara Y, Nakajima Y, Kimura T, Kikuchi N, Sagiuchi T. Full-endoscopic transcervical ventral decompression for craniovertebral junction pathologies: case series. Neurospine. 2020;17(S1):S138-44.
10. Ohara Y, Uchikado H, Hara T, Nojiri H, Abe E, Kikuchi N, et al. Endoscopic approach for a difficult cervical area: fully endoscopic uniportal transcervical approach for ventral pathologies of the craniovertebral junction. J Minim Invasive Spine Surg Tech. 2023;8(1):21-7.
11. Tubbs RS, Demerdash A, Rizk E, Chapman JR, Oskouian RJ. Complications of transoral and transnasal odontoidectomy: A comprehensive review. Childs Nerv Syst. 2016;32(1):55-9.
12. Ye J, Liu B, Li J, Zheng G, Duan K, Gao L, et al. Full-endoscopic uniportal retropharyngeal odontoidectomy: preliminary case report. Front Surg. 2023;9:973064.
13. Husain M, Rastogi M, Ojha BK, Chandra A, Jha DK. Endoscopic transoral surgery for craniovertebral junction anomalies: technical note. J Neurosurg Spine. 2006;5:367-73.
14. Yadav YR, Madhariya SN, Parihar VS, Namdev H, Bhatele PR. Endoscopic transoral excision of odontoid process in irreducible atlantoaxial dislocation: experience of 34 patients. J Neurol Surg A Cent Eur Neurosurg. 2013;74:162-7.