Traumatic or Inflammatory Lesions of C1-C2: Surgical Treatment with Extended Endonasal Endoscopic Approaches

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Abstract

This study evaluates the role of extended endonasal endoscopic approaches (EEA) in the surgical management of traumatic and inflammatory pathologies of the anterior craniovertebral junction (C1–C2). A retrospective analysis was performed on 33 patients treated between 2015 and 2025 using EEA alone or combined with conventional techniques for nonunion odontoid fractures, congenital craniovertebral malformations, and irreducible bulbar compression. Surgical strategies included endonasal odontoidectomy, C1–C2 decompression, and anterior fixation, with preservation of the C1 anterior arch when feasible. Clinical outcomes were assessed using the Nurick scale , while radiological follow-up included CT and MRI. All patients showed clinical improvement and effective, durable bulbar decompression; stable fusion was achieved in fixation cases. Postoperative complications were limited and successfully managed. These results support EEA as a safe and effective alternative to traditional anterior approaches in selected C1–C2 pathologies.

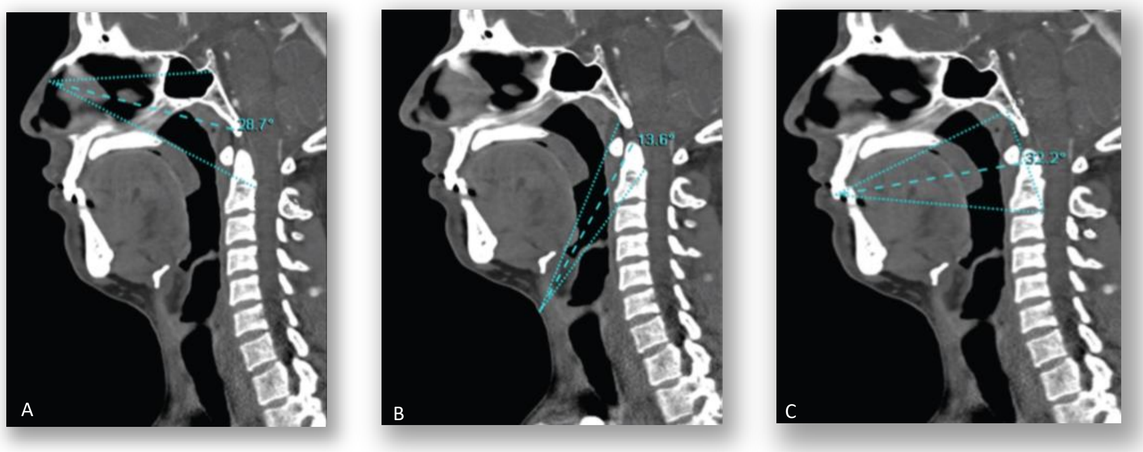
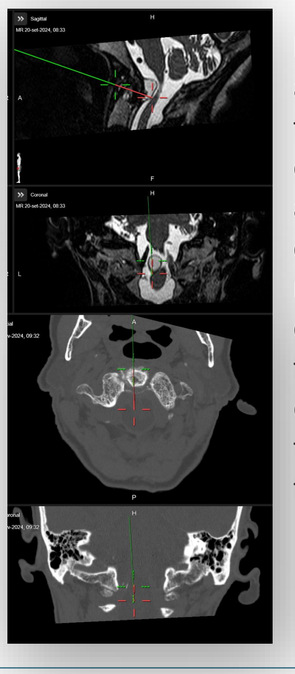


Figure 1 *Sagittal views of working angles in different anterior approaches to CVJ. In particularly image A shows endoscopic endonasal approach, image B shows endoscopic transcervical approach and image C endoscopic transoral approach*

Introduction

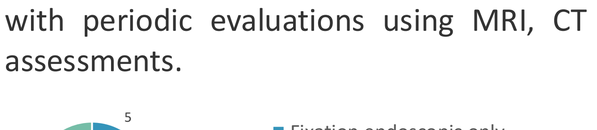


In recent years, extended endonasal endoscopic approaches (EEA) have become increasingly central in the treatment of disorders involving the anterior craniovertebral junction (aCVJ) (1). This type of surgical access has proven particularly useful in complex conditions such as bulbar compression associated with rheumatoid arthritis, basilar invagination secondary to congenital cranio-cervical malformations, and non-union fractures of the type CII odontoid process (2). Advances in endoscopic techniques have expanded the indications for this approach, offering less invasive yet effective solutions for managing potentially disabling clinical scenarios.

Figure 2: *intraoperative neuronavigation images of endoscopic endonasal trajectory*

Methods and Materials

At our institution, we conducted a retrospective analysis of 33 patients with aCVJ pathologies treated using an endonasal endoscopic approach, either as a standalone procedure or in combination with traditional surgical techniques, between January 2015 and June 2025. Eleven patients underwent anterior C1-C2 fixation using a combination of the endonasal endoscopic technique and a conventional anterior transcervical approach, all for the treatment of non-union odontoid fractures. Five patients with congenital CVJ malformations underwent C1-C2 decompression and fusion entirely through an endoscopic route. In seventeen patients with irreducible bulbar compression caused by odontoid process migration and/or a retro-odontoid inflammatory process, an endonasal odontoidectomy was performed. In these cases, the anterior arch of C1 was preserved and later used as a support point for anterior C1-C2 screw fixation. All patients were followed clinically and radiologically for at least five years, with periodic evaluations using MRI, CT scans, and endoscopic outpatient assessments.



Results

Clinically, all patients showed improvement in their Nurick scale scores (3). Radiologically confirmed bulbar decompression was effectively achieved and maintained in all cases. In patients treated with anterior endoscopic C1-C2 fixation, stable bony fusion was documented. Postoperative complications included cerebrospinal fluid leakage in two cases and mucosal incision dehiscence in another two. All complications were successfully managed without recurrence during subsequent follow-ups. Additionally, two patients underwent occipito-cervical posterior fixation due to pre-existing instability, and no long-term complications were observed in these cases.

Figure 3: *sagittal (A) and axial T2 MRI (B-C) views of a retro odontoid pannus in a 56-year-old woman affected by rheumatoid arthritis*

Discussion

The extended endonasal endoscopic approach proves to be a valid alternative to conventional surgical accesses—such as transcervical, transoral, or posterolateral routes—in the treatment of selected pathologies of the anterior craniovertebral junction. This technique offers direct visualization and improved control of the surgical field, reduces overall procedural invasiveness, and often allows preservation of key anatomical structures such as the anterior arch of C1. Moreover, the ability to perform both decompression and anterior C1-C2 fixation in the same surgical session presents a significant advantage, lowering the risk of cranial settling and reducing the need for additional posterior stabilization.

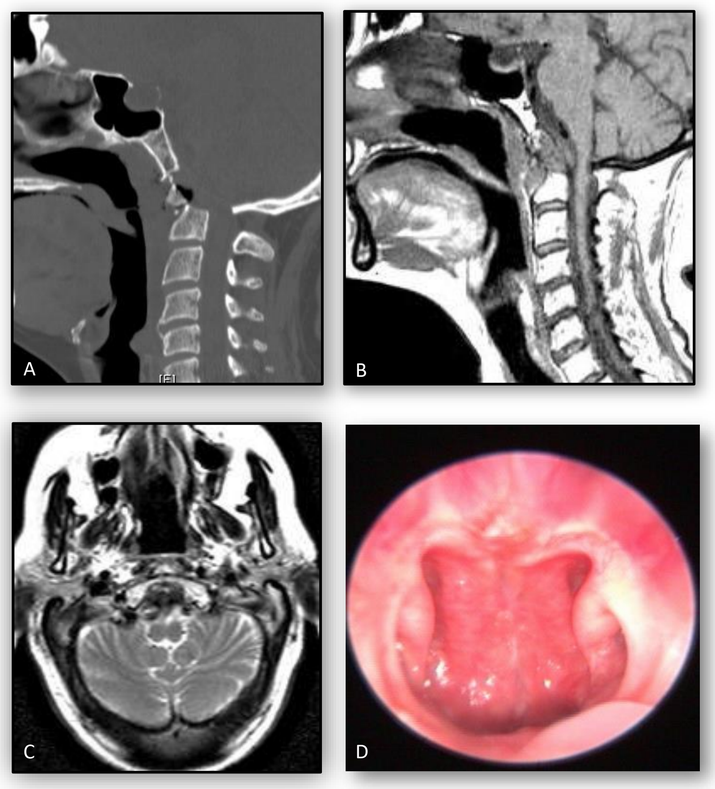


Figure 4: *postoperative neuroimaging studies show partial odointoidectomy in postop CT scan (A), adequate spinal cord decompression and rheumatoid pannus removal in sagittal T1 MRI (B) and axial T2 MRI (C). Mucosal flap at one month endoscopic evaluation (D).*

Conclusions

The outcomes obtained at our center over a ten-year period demonstrate that, in selected cases, EEA is not only technically feasible but also safe and effective, yielding favorable long-term clinical and radiological results.

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