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Introduction

Historically, the surgical corridor to the anterior craniovertebral junction (CVJ) has been the transoral-transpharyngeal approach.

Endoscopic endonasal approach (EEA) of the cranio-vertebral junction represents a viable option to address lesions extending from the lower clivus and foramen magnum to the odontoid process. This approach allows direct access to the craniovertebral junction and its neighboring structures, with the ability to manage extradural and intradural pathologies. Anatomical landmarks, in general, represent reliable external reference points to guide the surgical approach.

A major clival surgical landmark, the supracondylar groove, locates the hypoglossal canal (HC) and bilateral occipital condyles, which articulate with the corresponding lateral masses of C1. We propose a projection system (linear coordinates from outer to inner landmarks), based on the palatine line, to serve as an anatomically-based guide to access the craniovertebral region.

Objectives

To describe the anatomy of the craniovertebral region based on the projection of the horizontal portion of the palatine bone to this area.

To demonstrate and correlate the palatino-craniovertebral projection through a radiological study.

To corroborate the palatine line, as a projection system to the craniocervical junction, with six surgical cases.

Methods and Materials

Radiological:

Fifty CT scans in a bone window were analyzed to create an anatomic-radiological projection-coordinate system.

Surgical:

An inferior surgical window, using a U-inverted incision, was created, between the inferior turbinate laterally, septum nasale medially and the basiopharyngeal fascia posteriorly/deep. The muscular plane was preserved.

The lower clivus was exposed and the palatine line was used as a landmark to locate the anterior arch of C1. This arch, along with the dens and superior part of the body, were removed.

Anatomical:

A major clival surgical landmark, the supracondylar groove, locates the hypoglossal canal (HC) and bilateral occipital condyles, which articulate with the corresponding lateral masses of C1

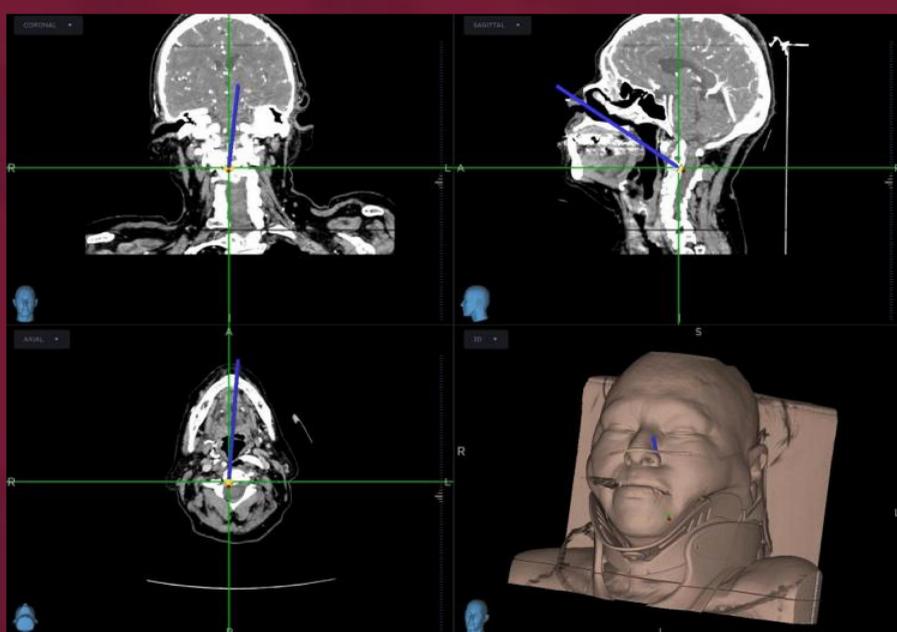


Figure 1. CT scan projection of the palatine line to the nasopharyngeal region, soft palate, septum, and inferior turbinate.

Results

In all CT scans, the palatine line was identified consistently, projecting directly from the lower clivus to the anterior arch of C1 and C2; the pharyngeal tubercle and anterior edge of the foramen magnum were found to be key landmarks along this line (Figure 1).

Surgical cases corroborated accurately with radiological (CT) measurements (Figure 2 and 3). In all cases, an adequate post-surgical and post-anesthetic outcome was reported, with minimal bleeding. All patients were properly extubated, awake, oriented, and mobilizing all 4 extremities. Patients remained under surveillance for 3 days, presenting an adequate mid-term postoperative condition. Post-operative followup reported at 6 months and one year, revealed adequate evolution and improvement in cervical and motor symptoms

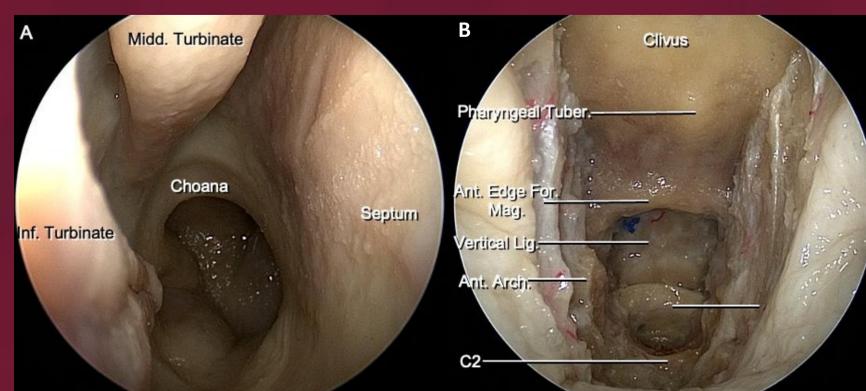


Figure 2. Dissection of the lower clivus and craniocervical region (A); F) the C2 arch and ligaments are visible (B)

Discussion

Anatomical principles highlight the CVJ's unique ligamentous stability and segmental motion, as described by Goel and Menezes, guiding posterior reduction techniques to alleviate cervicomedullary compression. De Almeida et al. introduced the nasopalatine line as the caudal limit for endonasal spine surgery, emphasizing its role in patient selection to optimize outcomes and minimize risks such as vascular injury.

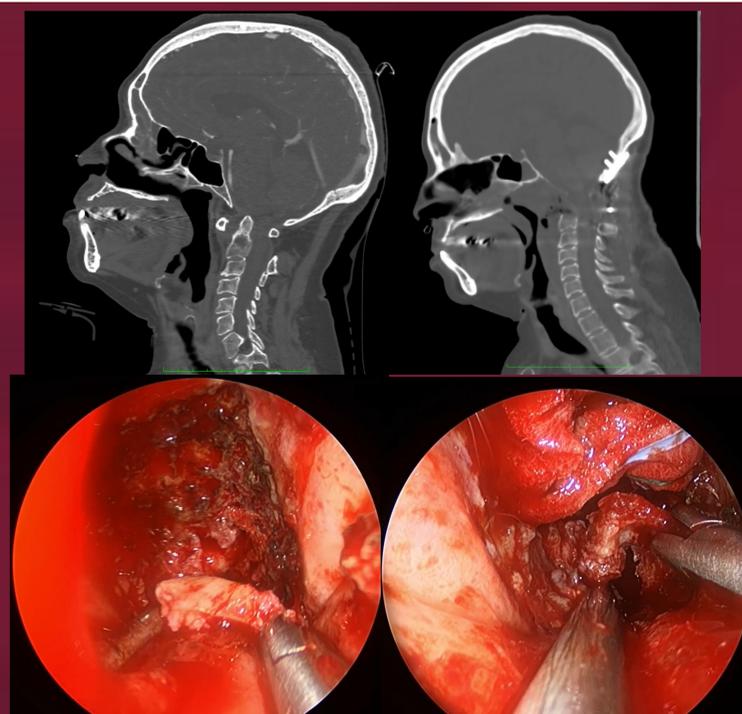


Figure 3. Preoperative image of a patient with C1-C2 subluxation, with occipitocervical fixation. Resection of the anterior arch of the atlas and resection of the C2 dens.

Conclusions

The palatine line, may provide a useful and reliable projection-coordinate line, to safely localize and access the craniovertebral junction. Although radiological studies were used as a means to consistently to mark and identify this coordinate, the palatine line may be especially useful in the absence of a navigation system in the operating room. Further surgical cases may be needed to assess efficacy and presence or absence of inter-operator variability.

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References

- De Almeida, J. R., Zanation, A. M., Snyderman, C. H., Carrau, R. L., Prevedello, D. M., Gardner, P. A., & Kassam, A. B. (2009). Defining the nasopalatine line: The limit for endonasal surgery of the spine. *The Laryngoscope*, 119(2), 239–244. <https://doi.org/10.1002/lary.20108>
- El-Sayed, I. H., Singh, H., Greenfield, J. P., & Schwartz, T. H. (2011). The importance of platybasia and the palatine line in patient selection for endonasal surgery of the craniovertebral junction: A radiographic study of 12 patients. *World Neurosurgery*, 76(1-2), 183–188. <https://doi.org/10.1016/j.wneu.2011.02.028>
- Burke, K., Benet, A., Abia, A. A., El-Sayed, I. H., & McDermott, M. W. (2014). Impact of platybasia and anatomic variance on surgical approaches to the craniovertebral junction. *The Laryngoscope*, 124(8), 1760–1766. <https://doi.org/10.1002/lary.24639>
- Nourelidine, M. H. A., Pressman, B. D., Agazzi, S., & Van Loveren, H. R. (2024). Defining the caudal limits of the endoscopic endonasal approach to the craniovertebral junction: Anatomic study correlating radiographic measures. *Acta Neurochirurgica*. Advance online publication. <https://doi.org/10.1007/s00701-024-06389-0>
- Singh, H., Essayed, W. I., Jada, S., Schwartz, T. H., & Greenfield, J. P. (2018). The importance of platybasia and the palatine line in patient selection for endonasal surgery of the craniovertebral junction: A radiographic study of 12 patients. *World Neurosurgery*, 116, e1–e8. (Actualización y referencia relacionada al estudio clave de platybasia).