Refined Anatomy and Classification of the Vidian Nerve – Foramen Lacerum Corridor: The Front Door to Coronal Plane Access in Lateral Endoscopic Endonasal Surgery

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Introduction

The vidian nerve (VN) and its canal are key surgical landmarks in endoscopic endonasal approaches (EEA), guiding safe access to the anterior genu of the petrous internal carotid artery (pICA). However, the precise anatomical relationship between the VN and adjacent structures, particularly the foramen lacerum (FL), remains inconsistently described, leading to potential variations in surgical practice and increased risk of ICA injury.

This study aims to clarify the VN–FL relationship in the coronal plane and to introduce a four-zone anatomical classification based on the VN–FL–pICA relationship, serving as a practical guide for safe and reproducible endoscopic access to the lateral skull base.

Methods

Five adult cadaveric specimens (10 sides) were utilized to describe the VN position and its division relative to the anterior genu of the pICA. In these specimens, the FL, the division of the VN into the greater superficial petrosal nerve (GSPN) and the deep petrosal nerve (DPN), along with relevant landmarks were exposed both endoscopically and transcranially. Distances between the vidian canal (VC)/VN division and relevant anatomical landmarks were obtained using neuronavigation measurement. Clinical cases are used to illustrate the four-zone model.

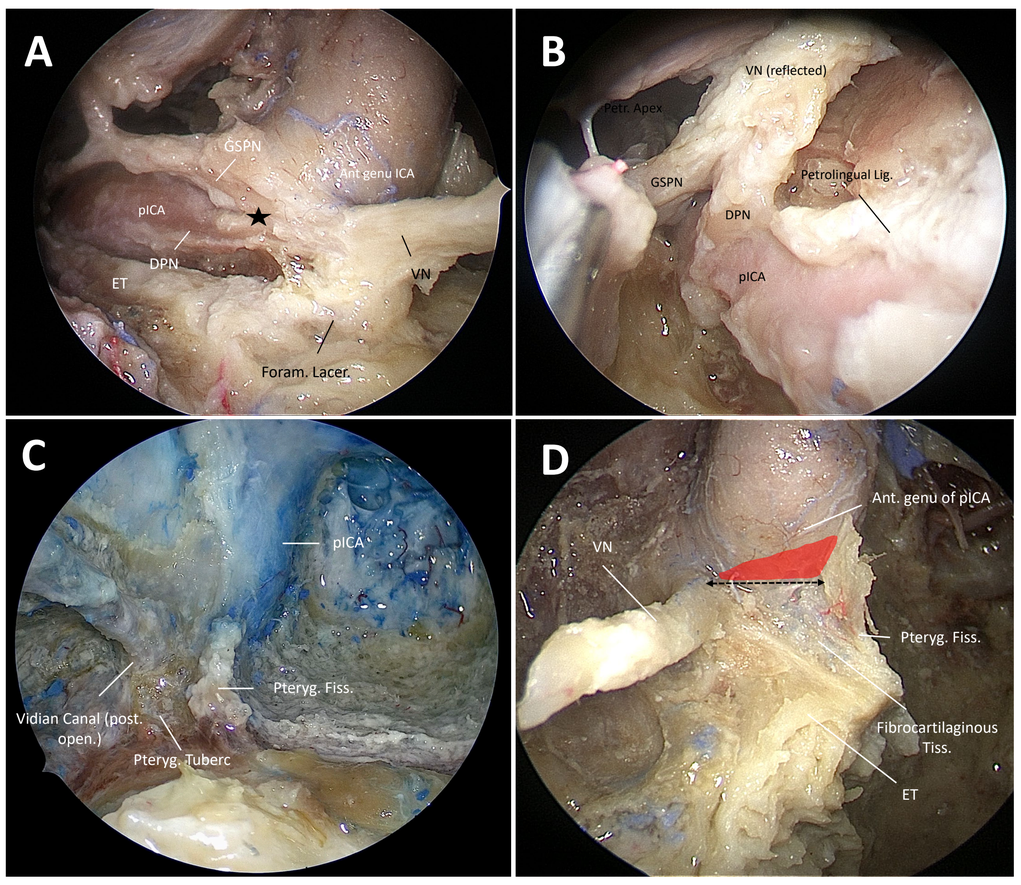

Figure 1. Vidian nerve division and its relationship with the foramen lacerum (right side)

Results

In all specimens, the posterior VC opened lateral to the FL at the inferior aspect of the anterior genu of the pICA, bounded by the pterygoid tubercle (inferomedial), mandibular strut (inferolateral), and lingual process/petrolingual ligament (superolateral). VC length was 17.7 ± 2.7 mm, and the distance between the medial aspect of the ICA and lateral aspect of the VC was 6.1 ± 1.4 mm. The VN divided into the GSPN (superior) and DPN (inferior) ~20.9 ± 3.5 mm posterior to the anterior VC opening, inferolateral to the ICA genu, and beneath the petrolingual ligament. The part of fibrocartilaginous tissue covering the FL, between the posterior opening of the VC and pterygosphenoidal fissure, did not extend to the level of the VC. Therefore, after removing the pterygoid tubercle, the anterior genu of the pICA is exposed without any cartilaginous protection.

We defined **four drilling zones** around the VN-FL corridor in the coronal plane. For the right side, these zones were defined as follows: **Zone 1** (inferomedial, 3:00–6:00): FL (1A) and sublacerum corridor (1B); **Zone 2** (superomedial, 12:00–3:00) : anteromedial petrous apex (Gardner's triangle) ; **Zone 3** (superolateral, 9:00–12:00): Meckel's cave and lateral cavernous sinus; and **Zone 4** (inferolateral, 6:00–9:00): infratemporal fossa and middle fossa floor.

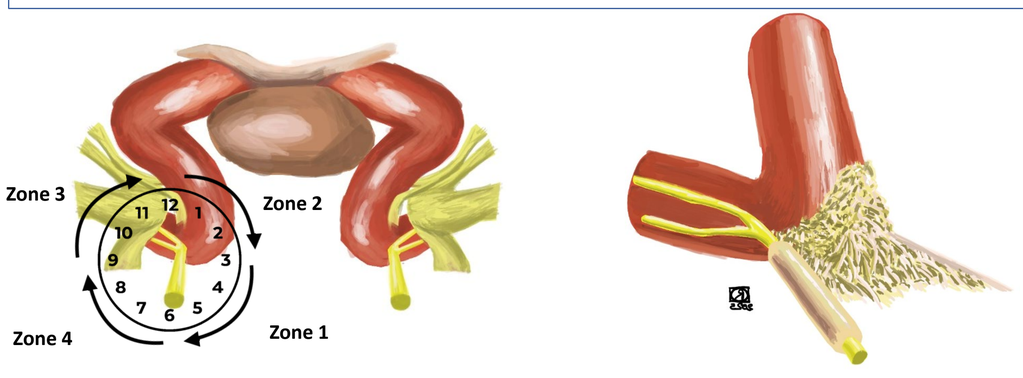

Figure 2. Illustration of the relationship between the VN division and FL along with the o'clock' concept showing the 4 drilling zones

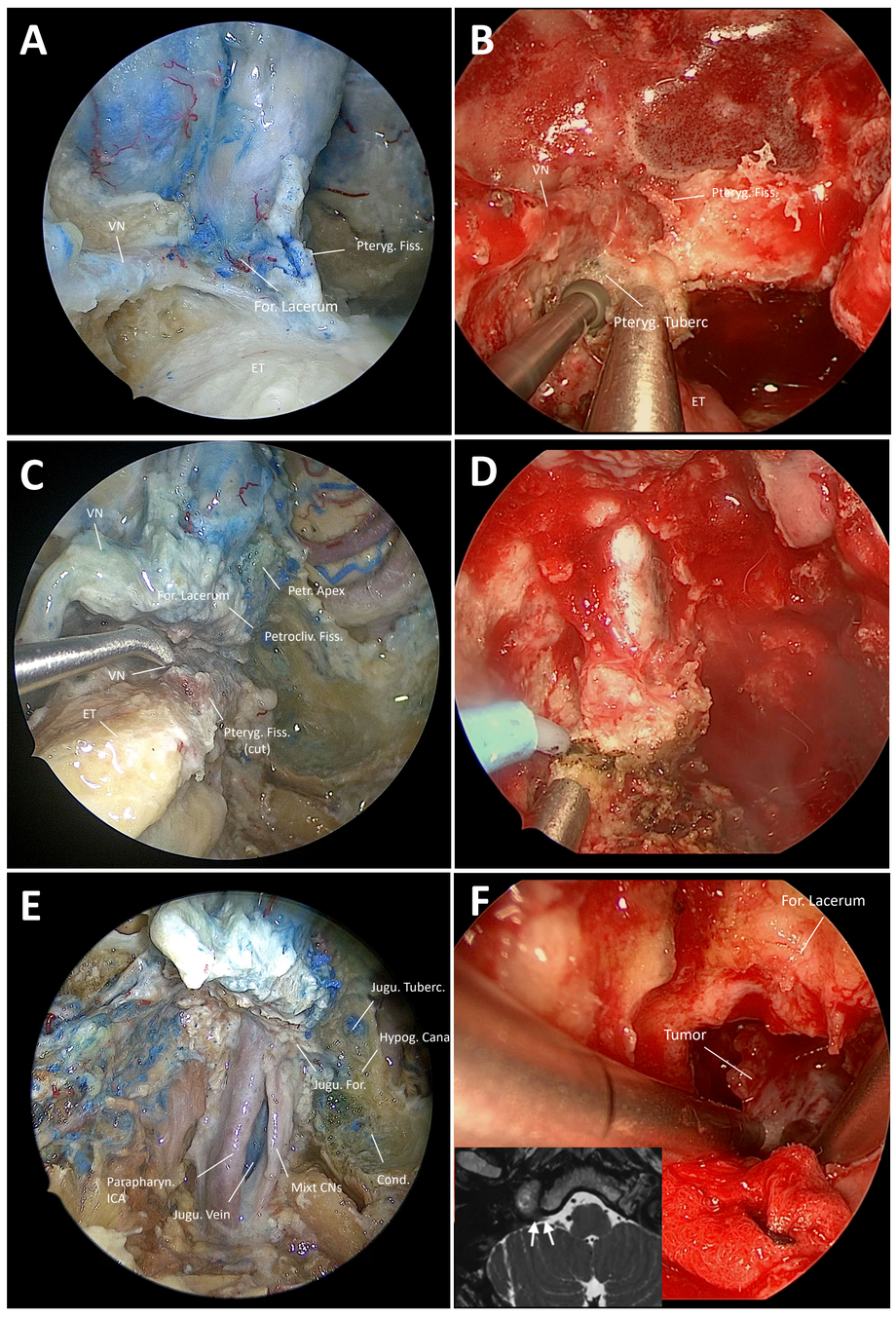

Figure 3. Zone 1 (inferomedial) : foramen lacerum (A,B) & sublacerum (infrapetrosal, C-F) – right side

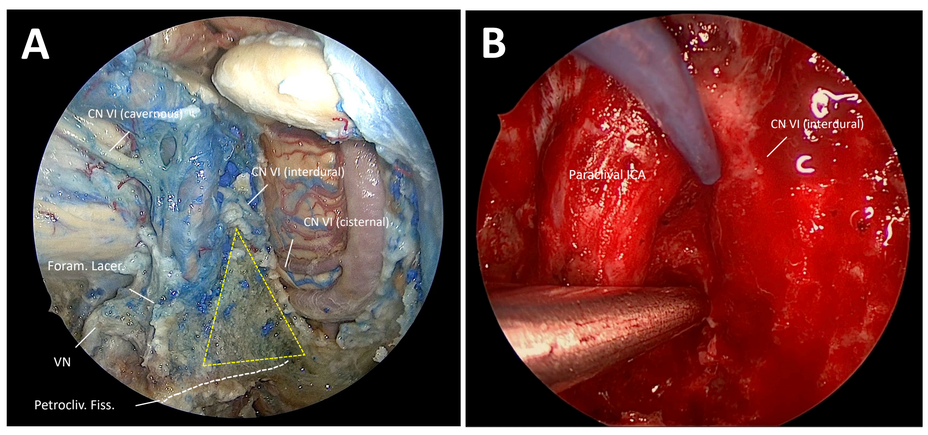

Figure 4. Zone 2 (anteromedial) : access to the petrous apex (Gardner's triangle) - right side

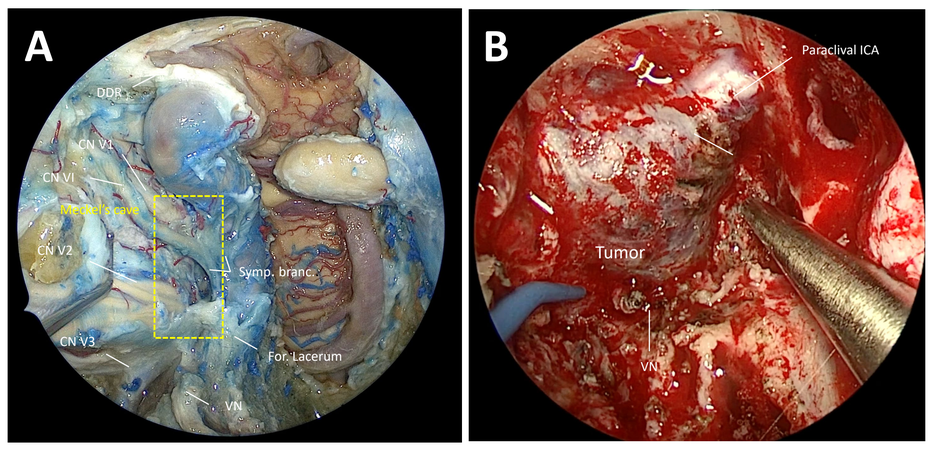

Figure 5. Zone 3 (superolateral) : access to the Meckel's cave and lateral cavernous sinus - right side

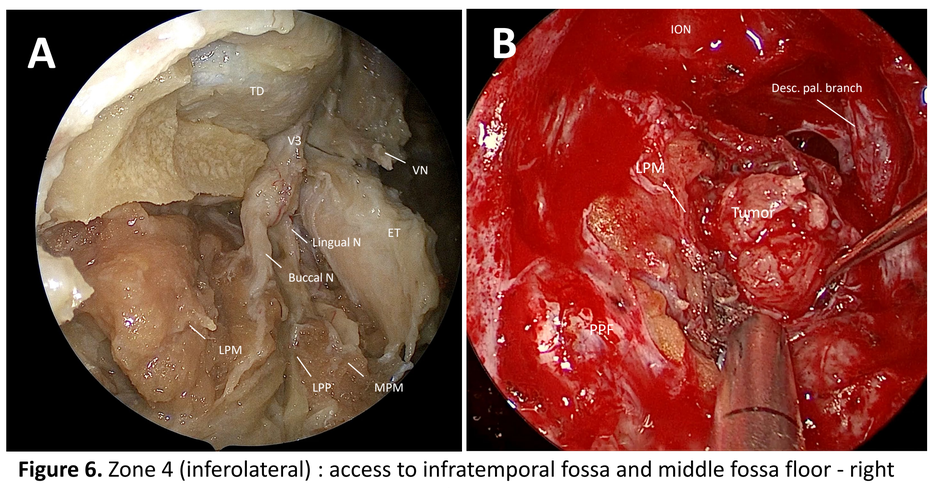

Figure 6. Zone 4 (inferolateral) : access to infratemporal fossa and middle fossa floor - right side

Conclusions

The VN–FL corridor represents a constant and reliable landmark for endoscopic endonasal approaches to the lateral skull base. The proposed four-zone classification improves surgical orientation, guides surgical corridor and extent of approach, and may reduce the risk of ICA injury during expanded EEA procedures.