Refining the Posterior Compartment of the Cavernous Sinus: Implications for Endoscopic Endonasal Surgery

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OBJECTIVE

Among the four compartments, the posterior compartment presents the greatest challenges during endoscopic endonasal surgery, for the reason that, not only its deepest location, hidden behind the posterior genu of ICA, but also the intricate neuro-vascular-ligamentous complex it enclosed, which increases the risk of severe complications with even minor missteps. However, to date, no comprehensive anatomical study has focused on the posterior compartment of CS. This study aims to delineate the surgical anatomy and technical nuances for the posterior compartment in the endoscopic endonasal approach.

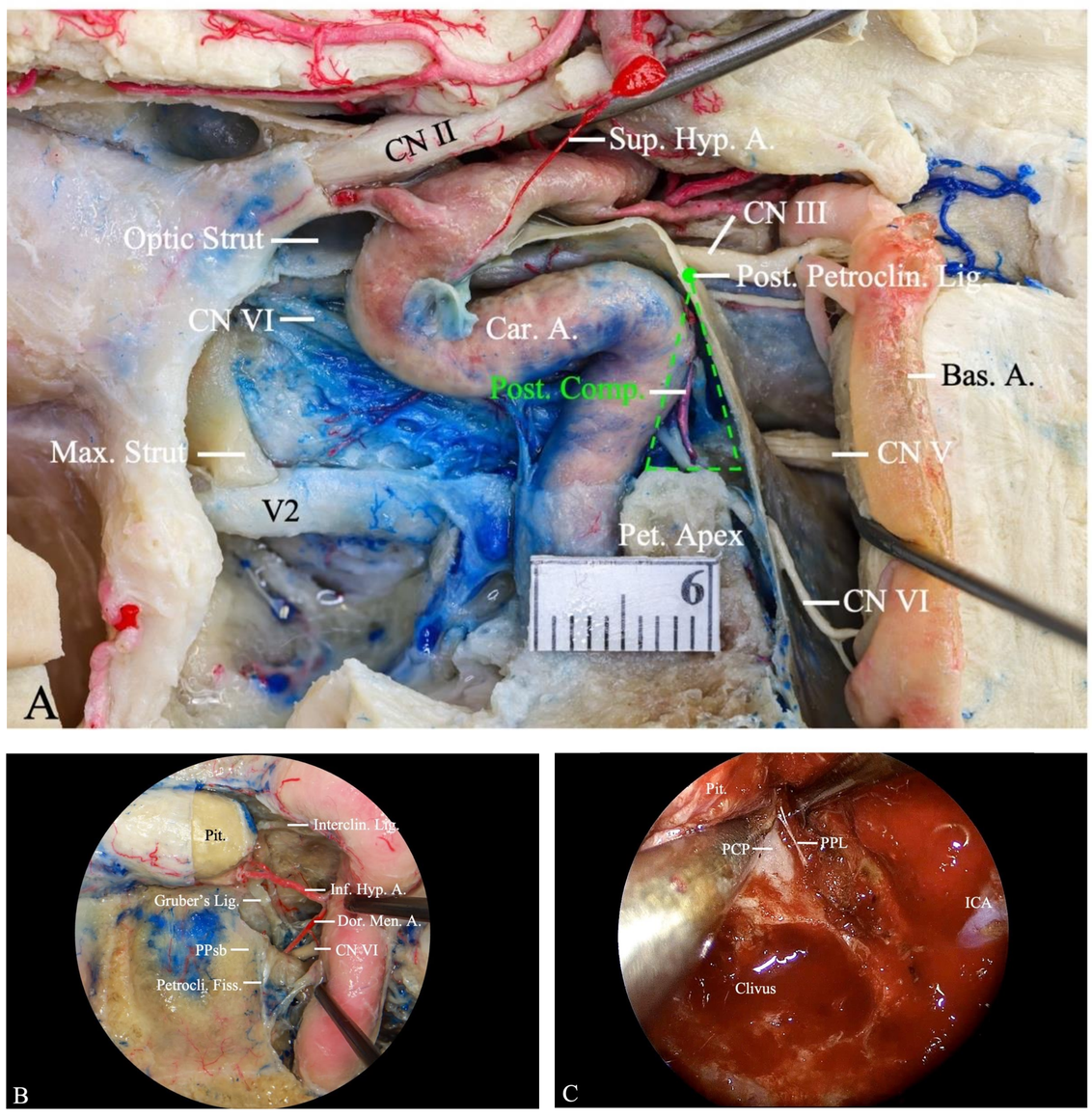


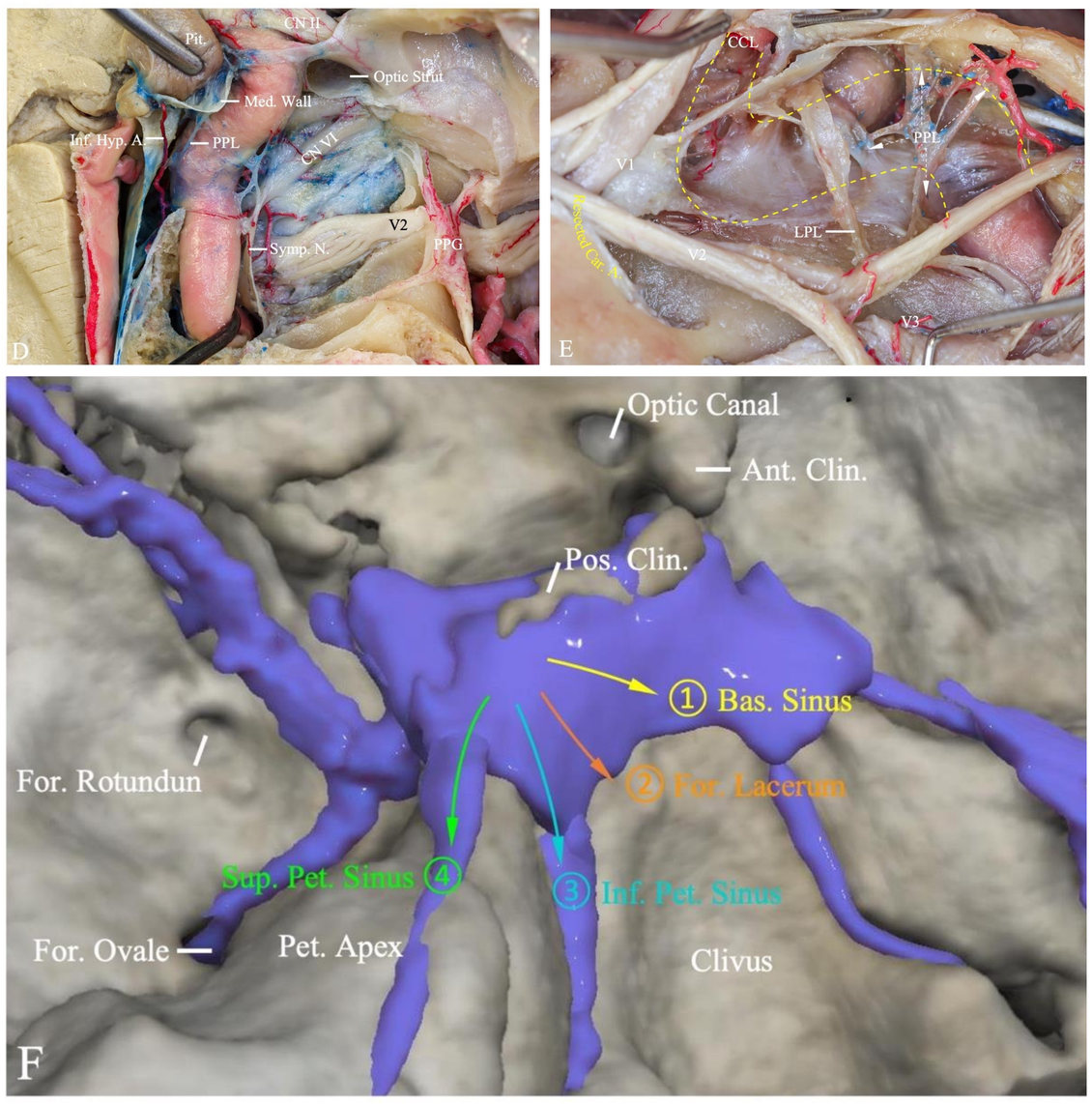
Figure 1. Microsurgical anatomy of posterior compartment of cavernous sinus. A., artery; Ant., anterior; Car., carotid; CCL, caroticoclinoid ligament; Clin., clinoid; CN, cranial nerve; Dist. Ring, distal dural ring; Dor., dorsal; Ling., lingual; Max., maxillary; Med., medial; Men., meningeal; MCP, middle clinoid process; N, nerve; Ophth., ophthalmic; Pit., pituitary; Post., posterior; Proc., process; Prox. Ring, proximal dural ring; Symp., sympathetic; Tent., tentorial; Tri., triangle; V1, ophthalmic nerve; V2, maxillary nerve.

METHODS

Thirty-nine colored-silicone–injected specimens were dissected in this study, in which nineteen underwent a transcranial approach and twenty were underwent using an endoscopic endonasal approach. Three illustrative cases involving the posterior compartment are included to highlight surgical anatomy and strategies for tumor resection.

RESULTS

From a lateral perspective, the posterior compartment of the CS manifests as an approximately isosceles triangle, with its apex at the posterior petroclinoid ligament, anterior boundary at the posterior genu of the ICA, and posterior boundary at the clival dura. The base of this triangle, representing the widest anterior-posterior dimension of the posterior compartment, is formed by the petrous process of the sphenoid bone (PPsb) medially and the petrous apex laterally, measuring 5 mm ± 0.6 mm. (Figure 1A, B) The posterior parasellar ligament (PPL) was found in 64% of hemispheres, being the least prevalent compared to other parasellar ligaments. Morphologically, 42% were typical ligaments with two anchors, with the medial anchor located on the medial wall of the CS and the lateral anchor on the posterior genu of the ICA (Figure 1C, D); and 58% were net-like, with multiple anchors attaching to various structures within the posterior compartment. (Figure 1E) Four venous outlets of the posterior compartment, including the basilar sinus, foramen lacerum, inferior petrosal sinus, and superior petrosal sinus, were identified (Figure 1F), highlighting the importance of effective hemostasis techniques targeting these outlets during endoscopic endonasal surgery.



CONCLUSION

This study meticulously investigates the anatomical landmarks within the posterior compartment of the CS, including ligaments, membranes, and venous, which elucidates the technical nuances essential for tumor resection.

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