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SCHOOL OF MEDICINE AND PUBLIC HEALTH

Cadaveric Step-by-Step Endoscopic Transorbital Approach to the Cavernous Sinus

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Abstract

This study evaluates the step-by-step execution and neurosurgical applications of the endoscopic transorbital approach to the lateral wall of the cavernous sinus. Five procedures were performed on three cadaveric heads at the University of Wisconsin-Madison Microneurosurgery Laboratory using Storz 0° and 30° endoscopes. Key anatomical landmarks, including the superior and inferior orbital fissures, optic nerve, ethmoidal arteries, and skull base foramina, were identified. The lateral wall of the cavernous sinus was successfully exposed, demonstrating feasible working distances and angles. The findings support the potential neurosurgical applications of this minimally invasive approach for accessing the cavernous sinus.

Introduction

To demonstrate the step-by-step process of performing an endoscopic transorbital approach to the lateral wall of the cavernous sinus, including a critical analysis and discussion of this approach's potential uses.

The study objectives are to demonstrate the step-by-step process of performing an endoscopic transorbital approach to the lateral wall of the cavernous sinus, and to perform a critical analysis of the potential neurosurgical utility of this approach.

The endoscopic transorbital approach offers a minimally invasive alternative for accessing the cavernous sinus, potentially improving surgical outcomes and reducing recovery times in skull base surgery.

Methods and Materials

The approach was performed on three cadaver heads, totaling five procedures, at the University of Wisconsin-Madison Microneurosurgery Laboratory. We utilized Storz 0º and 30º degree endoscopes with a 4mm diameter and 275mm length.

All dissections began with a transpalpebral incision, followed by the dissection of the periorbita from the lateral and superior walls of the orbit. We identified key anatomical landmarks for the approach's initiation, including the superior orbital fissure, inferior orbital fissure, optic nerve, and the anterior and posterior ethmoidal arteries. Using a high-speed drill, we performed a craniotomy to open the middle and anterior fossae by removing the sphenoid wing and opening the subtemporal fossa, followed by peeling off the middle fossa. We then measured the distances between the frontozygomatic suture and key skull base structures, including the foramen ovale, foramen rotundum, foramen spinosum, the anterior and posterior ethmoidal arteries, and between the supraorbital notch and these structures.

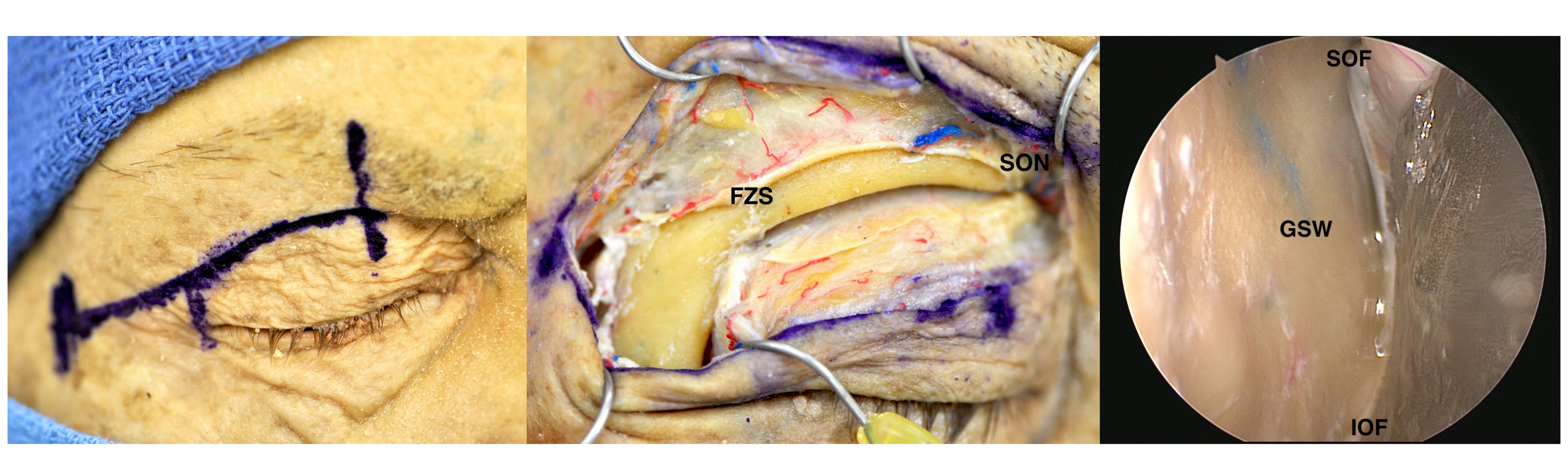

Figure 1. Right side dissection: Transpalpebral incision in the superior eyelid. Opening of the orbicular oculi and orbital septum and exposing the superior and lateral orbital rim to identify the frontozygomatic suture (FZS) and the supraorbital notch (SON). Dissection of the periorbita away from the bone and identification of the superior orbital fissure (SOF), inferior orbital fissure (IOF) and grater sphenoid wing (GSW).

Results

The lateral wall of the cavernous sinus was successfully exposed in all approaches, providing a good view of the lateral wall, along with the nerves and involved vascular structures. The working distance and angles were easily manageable with endoscopic surgical technique.

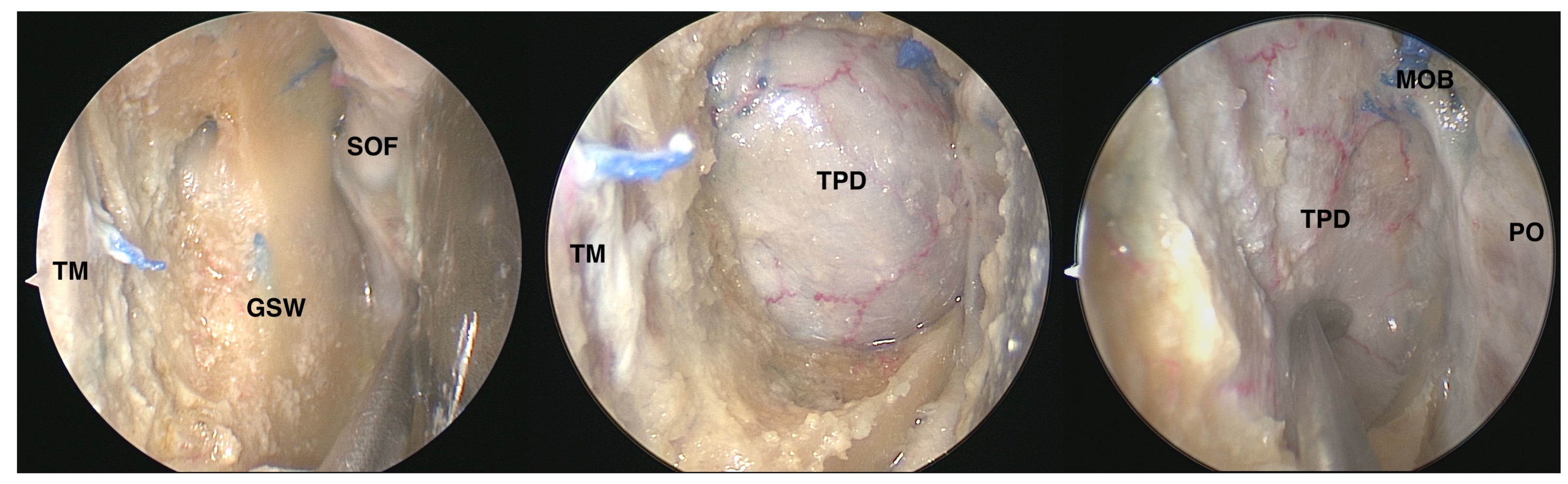

Figure 2. Drilling fo the GSW and orbital surface of the zygomatic bone to reach the temporals muscle (TM). Continue drilling to expose the temporal pole dura (TPD). Further drilling to increase exposure and identify the meaning orbital band (MOB) and the point where the dura and periorbita (PO) meets.

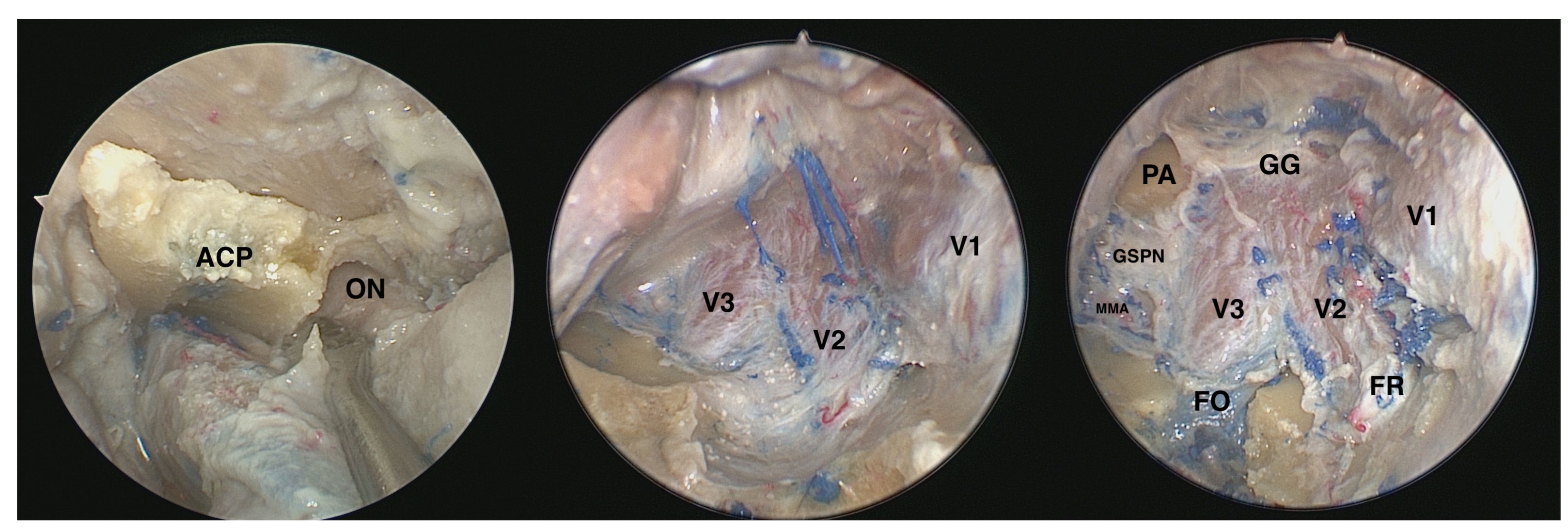

Figure 3. Cutting of the Meaning orbital band and clinoidectomy. Middle fossa peeling in progressive stages to expose the three divisions of the trigeminal nerve (v1, V2 and V3), the Gasserian ganglion (GG), greater superior petrosal nerve (GSPN, middle meningeal artery (MMA), petrous apex (PA), foramen rotundum (FR) and in this dissection the complete opening of the foramen oval (FO)

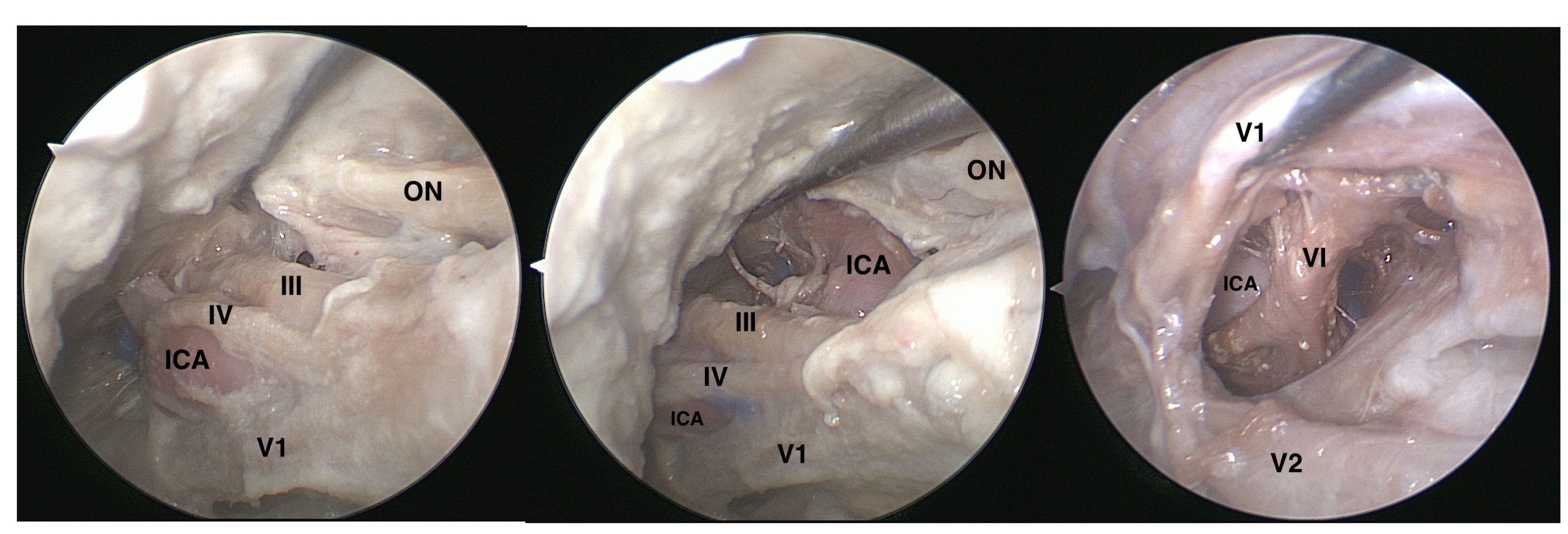

Figure 4. Further dissection of the cavernous sinus allows the identification of the optic nerve (ON), cranial nerves III, IV, V1, V2 and the internal carotid artery. The mobilization of V1 brings the cranial nerve VI into view in the Mullan's triangle (anteromedial triangle), as well as another view of the ICA

Discussion

The endoscopic transorbital approach provides a direct, minimally invasive route to the lateral wall of the cavernous sinus. Compared to traditional open approaches, this technique enhances visualization. The approach may be useful for selected cases involving cavernous sinus lesions, expanding the options for minimally invasive skull base surgery.

Conclusions

The endoscopic transorbital approach is a feasible method for exposing the lateral wall of the cavernous sinus and may be considered for various applications in skull base surgery.

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References

1. Guizzardi G, Di Somma A, de Notaris M, Corrivetti F, Sánchez JC, Alobid I, Ferres A, Roldan P, Reyes L, Enseñat J, Prats-Galino A. Endoscopic transorbital avenue to the skull base: Four-step conceptual analysis of the anatomic journey. Front Oncol. 2022 Sep 2;12:988131. doi: 10.3389/fonc.2022.988131. PMID: 36119506; PMCID: PMC9481282.
2. Santos C, Guizzardi G, Di Somma A, Lopez P, Mato D, Enseñat J, Prats-Galino A. Comparison of Accessibility to Cavernous Sinus Areas Throughout Endonasal, Transorbital, and Transcranial Approaches: Anatomic Study With Quantitative Analysis. Oper Neurosurg (Hagerstown). 2023 Apr 1;24(4):e271-e280. doi: 10.1227/ons.0000000000000547. Epub 2022 Dec 16. PMID: 36701689.
3. Vural A, Carobbio ALC, Ferrari M, Rampinelli V, Schreiber A, Mattavelli D, Doglietto F, Buffoli B, Rodella LF, Taboni S, Tomasoni M, Gualtieri T, Deganello A, Hirtler L, Nicolai P. Transorbital endoscopic approaches to the skull base: a systematic literature review and anatomical description. Neurosurg Rev. 2021 Oct;44(5):2857-2878. doi: 10.1007/s10143-020-01470-5. Epub 2021 Jan 22. Erratum in: Neurosurg Rev. 2021 Aug 14;: PMID: 33479806; PMCID: PMC8490260.