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Medial transmaxillary endonasal approach: evaluation of efficiency in accessing the pterygopalatine and infratemporal fossae

Abstract

Introduction: Endonasal approaches with endoscopic assistance are generally preferred for accessing the pterygopalatine fossa (PPF) and infratemporal fossa (ITF). To improve exposure of these regions, several extended maxillary sinus approaches and external accesses have been described.

Objectives: To determine whether the endonasal medial transmaxillary (MTM) approach provide adequate exposure of the PPF and ITF.

Methods: Patients treated for pathologies involving the PPF and/or ITF were included. The surgical technique consisted of performing a wide middle maxillary antrostomy, followed by opening the posterior bony wall of the maxillary sinus to expose the PPF. The MTM approach was considered adequate when it provided sufficient exposure of the lesion without requiring an extended maxillary approach or external access.

Results: Twenty-eight endonasal endoscopic approaches were performed for various pathologies originating in or extending into the PPF. Endonasal exposure of the PPF was adequate in all patients, and no intraoperative modifications of the surgical plan were required. No major complications occurred.

Conclusion: The MTM endonasal approach effectively exposed all relevant structures of the PPF and ITF, from the vidian nerve to V3. No extended endonasal maxillary approaches or external accesses were required for biopsies or complete resections.

Keywords: endoscopic surgery, pterygopalatine fossa, infratemporal fossa, maxillary antrostomy

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Candelaria Serrano,[1] Micaela Redivo,[2] María Pilar Mighera,[3] Carlos Santiago Ruggeri[4]

[1]Fellow in Rhinology and Skull Base Surgery, Hospital Italiano de Buenos Aires, Argentina
[2]Residents, Hospital Italiano de Buenos Aires, Argentina
[3]Head of Section, Hospital Italiano de Buenos Aires, Argentina
[4]Department of Rhinology and Skull Base Surgery, ENT Service, Hospital Italiano de Buenos Aires, Argentina

Correspondence: Carlos Santiago Ruggeri, Department of Rhinology and Skull Base Surgery, ENT Service, Hospital Italiano de Buenos Aires

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Abbreviations: PPF, pterygopalatine fossa; ITF, infratemporal fossa; MTM, medial transmaxillary approach

Introduction

The pterygopalatine fossa (PPF) is located deep within the cranial base and may be affected by a variety of pathologies. Access to the PPF may require creating a nasal corridor or using this corridor as an entry point to other skull base regions. Although external approaches allow exposure of the PPF, they are associated with substantial morbidity.

Endonasal approaches with endoscopic assistance are generally preferred for accessing the PPF and ITF due to their lower morbidity, the magnified and angled views offered by endoscopes, and the increased versatility of modern endoscopic instrumentation. The most frequently used endonasal corridor to these regions is the medial transmaxillary (MTM) approach.

Several expanded approaches involving the maxillary sinus have been described to improve exposure of the PPF and ITF. In this study, we present our experience using the endonasal MTM approach as the primary surgical corridor to the PPF and ITF.[1–3]

Objectives

To determine whether the endonasal medial transmaxillary approach with endoscopic assistance provides adequate exposure of the PPF and ITF to perform biopsies and complete resections of tumors and inflammatory lesions, without the need for extended maxillary sinus approaches or external access.

Design

Descriptive, retrospective study.

Materials and methods

Patients who underwent biopsies or definitive treatment for tumors or inflammatory lesions originating from or extending into the PPF or ITF between October 2014 and March 2024 were included. The study was approved by the institutional ethics committee (Italian Hospital; approval number 13463).

Data were retrospectively collected in a spreadsheet, including age, sex, approach type, PPF involvement, ITF involvement, pathology type, biopsy vs. complete resection, adequacy of exposure, and complications.

All surgeries were performed under general anesthesia. Postoperative hospitalization in a general ward or intermediate care unit depended on patient condition and surgical complexity.

Conventional endoscopic sinonasal instruments were used, including a drill with assorted burrs and, in selected cases, a neuronavigation system. The endonasal approach employed 0° and/or 30° endoscopes, accessing the PPF exclusively through the medial wall of the maxillary sinus.[4–6]

Surgical technique

The procedure began with an uncinectomy, identification of the natural maxillary ostium, and creation of a wide medial maxillary

antrostomy. The antrostomy extended from the pterygoid process—sometimes requiring cauterization of the sphenopalatine artery—to the lacrimal duct, which was preserved. Superiorly, the limit was the orbital floor, where the infraorbital nerve was identified; inferiorly, the limit was the superior surface of the inferior turbinate.

The posterior maxillary wall was then removed using Kerrison forceps or burrs to expose the PPF. In cases involving the sphenoid sinus, the MTM approach was combined with unilateral or bilateral sphenoidotomy and posterior septoplasty. The MTM approach was deemed adequate when it allowed complete exposure of the lesion without requiring medial maxillectomy, prelacrimal access, an endoscopic Denker approach, transseptal access, or anterior maxillary sinusotomy via sublabial route, and without conversion to an external approach (Figure 1).[7]

Results

Twenty-eight endonasal endoscopic MTM approaches were performed for pathologies involving or extending into the PPF. Sixteen patients were male and twelve female, with a mean age of 39.25 years. The MTM approach was used for three biopsies and for complete resection or treatment in 25 patients, including management of a lateral sphenoid meningocele.

In fifteen patients, the MTM approach was combined with unilateral or bilateral sphenoidotomy and posterior septoplasty; in one case, a craniotomy was also required due to an expansive angiofibroma with extradural intracranial extension. Eleven patients underwent an MTM approach alone. Three patients required a transpterygoid approach to reach the lateral recess of a pneumatized sphenoid sinus. One patient with an extensive vascular malformation involving the soft palate and nasopharynx required bilateral MTM access for cauterization of the internal maxillary arteries, combined with external cervicotomy and soft palate reconstruction using a free flap.

Four angiofibromas limited to the PPF, eight with extension to the ITF, and one vascular malformation involving the hard palate and extending into the PPF and ITF were resected using the MTM approach. ITF extension was managed by dissecting the lesions from the PPF and retracting them into the nasal cavity through the medial antrostomy, achieving complete resection without needing to expand the endonasal approach or switch to a sublabial route.[8,9]

Exposure of the PPF was adequate in all cases, and no changes to the preoperative surgical plan were necessary. No major complications occurred (Table 1).

Discussion

The PPF is a surgically challenging region due to its deep location and complex anatomy. It is shaped like an inverted quadrangular pyramid, approximately 2 cm high and 1 cm wide at its base. It lies posterior to the maxillary sinus, bordered posteriorly by the pterygoid process and greater wing of the sphenoid, and superiorly by the middle cranial fossa. Laterally, it opens into the ITF through the pterygomaxillary fissure, with the infraorbital nerve serving as the boundary between the fossae. Medially, it communicates with the nasal cavity through the sphenopalatine foramen; superiorly with the orbit through the inferior orbital fissure; and posteriorly with the middle cranial fossa through the foramen rotundum. Inferiorly, it communicates with the palate through the palatine canal. The PPF contains the maxillary artery and its branches, the maxillary nerve (V2), the vidian nerve, and the pterygopalatine ganglion.

External approaches - including lateral rhinotomy, sublabial incisions, facial translocation, and subtemporal routes - allow access to the PPF but are associated with significant morbidity and provide a funnel-shaped trajectory that restricts deep exposure.

In contrast, endonasal approaches with endoscopes have become preferred due to their wide visualization fields and reduced morbidity. Creating an adequate nasal corridor is essential for manipulating instruments, achieving hemostasis, and safely resecting lesions. In large tumors, especially angiofibromas involving the ITF, the MTM approach can be complemented with a transoral paramaxillary approach to control the maxillary artery when necessary. The MTM approach provided excellent exposure, allowing visualization from the vidian nerve medially to the mandibular nerve (V3) laterally.

In angiofibromas with ITF extension, complete resection was achieved by dissecting the tumor from the sphenoid, basisphenoid, posterior septum, and PPF, retracting the mass into the nasal cavity, and controlling the maxillary arterial branches- without expanding the endonasal approach.

Some authors advocate more extensive endonasal approaches, such as medial maxillectomy or the Denker approach. However, these techniques carry additional risks, including anterior superior alveolar nerve injury and loss of lateral alar support, potentially causing alar collapse. The prelacrimal recess approach also provides access to the PPF and ITF, and some extended approaches improve lateral exposure. Posterior septoplasty can enhance two-handed dissection, and anterior transseptal approaches may improve lateral visualization but require septal reconstruction. Cadaveric studies have described multiple access corridors to the PPF and ITF, but the MTM approach remains the principal route, with other corridors used selectively to enhance exposure. Our findings support previous studies showing that the MTM endonasal approach is sufficient for resecting PPF and ITF tumors.

Conclusion

The medial transmaxillary endonasal approach effectively exposed the PPF and ITF, providing access from the vidian nerve to V3. No extended endonasal maxillary approaches or external approaches were required for biopsies or complete resections of the diverse pathologies treated.

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None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

Ethical approval

The study was approved by the ethics committee of the Italian hospital: registration number 13463

Authorship

All authors contributed to the conception, design, and writing of the study and approved the final version.

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