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Transmaxillary approach to the infratemporal fossa

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The infratemporal fossa posses significant challenges to surgical access. Complete extirpation of the pathology in the region most be balanced with iatrogenic deficits and tumor biology. The advent of endoscopy has expanded the reach of anterior transnasal transmaxillary approaches. Herein we present a brief description of these techniques.

Creating surgical access to the infratemporal space is challenging. The complex anatomy of this deep region of the skull base has created a formidable obstacle to the surgical removal of pathology. Fortunately tumors of this region rarely occur.[1-5] However, in certain cases, particularly when cranial nerve damage and normal functioning is impaired, surgical removal becomes an appropriate option.[3,5]

Traditionally lateral approaches were employed for tumor extirpation. This culminated in the Fisch classification system that outlined a grading system (types A, B, and C) describing an expanding corridor to reach deeper pathology.[1,2,5] The drawbacks with these approaches are the significant craniofacial resection and the resultant morbidity. Significant osteotomies with mandibular resection, transection of the mandibular branch of the trigeminal nerve, significant retraction and manipulation of the facial nerve, and craniofacial defects commonly occur in open procedures.[6,7] The disadvantages of open surgery resulted in the pursuits of alternatives.

Open transfacial approaches through facial incisions or midface degloving had limitations related to visualization. With the advent of endoscopic technology the creation of a minimized corridor became possible. The endoscope was readily adopted by multiple surgical disciplines to create various forms of minimally invasive surgery. In otolaryngology, the endoscope was first used extensively in sinonasal surgeries.[4] The utilization of the endoscope then progressed to skull base applications. Midline structures of the skull base, such as the pituitary, were readily accessible endonasally. This access then expanded from the crista gali to the clivus.[6] Lateral approaches were then undertaken using combined transnasal and transmaxillary approaches. This facilitated access to the pterygopalatine fossa, infratemporal fossa, and parapharyngeal space. Transantral access helps complement access to these far lateral regions of the skull base.[2,4,8,9] The lateral limit to the endoscopic approach is considered to be the jugular foramen.

Utilizing the endoscope in skull base surgery helps to obviate the shortcomings of open surgery. Improved cosmetic outcomes, decreased hospital stays, and the absence of brain retraction have shown decreased morbidity following skull base surgery.[7] Even though endoscopic surgery has its advantages, its use is dependent on both location of the tumor and surgeon experience. Well-circumscribed benign pathology with a more anterior presentation in the infratemporal fossa is uniquely suited to a minimized endoscopic corridor.[10]

Indications

Tumors of the infratemporal fossa can either be of primary or metastatic origin. In either case, they are commonly slow-growing tumors and when the patient presents with symptoms the tumor usually has advanced size.[1,5] Patients commonly present with cranial nerve palsies including

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numbness, diplopia, hearing loss, hoarseness, and when there is lateral extension into the temporal bone and parotid facial nerve paresis or paralysis.[5] Localization of the tumor is done through neuroradiology with magnetic resonance imaging (MRI) and computed tomography scans. In addition to identifying the position of the tumor, an MRI scan will also elucidate the vascularity and assist with classification. It will also provide a foundation for neuro-navigation, increasing the overall safety of the procedure.[4]

An endoscopic transnasal transmaxillary approach can be utilized for most pathology of the infratemporal fossa. Using a transantral approach aids in the access to lateral regions. It is preferable if the tumor is located more medially and anteriorly within this space. Vascularity of the tumor is a concern. Bleeding can quickly cloud the corridor and there are limited options to control the hemorrhage. It is recommended that when faced with vascular tumors, such as juvenile angiofibromas, to have them devascularized. This is done through various forms of embolization utilizing endovascular techniques.[1]

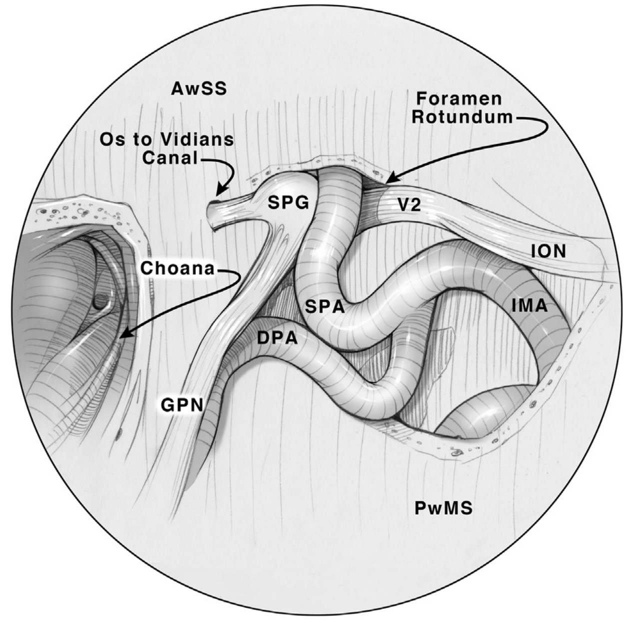

Figure 1 Wide maxillary antrostomy with partial removal of the posterior wall of the maxillary sinus exposing the contents of the pterygopalatine fossa. AwSS – Anterior wall of sphenoid sinus; DPA – descending palatine artery; GPN – greater palatine nerve; IMA – internal maxillary artery; ION – infraorbital nerve; SPA – sphenopalatine artery; SPG – sphenopalatine ganglion; V2 – maxillary branch of the trigeminal nerve.

Technique

The operation takes place in an operating room under general anesthesia. The nasal cavity is prepared with the application of oxymetazoline on cotton pledgets. The head is placed in a Mayfield bracket to help secure proper positioning. Neuro-navigation is the setup to help direct proper guidance to the surgical target. Some surgeons routinely inject one percent lidocaine containing 1:100,000 epinephrine into pterygopalatine fossa using a transoral approach through the palatine canal; however, the senior author (CAS) does not routinely perform this injection.

The next step is to create the endonasal or transmaxillary corridor. This commences with a middle turbinectomy. It is followed with a middle meatal antrostomy and posterior sphenoid or ethmoidectomies. A mucosal flap that is reflected posteriorly to expose the orbital process of the palatine bone is made. Creating a vertical incision posterior to the meatus facilitates the flap creation. Then the sphenopalatine foramen and artery are dissected. This followed by removal of the orbital process of the palatine bone permitting access into the maxillary sinus. The posterior wall of the maxillary sinus is then removed in a medial to lateral direction. This should then expose the contents of the pterygopalatine fossa including the internal maxillary artery and V2 (Figure 1). V2 is isolated and dissected medioposteriorly to the foramen rotundum. The vidian canal is also identified on the pterygoid process. The internal maxillary artery is then clipped and ligated and the adipose tissue of the pterygopalatine fossa is removed.

Injecting lidocaine with epinephrine into the buccogingival sulcus then begins the transantral approach. The lip is retratcted and an incision is made at the buccogingival sulcus. The mucosa is then dissected away to the bone. The dissection continues superiorly until the infraorbital nerve is located. The antrostomy is then created in the canine fossa. This can be facilitated by a high-speed drill. This osteotomy is sufficiently large to allow the passage of endoscope and microdissection instrumentation. Utilizing a combined endonasal and transmaxillary approach enables facile dissection into the infratemporal fossa. The transantral access allows 2 surgeons to work simultaneously allowing a 4-handed surgical technique. Alternatively, an anteromedial maxillotomy or Denker's approach can be performed.

In the infratemporal fossa, the superior and inferior attachments of the lateral pterygoid muscle are identified and detached. The muscle is then reflected inferiorly and its insertion point on the mandibular condyle is identified. Care is taken to identify the buccal nerve as it passes between the superior and inferior heads of the lateral pterygoid muscle. This nerve can be then dissected superiorly and medially to its origin from V3 as it exits the foramen ovale. As the dissection proceeds laterally, the temporalis muscle is identified and marks the lateral limit of the infratemporal fossa. The maxillary artery can be located in this region between the temporalis muscle and the insertion of the lateral pterygoid muscle. As the pterygoid plexus is encountered during this lateral dissection bleeding can occur. This hemorrhage can be adequately controlled with thrombin-soaked gel foam. Utilizing a high-speed drill, the lateral pterygoid is then transected at the cranial base. Once the lateral pterygoid plate and muscle are removed clear access to the infratemporal fossa is achieved. The middle meningeal artery is identified medially to the lateral pterygoid. The inferior alveolar and lingual divisions of