Endoscopic medial maxillectomy

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Historically, neoplastic processes of the lateral nasal wall and maxillary sinus have been treated with external procedures. Advances in endoscopic sinus surgery have enabled some of these same disease processes to be treated using endoscopic techniques. Endoscopic medial maxillectomy may be used as an alternative to more invasive external approaches while maintaining similar cure rates. In this article, the authors describe the endoscopic medial maxillectomy for neoplastic diseases involving the maxillary sinus.

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Indications

Indications for endoscopic medial maxillectomy are comparable to those of an open or external approach medial maxillectomy. These indications include sinonasal neoplasms, inverted papilloma, as well as intractable inflammatory sinus disease. However, in dealing with malignancies, the same oncological principles used in open procedures, such as complete resection, as well as margin control must be applied to the endoscopic technique. Application of this principle often precludes an endoscopic medial maxillectomy given the difficulty of visualizing, in particular, the anterior maxillary sinus wall. Involvement of soft tissue beyond the sinonasal cavity may preclude an endoscopic approach as well. Therefore, detailed examination of the tumor and the surrounding anatomy must be undertaken.
before recommending an endoscopic approach. Despite the recent advances in hand instruments and angled telescopes, sinus anatomy or tumor location may limit the applicability of the endoscopic approach. Therefore, the patient is always informed of the possibility of performing an adjuvant combined open approach, such as the Caldwell-Luc or midfacial degloving procedure. However, the superior image provided by the endoscope can still aid with visualization and identification of diseased mucosa to preserve as much healthy mucosa as possible if the procedure must be converted to an open approach.

Preoperative planning

When a neoplastic process, such as an inverted papilloma, is suspected, both computed tomography (CT) and magnetic resonance imaging (MRI) should be performed. The CT provides crucial information regarding the status of the bone surrounding the lesion. The CT should be examined for the location of the tumor and for any focal bony hyperostosis or erosion (Figure 1). Hyperostosis may indicate a site of attachment for inverted papilloma, and a close inspection along the lamina papyracea and walls of the maxillary sinus is performed. Evidence of bone erosion is concerning for malignancy. The addition of an MRI helps the surgeon distinguish tumor from inspissated secretions or polypoid mucoperiosteal thickening and reveals the status of extra-nasal tissue when sinus bone is eroded.

If possible, a biopsy is performed in the clinical setting; if a vascular tumor is suspected, the surgeon may choose to defer biopsy until in the operating room. As previously mentioned, if a patient is selected to undergo an endoscopic medial maxillectomy, we inform all patients that an adjuvant open procedure or conversion to open procedure may be necessary to ensure the complete removal of the lesion.

Surgical technique

Endoscopic medial maxillectomy is performed under general anesthesia using total intravenous anesthesia (TIVA). The use of TIVA has been shown to decrease intraoperative blood loss and may be beneficial when blood loss might be expected to be high. The nose is decongested topically with 1% oxymetazoline and 4% topical cocaine, and the mucosa of the inferior turbinate and lateral nasal wall is injected with 1% lidocaine with 1:100,000 epinephrine. A transoral pterygopalatine injection can be performed by inserting a 25-gauge needle into the greater palatine foramina, which is located opposite the second molar, to provide additional hemostasis.

After initial inspection with the 0-degree telescope, the resection is primarily performed with a 4-mm, 30-degree telescope. The middle turbinate is reflected toward the septum, and the middle meatus is inspected (Figure 2). The initial step involves debulking the tumor to locate the site of attachment. If it extends from the ethmoid into the maxillary sinus or vice versa, debulking is performed with the microdebrider. All sinonasal contents are collected in a suction trap to be sent to pathology. Care is taken to avoid injury to the septum and the inferior turbinate. We periodically stop and inspect the cavity to determine whether there are any attachment sites along these aforementioned structures. This point cannot be underscored because the tumor in its entirety, including attachment point, must be resected. This principle is followed during the entire surgery.

The next step is to identify and visualize the maxillary ostium. The uncinate process is resected with a backbiting instrument and the natural os of the maxillary sinus is identified. The natural ostium is widened with through-cutting forceps or the microdebrider. All sinonasal contents are collected in a suction trap to be sent to pathology. Care is taken to avoid injury to the septum and the inferior turbinate. We periodically stop and inspect the cavity to determine whether there are any attachment sites along these aforementioned structures. This point cannot be underscored because the tumor in its entirety, including attachment point, must be resected. This principle is followed during the entire surgery.

An inferior turbinectomy is performed next using the endoscopic scissors. Although a total turbinectomy may be performed, we often find total removal unnecessary and prefer to remove the middle third only, when permitted. The inferior turbinate, therefore, is incised between the anterior one-third and the posterior two-thirds of the turbinate, just behind Hasner’s valve (Figure 3). If tumor involves the nasolacrimal duct, it is sacrificed and a dacryocystorhinostomy is performed at the conclusion of the procedure to
prevent epiphora. The incision of the turbinate is carried up toward the antrostomy, just posterior to the lacrimal duct. Finally, the posterior portion of the turbinate is incised near the pterygoid plates.

The mucosa of the inferior meatus and nasal cavity floor is elevated toward the septum. Through-cutting instruments are used to resect the medial maxillary wall down to the nasal floor. If needed, a high-speed irrigating drill can be used to remove bone too thick for through-cutting punches (Figure 4). At this point, the maxillary sinus opens directly onto the floor of the nasal cavity, and the medial maxillary wall has been removed nearly completely. Because Hasner’s valve is situated in the superior aspect of the inferior meatus, the medial maxillary wall inferior to the valve can be resected to provide additional exposure and room for instrumentation. This is performed with a backbiting instrument until the anterior wall of the maxillary sinus is reached near the piriform aperture. Stereotactic navigation is very helpful in confirming the local anatomy and the location of the tumor during this exposure. If tumor is known preoperatively or intraoperatively to involve the medial maxillary wall just lateral to the lacrimal duct, this region cannot be addressed endoscopically unless the duct is resected or an adjuvant canine fossa puncture is performed for access and surgical manipulation.

Once opened (Figure 5), the maxillary sinus is inspected thoroughly to evaluate for a possible site of attachment and any unaddressed tumor. This is done with the 30- and 70-degree telescopes. Stereotactic probes are used to correlate the endoscopic view with the CT images to confirm the completeness of the resection. When present, tumor is extirpated from the maxillary sinus along with surrounding mucosa. When dealing with inverted papilloma, cautery is performed to fulgurate nests of inverted papilloma. Inverted papilloma may infiltrate the underlying bone at the site of

Figure 2  Endoscopic view with a 0-degree telescope of a left maxillary sinus inverted papilloma. The middle turbinate (*) is reflected toward the septum (S). A key distinction between inverted papillomas and benign sinonasal polyps is the lobulated papillomatous appearance of inverted papilloma.

Figure 3  The inferior turbinate is reflected superiorly to identify Hasner’s valve. Using endoscopic scissors, the inferior turbinate (IT) is excised just posterior to Hasner’s valve (arrowhead).
attachment\textsuperscript{10}, therefore, this bone must be removed. High-speed suction–irrigation diamond burs are used to thin the bone along the attachment site of the tumor to address these histologic nests.

Ethmoid involvement is addressed simultaneously during this approach, and this represents the superior-most aspect of the resection. When necessary (eg, tumor involvement), the middle turbinate is excised. In doing so, the turbinate should be removed in such a fashion to avoid postoperative lateralization and obstruction of the frontal recess (Figure 6). If the tumor is attached to any degree to the lamina papyracea, the site is resected along with the bone itself to expose the periorbita; bone may be removed with hand instruments or drilled down with the suction–irrigation bur. The ability to closely inspect the remainder of the ethmoid cavity and the frontal recess highlights the advantages the endoscopic approach has over the open or external approaches to the medial maxillary wall).

Margins around the sites of attachment are taken to ascertain the completeness of the resection. If a margin cannot be obtained using endoscopic instruments, a decision must be made regarding whether to perform an adjuvant open procedure. At the termination of the procedure, a final inspection is performed, and the maxillary sinus is irrigated and filled with a hemostatic agent. Light packing is placed within the ethmoid cavity.

Figure 4 Following a wide maxillary antrostomy, the medial maxillary wall is taken down using a combination of through-cutting instruments as well as the suction–irrigation diamond bur drill. In this figure, the posterior third of the IT, Hasner’s valve (arrowhead), and maxillary sinus (MS) is identified. Tumor (T) is identified along the floor of the maxillary sinus in this patient.

Figure 5 Surgical defect viewed with a 30-degree telescope. When complete, the defect permits complete visualization of the entire maxillary sinus. Surveillance can be performed with 30- and 70-degree telescopes. In this figure, the posterior choana (PC), inferior turbinate stump (IT), and MS are visualized.
Discussion

The endoscopic medial maxillectomy is rapidly replacing open medial maxillectomy, which has traditionally been considered the gold standard treatment for neoplastic disease involving the lateral nasal wall and maxillary sinus. The underlying principles of functional endoscopic sinus surgery aim to preserve as much normal mucosa to maintain sinonasal physiology. Endoscopic techniques offer decreased morbidity while maintaining comparable recurrence rates. The recurrence rate for external approaches for the inverted papilloma varies from 0% to 36%,11-14 whereas the recurrence rate of endoscopic approach for the inverted papilloma varies from 0% to 25%.4-6,15,16

The endoscopic technique offers several advantages to open techniques for patients and surgeons. For patients, the lack of facial scars is appealing cosmetically, but, for the surgeons, the endoscope also offers superior visualization of the tumor bed, allowing more accurate mapping and resection of the tumor. A study performed by Sukenik and Casiano2 found that, although preoperative CT imaging is adequate for detecting the presence of disease, it is inferior to endoscopic technique in differentiating between disease and normal mucosa. Their study found that CT was 69% sensitive and only 20% specific; however, intraoperative endoscopic examination had the same sensitivity but superior specificity (68%), further illustrating the capability of endoscopy to provide superior tumor delineation.

The endoscopic technique does maintain key oncological principles by performing complete resection of the tumor pedicle and allowing adequate margin control using frozen sections intraoperatively.5,17 There may be portions of disease that may have to be removed piecemeal to allow better visualization of the tumor attachment site; however, complete tumor removal should still be the guiding principle.4 In the present cost-conscience health care environment in which operative time and hospital stay are two important considerations in surgical planning, endoscopic medial maxillectomy offers advantages.3,18

Conclusions

When used appropriately, the endoscopic medial maxillectomy is a viable option for the treatment of refractory maxillary sinus disease and sinonasal neoplasms. Patients undergoing this treatment experience less morbidity when compared with traditional approaches and similar cure rates. Despite the advantages provided by the endoscopic approach, the authors strongly caution that oncological principles always be followed and that adjuvant external procedures be performed when necessary to completely eradicate any disease present.

References


