Chapter 10 – Medial Maxillectomy

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Medial maxillectomy is a procedure commonly used for the removal of benign and low-grade malignant tumors involving the medial aspect of the maxilla, the lateral nasal wall, the ethmoid sinuses, and the lacrimal sac. Medial maxillectomy may be carried out through a lateral rhinotomy incision or through a midfacial degloving procedure. It has been supplanted by endoscopic sinus surgery techniques for certain indications in recent years; however, the lateral rhinotomy approach continues to be useful because of the outstanding ex-posure provided. This technique has also proved to be quite valuable when used in conjunction with a craniofacial approach to aggressive neoplasms in the skull base. Lateral rhinotomy is useful as an approach to the management of neoplasms in the nasal septum. It may also be performed in conjunction with inferior maxillectomy for removal of tumors in the inferior aspect of the maxillary antrum or for tumors arising on the hard palate and alveolus. Performance of lateral rhinotomy for removal of oral cavity neoplasms is discussed in Chapter 27. Lateral rhinotomy and medial maxillectomy may also be used in selected patients with juvenile angiofibroma of the nasopharynx.

The midfacial degloving procedure has been used for modifications of the medial maxillectomy involving tumors isolated to the inferior turbinate or to the area of the premaxilla or nasal septum. The midfacial degloving procedure does not allow sufficient access for satisfactory exposure superiorly (e.g., removal of the anterior ethmoid air cell system or the area of the frontoethmoid recess).

LATERAL RHINOTOMY

Lateral rhinotomy was first described by Moure of Bordeaux and was primarily used for the removal of tumors in the ethmoid air cell system. Harrison later correctly pointed out that “lateral rhinotomy” is the name of an incision, not an operation, and that medial maxillectomy is the operation most commonly carried out through this incision.[1]

The lateral rhinotomy approach to lesions in the nose and paranasal sinuses has been part of the natural evolution of the otolaryngologist into a head and neck surgeon. The previous approaches for benign and low-grade malignant tumors in this area were far more limited and were generally carried out either transnasally or through external ethmoidectomy or Caldwell-Luc operations. The limited exposure provided by these approaches resulted in a high rate of recurrence of benign tumors and an inability to cure malignant tumors.

The most common use of lateral rhinotomy has been for the management of benign tumors, particularly inverted papillomas of the sinonasal tract. An awareness that inverted papillomas have a tendency to destroy bone, to recur after incomplete removal, and occasionally to undergo malignant transformation or coexist with malignancy has led to the belief that wide exposure is required for complete removal. The historically high recurrence rates reported after limited resection were due to inadequate tumor removal as a result of the limited access provided through the classic techniques of sinus surgery. The ideal surgical approach for the management of inverted papillomas must fulfill certain requirements: (1) adequate exposure for complete removal of tumor, (2) adequate view of the sinonasal cavity for postoperative examination, and (3) acceptable cosmetic and functional results.

For several decades, reports in the literature from Vrabec,[2] Lawson,[3] Thorp,[4] and Myers[5] and their colleagues described excellent results in the management of inverted papilloma with the technique of lateral rhinotomy and medial maxillectomy. However, in 1992, Waitz and Wigand reported excellent results with endoscopic sinus surgery in the treatment of inverted papilloma, even in advanced cases.[6]

With these promising results, together with the advent of powered instrumentation, endoscopes with magnification, and angled views, visualization has improved and allowed more accurate tumor localization, and an evolution in our management of these tumors has taken place. The presence of many nasal endoscopists in our residency training programs has resulted in a growing body of evidence to support the use of endoscopic surgery in the resection of these tumors because of results comparable to those achieved with the external approach.[7–12]

The technique of lateral rhinotomy and medial maxillectomy with removal of the lateral nasal wall, followed by meticulous removal of all mucosa in the ipsilateral maxillary antrum, ethmoid sinuses, and sphenoid sinuses, is a requirement for complete excision of large inverted papillomas. When satisfactorily executed and meticulously closed, the lateral rhinotomy incision heals well, is inconspicuous, and is accepted by most patients. The lateral rhinotomy incision is also used for total maxillectomy. It provides adequate exposure so that it is not necessary to use the Weber-Ferguson extension, which results in an unsightly scar and often a poor cosmetic outcome. Midfacial degloving is reserved for use in patients who have a tendency for the development of pigmented scars or

keloids.

PATIENT SELECTION

Patients who have benign and malignant tumors of the nasal cavity and paranasal sinuses, such as inverted papillomas, tumors of minor salivary gland origin, tumors of the lacrimal sac, and tumors of the nasal septum, may all be adequately treated with the technique of medial maxillectomy. An occasional patient may have a foreign body in the nose that may become quite large and produce concretions known as “rhinoliths” that may have to be removed through a lateral rhinotomy. Tumors of the nasal septum may also be approached in this manner. Lateral rhinotomy alone does not provide adequate exposure if the tumor is located in the posterior two thirds of the septum, so other approaches will be required as well. Patients who have malignant tumors in these anatomic sites, as well as the cribriform plate area, such as esthesioneuroblastoma, may benefit from a lateral rhinotomy carried out as part of the craniofacial resection.

PREOPERATIVE PLANNING

Computed tomography (CT) and magnetic resonance imaging (MRI) provide very precise information about the exact location and the dimensions of the tumor to be removed. These imaging studies also provide an exact view of the anatomy, including any anatomic variations, thereby facilitating preoperative planning (Fig. 10-1). CT scanning offers precise evaluation of bone detail, particularly the presence of bone erosion or tumor invasion into adjacent structures such as the cranial base or the orbit. However, CT scanning may overestimate the mass of the tumor, especially if thetumor obstructs the sinus, because CT cannot differentiate tumor from adjacent inflamed mucosa or retained secretions. In contrast, MRI may be used to distinguish tumor from secretions secondary to obstruction of the sinus (Fig. 10-2). In particular, T2-weighted images and contrast-enhanced T1-weighted images can differentiate between tumor and adjacent inflammatory changes. In general, inverted papilloma exhibits intermediate signal intensity on T2-weighted images, whereas in-flammatory changes adjacent to an inverted papilloma exhibit extremely high signal intensity. In addition, inverted papilloma shows a solid enhancement pattern resembling that exhibited by malignant tumors, whereas inflammatory mucosa shows intense peripheral rim enhancement. Oikawa and associates[13] demonstrated in their series of patients with inverted papilloma that MRI assessment of inverted papilloma can accurately predict the extent of tumor involvement. Preoperative staging of inverted papilloma by MRI may be useful for planning an appropriate surgical approach. Positron emission tomography (PET) yields qualitative information about the malignant potential of the tumor based on its fluorodeoxyglucose (FDG) avidity and may be even more useful when combined with simultaneous CT scanning (PET/CT scan).

Figure 10-1 Computed tomography scan demonstrating a tumor involving the lateral nasal wall, the nasal cavity, and the paranasal sinuses.

Figure 10-2 **A,** Coronal computed tomography (CT) demonstrating opacification of the left-sided maxillary sinus. With CT images it is difficult to determine which portion of the opacification represents the tumor and which represents obstructed secretions. **B,** Coronal T2-weighted magnetic resonance image demonstrating an inverted papilloma as an intermediate–signal intensity mass *(arrow)* involving the medial portion of the left maxillary sinus. High-signal intensity *(star)* indicates the obstructed secretions in the left maxillary sinus.
(Reprinted with permission from Oikawa K, Furuta Y, Oridate N, et al: Preoperative staging of sinonasal inverted papilloma by magnetic resonance imaging. Laryngoscope 113:1985, 2003.)

Biopsy is important to establish a histologic diagnosis before surgery, particularly in this anatomic area because of the wide variety of tumors that may be encountered. If the tumor is extensive and high grade on biopsy, a more extensive procedure may be required. Concern about hemorrhage after biopsy has led many surgeons to routinely perform the biopsy in the operating room. The use of sinonasal endoscopy has also helped determine the extent of the disease more precisely, thus aiding in planning of the procedure.

SURGICAL TECHNIQUE

Lateral rhinotomy is performed with the patient under general oral endotracheal anesthesia. The endotracheal tube should be fixed by tape or suture to the side of the oral cavity contralateral to the surgical procedure. Perioperative antibiotics are administered. This skin is marked for the incision before skin preparation. The incision for lateral rhinotomy extends from just above the medial canthus along the lateral aspect of the nose into the alar crease (Fig. 10-3). If necessary, wider exposure may be gained by splitting the lip. When the lip is to be split, as with a radical maxillectomy, a mark should be made in the vermilion border with the tip of the knife blade to reapproximate the two sides of the lip properly. Accurate approximation of the vermilionborder is critical for satisfactory cosmesis when the lip is reapproximated at the end of the procedure. The vertical line for the lip-split should be placed in the vertical line of the philtrum on the ipsilateral side because such placement helps

camouflage the scar. The line of the incision is marked with a marking pen.

Figure 10-3 The lateral rhinotomy incision is outlined. It is not usually necessary to split the lip. The nasal vestibule should not be violated.

After the face is prepared and draped, a temporary tarsorrhaphy is performed on the ipsilateral eye with 6-0 silk on a cutting needle to prevent injury to the cornea during the procedure. The incision is made with a scalpel, and the underlying soft tissues are dissected with electrocautery. The periosteum, together with the soft tissue, is elevated off the anterior wall of the maxilla as far lateral as the lateral aspect of the maxillary antrum and as far superior as the orbital rim to expose and preserve the infraorbital nerve (Fig. 10-4). The periorbita is then undermined off the lamina papyracea. This complete undermining will also dislocate the lacrimal sac out of the lacrimal fossa. The lacrimal duct should be transected as far distally as possible (Fig. 10-5). Such transection will allow further undermining of the periorbita to expose the medial third of the floor of the orbit. Bleeding from the lacrimal bone may be managed by electrocoagulation. The periorbita is then elevated posteriorly to the anterior and posterior ethmoid arteries, which should be identified but not ligated or divided because these vessels provide the most constant landmarks for the frontoethmoid suture. Staying below this suture line is a safety feature of unparalleled importance in avoiding entrance into the anterior cranial fossa.

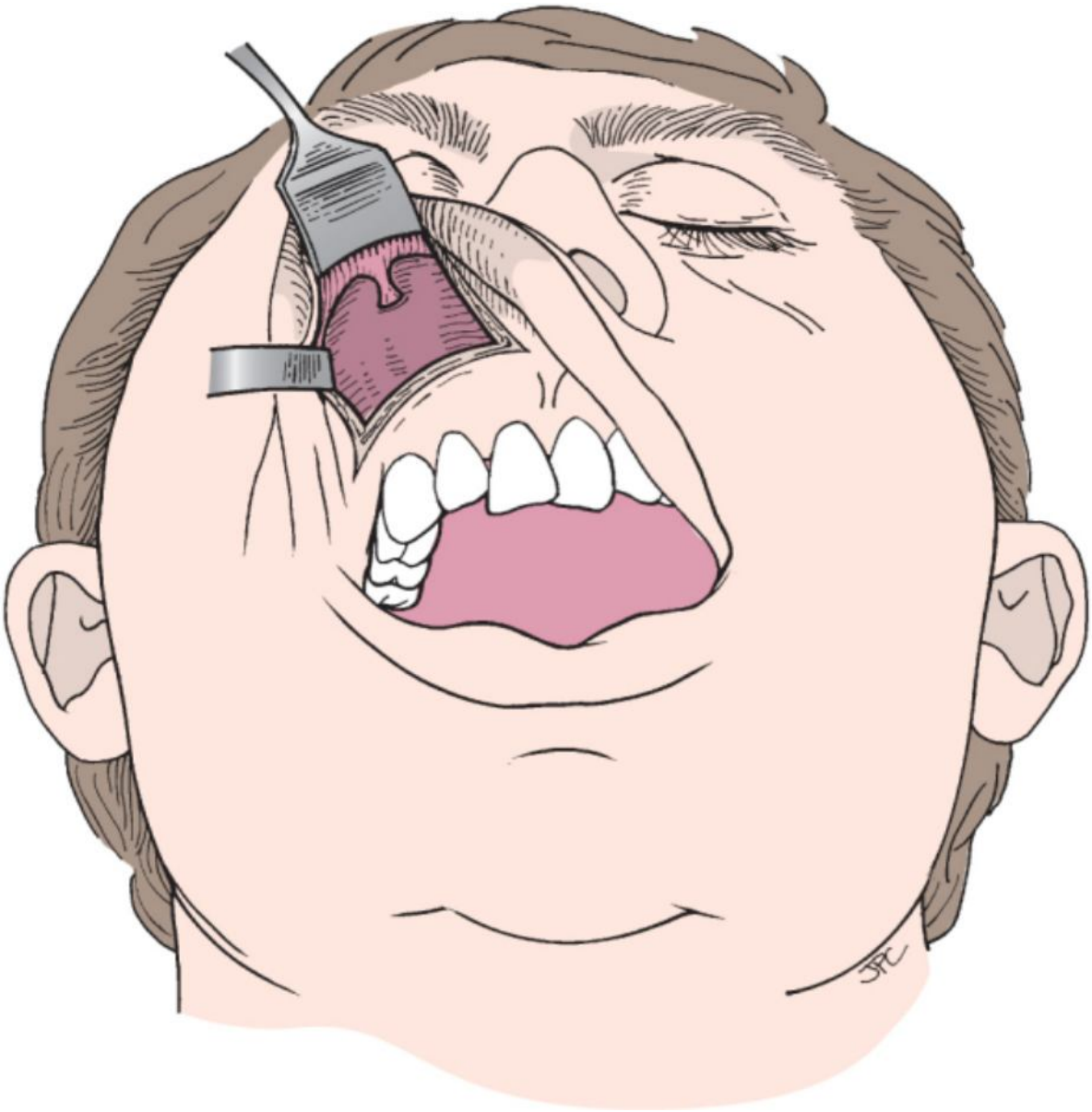

Figure 10-4 Elevation of the periosteum off the maxilla with exposure of the infraorbital nerve.

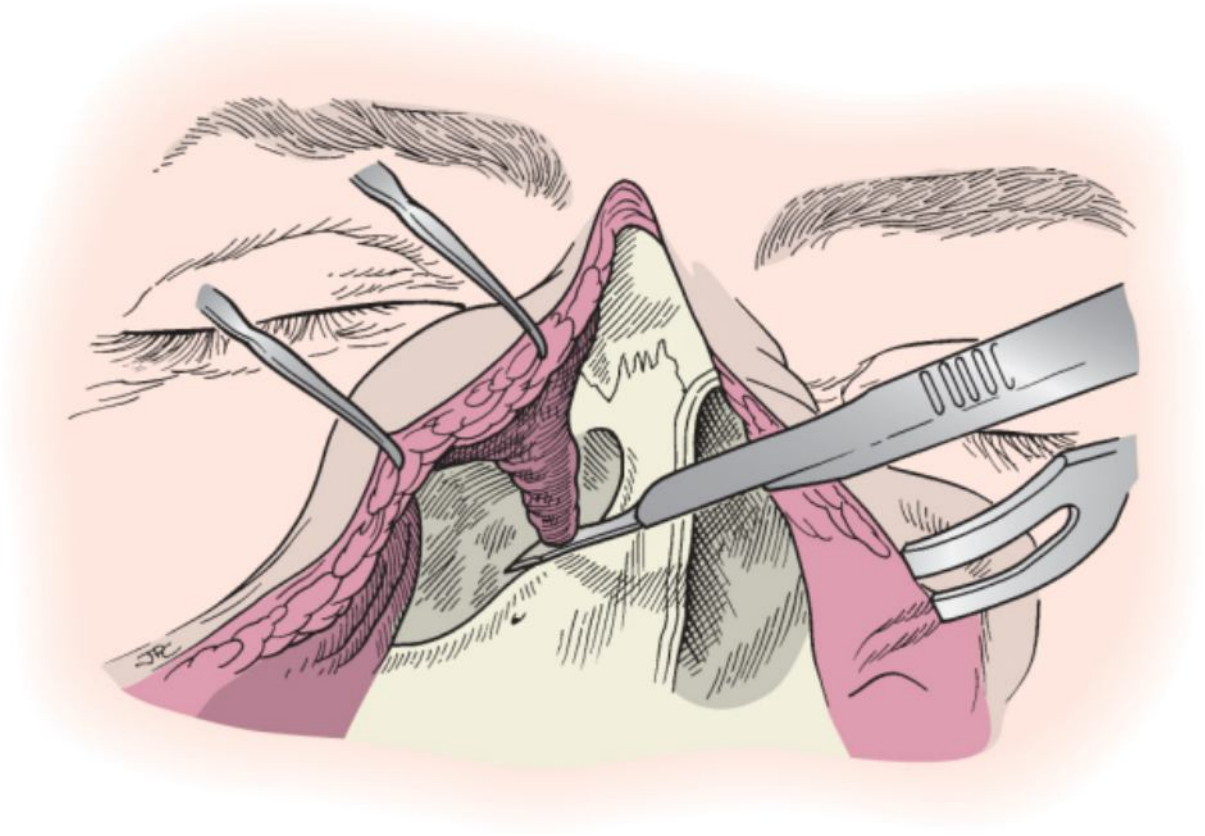

Figure 10-5 The lacrimal sac is elevated from the lacrimal fossa and transected as far distally as possible.

The nasal cavity is then entered by incising the mucosa along the piriform aperture. Transection of the nasal mucosa anterior to the inferior turbinate with an electrocoagulating current decreases the bleeding. The nasal ala is kept intact as a unit to avoid subsequent distortion with narrowing of the nasal vestibule.

An opening is made through the anterior wall of the maxillary antrum with a mallet and osteotome or a cutting burr. The entire front wall of the maxillary antrum is removed up to the orbital rim and the medial wall to provide access for subsequent osteotomies. The infraorbital nerve must be preserved whenever possible. Caution should be exercised to not remove bone too close to the infraorbital nerve because vessels accompany the nerve. These vessels are too small to ligate, and the nerve is endangered when electrocautery is used to control the bleeding. Subperiosteal dissection is carried out along the nasal bone and ascending process of the maxilla. At this point, elevation of the periorbita may be completed more easily. Osteotomies are made (Fig. 10-6A to C) (1) along the nasal bone, (2) along the floor of the nose connecting the nasal cavity with the antrum, (3) below the frontoethmoid suture, and (4) at the junction of the lamina papyracea with the floor of the orbit. An oscillating saw or a rongeur may be used for osteotomies 1 and 2; however, osteotomies along the frontoethmoid suture and junction of the lamina papyracea with the floor of the orbit should be carried out under direct vision with a thin osteotome. After the osteotomies have been completed, heavy scissors are used to separate the posterior soft tissue attachments from the bone (Fig. 10-7). One blade of the scissors is placed in the orbit just below the frontoethmoid suture in the osteotomy, and the other blade is placed in the nasal cavity at approximately the level of the midportion of the middle turbinate. By applying gentle traction inferiorly while cutting, the surgeon separates the block consisting of the lateral nasal wall (medial maxillectomy) from the surrounding tissues. Bleeding may be encountered from branches of the internal maxillary artery.

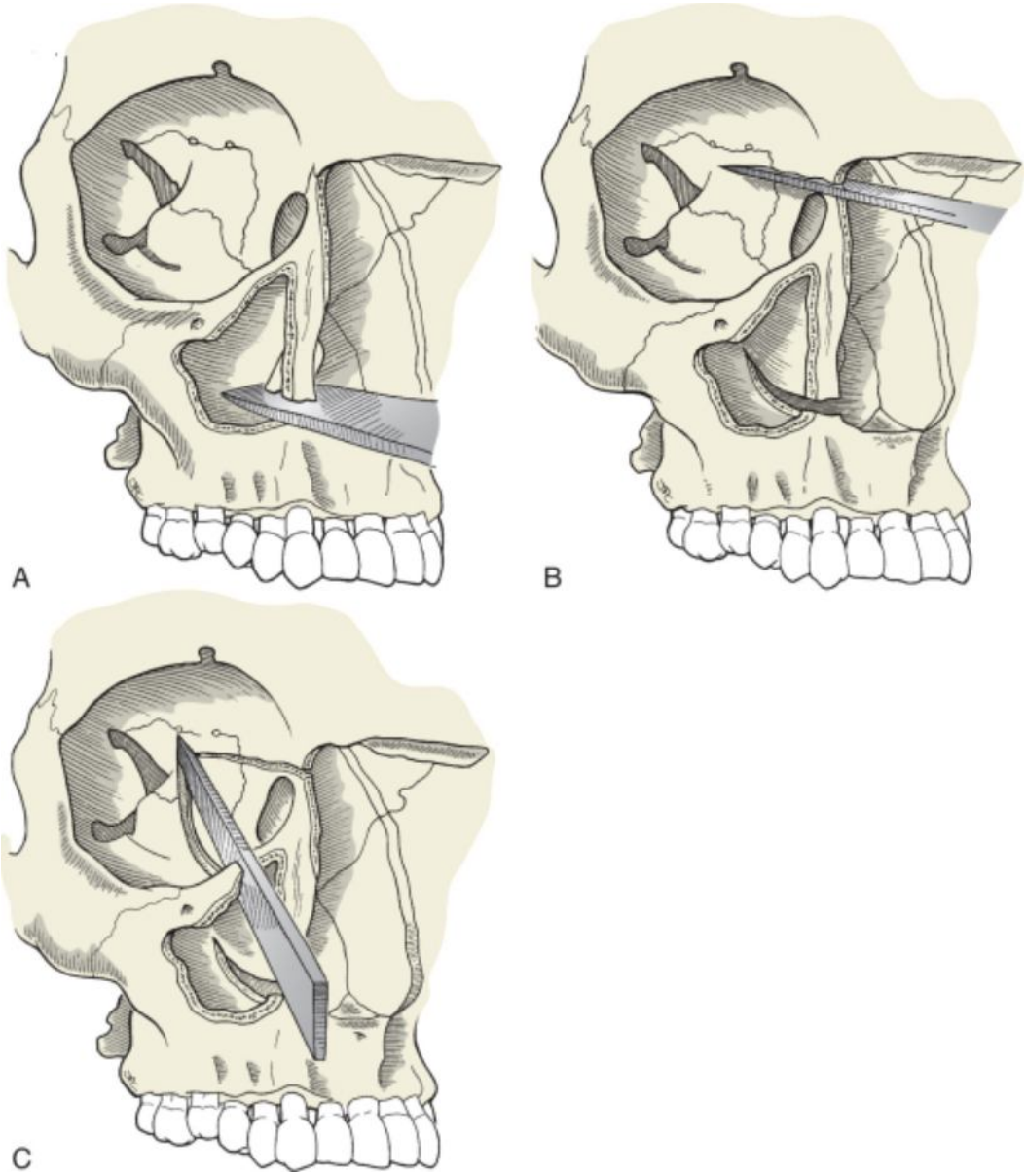

Figure 10-6 Osteotomies are made along the floor of the nose through the bone between the antrum and the nasal cavity (**A**), through the frontal-ethmoid suture below the level of the anterior ethmoid artery (**B**), and along the medial floor of the orbit to the posterior wall of the antrum (**C**).

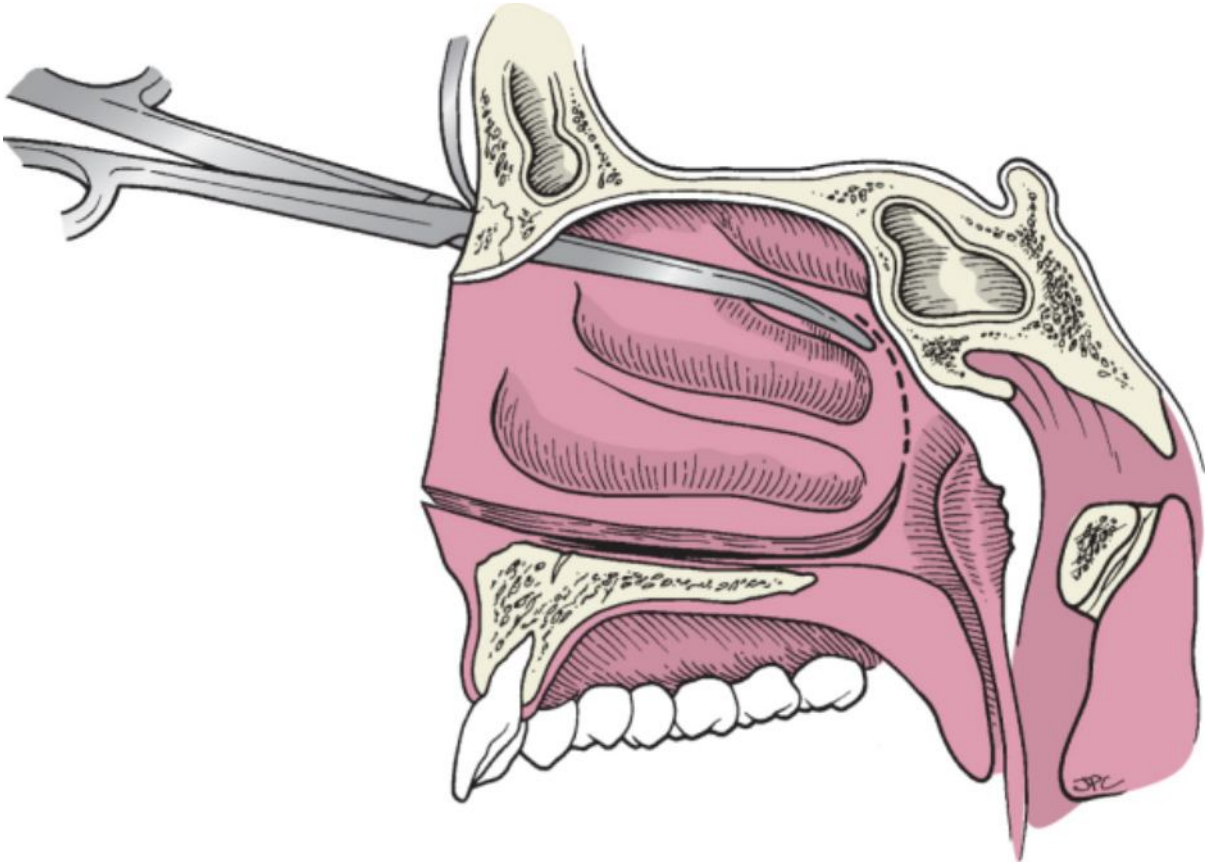

Figure 10-7 Heavy scissors are used to cut through the middle and inferior turbinate attachments.

After removal of the specimen, all of the mucosa is removed from the maxillary antrum and sent to the pathology department as a separate specimen. Individual bleeding points may be controlled by electrocoagulation at that time, with the exception of the area around the infraorbital nerve. The mucosa from any remaining ethmoid cells is removed and sent to the pathology department as a separate specimen. Fragments of the lamina papyracea are removed to ensure good healing and an easy-to-clean nasal cavity. Failure to remove residual mucosa may result in infection or edema. The sphenoid sinus is then opened, and the front wall of the sinus is removed with a small Kerrison rongeur. The mucosa of the sphenoid sinus is removed to prevent subsequent infection and edema. Removing the mucosa prevents the possibility of mistaking edematous mucosa for tumor in follow-up. It is appropriate at this time to perform a dacryocystorhinostomy. The lacrimal sac is opened (Fig. 10-8A) and sutured to the surrounding soft tissues with absorbable catgut suture to prevent postoperative epiphora (Fig. 10-8B). The bone around the nasofrontal recess must be removed widely to ensure adequate ventilation and prevent subsequent stenosis with mucocele formation.

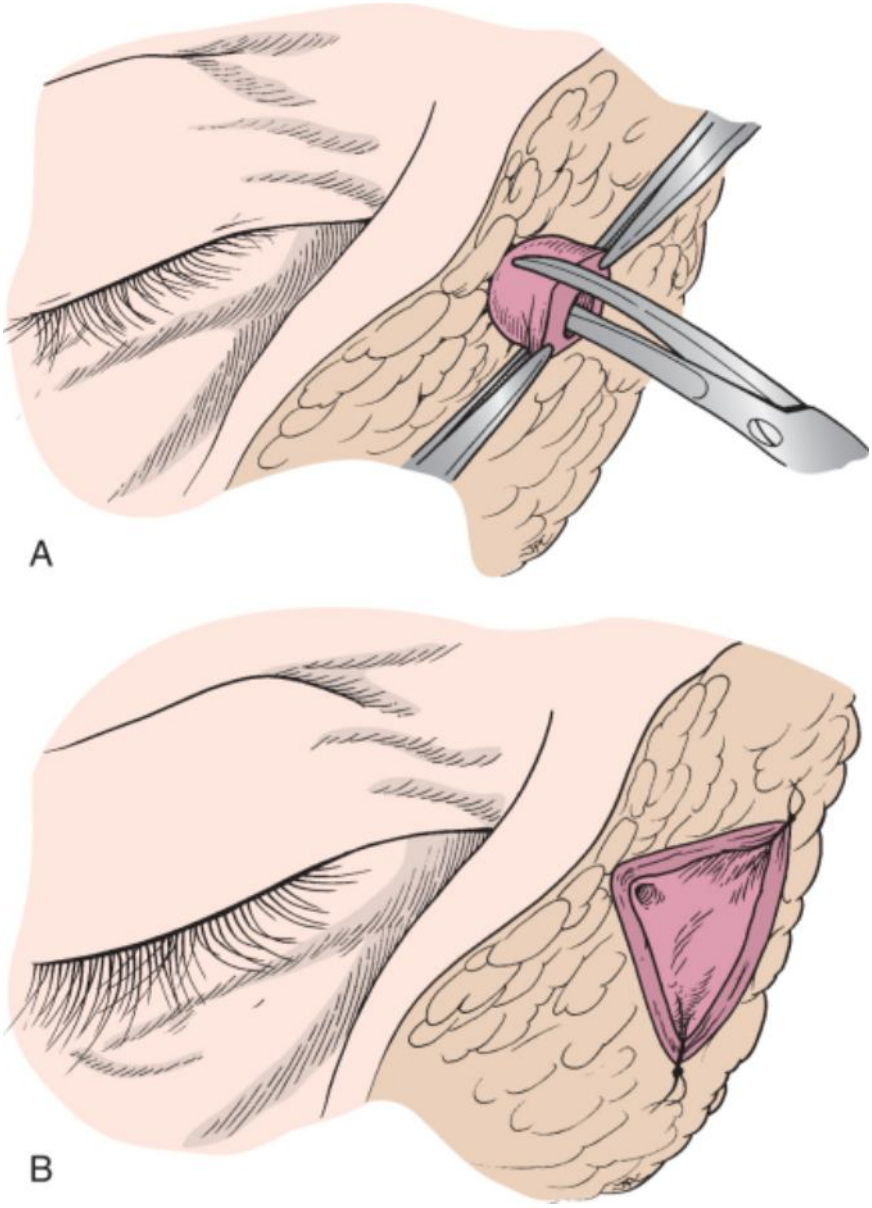

Figure 10-8 **A,** The lacrimal sac is incised along its long axis. **B,** The sac is sutured open to prevent stenosis.

Although lacerations of the periorbita occur infrequently, when present, they should be repaired with absorbable suture. The wound is irrigated. Once the mucosa has been removed in its entirety, there should be no bleeding. The sphenoid sinus is packed with Gelfoam. The bone along the roof of the ethmoid and the entire maxillary antrum should be lined with pledgets of Gelfoam. A gauze plug impregnated with antibiotics is placed in the posterior choana. One string is brought out through the oral cavity and taped to the cheek. The other strings are brought out through the anterior nasal cavity and tied over a dental roll (not around the columella). The sinonasal cavity is then packed loosely with 1–2-inch gauze impregnated with antibiotic ointment. Lining the cavities with Gelfoam before packing promotes hemostasis and facilitates removal of the nasal packing because it is removed from the Gelfoam rather than from the bony walls of the sinus and thus reduces the chance of bleeding.

Repositioning of the medial canthal ligament must be precise. It is important to compare the repair with the contralateral normal side to make certain that the repositioning is accurate. If the periorbita is respected and minimal nasal bone has been removed, meticulous closure of the skin and subcutaneous tissue will result in adequate realignment of the medial canthal ligament.

The wound is meticulously closed to provide a good cosmetic outcome. If the lip has been split, the area of the vermilion border must be reapproximated first as the keystone to closure of the incision. The skin along the lateral rhinotomy should be closed, with the subcutaneous layer of 4-0 chromic catgut sutures placed close together. Care must be taken to not catch the gauze pack in the suture because this will make it difficult to remove the pack later and runs the risk of leaving part of the pack in the nasal cavity as a foreign body. The gingivobuccal sulcus incision, when present, is closed with interrupted 3-0 chromic catgut suture.

If the lip has been split, this incision should be closed in four layers (mucosa, muscle, subcutaneous tissue, and skin). A 6-0 plain catgut suture, either running or interrupted, is used for the skin closure. Mastisol is then spread along the suture line and allowed to dry. Once the Mastisol is dry, Steri-Strips are applied along the suture line as a sterile dressing and to reduce tension on the skin. A nasopharyngeal airway is placed in the nasal cavity contralateral to the lateral rhinotomy. The tarsorrhaphy suture is now removed. Ophthalmic ointment is placed in the eye, and an eye patch dressing is used. A gentle pressure dressing may be used to prevent edema of the face and upper lip. The pharynx is suctioned clear of blood, and the patient is extubated.

POSTOPERATIVE MANAGEMENT

The head of the bed is elevated in the recovery room. The posterior plug and eye patch are removed on the first postoperative day. The nasal airway is also removed at this time. If a gingivobuccal incision was made, half-strength peroxide should be used to rinse the mouth four times a day over the next 5 days. The nasal packing is removed on the third postoperative day, and the patient is discharged on the following day. The patient is seen in the office 7 to 10 days postoperatively, and the Steri-Strips are removed at that time. The absorbable skin sutures come out when the Steri-Strips are removed. The patient is requested to use bacitracin ointment on the incision line over the next week to enhance healing. The patient is seen in the office 3 to 4 weeks later, at which time crusts of dried mucus are removed from the sinonasal cavity and the patient is given instructions for once- or twice-daily sinonasal irrigation with saline solution through a small rubber bulb syringe.

COMPLICATIONS

The major potential intraoperative complications associated with this operation have to do with the central nervous system and the orbit. If an osteotomy is performed superior to the level of the anterior ethmoid artery and frontoethmoid suture, it is possible to enter the cranial cavity with resultant leakage of cerebrospinal fluid (CSF). Extending the dissection medial to the attachment of the middle turbinate will also precipitate CSF leakage. This complication should be recognized and repaired immediately. The bone edge is débrided to widen the defect to afford the surgeon ample exposure to fully evaluate the injury. The laceration is closed with a small circle needle. Using fibrin glue, a piece of fascia is placed over the laceration with the edges tucked under the edges of bone. If an actual defect in the dura is noted, a septal mucosal flap or a flap from the middle turbinate may be used. Most CSF leaks can be controlled when they are encountered. Those that are identified in the postoperative period can often be managed endoscopically (see Chapter 18).

The proximity of the orbit puts the eye at risk in all operations involving the lateral nasal wall. Injury to the orbit and the optic nerve is a potentially serious complication. It is important to not lacerate the periorbita to avoid herniation of fat with the subsequent possibility of enophthalmos. If such lacerations occur, effort should be made to replace the herniated fat within the periorbita to close the laceration. If the periorbita has been removed, it may be replaced with temporalis fascia.

Carrying the osteotomies too far posteriorly or not being precise with the soft tissue cuts may result in direct injury to the optic nerve. Preserving the posterior third of the lamina papyracea and being cautious with the osteotomies can prevent inadvertent optic nerve injury. Blindness after medial maxillectomy is an extremely rare complication. Other orbital complications of medial maxillectomy include epiphora, dacryocystitis, ectropion, diplopia, and orbital hemorrhage. Kalavagunta and coauthors reported a case of blindness after medial maxillectomy that they attributed to indirect injury to the optic nerve.[14]

Accurate repositioning of the medial canthal ligament will help prevent malalignment of the structures. An unsightly scar is virtually always avoidable by accurate placement of the incision before distortion with infiltration anesthesia and by adequate marking of the skin along the incision to ensure precise realignment during skin closure.

Epiphora is usually avoided by opening the lacrimal sac and suturing it to the soft tissues to prevent stenosis. Occasionally, even after taking these precautions it is necessary to dilate the punctum, use a stent, or revise the dacryocystorhinostomy.

Rarely, a mucocele may form in the operated maxillary antrum. It may be asymptomatic or may produce diplopia as a result of superior displacement of the globe (Fig. 10-9).

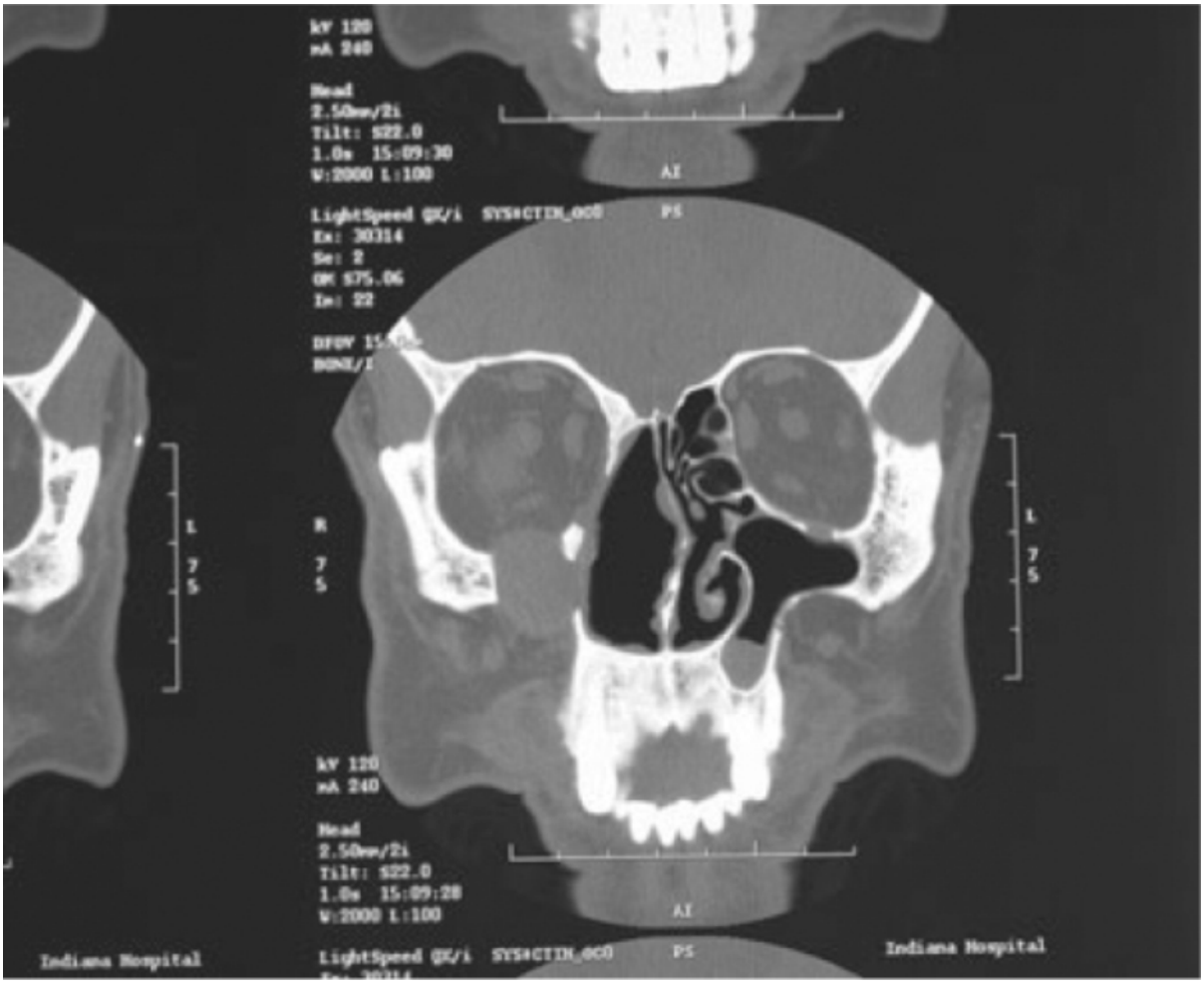

Figure 10-9 A scan reveals a mucocele of the operated maxillary antrum with destruction of the floor of the orbit. Superior displacement of the globe is causing diplopia.