– MAXILLARY SINUS

Chapter 7 – The Endoscopic Approach

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The goals of treatment of maxillary sinus disease are aeration and resumption of normal mucociliary flow. Normal mucociliary function from birth results in continuous removal of mucus against gravity through the natural ostium of the maxillary sinus. This ostium is bounded by the uncinate process and the ethmoid bulla. In some cases (Fig. 7-1), additional cells on the floor of the orbit known as Haller cells can also contribute to obstruction.

A patient with chronic maxillary sinusitis must be evaluated completely. After a thorough history is elicited, the nose should be maximally decongested and endoscopic examination of the nose, including the inferior, middle, and superior meatus, should be performed. Abnormal secretions can be sampled endoscopically for culture, and abnormalities should be noted. Traditional examination with a headlight and nasal speculum is of historic interest only in evaluating patients with chronic sinusitis. Detailed notes of the nasal endoscopy and, if possible, clinical photographs allow better preoperative surgical planning. Correlation of endoscopic findings with those on computed tomography (CT) allows further evaluation of the anatomy and function of these highly variable and very interesting structures. Diagnostic information about nasal tumors, as well as diseases of the mucous membranes such as Kartagener's syndrome, cystic fibrosis, and Wegner's granulomatosis, can be gleaned from nasal endoscopy.

Inferior meatal antrostomy is no longer considered a worthwhile procedure for the treatment of patients with chronic sinusitis. The natural ostium is the only functional ostium within the sinus, and the inferior meatus will be ignored by mucociliary activity. Patients who have undergone inferior meatal antrostomy can easily be examined in the office through that opening with 0- and 30-degree endoscopes, and not infrequently, an obstructed natural ostium can be seen despite a surgically patent inferior meatal antrostomy.

Patients evaluated by the otolaryngologist because of symptoms of recurrent or persistent maxillary sinusitis and who are noted to have endoscopic findings consistent with this condition are treated for 4 to 6 weeks with antibiotics and adjunctive medications as deemed appropriate. Medical treatment of chronic sinusitis is beyond the scope of this surgical text. Those whose symptoms persist should undergo imaging studies at the end of treatment. Coronal CT without contrast enhancement is the “gold standard.” High-quality coronal scans effectively delineate the area of the maxillary sinus ostium or ostiomeatal complex and provide verification of anatomic abnormalities that may be contributing to the sinus obstruction. When using the standard window approach popularized by Zinreich and colleagues,[1] no mucosa should be apparent, so any amount of mucosal thickening seen within the boundaries of the maxillary sinuses is considered abnormal. Coronal CT scans are mandatory for preoperative planning in patients who are expected to undergo endoscopic surgery. The surgeon should review the CT scans several times with particular emphasis placed on the important structures that lie adjacent to the sinus cavities. For the maxillary sinus, this primarily entails a thorough evaluation of the lamina papyracea and the floor of the orbit to look for any areas of dehiscence.

Figure 7-1 Haller cell *(star)* on a coronal computed tomography scan and natural ostium of the right maxillary sinus *(arrow)*.

PATIENT SELECTION

Controversy continues regarding the optimal extent of surgery that should be performed in patients with chronic sinusitis, and surgical treatment of the maxillary sinus is no exception. Some surgeons recommend wide antrostomy to improve sinus drainage. Others maintain that the goal of maxillary sinus surgery should be removal of the minimal amount of tissue necessary to restore patency of the outflow tract.[2–4] Practitioners of both schools continue to espouse their own philosophies, and both schools seem to be getting reasonable results. The following is our philosophy in terms of treatment of the maxillary sinus.

The hallmark of all endoscopic techniques is preservation of the mucosa. The idea of stripping mucosa is certainly no longer believed to be recommended by experts in the field. The excellent studies of Moriyama and coworkers[5] have demonstrated that once this lining is removed, the subsequent reparative lining is never organized in a ciliated pattern that would be able to return to normal. Thus, all current endoscopic sinus procedures are predicated on an improved ability to preserve the mucous membrane.

A patient who has additional openings in the maxillary sinus presents a different problem. These openings will lie in the sagittal plane and appear as though the fontanelle had a punched-out area in its membrane (Fig. 7-2). They will be round and lack the anterior elliptical extension that only the natural ostium provides. Patients are frequently symptomatic when there is circular movement of secretions between the natural ostium and one of these additional openings. Such patients will complain of thick postnasal discharge, as well as symptoms of recurrent infection. Examination in the office with a 30-degree nasal endoscope pointed laterally will often demonstrate these secretions, which frequently contain bubbles moving between the two ostia. CT will demonstrate these bubbles (Fig. 7-3) on the floor of the maxillary sinus. When faced with an additional opening, obvious recirculation seen endoscopically, and bubbles on CT scan, the decision is usually made preoperatively to enlarge the natural ostium into these accessory ostia.

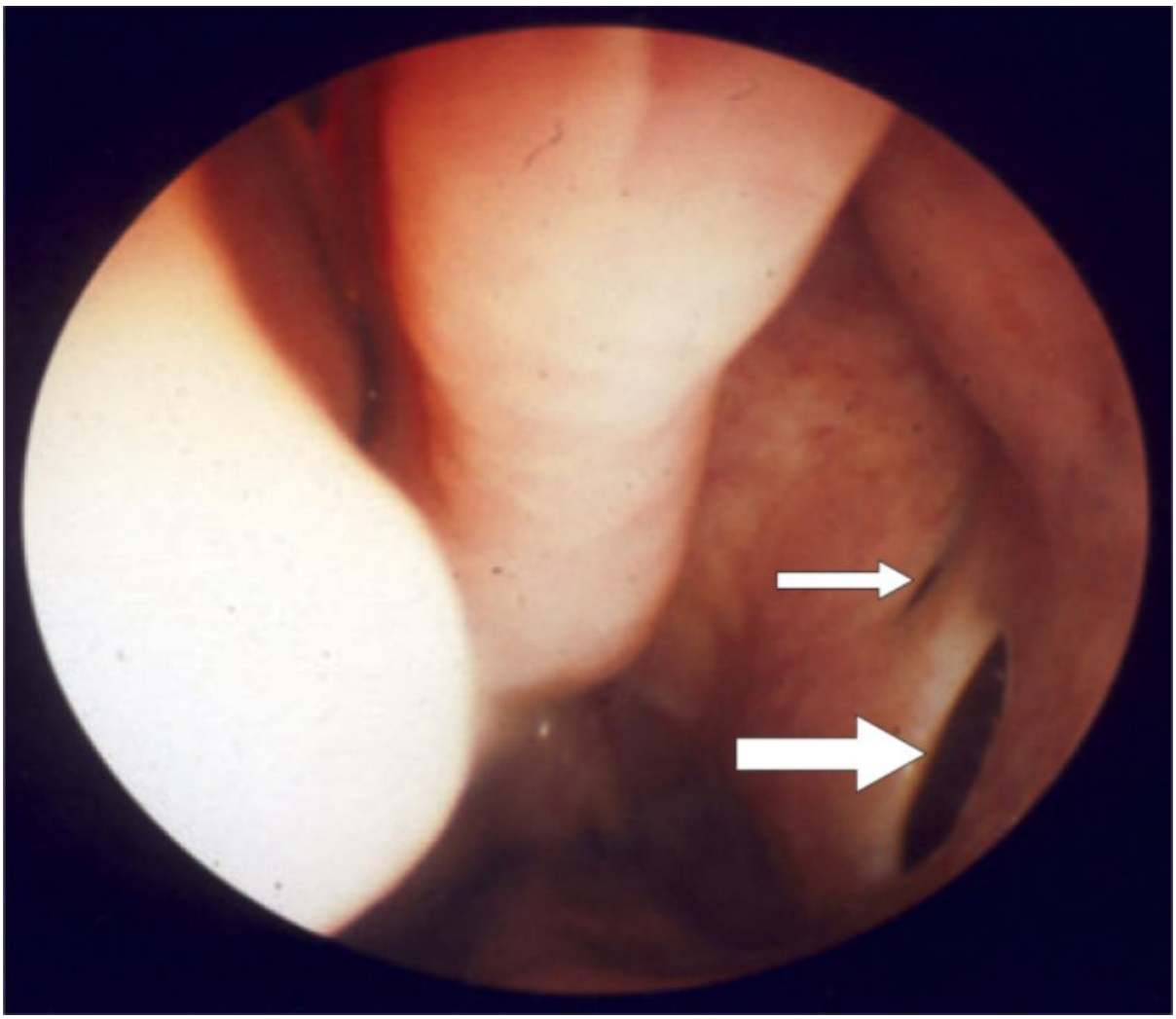

Figure 7-2 Endoscopic view of accessory ostia *(arrows)* in the left posterior fontanelle.

Figure 7-3 Bubbles *(arrow)* suggesting recirculation in the floor of the right maxillary sinus.

PREOPERATIVE PLANNING

The procedure begins in the holding area with the application of topical decongestants 30 minutes before the procedure, and repeat topical therapy is given at 15 minutes and on call in the operating room. The patient arrives in the operating room and undergoes either general or local anesthesia with intravenous sedation,depending on patient preference and the planned extent of surgery.

Surgical preference will dictate the manner in which the operating room and Mayo stand are organized. We use a two-handed technique,[6] which is particularly helpful in patients with acute inflammation and bleeding. Many different systems of powered instruments are available, and optimal settings will vary. In general, if one is having difficulty, the device should be slowed down to allow a greater period when the window is open to entrap the tissue, particularly in the case of polyps.

There are many ways to clean the lens of the scope and prevent fogging, and some scopes are self-irrigating. In the two-surgeon technique, the assistant instills water into the nose via a 60-mL syringe with a blunt 18-gauge needle, and some soft tissue shavers irrigate the lens by squirting water from the tip of the dissecting instrument. Antifog agents are available from multiple manufacturers as well. Such agents are helpful but should not be used if an irrigating sleeve is on the endoscope because the film prevents irrigation of the tip of the scope. A clean endoscope and a dry field will enable surgical precision and decrease frustration and complications.

To maintain a dry field, oxymetazoline and 1:1000 topical adrenaline are applied on ½- by 3-inch radiopaque neuropatties. Both are poured by the circulator into labeled basins. The adrenalin is dyed with a single drop of methylene blue to further decrease the risk of confusing it with local anesthetic and injecting it in the nose.

Local anesthesia is provided by injecting 1% lidocaine (Xylocaine) with 1:100,000 epinephrine as a vasoconstrictor before all procedures. The injections sites are the superior attachment of the middle turbinate and the inferior aspect of the uncinate process, as well as the tail of the middle turbinate (Fig. 7-4). After 5 minutes has elapsed, the procedure is begun.

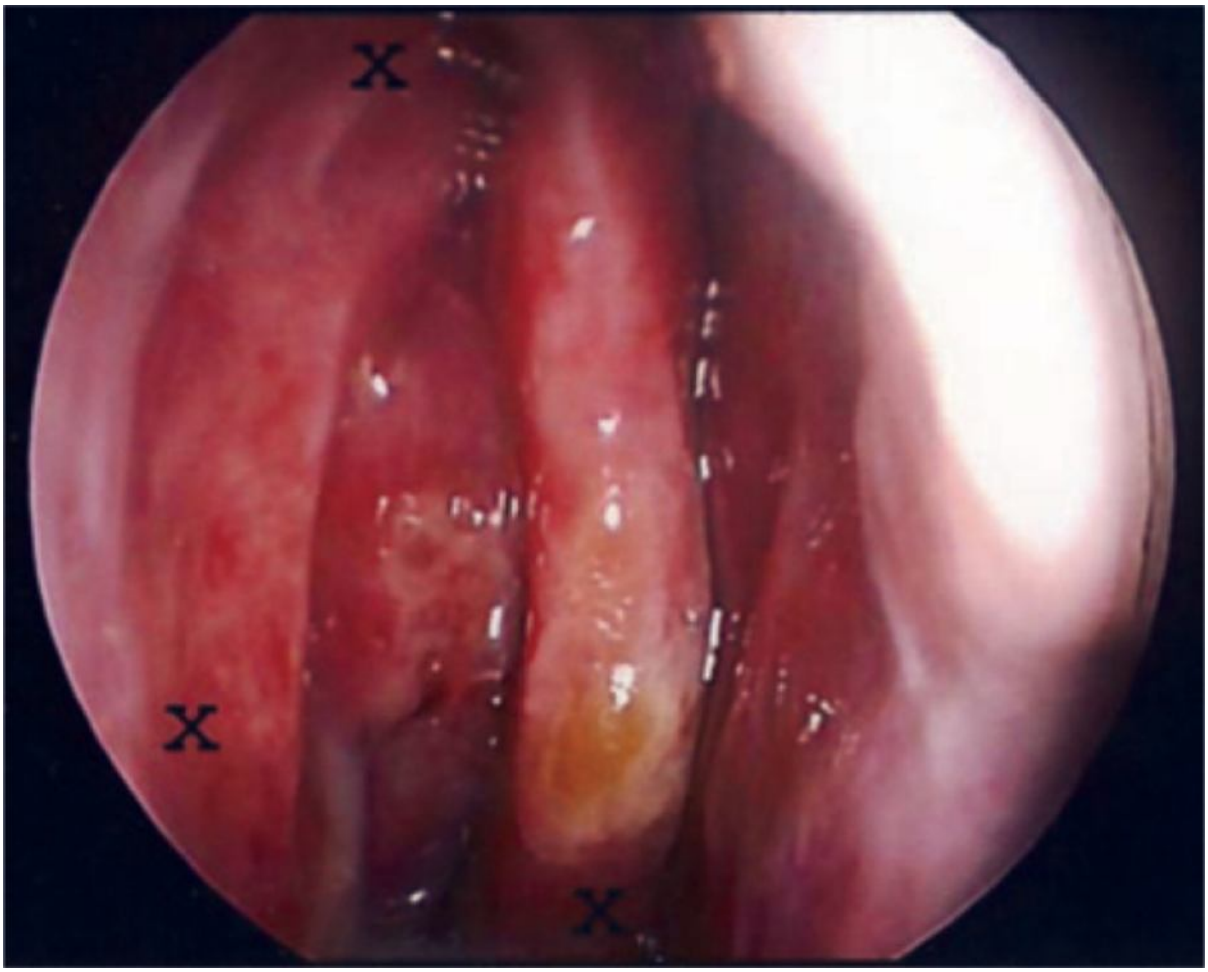

Figure 7-4 Injection sites for maxillary sinus surgery (marked with an X).

TECHNIQUE

A right-handed surgeon stands on the right side of the patient. However, risk is increased when operating this side. Right-handed surgeons have more right-sided orbital complications because of the ergonomics of holding the scopes and instruments. This may not be true now that endoscopic sinus surgery has matured as a discipline, and no recent study on this subject could be found. The scope is positioned in the superior aspect of the nasal vault so that placement of surgical instruments is unencumbered. Surgery may proceed with visualization either via the monitor or directly through the telescope, although only the use of a monitor allows the superb teaching afforded by this technique.

The middle turbinate is gently medialized with attention paid to transmission of force to the lateral lamella of the cribriform plate. With a bulky, paradoxically curved turbinate and certainly for the concha bullosa, access is achieved by lateral reduction of the middle turbinate with a soft tissue shaver. Most patients do not require more than just gentle retraction of the middle turbinate. The narrowest part of the ethmoid labyrinth is located between the anterior portion of the middle turbinate and the uncinate and lacrimal processes. Care should be taken in this area to avoid mucosal damage and subsequent synechia formation.

After studying the orbital complications associated with endoscopic sinus surgery, we found that the orbit is entered most commonly during uncinectomy, primarily as a result of the tip of the sickle knife going through the lamina papyracea. We now routinely perform retrograde dissection of the uncinate with pediatric back-biting forceps.[7]

After confirming the location of the free edge of the uncinate process, retrograde dissection is performed approximately a third of the way from the attachment of the uncinate process to the ethmoidal process of the

inferior turbinate. A powered instrument is then used to remove the uncinate superior to the retrograde cut up to the level of the agger nasi or as dictated by the remainder of the procedure. The portion inferior to the uncinate window then consists of the nasal mucosa, the residual bone of the uncinate process, which inserts into the inferior turbinate, and the mucosa on the sinus side (Fig. 7-5). The mucosa on the nasal side is gently removed with the microdébrider to expose the uncinate bone, which is dissected and elevated submucosally with a double-ball probe seeker (Fig. 7-6). This instrument is used to deliver the uncinate out of the mucosal pocket while leaving the maxillary ostium intact (Fig. 7-7). This allows the microdébrider to bring the mucosal flap to meet the nasal side. Removing the uncinate process in this submucosal fashion permits the natural ostium of the maxillary sinus to be enlarged without damage to the entire mucosal circumference of the ostium. The parasagittal orientation of the sinus opening is also maintained. Care is taken to not damage any of this mucosa, which could result in at least obstruction and edema with resultant infection and, at worst, maxillary ostial stenosis. If irrigation of the sinuses is required, it is performed externally or by passing a small pediatric suction device through the natural ostium in atraumatic fashion for use as irrigation. Irrigation can also be performed through the accessory ostium or via the inferior meatus. This technique is used for standard cases of recurrent acute sinusitis and chronic maxillary sinusitis

(see Video 7-1).

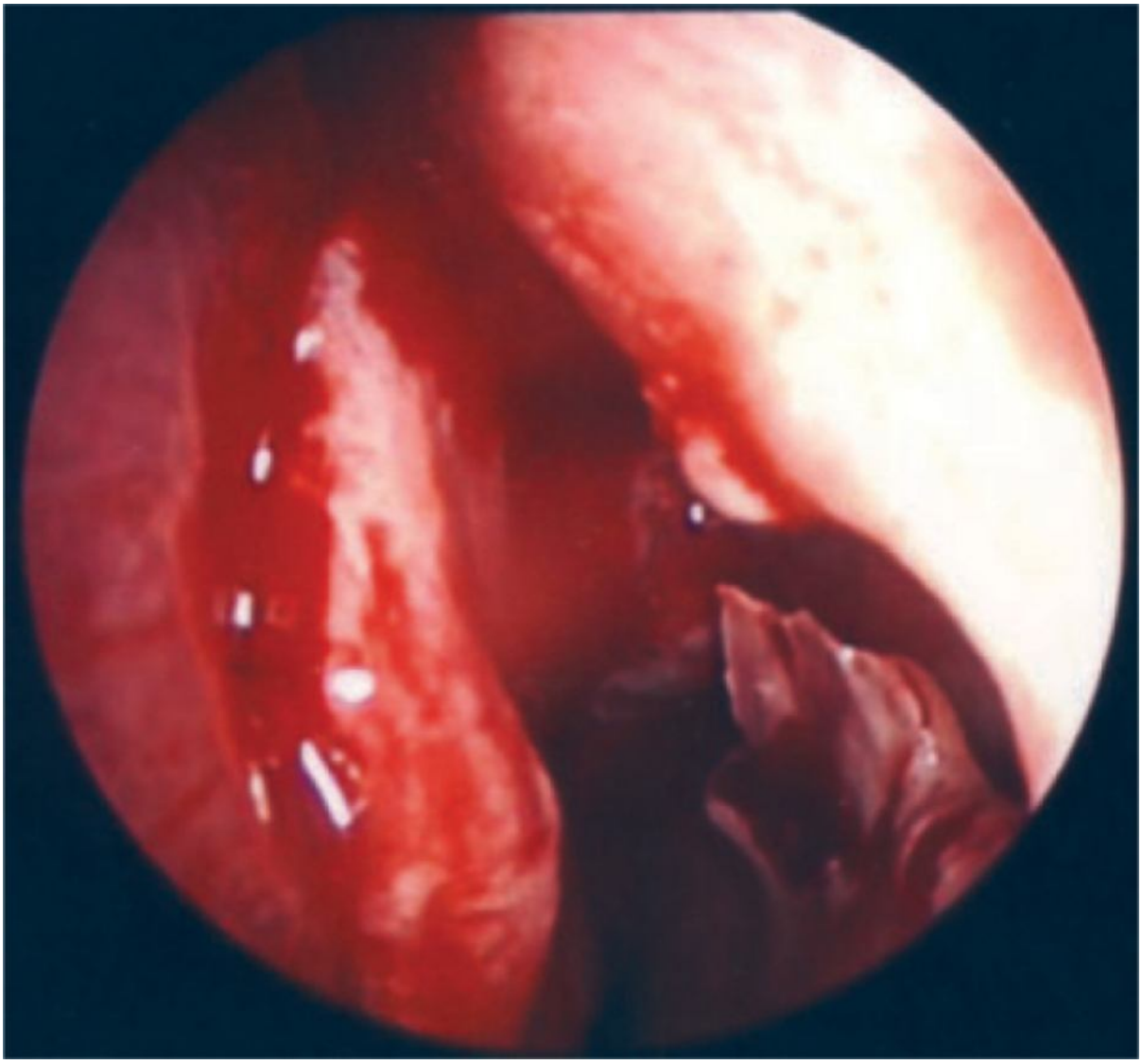

Figure 7-5 Uncinate window created by retrograde dissection on the left side with pediatric back-biting forceps. The inferior portion consists of the remaining uncinate attached to the ethmoidal process of the inferior turbinate and the mucosa medially and laterally.

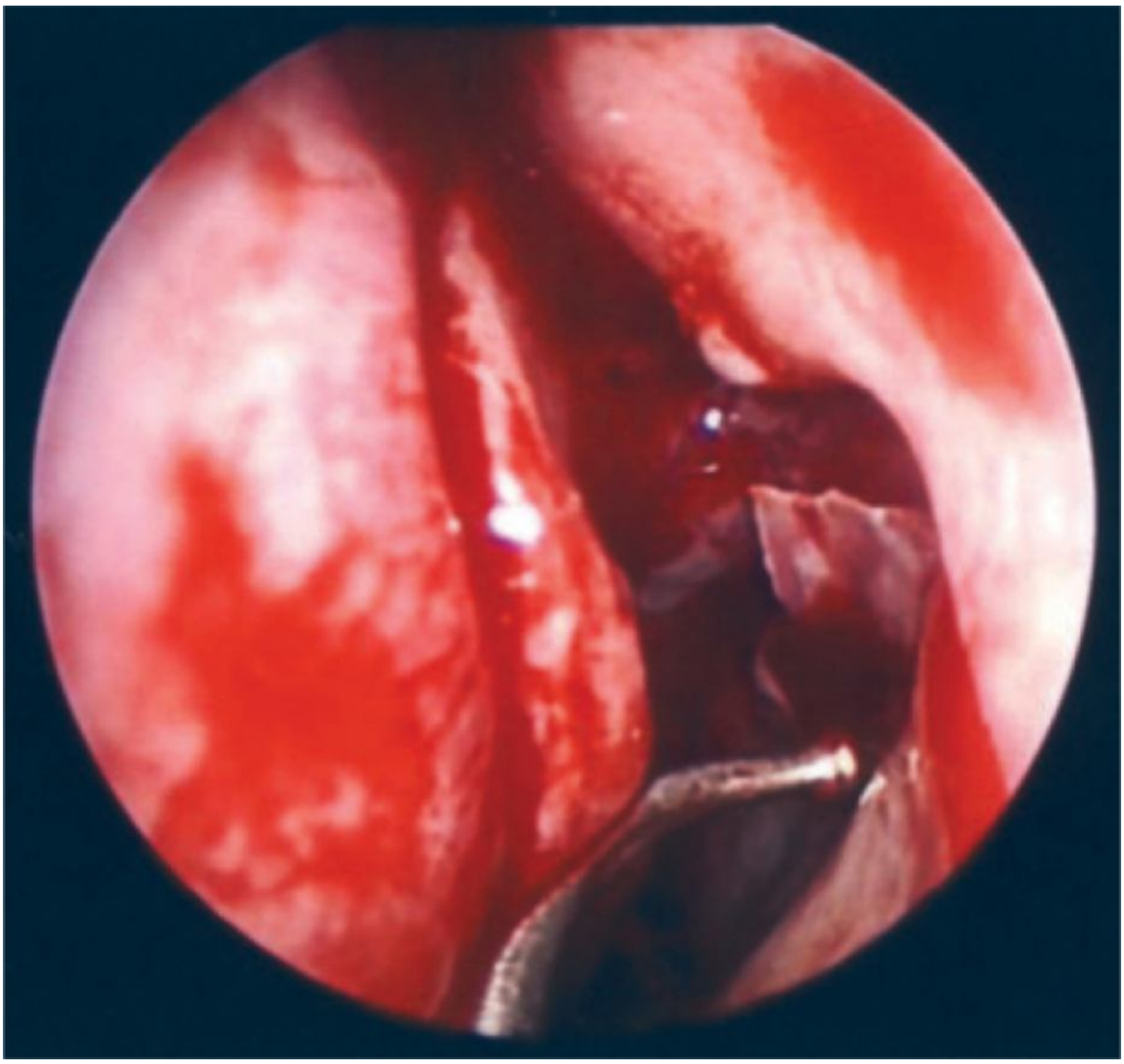

Figure 7-6 Submucosal dissection of the uncinate process on the left side with a double-ball probe seeker.

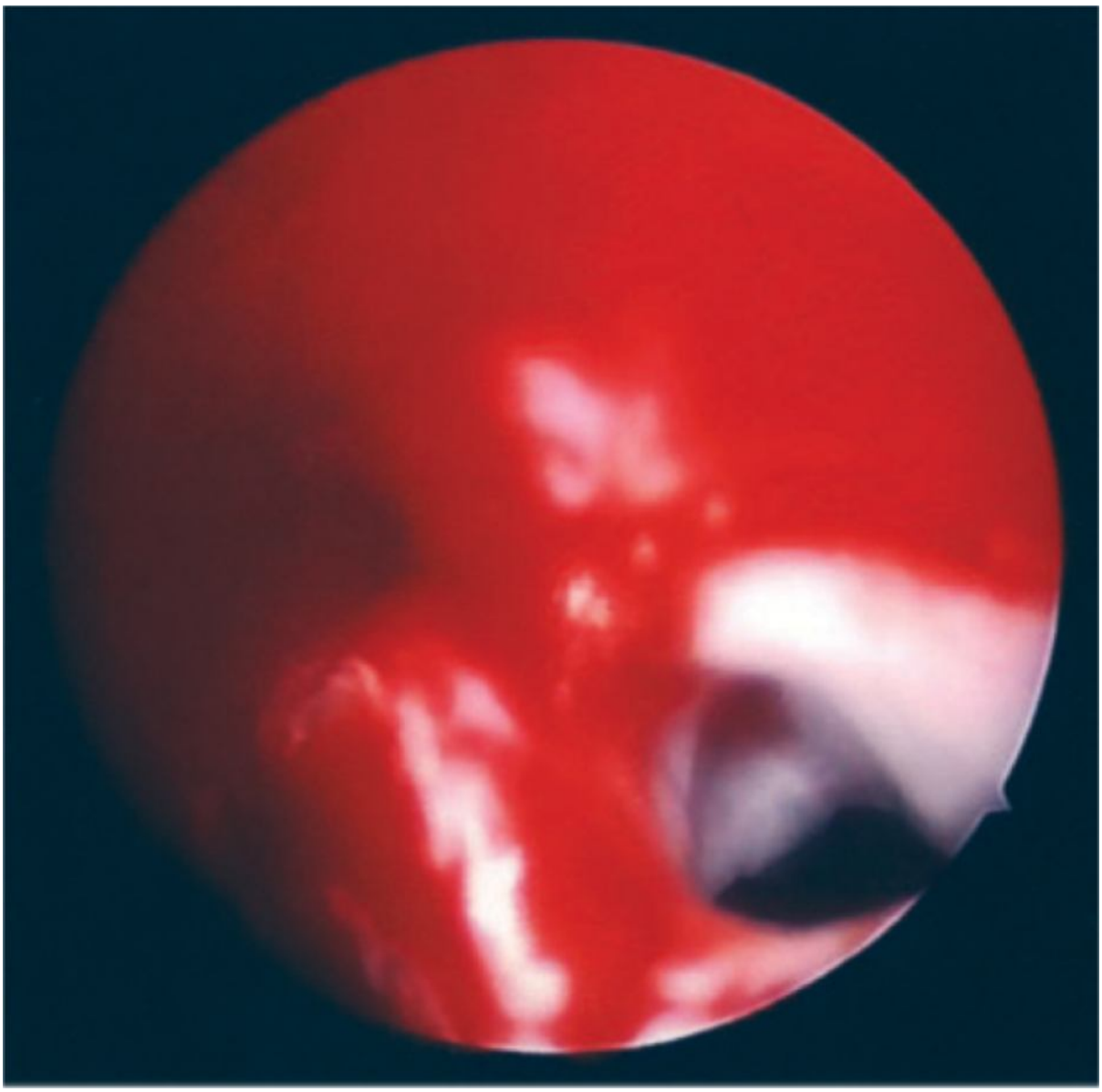

Figure 7-7 Mucosal preservation of 360 degrees of the left natural ostium.

Patients who have severe primary mucosal defects are not always candidates for the standard marsupialization as performed in the maxillary ostium approach just described. Instead, these patients often require creation of a formal maxillary antrostomy. Such patients include those with cystic fibrosis, allergic fungal sinusitis, eosinophilic mucin, rhinosinusitis, and Kartagener's syndrome, as well as many patients with Samter's triad, multiply recurrent polyposis, and some revision sinus cases.

The natural ostium is found by retrograde dissection of the uncinate process as described earlier. Once the location of the natural ostium has been verified, the posterior fontanelle is entered while preserving the maxillary sinus mucosa 270 degrees anteriorly. A ball probe seeker with a knife blade on its rounded end can be used to enlarge the area posteriorly to the perpendicular plate of the palatine bone. A side biter or microdébrider is then used to remove the residual fontanelle membrane while taking care to not abrade any of the mucosa of the maxillary sinus. Difficult pathology can then be addressed by suctioning and irrigation techniques. It may at times be necessary to access the sinus simultaneously from both the inferior and middle meatus, as well as through a canine fossa endoscopic approach.[8]

POSTOPERATIVE CARE

The majority of patients require minimal to no postoperative management. Routine examination and removal of dried blood and crust are rarely necessary with the technique described here. Sinus irrigation is usually sufficient to keep this area clean. The major complication is the development of synechia. However, a large number of studies are now investigating the use of different spacers to avoid this complication, as well as other techniques such as middle turbinate transseptal suturing.[9] The best results are obtained by meticulous surgical technique, as well as

by minimizing inflammation and infection at the time of surgery and during the healing process with the use of steroids and antibiotics.

COMPLICATIONS

In many patients, the lack of a clear diagnosis and indication for surgery can result in unwarranted surgery. It is difficult to know what to do with patients who have a great deal of symptoms and no objective endoscopic or CT evidence of sinus disease. This group creates a great deal of confusion diagnostically, and ideally they should undergo multiple nasal endoscopic examinations in an attempt to ascertain what is occurring in the nose when they are sick. One should endeavor to reevaluate them during acute infections so that a correct diagnosis can be made. Patients with facial pain in the absence of other symptoms are rarely offered surgery unless every other avenue has been undertaken and the patient understands that no guarantee can be made.

Bleeding is not usually a major problem with maxillary sinus surgery unless one violates the posterior limit of dissection, which is the ascending process of the palatine bone, or causes the inferior turbinate to bleed by overly aggressive resection of the uncinate attachment site.

The main pitfall remains synechia formation, and the use of powered instrumentation has minimized mucosal trauma and thus has avoided the vast majority of these problems. Powered instruments allow preservation of most or all of the mucosal ring of the natural ostium. If the mucosal preservation technique is used without a formal antrostomy, the middle turbinate will not obstruct the sinus even if it does lateralize. Figure 7-8 demonstrates such a case. The sinus does not become obstructed because the natural ostium is still in the parasagittal plane and its outflow tract is inaccessible to the lateralized middle turbinate. This is not the case if a formal antrostomy is performed and lateralization of the turbinate occurs as seen in Figure 7-9. Complications are minimal when an antrostomy is not performed.

Figure 7-8 The lateralized middle turbinate *(arrow)* on the left side cannot obstruct the maxillary sinus because the undisturbed maxillary ostium is left in the parasagittal plane.

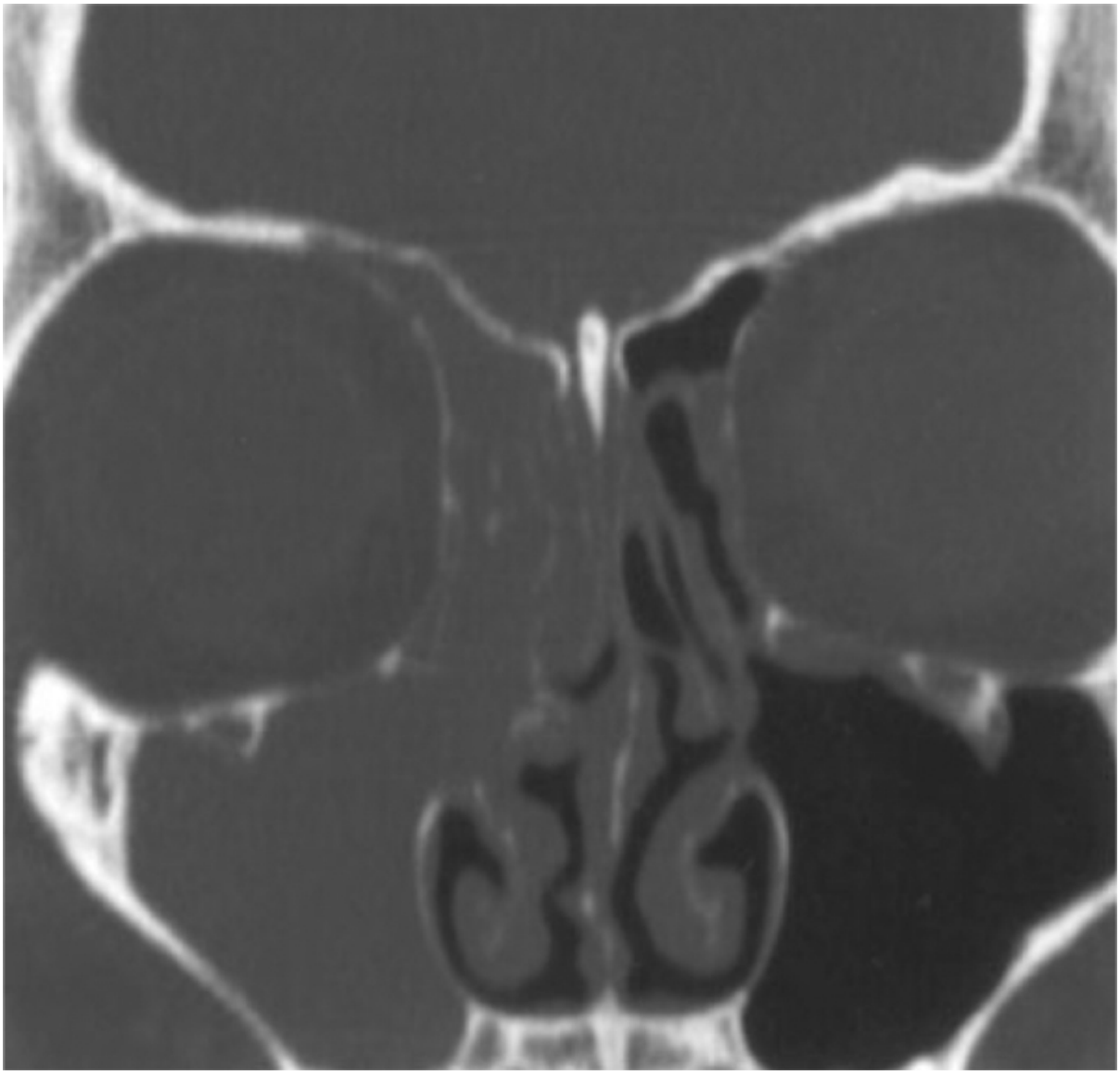

Figure 7-9 Computed tomography appearance of a scarred lateralized middle turbinate causing right maxillary obstruction after antrostomy.

In general, the complications associated with maxillary sinus surgery consist of persistent disease, ostial stenosis, lacrimal injury, orbital entry, bleeding, and recirculation of mucus from failure to incorporate the natural ostium into a surgically created antrostomy.

PEARLS

- Removal of the uncinate process is the key opening step in maxillary sinus surgery.
- A retrograde approach to the uncinate process decreases the risk of orbital injury.
- Not every case requires a formal maxillary antrostomy.
- The best results occur when operating with good vasoconstriction, minimal bleeding, good visualization, and minimal mucosal trauma.

PITFALLS

- Patient selection is important for successful maxillary sinus surgery.
- Do not rely solely on the patient's history.

- Abnormal pneumatization of the maxillary sinus increases the risk of orbital injury.
- Creating an antrostomy does not solve all maxillary sinus problems.