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Chapter 3 – Surgical Correction of Nasal Obstruction

Berrylin J. Ferguson

The most common cause of persistent nasal obstruction unresponsive to nasal decongestants or medical therapy is a deformity of the nasal septum. Frequently an internal nasal deformity obstructing airflow coexists with contralateral turbinate hypertrophy. Thus septal correction frequently requires concomitant reduction of the hypertrophied inferior turbinate.

The differential diagnosis of nasal obstruction is outlined in Table 3-1. In addition, nonfixed or transient causes of obstruction include secretions such as mucus, purulent secretions, and blood or turbinate swelling from a number of etiologies including rhinitis medicamentosum. Finally, the patient may have no objective evidence of obstruction but may complain of inadequate airflow, presumably from inadequate sensation of airflow in the nose.

Table 3-1 -- CAUSES OF NASAL OBSTRUCTION

Common	Uncommon or Rare
Deformity of the nasal septum	Foreign body
Hypertrophy of the inferior turbinate	Septal body swelling
Nasal polyps	Choanal atresia (unilateral or bilateral)
Inverting papilloma	Tumors
Collapse of the internal or external nasal valve	Acquired stenosis (postsurgical or secondary to systemic disease such as pemphigoid)
Large concha bullosa	Septal hematoma

PATIENT SELECTION

Objectively the physical finding of a septal deflection is more common than not, and deflections that do not significantly impair the airway do not require correction, except in providing access for endoscopic sinus surgery or to control epistaxis. A nasal septoplasty is of benefit to the patient who has nasal obstruction because of the deflection. The narrowest point of the nose is at the internal nasal valve. A deviation of the septum of only a few millimeters can cause significant obstruction in this location. Lateral traction on the cheek opens the nasal valve. Relief with this maneuver pinpoints the obstruction to the nasal valve area. This is called eponymously a *Cottle maneuver* after Dr. Maurice Cottle, who promulgated the technique. In addition to septal deflections at the nasal valve, sometimes the nose collapses at the valve because of inadequate presence or strength of the lateral cartilage (see Video 1-8). Correction requires a lateral nasal batten.[1] A prior rhinoplasty with over-resection of the lower lateral cartilages is a risk factor for nasal valve collapse. In the more posterior aspects of the nose, beyond the narrow nasal valve, more significant septal deflections are required to cause obstruction.

Occasionally, epistaxis requires a septoplasty for control, particularly if the bleeding is coming from beneath or posterior to a septal spur or the deflection precludes endoscopic visualization of the bleeding vessel. Epistaxis is more common on the obstructed side of the nose, in which the drying effects of unhumidified air impact more directly upon the septum. Many insurance carriers will not pay for a septoplasty performed only for exposure for endoscopic sinus surgery, but will pay for concurrent septoplasty performed to correct significant nasal obstruction.

Septal spurs, with projections of up to a centimeter or more, are common and frequently asymptomatic. In some patients, they may be associated with facial pressure or a trigger for referred pain in the ethmoid area or temple. Relief of pain or pressure with the application or injection of a local anesthetic to the contact point may assist in predicting a successful result with surgical removal of the spur. Long-term results with sinus surgery and relief of headache and facial pain are conflicting.[2,3] If a septoplasty is performed for obstruction, the author generally removes incidental septal spurs as well. This provides unobstructed nasal inspection and nasal intubation in the future if required.

During the office examination, the patient's nasal passages are sprayed with a topical decongestant spray. If this provides relief of nasal congestion, then a potentially reversible cause of nasal obstruction related to turbinate

hypertrophy is present. This patient is more likely to have relief of nasal obstruction with either a steroid nasal spray or a topical antihistamine spray or both. Before approving a septoplasty, some insurance carriers require that a patient have persistent nasal obstruction of at least 70% despite the use of a nasal steroid spray. Overuse of topical nasal decongestants leads to rebound nasal congestion and is termed *rhinitis medicamentosum*. Treatment of this condition requires elimination of the topical decongestant, which may be facilitated by using a steroid nasal spray.[4] The patient complaining of persistent nasal obstruction, despite the use of a steroid nasal spray, usually requires endoscopic assessment for infection or polyps, which if present and unresponsive to medical therapy should be addressed with surgery.

In patients with nasal airway obstruction responsive to medical therapy, the anatomic obstruction almost always involves responsive nasal structures such as the turbinates or nasal polyps. If the patient has other symptoms, such as thick mucus, or allergy symptoms, such as sneezing or rhinorrhea, which are relieved by medical therapy, such as steroid nasal sprays, then one might recommend continued use of the steroid nasal spray or allergy evaluation. Surgery does not relieve production of mucus or sneezing. One should attempt to provide comprehensive relief of the patient's symptoms with the safest and most cost effective intervention. In the patient with symptoms in addition to nasal obstruction, indefinite use of a steroid nasal spray or allergy evaluation and allergy desensitization may provide the optimal treatment. If nasal congestion persists despite treatment, then surgical correction of septal deformities and turbinate hypertrophy should be considered.

Subjective nasal obstruction may not correlate with objective obstruction. The reverse is also true. Some patients get so accustomed to nasal blockage that they are unaware of the obstruction. Surgery will not benefit the patient with an objectively patent airway. The subjective sensation of obstruction may be caused by reduced sensation of airflow, which sometimes results from prior overaggressive surgery on the turbinates. In the patient who has undergone multiple nasal procedures and objectively has a patent airway, one must also be aware of somatization or psychological issues that underlie the patient's persistent complaints of inadequate airway. In these patients objective demonstration of airway patency with acoustic rhinometry or video endoscopy may be helpful in explaining why further surgery will not be beneficial.

Other causes of subjective/objective mismatch include overlooking nasal valve collapse or nasal septal body swelling.[5] These latter causes may be amenable to surgical correction.

ETIOLOGY OF NASAL SEPTAL DEFORMITY AND TURBINATE HYPERTROPHY

Trauma, which is frequently associated with a fracture of the nose, is an obvious cause, but not the most frequent cause of septal deflection. More commonly, septal deflection is congenital and not appreciated by patients who have become accustomed to unilateral nasal obstruction. When turbinate swelling or laxity of cartilage, which is associated with aging, further aggravates the congestion, the patient may then present for evaluation of nasal blockage. As obstructive sleep apnea (OSA) is more frequently appreciated, contributing factors such as nasal obstruction are investigated and appear to either contribute to the OSA or impair effective usage of continuous positive airway pressure (CPAP). Some of the patients with OSA may have autonomic nervous system dysfunction, probably mediated by sympathetic tone impairment, which is greater than parasympathetic tone impairment. This most likely plays a role in recumbent nasal congestion caused by turbinate swelling.[6]

The deviated nasal septum in some cases is associated with a twisted nose deformity. In such cases, a nasal septoplasty must be carried out together with a rhinoplasty, because such severe nasal deformities cannot be satisfactorily managed by septoplasty alone. Conversely, a twisted nose deformity can rarely be satisfactorily corrected without performing a nasal septoplasty.

Turbinate hypertrophy may be congenital, but is more often acquired and is initially reversible. The etiologies of inferior turbinate hypertrophy include allergies, vasomotor rhinitis, nonallergic rhinitis with eosinophilia, and rebound congestion from overuse of topical decongestants (rhinitis medicamentosum).

PREOPERATIVE PLANNING

If the decision is made that a septoplasty or turbinate reduction will be beneficial, then the patient is informed of the anticipated course and risks involved. A summary of the patient handout used to explain the postoperative course and the possible risks is outlined in Table 3-2 and 3-3. Elective surgery should be postponed if the patient develops an infection or exacerbation of asthma. Patients with active sinus infection should have nasal cultures performed and be prescribed appropriate culture-directed antibiotics to clear the infection before septal surgery. We do not obtain a computed tomography scan of the sinuses before septoplasty or turbinate reduction, unless the patient has subjective or endoscopic evidence suggesting sinusitis. We always perform assessment of the decongested nose before surgery and almost always with endoscopy.

Table 3-2 -- PATIENT HANDOUT: WHAT TO EXPECT POSTOPERATIVELY FOLLOWING NASAL

SEPTOPLASTY OR TURBINATE REDUCTION

- Bloody nasal discharge for several days is common in the postoperative period.
- Use nasal slings to absorb nasal drainage (nurses in postoperative area will provide).
- Swelling and bruising is minimal.
- Your nose will look the same or almost the same externally postoperatively.
- Your nose will likely be more congested because of blood and mucus until the splints are removed. Use saline nasal washes twice a day to relieve congestion.
- Reduced energy for several days to weeks postoperatively is common; take it easy.
- You should be able to return to work in 5 to 7 days postoperatively, unless you work in a dirty or polluted environment.
- Schedule an appointment 3 to 4 days after surgery for splint removal.
- Your nose is “fragile” for at least 6 weeks; avoid trauma to the nose in this period.

Table 3-3 -- INFORMED CONSENT FOR SEPTOPLASTY AND TURBINATE REDUCTION

Common Occurrences

- If bleeding occurs, you may require nasal packing.
- You should take an antibiotic postoperatively, but you may still develop an infection. Notify our office if you have severe pain or fever greater than 100.5° F within the first 10 days after surgery.
- Up to 20% of septoplasties fail to resolve nasal blockage and revision may be required.
- Turbinate rehypertrophy is common, and several years after turbinate reduction regrowth of the turbinates may lead to nasal blockage.
- Over-reduction of the turbinates in some patients may lead to loss of sensation of nasal airflow. This is termed *empty nose syndrome*. We will try to optimally reduce your turbinates; however, we would rather inadequately reduce rather than over-reduce. We can correct inadequate reduction. We cannot correct over-reduction.
- Septal perforation or a hole in the septum occurs occasionally. This frequently causes no symptoms, but if small may lead to a “whistling” sound with nasal breathing and if large may crust and bleed.
- Loss of smell occurs in 1 in 10,000 septoplasties.
- Toxic shock syndrome, a life-threatening condition, occurs in 1 in 100,000 cases. Notify your doctor immediately if you have skin discoloration, fever, or pass out in the first week after surgery.

A thorough history should be taken to establish the presence of coagulopathies, allergies to local anesthetics, or correctable medical conditions. Patients should be cautioned not to take aspirin or aspirin-containing compounds for 10 days before surgery or nonsteroidal anti-inflammatory drugs for at least 7 days before surgery in order to minimize intraoperative bleeding.

SURGICAL TECHNIQUE

Until 3 or 4 decades ago, a septoplasty was usually performed with a *submucous resection of the nasal septum*, which removed a variable amount of the deviated portions of the septal cartilage and bone. If aggressive resection was required to correct a deflection, then the patient might develop a saddle nose deformity because of inadequate support of the nasal dorsum. Today, a nasal septoplasty corrects the deformity by repositioning the twisted cartilage and bone and removing minimal bone and cartilage.

Nasal surgery is usually performed as an outpatient surgical procedure without overnight admission. The procedure may be performed under local anesthesia with intravenous sedation or more commonly, as in my cases, under general anesthesia.

The facial skin is usually not prepped unless a concomitant rhinoplasty is being performed. Drapes are arranged so that the nose is entirely exposed. The eyes may be covered to avoid the glare of the lights. Strips of Merocel (3 to 4 cm by 1 cm) cut from a Deaver retractor cover are soaked in 4% lidocaine (Xylocaine) solution and an equal amount of oxymetazoline (Afrin), then inserted into the nose and ideally left for 10 minutes to adequately anesthetize the sedated patient before injection of local anesthesia with a 30-gauge needle and a solution of 1% lidocaine with 1 : 100,000 epinephrine. If the surgery is performed under general anesthesia, one still injects in order to achieve vasoconstriction. To provide adequate anesthesia for sedated surgery, the anterior septum as well as the infraorbital nerve is injected by aiming laterally submucosally toward the infraorbital foramen, and finally the sphenopalatine ganglion region is anesthetized intranasally by injecting the area in the posterior 1-cm insertion of the middle turbinate in the middle meatus. At least 10 minutes is required for the vasoconstrictive effect of the

epinephrine to become effective. The more posterior aspects of the septum are injected to facilitate dissection as well as to increase vasoconstriction and anesthesia. During this time the vibrissae, if present, are trimmed from the nasal vestibule with small, blunt-tipped scissors or a no. 15 blade dipped in petrolatum (Vaseline) or an antibiotic ointment, so that the cut hairs stick to the blades of the scissors rather than falling into the nasal cavity. The inferior turbinates on both sides are also anesthetized. In the case of the severely deviated septum, anesthesia of the mucosa posterior to the deviation may be obtained by inserting a medium-length speculum, opening the blades, and pushing the deflection toward the concave side, thus exposing the mucosa posterior to the deviation. Infiltration anesthesia can then be carried out. Occasionally with bony deflections, this is impossible, and if working on a sedated patient, one must sequentially correct the deflection and then anesthetize more posteriorly.

The surgery begins with an incision made at the septocolumellar junction on one or both sides (hemitransfixion vs. total transfixion) (Fig. 3-1); with a total transfixion incision, the two incisions are joined by sharp dissection with small, curved scissors.

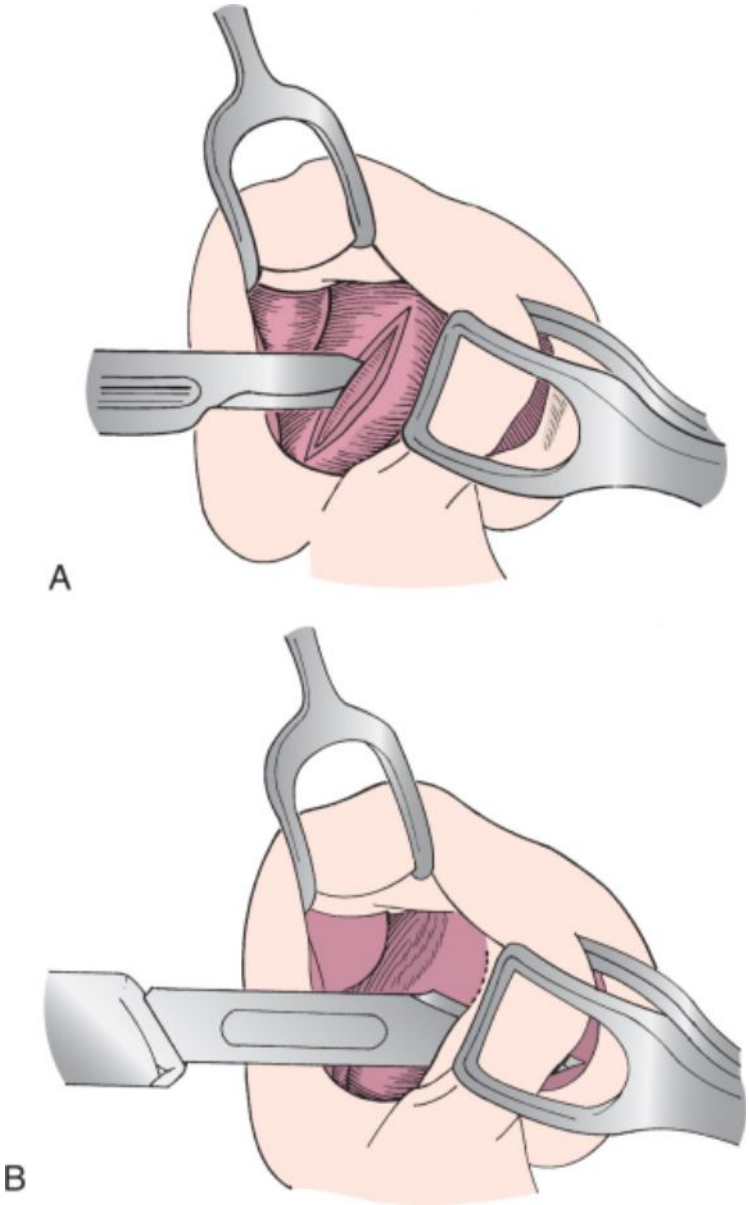

Figure 3-1 The septocolumellar incisions are made and the caudal end of the septum is identified.

Accurate identification of the septal cartilage deep to the mucoperichondrial layer is the single most important maneuver in this surgical procedure and is absolutely fundamental to successful septal surgery. If this plane is found, the dissection is bloodless and fast in most cases. With a no. 15 blade knife, the cartilage is identified by minimally undermining the mucoperichondrium (Fig. 3-2). It may be helpful to have the assistant hold the caudal end of the septum with a hook, in order to gain exposure of the septal cartilage. Once the cartilage, with its glistening white color, is identified, the sharp edge of a Cottle elevator is used to completely undermine the mucoperichondrium (Fig. 3-3). When the mucoperichondrium has been elevated approximately 2 cm posterior to

the caudal margin, the hook is removed and a nasal speculum with narrow flanges and medium-length blades is inserted into the nose to observe the dissection from within the nasal cavity or inserted between the perichondrial flap and the septal cartilage in order to observe the dissection. Adequate light and suction with amplified magnification with “loupes,” if necessary, are required to optimize this dissection. Initiation of the dissection in the mid/superior portion of the septum facilitates the dissection in that the mucoperichondrium is less adherent there than it is more inferiorly. After one has dissected far posteriorly, it is easier to bring the Cottle elevator inferiorly in gentle, tight circular sweeping motions and divide the more adherent mucoperichondrial fibers anteriorly and inferiorly from the septal cartilage. In the very adherent connection of the mucoperichondrium to the inferior caudal septum, a no. 64 “beaver” blade may be helpful. Caution is necessary when undermining the flaps near the floor of the nose over a “septal spur,” because the mucosa in this area is usually adherent to the subluxed cartilage and is easily torn (Fig. 3-4). A septal spur may be removed by elevating the mucoperichondrium up to the point of most lateral extension, then using a beaver blade or Cottle elevator to perform a horizontal transection at the point where the spur deviates laterally, to remove the spur. It is often fairly easy to remove at that point.

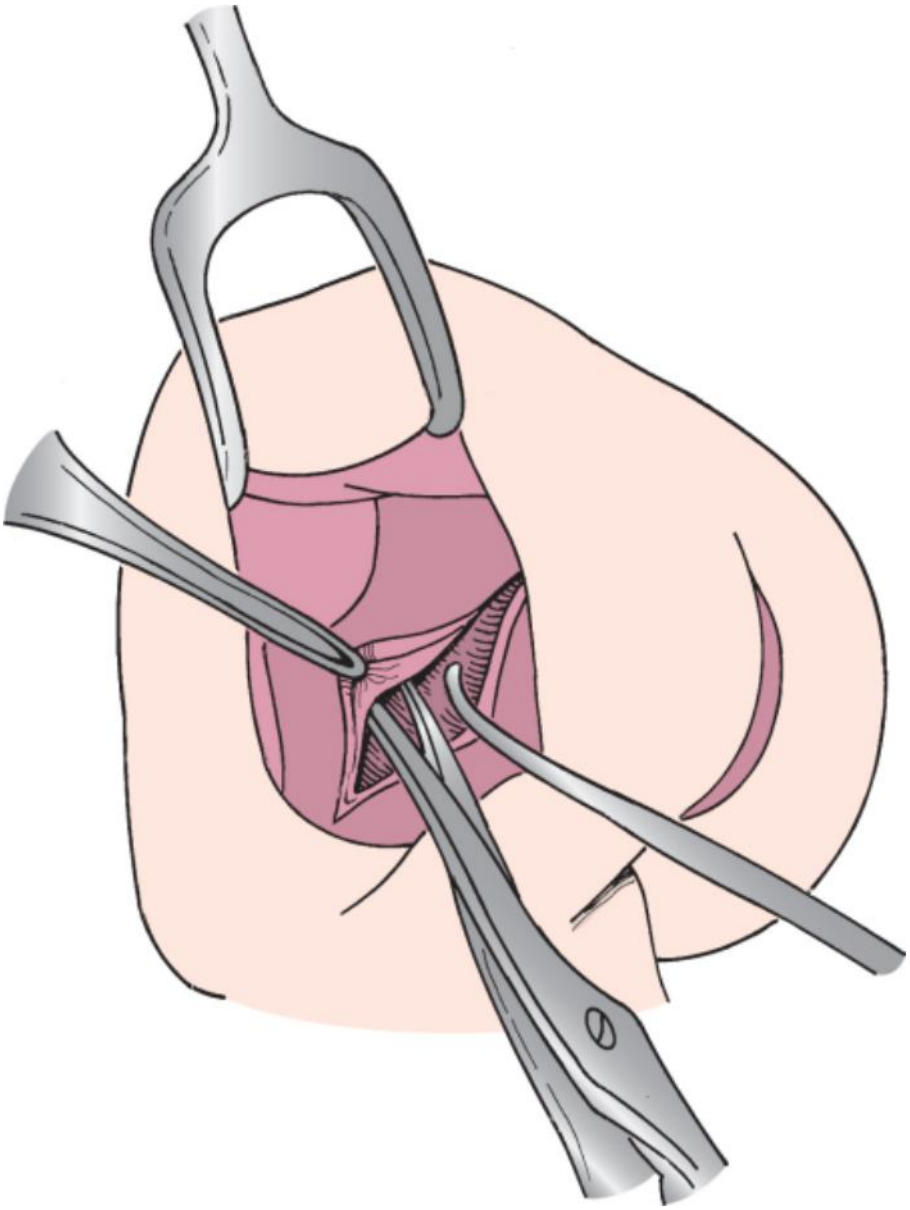

Figure 3-2 Proper identification of the septal cartilage is important in order to find the proper plane for undermining the mucoperichondrium.

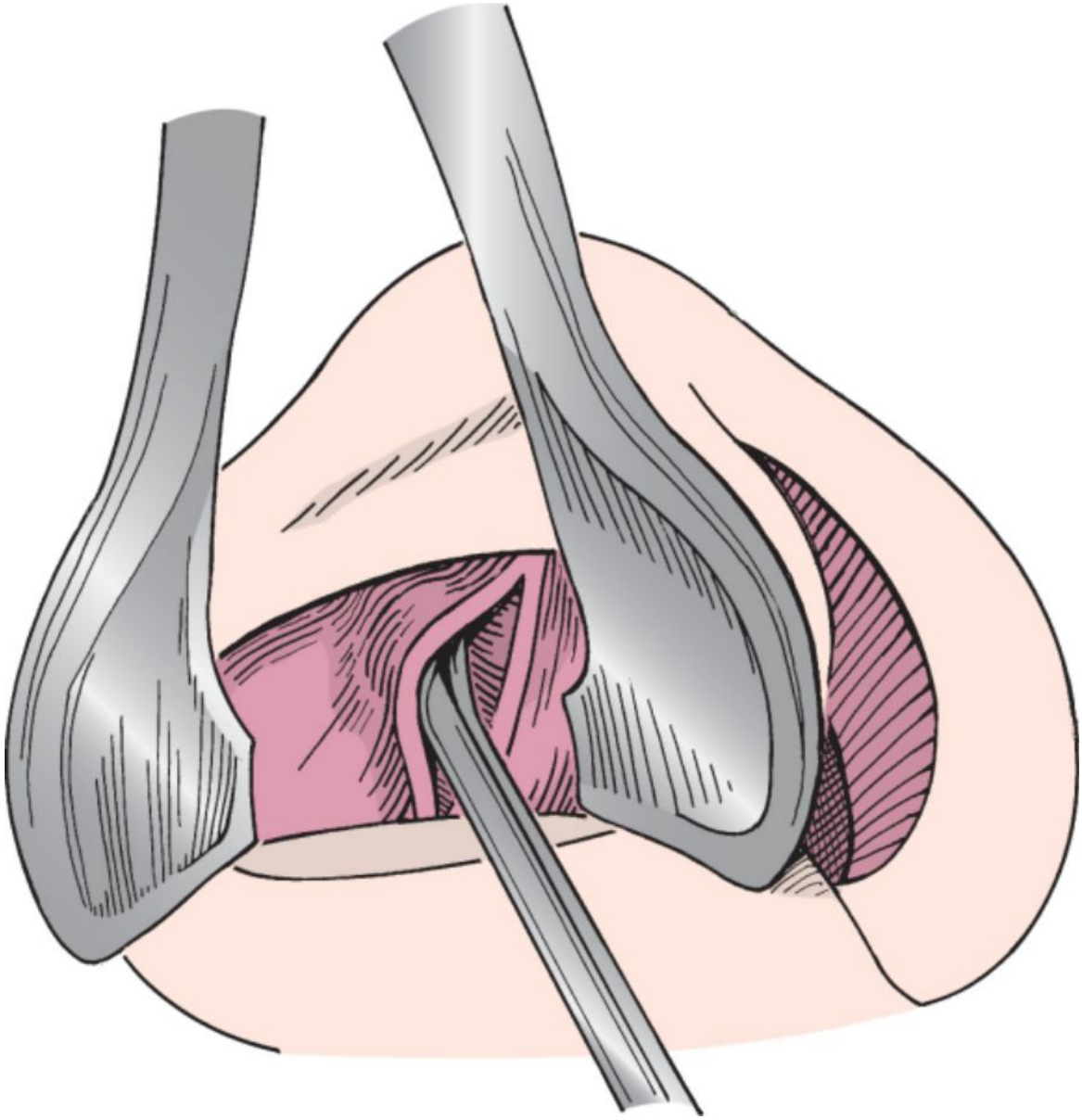

Figure 3-3 The sharp edge of a Cottle elevator is used to undermine the mucoperichondrium under direct vision. A Killian speculum is inserted between the mucoperichondrial flap and the septal cartilage in order to provide direct vision for further undermining.

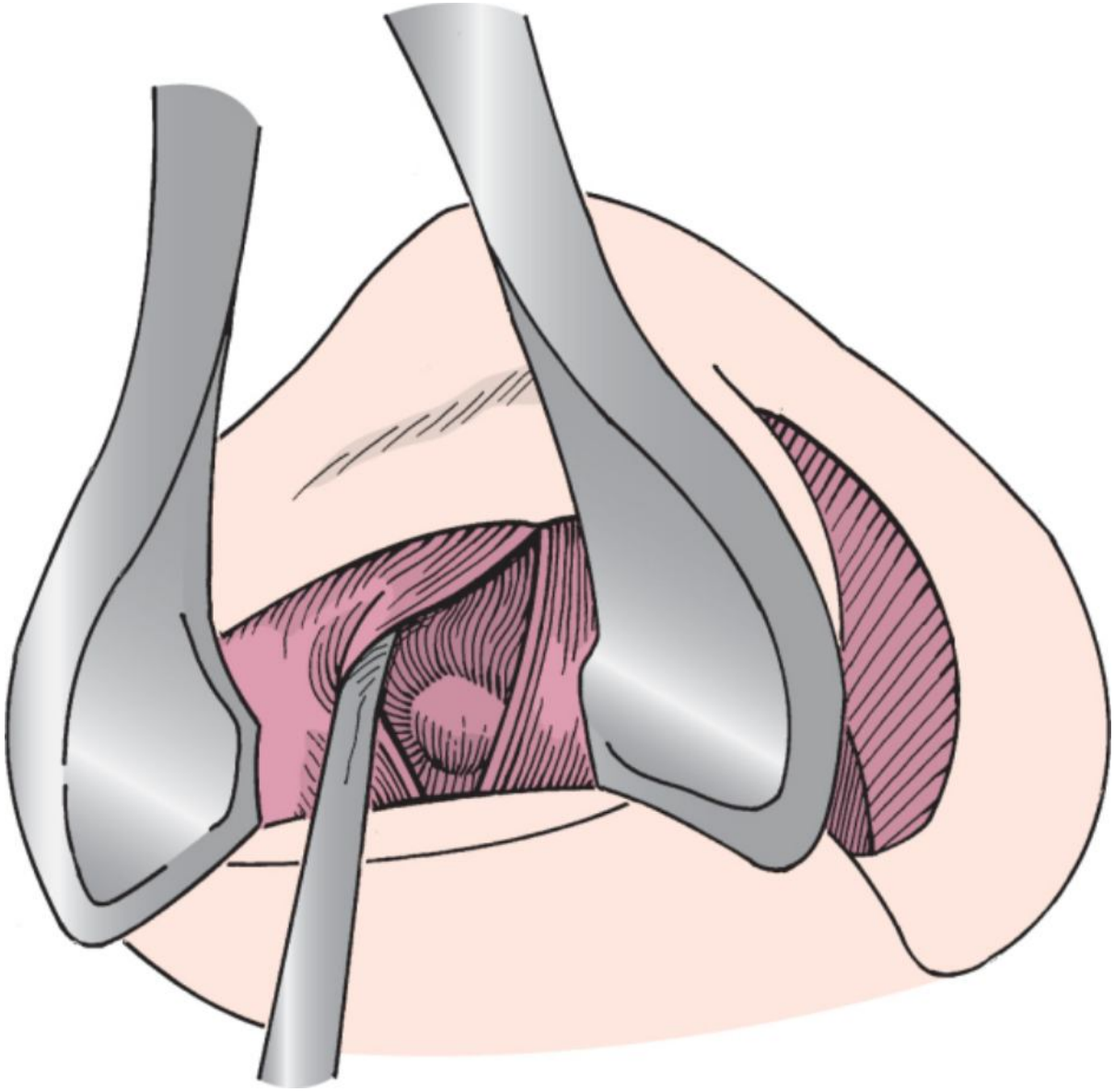

Figure 3-4 It is important to proceed cautiously in the area of the septal spur, because the mucosa in this area is densely adherent to the subluxed cartilage and may be easily torn.

The mucoperichondrium should be elevated bilaterally from the anterior 2 cm of septal cartilage if repositioning of the most caudal septum is required to obtain a straight septum. The narrowest point of the nose is at the nasal valve and small deflections in this area may “bottle-neck” the entire airway and cause obstruction. Bilateral elevation is required to allow satisfactory redraping of the mucosa, once the cartilaginous structure has been satisfactorily repositioned. If the septal obstruction begins posterior to the anterior 2 cm, then the elevation of the mucoperichondrium is performed on only one side anteriorly, but bilaterally at the site of deflection. At the site of the deflection, a Cottle elevator is used to make a vertical incision and then to begin the elevation of the contralateral side. A suction, the Cottle elevator, or a suction elevator, maybe used in the dissection of the mucoperichondrium/periosteum off the cartilaginous or bony septum. Preservation of at least a 1 cm superior cartilage strut and a 1.5 to 2 cm caudal strut of cartilage is critical to maintain nasal support and prevent saddling. To remove deflected cartilage, a vertical incision is made anterior to the deflection and a Cottle elevator, or a sharp suction elevator or a Ballenger swivel knife is inserted, and the cartilage is incised (Fig. 3-5). As more anterior deflected portions of cartilage are removed, one is able to visualize more posterior deflections. All superior cuts should be made sharply to avoid the very rare complication of fracturing the cribriform plate and creating a cerebrospinal fluid fistula. For this reason, a sharp superior transection is made initially over the deflection, with an instrument such as the slotted Jansen Middletons. Once the superior cut is made, one can use techniques that grasp or remove the inferior cartilage by gently twisting to disrupt the attachment and then removing. If removed cartilage is fairly straight, it may be replaced between the mucoperichondrial flaps at the end of the case. A V-shaped osteotome and mallet are useful in removing bony deviation of the maxillary crest inferiorly.

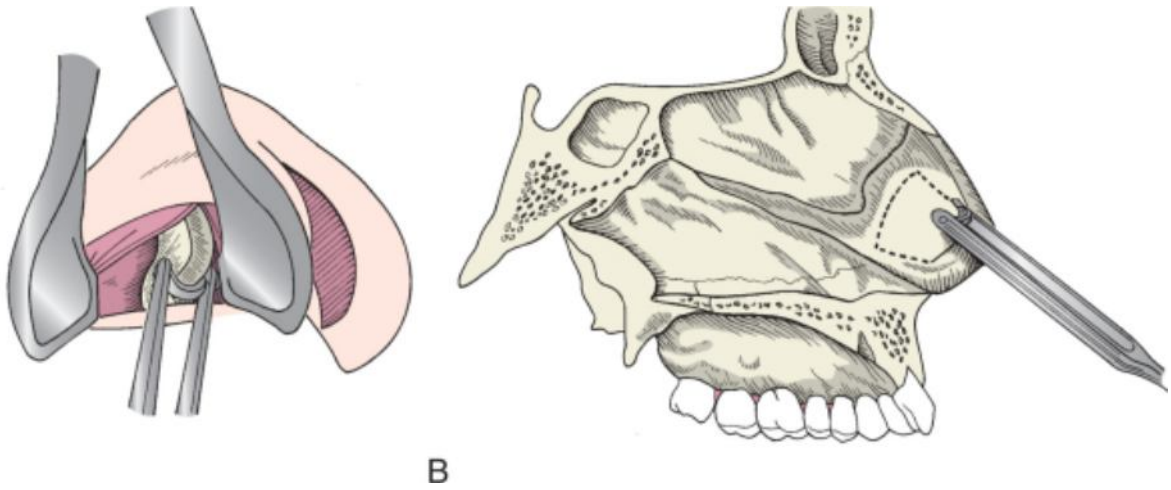

Figure 3-5 A Ballenger swivel knife is used to remove a portion of the quadrilateral cartilage.

Today, the more conservative cartilage-sparing techniques are preferred to the more radical removal of septal cartilage. However, if the cartilage is deformed, repositioning is frequently impossible and the deflected septum must be removed.

The most difficult septal deformities involve the most caudal portion of the septum, because this caudal strut is required for support and its removal frequently results in nasal tip collapse. Two methods are employed in the severe caudal deflection. The first method involves disarticulation of the caudal strip, if required, and scoring incisions that alter the concavities and convexities to render the septum straight. This method is only moderately successful and an initially straight septum may rebound a month or two postoperatively into its preoperative shape and defection. Once it is brought into the midline vertical position, the deflected caudal septum is longer than required, so an appropriate reduction of 1 to 3 mm from the inferior aspect of the caudal septum is performed to allow the septum to swing to the midline position (Fig. 3-6).

Figure 3-6 Caudal deviation of the nasal septum.

In the second method, one may remove the deflected septum completely and replace it with an adequate portion of straight septum harvested posteriorly. Securing the caudal repositioned or replaced septum to the mucopericondrium of the anterior maxillary spine with a nonabsorbable figure-of-eight suture is helpful (Fig. 3-7). Occasionally, the anterior nasal spine may be dislocated. This may be replaced into the midline by grasping the bone with a Jansen-Middleton rongeur and twisting the bone toward the concave side.

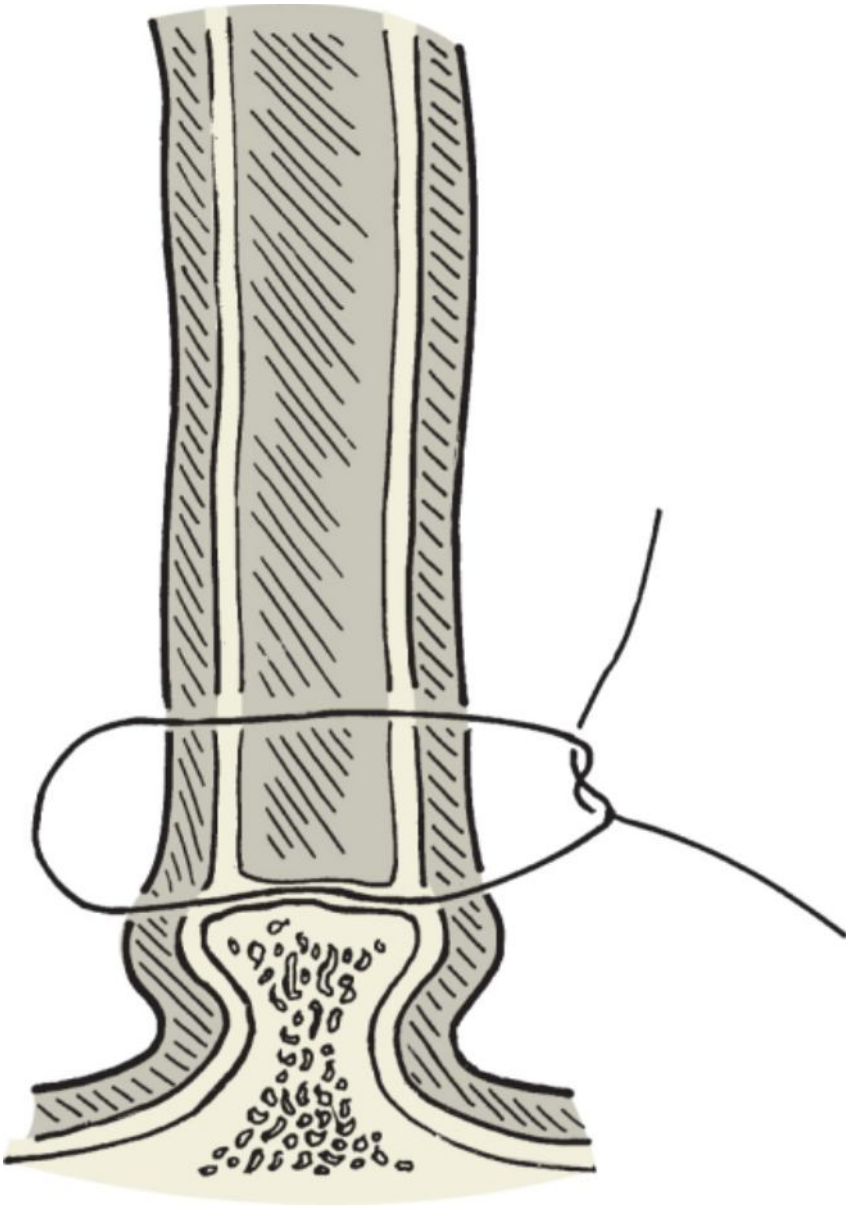

Figure 3-7 It is helpful to suture the mucoperichondrial flaps of the caudal strut when the caudal deviation has been repaired.

The septal mucosa is carefully inspected, and any opposing tears in the mucoperichondrial flaps should be closed with 4-0 chromic catgut suture on a curved needle with a small circle in order to prevent a nasal septal perforation. A piece of resected cartilage should be placed between opposing tears if not already present. An isolated laceration need not be sutured and in fact may be useful in preventing hematoma. Some authors suggest that if no laceration of the flap occurred during the procedure, a “controlled drainage site” should be produced by making several stab wounds in the flap.[1] The blood is aspirated from the dead space between the mucoperichondrial flaps, and the septum is closed with a small absorbable suture, such as 5-0 Biosym or 6-0 chromic.

Soft septal splints made commercially with nasal ports or fashioned from sterilized plastic food container lids, can be used to compress the mucoperichondrial flaps (Fig. 3-8). This eliminates the need for packing, and helps prevent septal hematoma and synechiae formation. If commercial septal splints with nasal ports are used (e.g., Doyle splints), then the port provides pressure against the turbinates and prevents the accumulation of blood or swelling of the turbinate, particularly if a submucous resection of the turbinate is performed. The splints are secured anteriorly with a nonabsorbable colored suture, usually 3-0 Ethilon. This facilitates visualization of the suture for removal postoperatively. These splints are removed in the office in 3 to 8 days. Other surgeons prefer using mattress sutures passed through the mucoperichondrial flaps, and others rely on nasal packing. If packing is used, the gauze should be impregnated with antibiotics. Antibiotics should be administered systemically intraoperatively and postoperatively if packing is used. A small gauze dressing is placed below the nasal tip to catch any bloody mucous nasal drip.

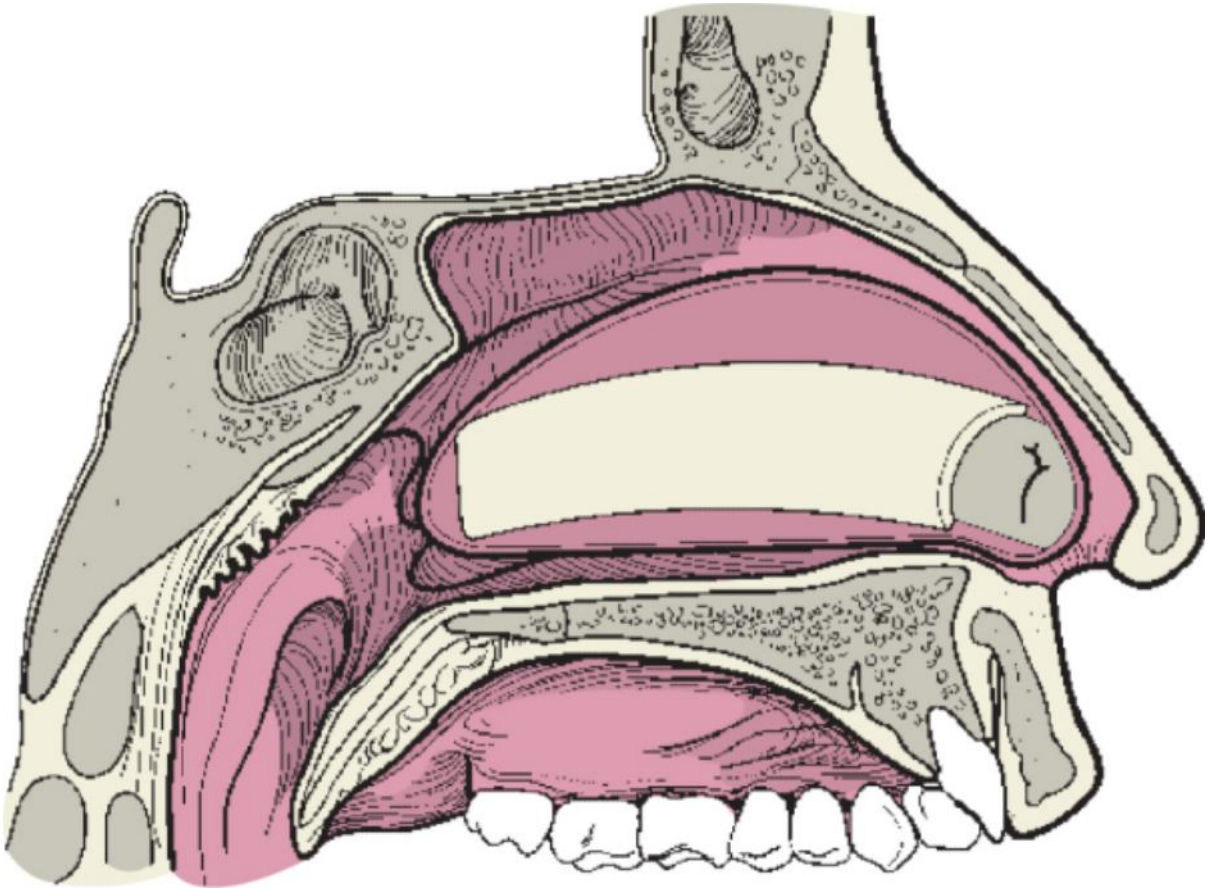

Figure 3-8 Doyle splint secured anteriorly with 3-0 Ethilon suture.

The septoplasty usually precedes a rhinoplasty. If endoscopic sinus surgery is performed at the same sitting, then the endoscopic procedure is first performed on the more open side. The turbinate on this side is then reduced, if it will cause obstruction once the septum is in the midline. The septoplasty is performed and the other side is addressed endoscopically with the improved visualization.

Turbinate Reduction

Turbinate reduction of the turbinate contralateral to the septal deflection should always be considered because frequently compensatory hypertrophy has occurred. The turbinate can be reduced in a number of ways. If there is a prominent bony obstruction, then a submucous resection using either an endoscope or a headlight is preferred. A vertical incision is made down to the turbinate bone at the anterior aspect of the inferior turbinate with a guarded Colorado-tipped electrocautery device. The inferior turbinate bone is dissected free of the turbinate tissue with a Cottle elevator, which is also helpful in fracturing the superior bony attachment, so that the turbinate bone can be removed. If a headlight is used, the medium-length speculum with narrow flanges is used to isolate the turbinate bone in the center. This optimizes visualization for dissection and removal of the bone. More posteriorly, bony hypertrophy can be fractured laterally (Fig. 3-9). If there is abundant soft tissue hypertrophy, the 3.5 mm or smaller microdébrider may be used to remove tissue submucosally (see Video 3-1 .) This is done under direct endoscopic vision more posteriorly. The most dangerous part of this procedure is at the level of the middle turbinate, where the operator's natural inclination is to continue the angle of dissection upward, rather than inferiorly, to follow the downward angling of the inferior turbinate (Fig. 3-10). If the microdébrider perforates the inferior turbinate and then damages the middle turbinate, brisk bleeding may result. Keeping the blade of the microdébrider toward the turbinate bone in difficult areas helps prevent turbinate perforation. Perforation is common, resulting in more bleeding and the potential for scarring. In very hypertrophied turbinates, a more aggressive turbinate reduction involves resection of the lateral aspect of the inferior turbinate, particularly anteriorly, and rolling the medial turbinate up to cover the abraded area (Fig. 3-11).

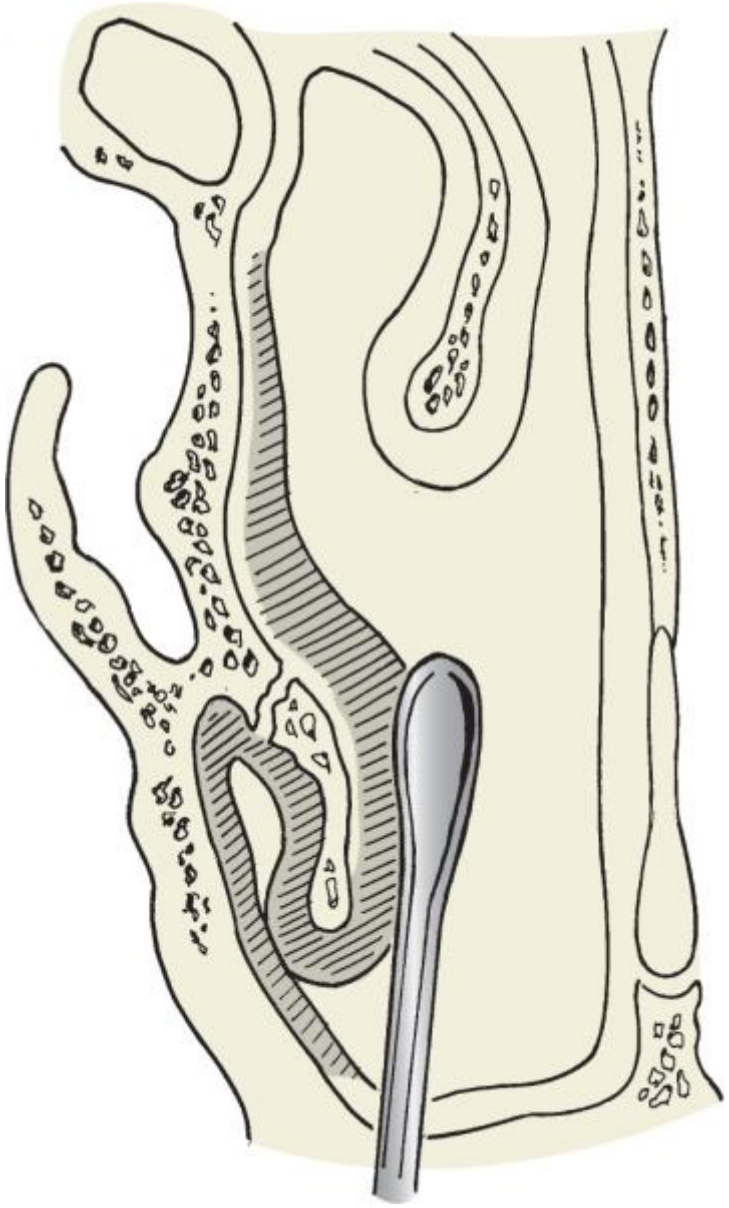

Figure 3-9 Outfracture of a prominent inferior turbinate.

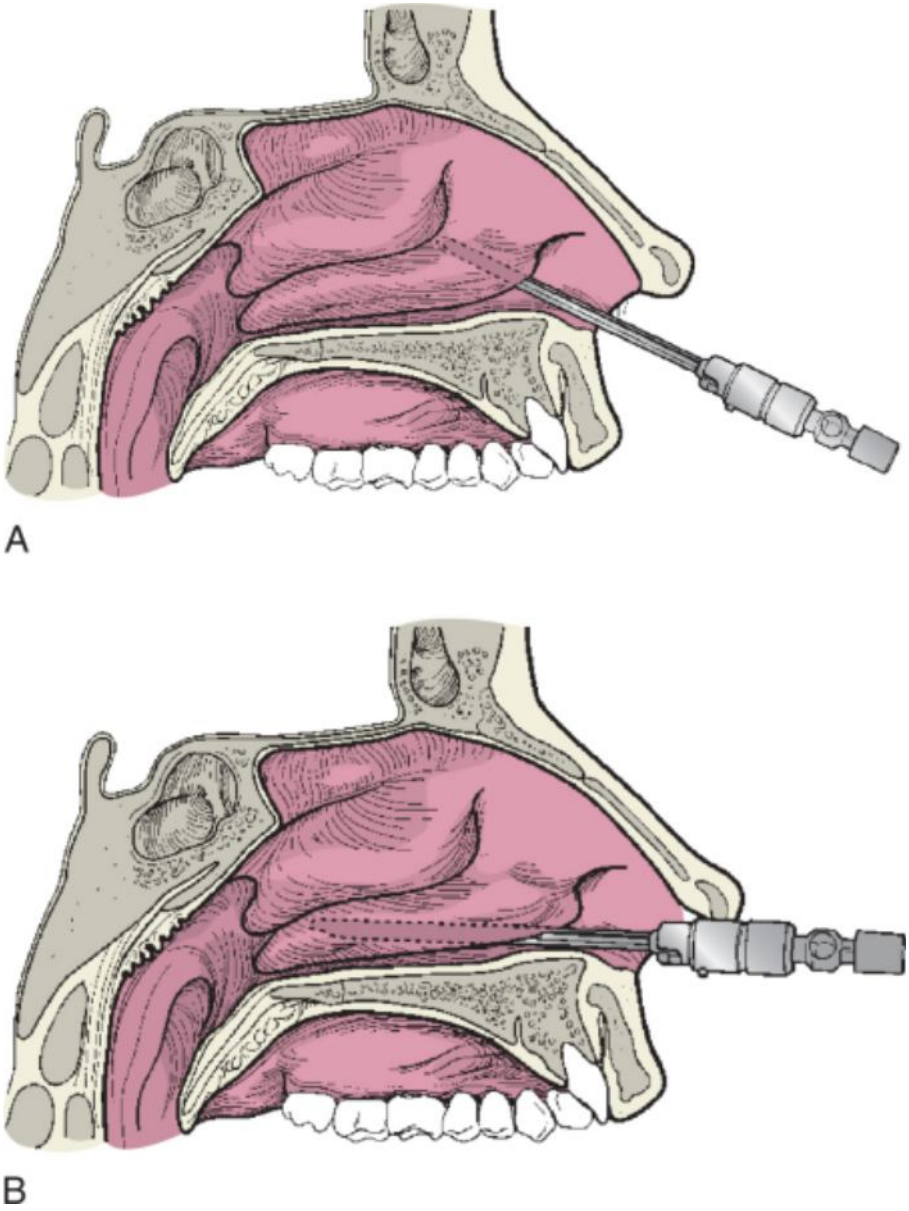

Figure 3-10 **A,** Microdébrider inserted into inferior turbinate inappropriately angled so that it will potentially go through inferior turbinate superiorly and engage middle turbinate. **B,** Microdébrider inserted correctly into inferior turbinate, pocket minimizing risk of middle turbinate injury.

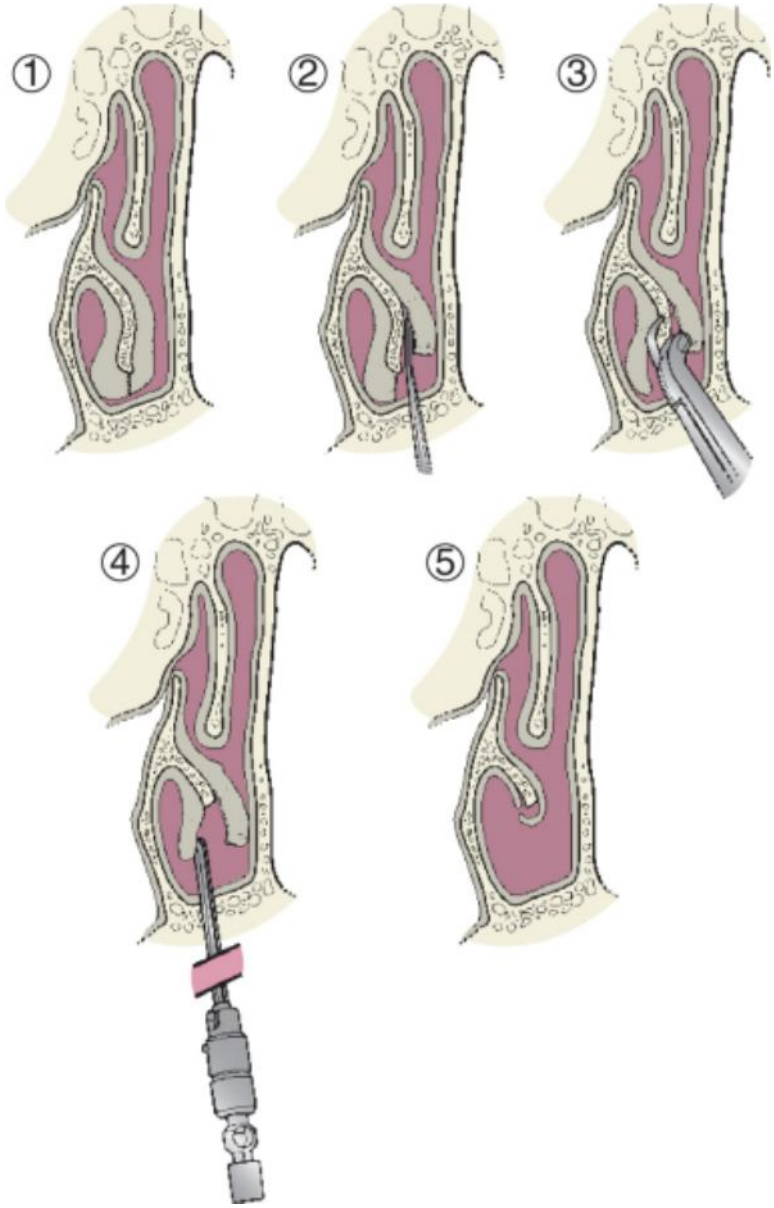

Figure 3-11 **1,** Incision in the mucosa of the turbinate. **2,** The mucosa is elevated off the turbinate bone. **3,** The bone is removed with biting forceps. **4,** Microdébrider to remove lateral wall. **5,** Medial mucosa rolled laterally.

Other methods of turbinate reduction include radiofrequency reduction with devices such as the Coblator. The tip of the Coblator is inserted into multiple areas of the inferior turbinate and activated for about 10 seconds. This heats the tissue and results in subsequent reduction of the tissue as it heals. Extensive coblation of the turbinate prolongs the healing time, in my experience from less than 3 weeks with a microdébrider to more than 6 weeks on average.

POSTOPERATIVE MANAGEMENT

Patients may be discharged the same day, unless they are slow to recover from the general anesthesia, suffer from persistent nausea or bleeding, or if a complication is suspected or has been diagnosed. Patients with known OSA should be monitored postoperatively with pulse oximetry and not discharged to home if the pulse oximetry falls below 85%. It is important to require all men to void before discharge, because urinary retention postoperatively may lead to prolonged catheterization. During the week following surgery, strenuous exercise or heavy lifting is avoided. The patient should be cautioned to blow the nose gently, if necessary, and sneeze with the mouth open. Saline nose drops or sprays or nasal lavage may be used several times each day to help keep blood from becoming hard crusts, particularly in the ports of septal splints. Patients are usually seen again within 3 to 8 days to remove septal splints and decongest and clear the nasal cavity.

COMPLICATIONS

Complications following nasal septal surgery occur infrequently. Bleeding is rarely more than enough to change the

nasal drip pad every 20 minutes and slowly tapers off over the next few days. Nasal swelling or ecchymosis is unusual if no rhinoplasty has been performed. If the patient's drip pad must be changed every 10 minutes because of bleeding, then this patient must be reevaluated for a bleeding vessel that requires cauterization or packing. Occasionally these patients have a coagulopathy. A septal hematoma may occur if the focus of bleeding is within the septum and there are no septal perforations to allow egress into the nasal cavity. For this reason, small venting stab incisions should be made in the septal mucosa if there are no inadvertent mucosal tears. A septal hematoma is usually diagnosed and must be evacuated when the patient complains of severe pain in the nose. This can be carried out by anesthetizing the mucosa topically with lidocaine followed by injections of a small amount of lidocaine and then aspirating with an 18-gauge needle. Additional small stab incisions with a small blade helps prevent reaccumulation. Packing may be inserted to prevent recurrence of the hematoma. Septal hematoma, unrecognized and untreated, may lead to pressure ischemia and loss of the remaining septal cartilage with a possible late saddle nose deformity.

Cerebrospinal fluid rhinorrhea has been reported infrequently and is probably attributable to avulsion of the perpendicular plate of the ethmoid and its attachment to the cribriform plate. This can be avoided by not avulsing any bone or cartilage unless it has already been fractured off the remaining bone or cartilage.[7]

Toxic shock syndrome has been reported in patients with and without nasal packing following nasal septoplasty and is thought to be due to colonization of the nasal packing by *Staphylococcus aureus*, which produces exotoxin. There does not appear to be an absolutely certain way to prevent this complication.[8,9] Avoidance of nasal packing, packing with bacteria-resistant material, and early removal of packing are appropriate, but will not necessarily prevent this rare complication. If a patient reports early fever, serious diarrhea, or ischemia of the limbs, evaluation for toxic shock syndrome should be done immediately. The packing should be removed and cultured, antistaphylococcal antibiotics should be administered, and careful observation and intervention should be done as needed.

Nasal septal perforation should occur infrequently following this procedure.[10] This complication is probably the result of inadequately repaired or unrepaired opposing lacerations of septal mucoperichondrium or avulsion of a portion of the mucoperichondrium and occasionally secondary to postoperative infection. Some patients with nasal obstruction secondary to septal deviation traumatize the nasal mucosa by picking their nose. These traumatized areas become atrophic and may be predisposed toward laceration or avulsion during elevation of mucoperichondrial flaps.

Saddle nose deformity or supratip depression may result if there is failure to leave an adequate dorsal cartilaginous strut.

The caudal septal edge is usually left untouched except in cases of protrusion of the septum caudally when it can be resected. Over-resection results in columellar retraction.

For the carefully selected patient, a septoplasty or turbinate reduction produces a significant improvement in quality of life.[11]

PEARLS

Septoplasty

- A septal hematoma can be prevented or the likelihood reduced by placing small venting stabs in the septal mucosa if there are no inadvertent mucosal tears.
- A septal mucosal tear on one side will not cause a perforation unless the opposing contralateral mucosa is also torn.
- Palpating the nose at the caudal border allows one to determine on which side the septum is most prominent and to make a hemitransfixion incision on this side. This does not correlate with the side to which the septum is most deflected posteriorly.
- Developing the mucoperichondrial flap is usually easiest in the superior plane.
- Posterior isolated spurs are most easily removed endoscopically with an incision over the spur, followed by removal, leaving the contralateral mucoperichondrium intact.

Inferior Turbinate Reduction

- Doyle splints with a vent tube laterally not only hold the septum in position but also provide pressure against the turbinate, ensuring that the reduced inferior turbinate does not swell with blood and can be used even when no septoplasty is performed.
- The clogging of Doyle splints with hardened bloody drainage and mucus can be minimized by vigorous cleaning of the splints and nose with saline, up to 5 to 10 mL, three or more times a day combined with gentle cleaning anteriorly with a cotton-tipped applicator.

- The inferior turbinate mucosa should be spared as much as possible in order to prevent the “empty nose” sensation.
- The turbinate bone can be fractured laterally by either placing a Cottle elevator in a submucosal pocket or fracturing from the intranasal mucosal side of the inferior turbinate.
- An obstructing polypoid posterior inferior turbinate can be addressed with a microdébrider and suction cautery under endoscopic guidance to minimize hemorrhage.

PITFALLS

Septoplasty

- Cerebrospinal fluid rhinorrhea resulting from septoplasty is extremely rare and can be avoided by sharply cutting (and not avulsing) the superior attachment of cartilage or bone to be removed.
- Toxic shock syndrome is a rare complication more commonly encountered when nasal packing is used. This diagnosis should be considered when a patient reports early fever, serious diarrhea, or ischemia of the limbs.
- Saddle nose deformity or supratip depression may result if there is failure to leave an adequate dorsal cartilaginous strut.
- The caudal septal edge is usually left untouched, except in cases of protrusion of the septum caudally; when it can be resected, over-resection results in columellar retraction.
- The most important element of septal cartilage for support is the caudal 15-mm strip.

Inferior Turbinate Reduction

- Over-resection of the inferior turbinate can result in loss of sensation of airflow, resulting in the “empty nose syndrome” or nasal crusting secondary to inadequate moisturization of the inspired air.
- The most common site of inadvertent injury in performing a submucosal microdébridement of the inferior turbinate is perforation of the inferior turbinate superiorly with injury of the middle turbinate above. Microdébridement of the middle turbinate may result in brisk bleeding.