29 Adjunctive Endonasal Procedures During Lacrimal Surgery

Alkis James Psaltis and Luis Fernando Macias-Valle

Introduction

Endoscopic dacryocystorhinostomy has become a common procedure for the management of certain lacrimal conditions. Its high success rate and no cosmetic morbidity have made it an attractive alternative to traditional external approaches. To perform this procedure well, the surgeon must have a sound understanding of endoscopic endonasal anatomy and its normal anatomic variants and be well trained in the use of the nasal endoscope. Figure 29.1 highlights important normal endoscopic anatomy that will be referenced in the chapter.

Preoperative Assessment

Prior to endoscopic surgery all patients should undergo a complete endoscopic assessment of their nasal cavity. This examination will allow the preoperative identification of normal anatomical variants such as a deviated nasal septum or pneumatized middle turbinate, which may hinder visualization and access to the lacrimal sac during endoscopic surgery. The decision on whether adjunctive endonasal procedures will be required at the time of lacrimal surgery should therefore occur in the preoperative setting to facilitate the informed consent process and optimize surgical planning. Figures 29.2 and 29.3 represent the basic office setup required to perform the preoperative examination.

A.J. Psaltis, F.R.A.C.S. (✉)
Department of Otolaryngology, Head Neck Surgery, The Queen Elizabeth Hospital, Adelaide, Australia
e-mail: alkispsaltis@gmail.com

L.F. Macias-Valle
The Queen Elizabeth Hospital, Adelaide, Australia

Topical Anesthesia

The preoperative examination occurs in the ambulatory clinic setting under topical anesthesia. Topical agents are most commonly administered in an aerosolized form or on presoaked packing materials and usually contain rapid-onset anesthetic agents such as lidocaine and a vasoconstrictor agent such as phenylephrine or oxymetazoline. Commercially available combination sprays are available and provide an easy and effective way of preparing the nose for the examination. One such example of this is the product Cophenylcaine Forte[R] (ENT technologies, Melbourne Victoria, Australia) which contains 50 mg/ml of lidocaine hydrochloride and 5 mg/ml of phenylephrine. Figures 29.4 and 29.5 show this product with the patented single-use disposable nozzle that allows delivery deep with the nasal cavity. The use of these agents will not only increase the comfort of the endoscopy but also improve the overall visibility and access by reducing mucosal edema.

Basic Nasal Endoscopy

Patients should be positioned comfortably in an upright position with their head supported by a firm headrest. Ideally, the neck should be in the neutral position with minimal flexion or extension. To perform rigid nasal endoscopy in adults, a 3-mm or 4-mm, 0°or 30°**,** rigid endoscope is typically well tolerated, while in younger children a 2.7-mm scope may be preferred to navigate the smaller nasal cavity. The scope lens is first prepared with a thin layer of antifog solution to prevent the warm expired nasal air clouding the field of vision. Although commercially available preparations are present, cetrimide solution typically works just as well. Endoscopy should then be performed in a structured systematic fashion. The endoscope is introduced into the nasal cavity and anchored at the apex of the nostril superiorly to add stability to the procedure. Contact with the nasal mucosa should be avoided at all times. Employing a three pass technique, the

© Springer Nature Singapore Pte Ltd. 2018
M. Javed Ali (ed.), *Principles and Practice of Lacrimal Surgery*, https://doi.org/10.1007/978-981-10-5442-6_29

first pass is made along the nasal floor to visualize the inferior meatus as well as the post nasal space. The second pass is then made between the inferior and middle turbinates to visualize the middle meatus. Edema, purulence, and polypoid disease should be looked for as possible markers of concomitant sinus disease. If present, then further imaging should be organized typically comprising of a fine-cut computerized tomography of the paranasal sinuses. Close inspection of the shape and size of the middle turbinate will also be performed during this pass to exclude a concha bullosa or paradoxically curved middle turbinate that may need to also be dealt with at the time of DCR surgery to improve access. The third pass should then be performed to visualize the olfactory cleft and swept superiorly to visualize the axilla of the middle turbinate. This will not only allow visualization of any polyps within the sphenoethmoidal recess but will also allow the surgeon to assess whether the patient has a septal deviation that may preclude access to the lateral nasal wall during surgery. If the axilla cannot be visualized completely or the access is deemed too narrow for an obstructed endoscopic DCR, then the patient should be counseled preoperatively of the highly likelihood of also requiring a septoplasty as part of their lacrimal procedure. Having identified all of the anatomical variations on preoperative endoscopy, a clear surgical plan can be conveyed to the patient and informed consent obtained.

Surgery

Patient Positioning

Patient positioning is critical to the safety of the patient, the surgical field attainable, and the ergonomics of the surgery. In our department, the surgery is performed with the surgeon seated on the right of the patient. The operating bed is typically reversed to allow the surgeon to have their legs under the bed while in this sitting position. The surgeon's left elbow is supported on an arm board anchored to the operative bed to increase the stability of the scope held in the non-dominant hand. The patient is positioned supine, with their head in a neutral position and the bed placed in a reverse Trendelenburg position. Head elevation has been shown to reduce the mean arterial pressure in the elevated region by 2 mm Hg for every 2.5 mm above cardiac level [1]. Cerebral perfusion studies have also demonstrated that the ideal angle of tilt is between 20 and 30° above the horizontal as this decreases venous congestion without affecting cerebral perfusion [2]. The angle of tilt has also been correlated with improvement of surgical field of view scores and decrease blood loss [3]. The endoscopic tower is positioned in the surgeon's straight line of sight to increase surgeon comfort and avoid rotation of the surgeon's neck. The monitor should be positioned at eye level to minimize extension of the surgeon's neck. Figures 29.6 and 29.7 demonstrate the ideal positioning of the bed and the operating room setup.

Instrumentation

Table 29.1 summarizes a list of the endoscopic surgical instruments required for endoscopic DCR surgery and adjunctive nasal procedures. Items produced only by a single company include the manufacturer's details also. Using a bimanual technique, the surgeon holds the rigid endoscope in his/her left hand, with their elbow firmly positioned on the arm rest. The endoscope is inserted into the nostril retracting the apex of the nasal vestibular skin. Tenting the nostril in this way not only adds further stability to the endoscope but also increases the working space for the second surgical instrument held in the dominant hand. The surgeon should consciously avoid any instrument cross by always maintaining the endoscope in a superior position to the operating instrument. Nasal procedures including septoplasty, middle turbinate surgery, and anterior ethmoid surgery will typically require the use of a 0° endoscope, while the majority of the DCR procedure itself is performed with the 30° endoscope given the lateral location of the lacrimal sac on the nasal wall.

Table 29.1 Endoscopic DCR instrumentation

Basic endoscopic equipment
0° and 30° 4-mm rigid endoscope
Endo-scrub two lens-cleaning sheaths (Medtronic ENT Jacksonville, Fl, USA)
15 scalpel or monopolar needle tip for mucosal incisions (Bovie Medical)
Malleable suction Freer elevator (Medtronic ENT)
Malleable suction curette (Medtronic ENT)
Hajek-Koffler forward-biting punch
Freer's dissector
Tilley-Henkel forceps
Variable sized osteotomes
Endoscopic sinoscopy scissors
DCR instrumentation
Microdebrider instrumentation (Medtronic ENT)
Medtronic integrated power console
M4 or M5 handpiece
25° curved 2.5-mm rough diamond DCR bur
Wormald dacryocystorhinostomy set (Medtronic ENT)
Spear knife
Micro sickle knife
Lusk MicroBite forceps
Lacrimal punctum dilator
Bowman lacrimal probe
O'Donoghue lacrimal intubation tubes (Beaver-Visitec International Waltham, MA, USA)

Surgical Field

Nasal Preparation

Optimizing the surgical field is critical to the performance of safe and efficient endoscopic endonasal surgery. This commences with the preparation of the nasal mucosa. After induction of general anesthetic, the surgeon injects 1–2 ml of 2% lignocaine with 1:80,000 adrenaline into the region of the axilla of the middle turbinate and the adjoining lateral nasal wall. Injection continues until blanching of the mucosa is seen. The use of pre-filled anesthetic cartridges in a dental syringe can eliminate the inadvertent injection of higher concentrations of adrenaline. This injection can be performed with the use of a headlight or under direct endoscopic visualization if access is difficult. If a septoplasty or middle turbinate surgery is to be performed for surgical access, the surgeon should also inject the caudal septal mucosa and head of the middle turbinate, respectively, at the site of the likely incisions. For DCR surgery the lateral nasal wall is injected around the insertion of the middle turbinate. To ensure adequate topicalization of the entire nasal mucosa, the surgeon then places three ½ in. × 1 in. cottonoid pledgets soaked in a mixture of 2 ml 10% cocaine solution, 1 ml 1:1000 adrenaline, and 4 ml normal saline into each nasal cavity. If there is a contraindication to cocaine or difficulty in obtaining cocaine solution, 1:1000–1:10,000 adrenaline can be used alone. For endoscopic lacrimal surgery, we typically recommend placing one pledget along the septal mucosa, one into the middle meatus between the middle turbinate and lateral nasal wall and one along the lateral nasal wall overlying the axilla. Any solution left over from the initial mixture is handed over to the scrub nurse for later use if required.

Anesthetic

The manner in which general anesthesia is induced and maintained is critical for the surgical field. Ideally for nasal surgery, a laryngeal mask (LMA) is preferred over endotracheal intubation. It is associated with less respiratory and cardiovascular reflex responses due to reduced stimulation of the larynx as compared to endotracheal intubation. Moreover, LMA facilitates controlled hypotension, allows for a lighter depth of anesthesia, and is associated with less coughing and strain upon emergence. The use of a small throat pack above the mask can minimize the risk of any contamination of the upper airway by the blood during the case [4]. Total intravenous anesthesia (TIVA) utilizing propofol and an opioid such as remifentanil has been shown to be an effective way of delivering controlled hypotensive general anesthetic. TIVA avoids the use of inhalational agents that typically cause end arteriolar vasodilation and may increase surgical bleeding. Ideally, if not medically contraindicated, pulse rate should be maintained between 60 and 70 beats per minute to increase venous return by increasing end-diastolic filling time, and mean arterial blood pressure should be maintained around 65–70 mmHg to avoid organ and cerebral hypoperfusion [5].

Surgical Technique: Adjunctive Nasal Procedures

A recent review by our department revealed that additional adjunctive procedures are required in approximately half of the patients undergoing endoscopic DCR [6]. These procedures range from those aimed at improving access to the lateral nasal wall such as septoplasty and middle turbinoplasty as well as performing functional endoscopic sinus surgery (FESS) for concomitant sinus disease. The next section describes in detail the surgical steps involved in performing an endoscopic septoplasty and concha bullosa reduction. Oculoplastic surgeons wishing to perform endoscopic lacrimal surgery should be well skilled in these two procedures.

Endoscopic Septoplasty

Exposure and access are the two primary indications for performing a septoplasty during endonasal lacrimal surgery. Deviations precluding complete visualization of the axilla of middle turbinate should be addressed. By performing a septoplasty early, inadvertent trauma to the septal mucosa can be avoided. This further reduces the risk of synechiae formation that may compromise success rates. Before performing this procedure, the operating surgeon should be familiar with the anatomy of the septum and important regions that must be respected to avoid compromising structural support.

The septum is composed of the cartilage anteriorly and bone posteriorly. The cartilaginous component is formed by the quadrilateral cartilage that articulates posteriorly with perpendicular plate of the ethmoid, inferiorly with the maxillary crest, posterosuperiorly with the nasal bones, and postero-inferiorly with the vomer. It is lined by mucosa that firmly attaches to the cartilage by a mucoperichondrial layer and the bone by a mucoperiosteal layer. These layers are not continuous but rather fuse inferiorly to insert into the septum as decussating fibers. When performing a septoplasty, at least 1.5 cm of dorsal and caudal cartilage needs to be preserved to preserve its support and structure. Violation of this can compromise function as well as lead to cosmetic abnormalities such as saddling of the nasal dorsum or ptosis of the nasal tip.

Septoplasty was traditionally performed using a headlight and nasal speculum (Figs. 29.8 and 29.9). The performance of this procedure with an endoscope confers many advantages including improved magnification and illumination.

A recent literature review comparing endoscopic versus open septoplasty concluded that the endoscopic technique had shorter operating times, less mucosal damage, and less residual deformity [7]. Irrespective of the technique employed, the principles of surgery remain the same. A stepwise summary of the procedure is described in Figs. 29.10, 29.11, 29.12, 29.13, 29.14, 29.15, 29.16, 29.17, and 29.18. The procedure commences with the mucosal incision. Broad anterior deviations are best addressed through a hemi-transfixion incision (Fig. 29.9), while more posterior deflections can be addressed through a Killian incision. The advantage of the Killian incision is that it can be performed with the endoscope, while the hemi-transfixion incision still requires the use of a headlight and nasal speculum at the beginning of the procedure. The Killian incision is placed at the mucocutaneous junction and typically performed with a 15″ scalpel blade. It should be broad based extending from the dorsum of the nose, inferiorly onto the maxillary crest. Curving the incision posteriorly at its most inferior extent may prevent the septal mucosal flap from tearing during the procedure. The depth of the incision should traverse all the soft tissue layers of the mucosa down to the cartilage to facilitate early identification of the sub-mucoperichondrial plane. Identification of this plane is critical to the entire procedure as dissecting beneath it yields an avascular surgical plane and maximizes flap vascularity and strength [8]. Given its adherence to the cartilage, this plane can be difficult to identify and raise. The use of a sharp instrument such as the sharp end of a Freer's dissector, a suction curette, the tips sharp tapered iris scissors, or the back of the # blade 15 can help identify the cartilaginous surface. This surface typically is pearly white with a blue tinge when viewed under the endoscope and has a less smooth sensation than the mucoperichondrium. Once identified, the flap is further raised to allow the endoscope to be inserted. The surgeon can then proceed to raise the entire sub-mucoperichondrial plane in a sweeping motion from superior to inferior using Freer's suction instrument. The tip of the freer should always be angled toward the septum and kept in close contact with the septum to avoid causing an inadvertent perforation of the mucosal flap. The flap should be raised beyond the deviation and beyond the osseocartilaginous fusion of the quadrilateral cartilage with the ethmoid plate. Once ipsilateral dissection has been performed, the cartilage is then transected carefully using a freer to allow a contralateral mucosal flap to be elevated. This cartilaginous incision is placed anterior to the deviation and should not extend higher than 1.5 cm beneath the dorsal edge of the septum. In this way the dorsal support of the septum will be maintained and the risk of "saddling" will be minimized. Once the transection incision has been carried through the cartilage, the freer will enter the sub-mucoperichondrial plane on the contralateral side, and the contralateral mucosa can then be elevated off the cartilage and ethmoid bone. This will isolate the cartilage/bone from the mucosa bilaterally and allow it to be resected without injuring the mucosa. Prior to removing the cartilage/bone, a superior cut should be performed parallel but inferior to the dorsum using an endoscopic scissor. This will safeguard against inadvertently fracturing of the skull base at the insertion of the ethmoid plate when the ethmoid bone is removed. The deviated cartilage/bone can then be removed using a grasping instrument such as an Irwin Moore or Tilley-Henkel forceps. Following removal of the deviation, the bilateral mucosal flaps can then be laid back down. If completely intact, a unilateral drainage hole placed as posteriorly as possible in a dependent position should be created to allow drainage of the blood from the surgical site and prevent a septal hematoma. The two flaps can then be approximated using a quilting stitch with a dissolvable suture such as a 4/0 Vicryl Rapide. The anterior incision site can be incorporated into this closure or closed separately. The purpose of the quilting stitch is to remove as much "dead-space" as possible and allow the two mucosal flaps to adhere to each other.

Complications

All patients undergoing septoplasty should be consented of potential complications prior to surgery. Complications include bleeding, infection, septal hematoma or abscess formation, septal perforation, cosmetic complications, loss of structural support, tip ptosis, paresthesia of the upper teeth, and cerebrospinal fluid leak. The rate of perforation varies considerably between studies. Older studies employing more extensive submucosal resection of the septal cartilage quote up to 25%, whereas modern septoplasty techniques aimed at conserving as much cartilage as possible report lower rates, closer to 5%. The risk of perforation can be minimized by meticulous surgical technique, dissecting beneath the sub-mucoperichondrial/sub-mucoperiosteal plane and ensuring that at least one mucosal flap remains completely intact during the procedure. It is important to remember that all surgical procedures have a learning curve to reduce complications and standardize success rates. Champagne et al. [9] recently demonstrated that after 60 endoscopic septoplasties, rates of intra- and postoperative complications decreased satisfactorily.

Concha Bullosa Reduction

Pneumatization of the middle turbinate is not an uncommon occurrence. The reported incidence of concha bullosa ranges anywhere between 14 and 53% with the variation in incidence reflective of differing anatomical definitions [10]. Although most commonly occurring unilaterally, bilateral pneumatization can be present in up to 20% of patients [11].

Although considered a normal anatomical variant, concha bullosa appear significantly associated with a contralateral septal deviation and may require reduction if particularly large or if it interferes with endoscopic access during a DCR (Fig. 29.19). A recent study by Ali et al. [6] reported the necessity for a concurrent middle turbinoplasty in up to 6% of endoscopic DCR cases.

Numerous techniques for reducing a middle turbinate concha bullosa have been described. All share a common principle of resection of the lateral aspect or lamella, with preservation of as much of the medial lamella as possible. Excessive manipulation of this medial portion should be avoided at all times given its insertion into the skull base. Our preferred technique is described as follows. Using a #15 blade, a vertical stab incision is made into the head of the middle turbinate. Using a sawing motion, this incision is extended superiorly and inferiorly. 5-mm endoscopic scissors can then be inserted and rotated 90 degrees to further distract the lateral and medial lamellae. The surgeon can then use the scissors or knife to continue the incision posteriorly along the inferior and superior margins of the middle turbinate to their lateral insertion. Once removed, the straight microdebrider can be used in forward high-speed motion to tidy up the mucosa edges, ensuring preservation of the anteromedial mucosa (Figs. 29.20, 29.21, 29.22, and 29.23).

Often reducing a concha bullosa can destabilize the middle turbinate. If this occurs and there is any risk of lateralization, the remaining middle turbinate should be sutured with a 4/0 Vicryl Rapide to the septum. This will minimize the risk of a postoperative adhesion to the lateral nasal wall that may interfere with the drainage of the ostiomeatal unit.

Inferior Turbinoplasty

Proper patient assessment and a trial of medical therapy should be performed before the decision is made to reduce the turbinates. In those patients that fail medical therapy and in whom other contributing factors have been eliminated (allergies, sinus disease, etc.), turbinate reduction is a valid option with improvement of the patient's nasal airway and frequently in their quality of life. Occasionally the inferior turbinate may be grossly hypertrophied, and one may need a turbinoplasty to gain a comfortable space for other procedures like septoplasty or even balloon lacrimal procedures of the NLD in adults.

Inferior turbinoplasty is the procedure of choice as it maintains the functional medial surface of the turbinate while effectively reducing the size of the turbinate avoiding such complications as atrophic rhinitis and empty nose syndrome. This preservation of the medial wall of the inferior turbinate maintains the airflow receptors in this wall and avoids the "empty nose syndrome" in which the patient cannot perceive airflow despite a widely patent nasal airway. In this technique, local anesthetic agent is infiltrated into the head of the inferior turbinate (IT) (Fig. 29.24), and an incision is taken on the head (Fig. 29.25). The head is trimmed onto the bone allowing space for the endoscope and a powered microdebrider to be placed. The microdebrider is used to remove the soft tissue over the inferior and medial portions of the turbinate. Next a dissector is used to dissect in the subperiosteal plane (Fig. 29.26) the medial mucosa and remaining lateral mucosa from the vertical portion of the inferior turbinate bone, isolating the bone (Fig. 29.27). The bone is removed, and any residual bone fragments are cleared with a ball probe, backbiter, or other endoscopic instruments (Fig. 29.28). Once this bone is removed, the two vessels supplying the inferior turbinate can be visualized in the posterior region of the turbinate. These vessels are cauterized with a bipolar forceps. The residual turbinate is then rolled laterally so that the medial mucosa covers any exposed tissue minimizing postoperative crusting (Fig. 29.29). The rolled turbinate is held in place with a strip of oxidized cellulose or Surgicel. No other packing is used in the nose. The powered inferior turbinoplasty preserves the medial aspect of the mucosal covering of the inferior turbinate and therefore reduces the risk associated with standard turbinectomy procedures while still giving long-lasting results [12] (Fig. 29.30).

Other Adjunctive Procedures

There can be occasions when associated conditions like sinusitis (Fig. 29.31) and polyposis in the middle meatus (Fig. 29.32) may have to be dealt at the same time along with DCR surgery. Literature review has shown that in rhinology practices, up to 6% of patients underwent ancillary endoscopic sinus surgery and concha reduction for ongoing non-responsive chronic sinusitis or nasal polyposis along with lacrimal surgery [6, 9]. The various nuances of functional endoscopic sinus surgery (FESS) are too numerous to cover in this chapter although certain points are worth mentioning. Due to the small but devastating chances of catastrophic complications such as carotid artery injury, skull base violation, and blindness, sinus surgery is generally performed only by a fully trained otolaryngologist. Regardless of the technique used, the DCR is most often performed prior to the sinus surgery. During the initial steps of the DCR, the axillary flap can be raised and the agger nasi cell opened, thus preparing for further exenteration of the ethmoid and frontal cells during the FESS. Occasionally, severe polyposis requires that the FESS be initiated prior to the DCR as the disease may block the middle meatus and the area of lacrimal dissection.

Conclusion

It is beneficial for both ophthalmologists and otolaryngologists to develop a close liaison with each other when starting an endoscopic DCR practice. Both have expertise in different areas and can improve the overall patient care, the preoperative evaluation, the surgical outcomes, and even the postoperative management. The main advantage of a two-team approach is allowing the ophthalmologist to assess for additional eye disease while the sinus surgeon is able to endoscopically assess the nasal cavity, septum, and perform ancillary endonasal procedures that may be necessary while avoiding multiple trips to the operating room. An oculoplastic surgeon performing endoscopic DCR's should get himself trained in at least septoplasty and concha reduction. Similarly an ENT surgeon should learn all the basics of handling the proximal lacrimal system, probing, and intubation. Hence surgeons should be able to assist each other with ease, when needed, in order to provide optimal patient care.

References

1. Simpson P. Perioperative blood loss and its reduction: the role of the anaesthetist. Br J Anaesth. 1992;69:498–507.
2. Palazon JH, Asensi PD, Lopez SB, et al. Effect of head elevation on intracranial pressure, cerebral perfusion pressure, and regional cerebral oxygen saturation in patients with cerebral hemorrhage. Rev Esp Anestesiol Reanim. 2008;55:289–93.
3. Gan EC, Habib AR, Rajwani A, et al. Five-degree, 10-degree and 20-degree reverse trendelenburg position during functional endoscopic sinus surgery: a double-blind randomized controlled trial. Int Forum Allergy Rhinol. 2014;4:61–8.
4. Atef A, Fawaz A. Comparison of laryngeal mask with endotracheal tube for anesthesia in endoscopic sinus surgery. Am J Rhinol. 2008;22:653–7.
5. Ha TN, van Renen RG, Ludbrook GL, et al. The relationship between hypotension, cerebral flow, and the surgical field during endoscopic sinus surgery. Laryngoscope. 2014;124:2224–30.
6. Ali MJ, Psaltis AJ, Wormald PJ. The frequency of concomitant adjunctive nasal procedures in powered endoscopic dacryocystorhinostomy. Orbit. 2015;34:142–5.
7. Champagne C, Ballivet de Régaloix L, Genestier L, et al. Endoscopic vs conventional septoplasty: a review of the literature. Eur Ann Otorhinolaryngol Head Neck Dis. 2016;133:43–7.
8. Kim DW, Egan KK, O'Grady K, et al. Biomechanical strength of human nasal septal lining: comparison of the constituent layers. Laryngoscope. 2005;115:1451–3.
9. Champagne C, Ballivet de Régloix S, Genestier L, et al. Endoscopic septoplasty: learning curve. Eur Ann Otorhinolaryngol Head Neck Dis. 2016;133:167–70.
10. Stallman JS, Lobo JN, Som PM. The incidence of concha bullosa and its relationship to nasal septal deviation and paranasal sinus disease. AJNR Am J Neuroradiol. 2004;25:1613–8.
11. Lloyd GA. CT of the paranasal sinuses: study of a control series in relation to endoscopic sinus surgery. J Laryngol Otol. 1990;104:477–81.
12. Fradis M, Golz A, Danino J, et al. Inferior turbinectomy versus submucosal diathermy for inferior turbinate hypertrophy. Ann Otol Rhinol Laryngol. 2000;109:1040–5.

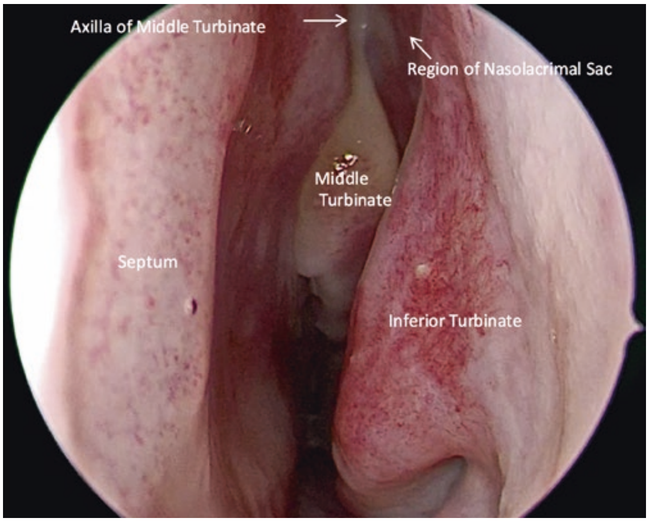

Fig. 29.1 Endoscopic view of the normal nasal anatomy

Fig. 29.2 The typical office setup for nasal endoscopy requires an electric adjustable examination chair, instrument trolley, and endoscopic camera stack and screens

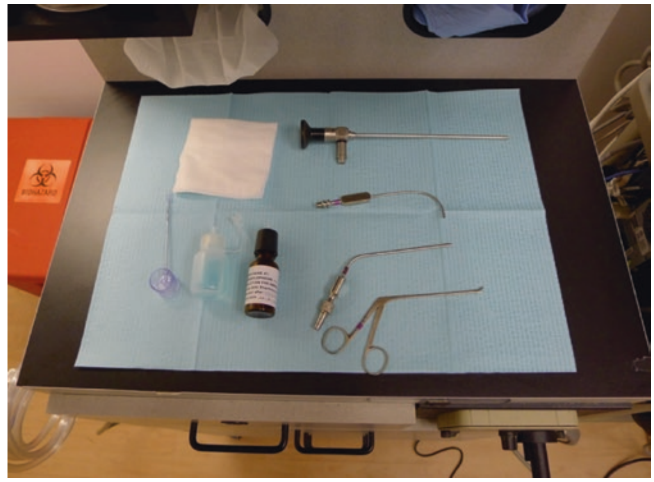

Fig. 29.3 Basic instrumentation includes topical anesthetic, rigid endoscope, angle and straight suctions, and endoscopic forceps

Fig. 29.4 Commercially available Cophenylcaine Forte™ (ENT technologies, Melbourne, Australia) is a combination spray containing a vasoconstrictor agent (phenylephrine hydrochloride) and an anesthetic agent (lignocaine hydrochloride)

Fig. 29.5 Using a flexible extended nozzle, this agent can adequately decongest and anesthetize the nose

Fig. 29.6 Positioning of the patient. The operating bed is reversed to allow the surgeons to sit and placed in a reverse Trendelenburg position to increase venous drainage away from the surgical field

Fig. 29.7 The surgeon is seated with his left elbow supported on an arm board. The monitor is placed directly across at eye level for comfort

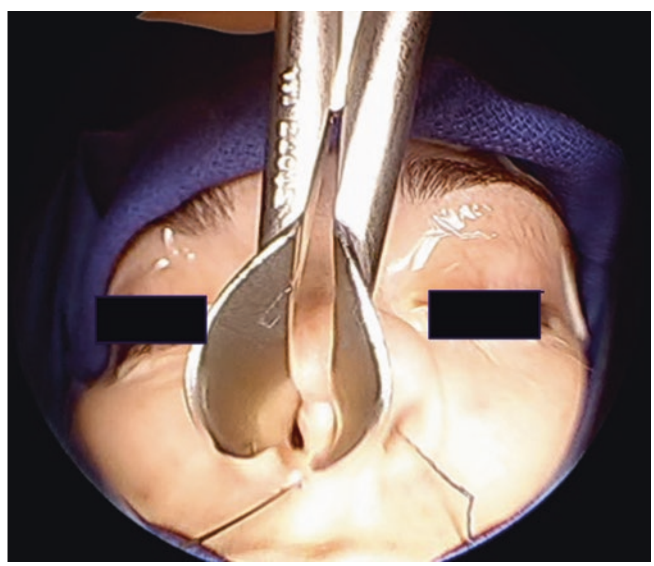

Fig. 29.8 External view of right caudal deviation

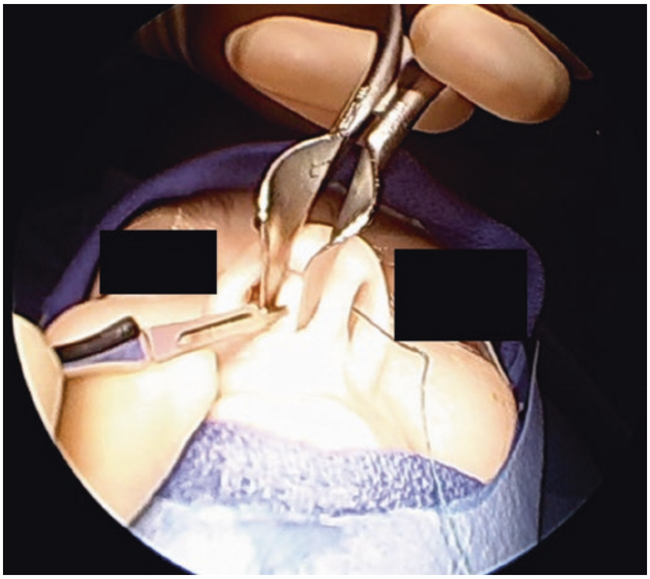

Fig. 29.9 Right hemitransfixation incision

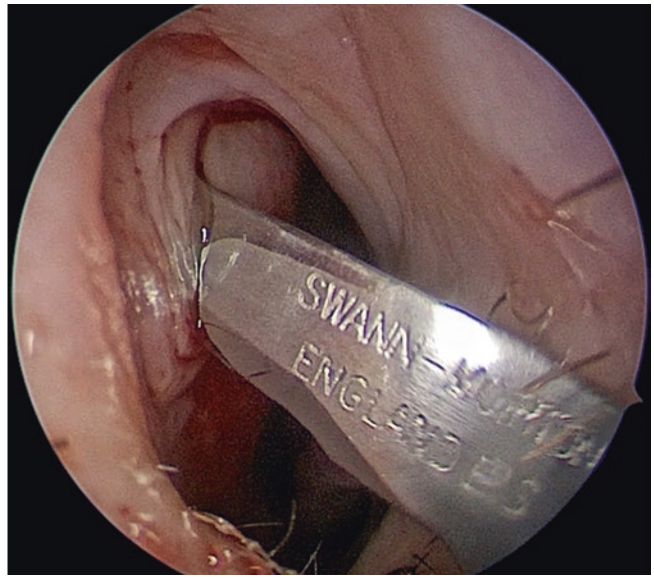

Fig. 29.11 Steps of endoscopic septoplasty. Killian incision with a 15″ blade at the mucocutaneous junction

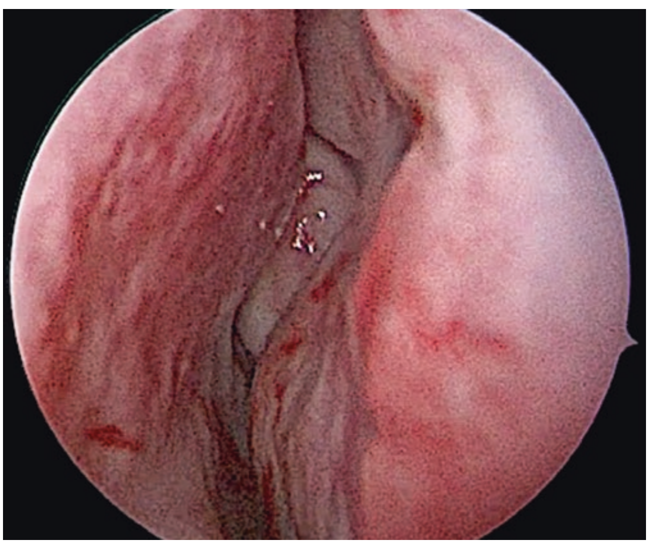

Fig. 29.10 Steps of endoscopic septoplasty. The high deviation of the septum prevents visualization and access to the axilla of the middle turbinate

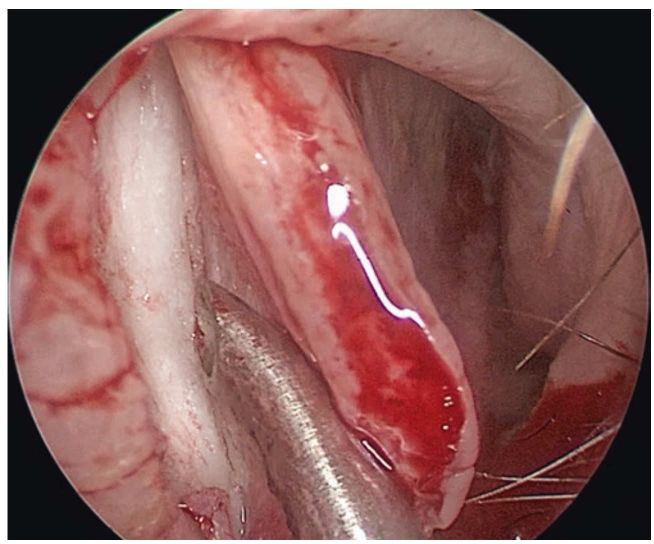

Fig. 29.12 Steps of endoscopic septoplasty. Identification of the submucoperichondrial plane using the sharp end of a malleable suction curette

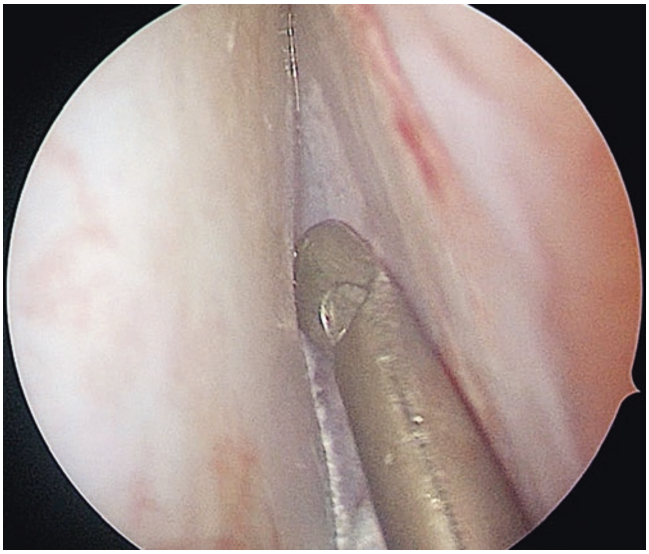

Fig. 29.13 Steps of endoscopic septoplasty. Raising of the sub-mucoperichondrial mucosa flap with the Freer's suction. Note the pearly white appearance of the underlying cartilage

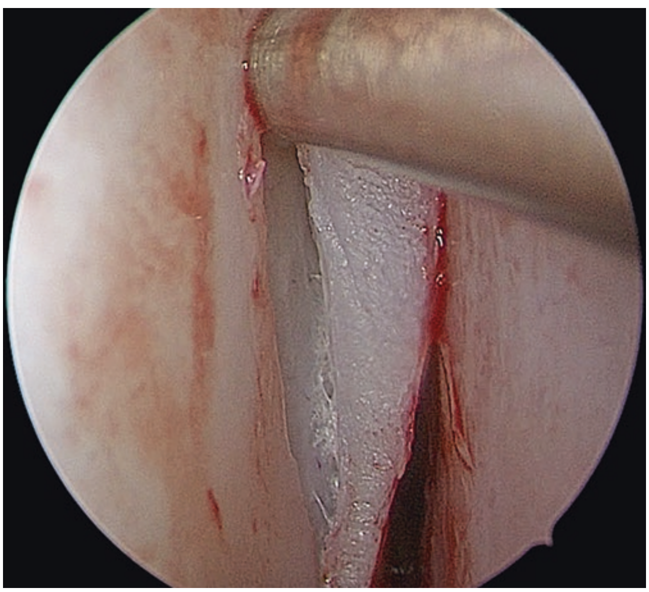

Fig. 29.14 Steps of endoscopic septoplasty. Transection of the cartilage just anterior to the deviation

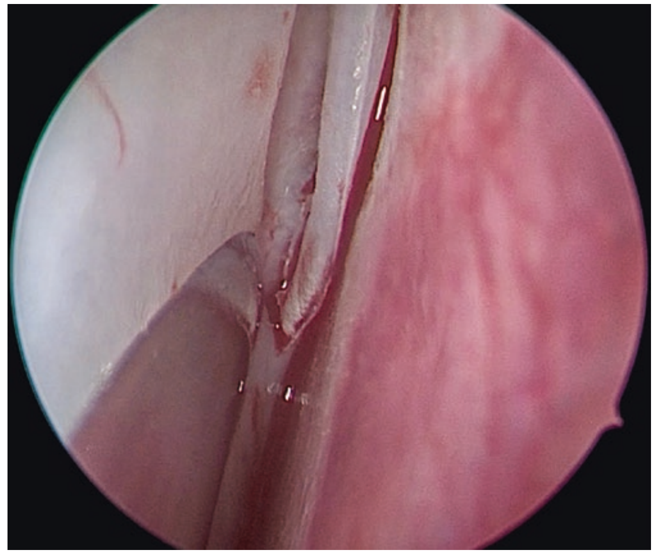

Fig. 29.15 Steps of endoscopic septoplasty. Raising of a contralateral sub-mucoperichondrial mucosal flap with isolation of the cartilage and bone centrally

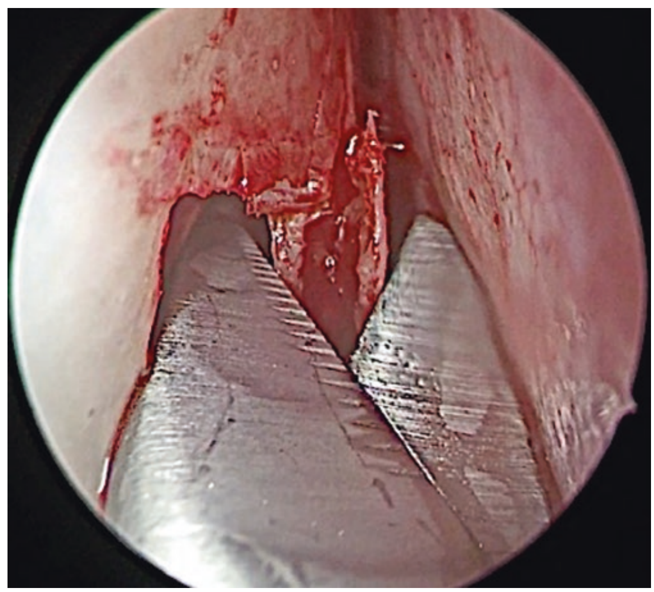

Fig. 29.16 Steps of endoscopic septoplasty. Superior "safety" cut with the turbinectomy scissors to prevent injury of the skull base on removal of the ethmoid bone

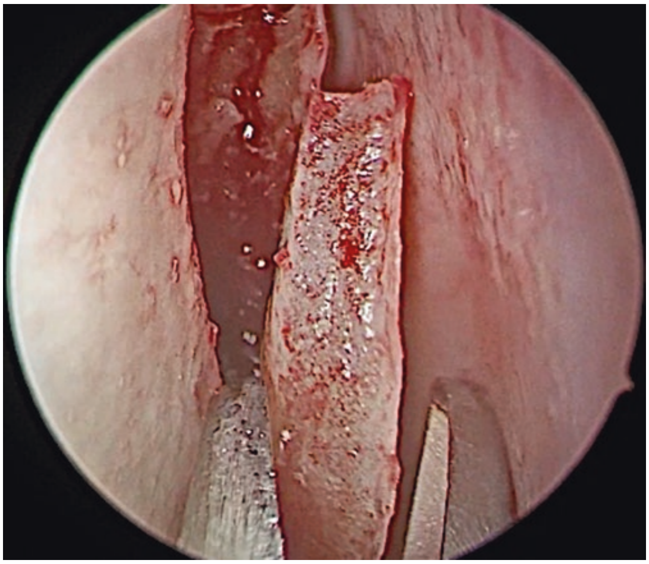

Fig. 29.17 Steps of endoscopic septoplasty. Removal of the cartilage using a grasping instrument

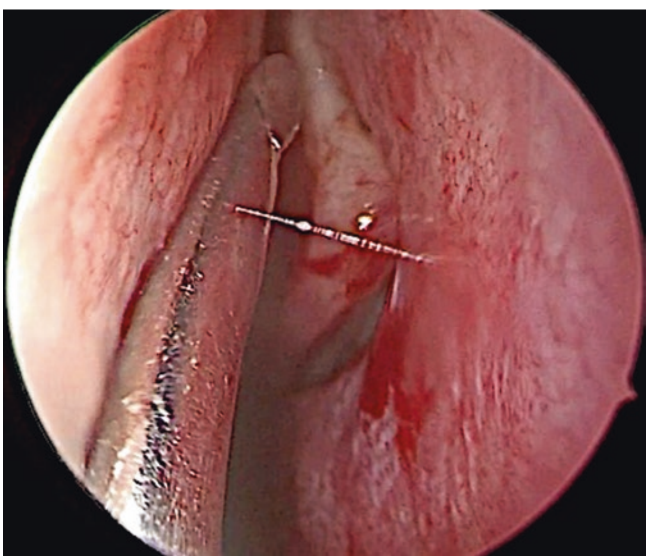

Fig. 29.18 Steps of endoscopic septoplasty. Freer's suction demonstrating the residual soft tissue of the septal mucosa that can now be easily retracted to allow visualization of the axilla of the middle turbinate and direct access to the frontal process of the maxilla for DCR surgery

Fig. 29.19 Coronal CT of the sinuses showing a pneumatization of the right middle turbinate (concha bullosa) with a corresponding deviation of the nasal septum to the left

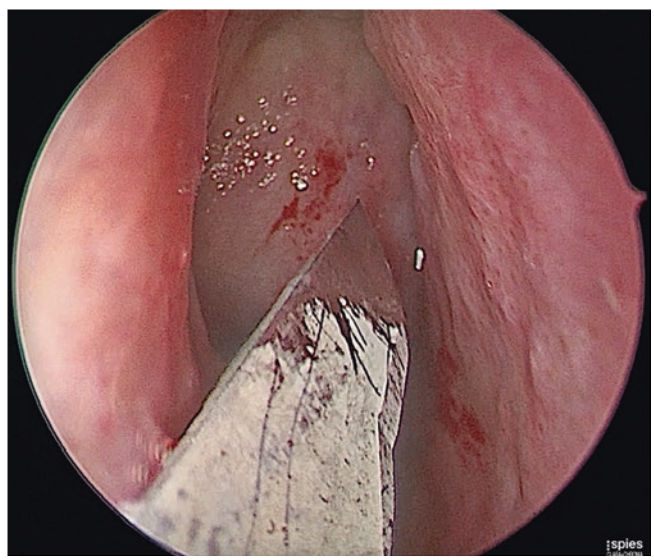

Fig. 29.20 Steps of middle turbinoplasty: stab incision is made in the head of the middle turbinate with a #15 blade

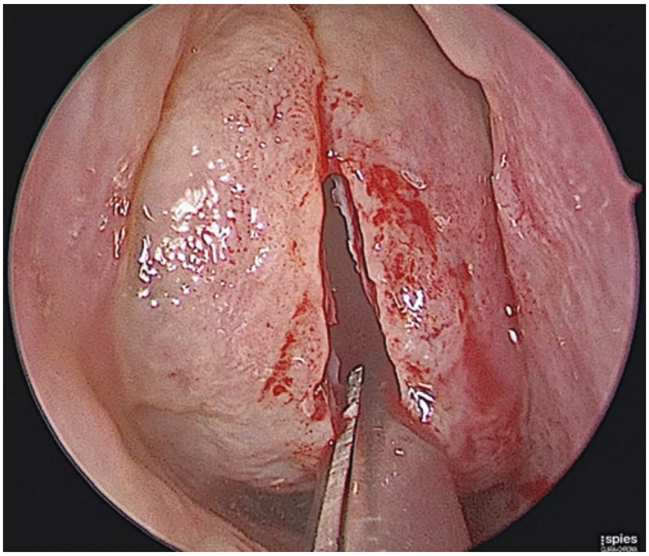

Fig. 29.21 Steps of middle turbinoplasty: incision is extended superior and inferiorly to distract the two leaflets of the middle turbinate

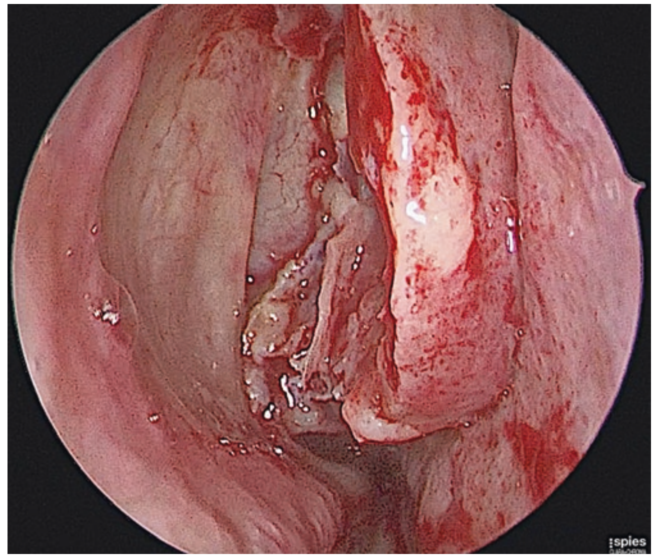

Fig. 29.23 Steps of middle turbinoplasty: completion of the concha bullosa resection. The medial leaflet is preserved and access to the lateral nasal wall increased

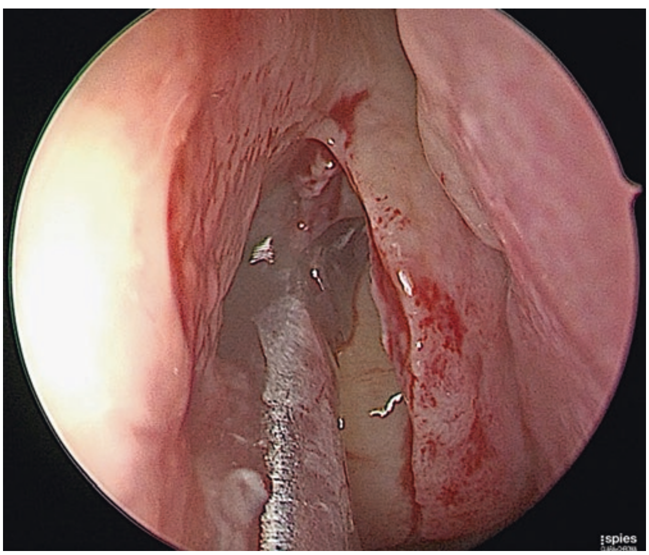

Fig. 29.22 Steps of middle turbinoplasty: cutting Blakesley forceps are used to complete the cut posteriorly

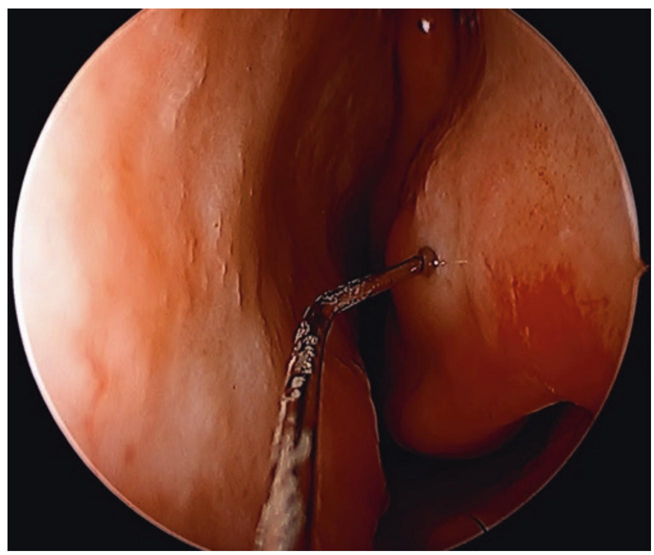

Fig. 29.24 Injecting into the head of inferior turbinate for decongestion

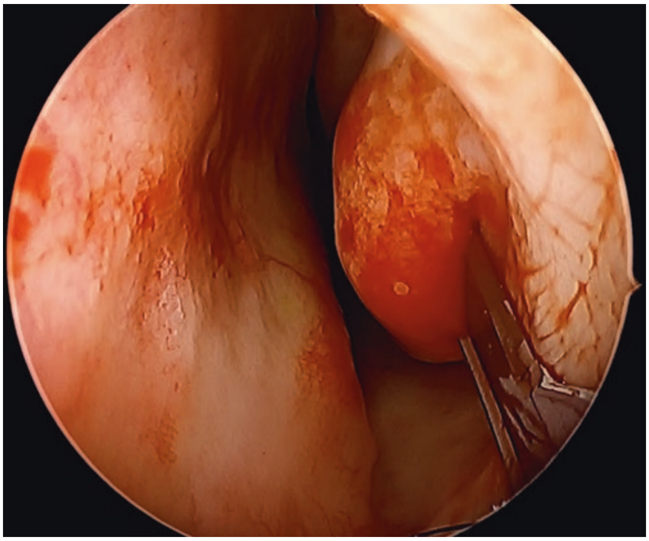

Fig. 29.25 Inferior turbinate incision

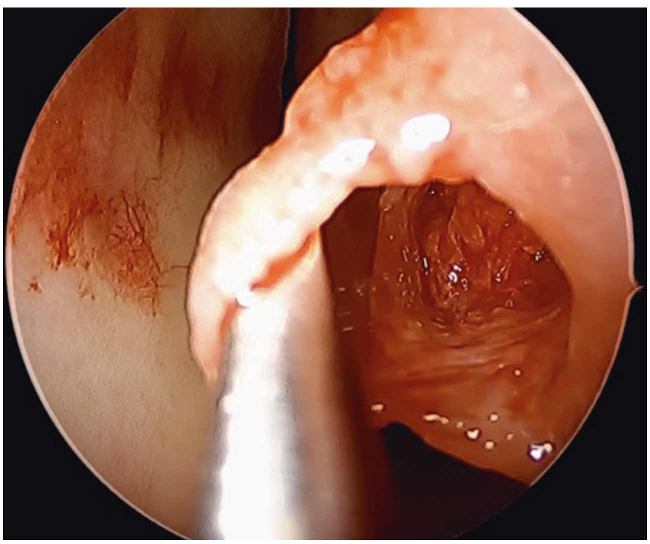

Fig. 29.26 Raising the submucosal plane

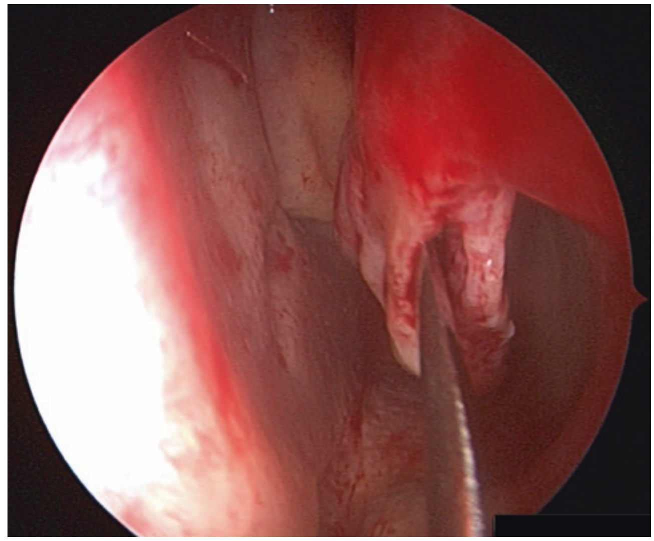

Fig. 29.27 Isolation of the inferior turbinate bone

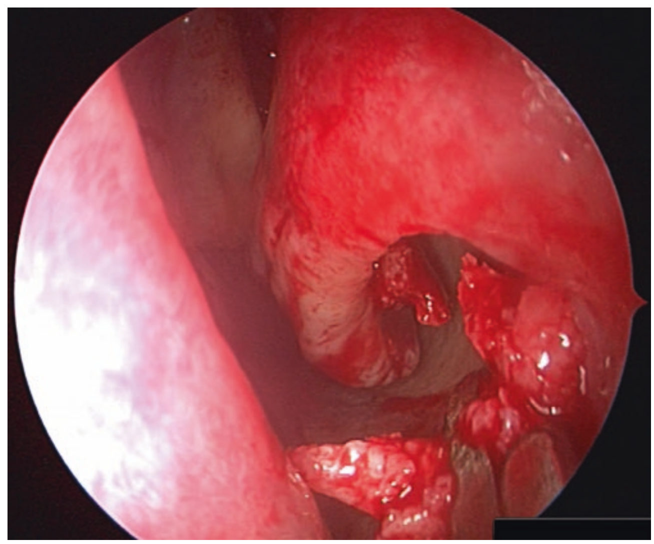

Fig. 29.28 Removal of the inferior turbinate bone

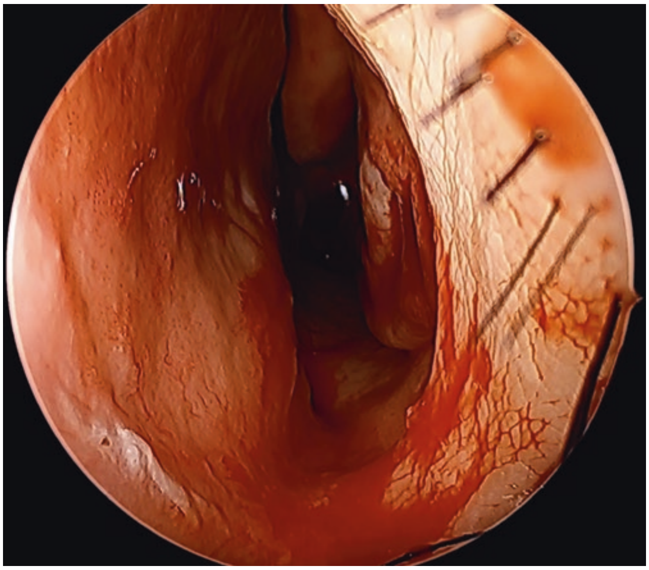

Fig. 29.29 Intraoperative photo following turbinoplasty

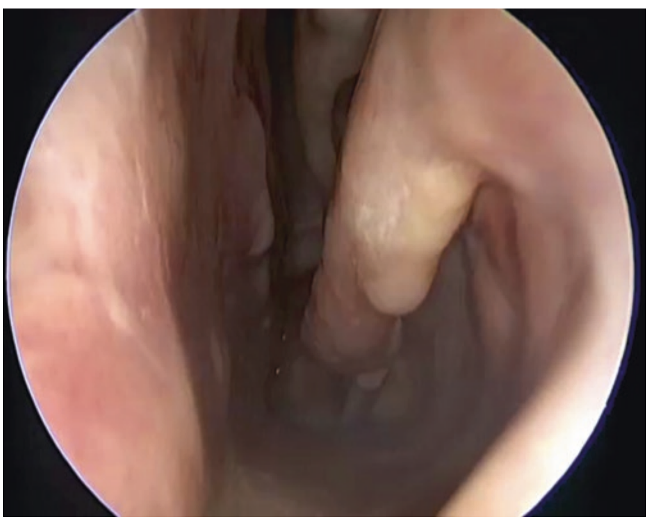

Fig. 29.30 Several months after septoplasty and inferior turbinoplasty, the well-healed mucosa and patent airway

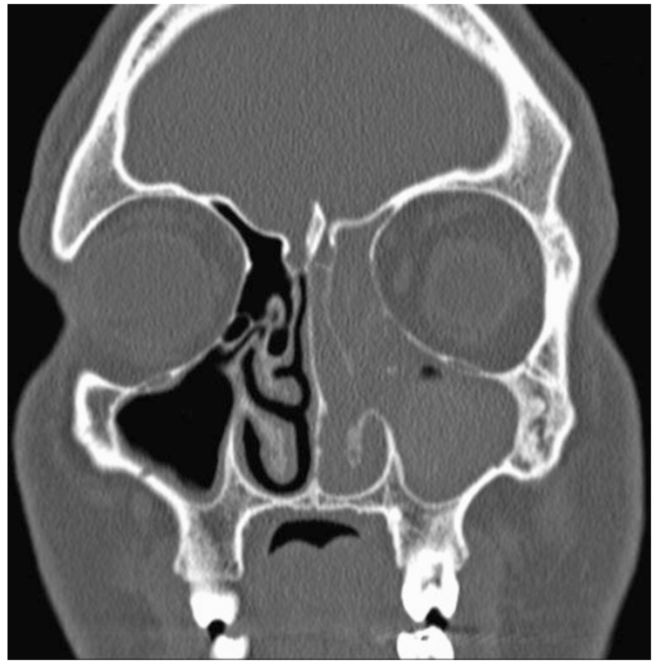

Fig. 29.31 Patient with a one-sided pansinusitis, seen as opacification of the sinuses and involvement of the lacrimal system

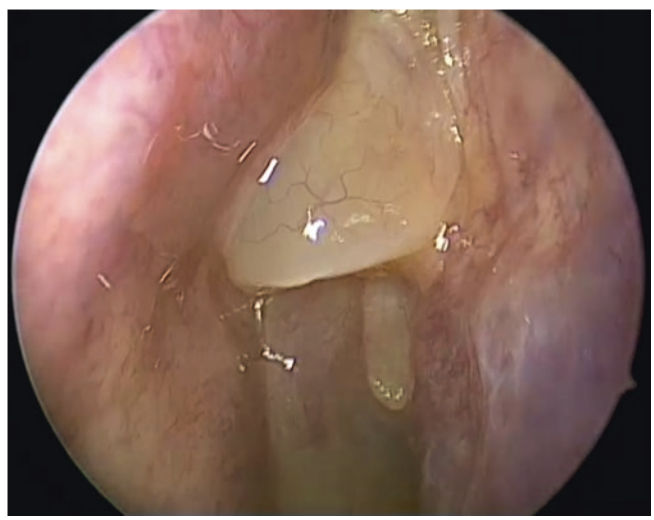

Fig. 29.32 Classic view of severe but benign-appearing nasal polyps