CHAPTER 12

SURGICAL MANAGEMENT OF THE SEPTUM, TURBINATES, AND NASAL VALVE IN THE TREATMENT OF NASAL OBSTRUCTION

INTRODUCTION

A detailed history and physical examination are critical first steps in the evaluation and treatment of every patient presenting with nasal obstruction. Sources of nasal obstruction may include septal deviation, inferior turbinate hypertrophy, nasal valve collapse, air filled middle turbinates (concha bullosa), polyps (FIGURE 1A), tumors, and others (TABLE 1). Chronic nasal obstruction is the most common presenting symptom of anterior ethmoid sinus disease, so the history should elicit the presence of post-nasal drip and cough, facial pressure or pain, ear pressure or pain, hearing loss, loss of sense of smell or taste, halitosis, and other pertinent findings suggestive of chronic or recurrent sinusitis. The patient should be questioned and, when appropriate, evaluated for allergies. All medications taken should be carefully recorded; a history of topical nasal decongestant abuse may lead to the diagnosis and treatment of rhinitis medicamentosa. It is critical to elicit a history of prior sinus surgery, rhinoplasty, or other nasal surgery (TABLE 1).

FIGURE 1A. Nasal polyps may cause nasal obstruction. This endoscopic photograph demonstrates nasal polyps emanating from the middle meatus into the nasal cavity.

SEPTUM

The nasal septum is a bony and cartilaginous structure located in the rough midline of the nose, which separates the right from the left side. While the septum may be slightly deviated to one side or the other in many patients, in some patients this deviation will cause a functional obstruction. Some areas in particular are more likely to cause functional obstruction. The front of the nares – the "nasal vestibule" – is the most narrow portion of the nasal airway. Deviation in this already narrow area, for instance, will often lead to functional obstruction.

TURBINATES

The inferior turbinates are highly vascular structures that extend from the front of the nose along the side of the nasal floor all the way back towards the opening into the throat (nasopharynx). These are the only structures within the nasal cavity that freely swell and shrink on a routine basis (the nasal cycle). When these structures are enlarged (hypertrophied), especially at the front of the nose, they can cause significant functional obstruction. In many instances patients with inferior turbinate hypertrophy can be managed with medical and allergy treatments. In other cases surgical reduction of the inferior turbinates may be indicated.

NASAL VALVE

The internal nasal valve refers to the cross-sectional area bordered by the junction of the caudal portion of the upper lateral cartilage and the nasal septum, circumscribing an angle of 9° to 15° in the normal Caucasian nose. The anterior head of the inferior turbinate, the septum, and the tissue surrounding the pyriform aperture also constitute a portion of this so-called "flow-limiting segment." The nasal valve area includes the cross-sectional area described by the internal nasal valve and is affected by the anterior head of the inferior turbinate, the septum, and the tissues surrounding the pyriform aperture.

Inspiratory collapse of the lateral nasal sidewalls with normal inspiratory negative pressure suggests inadequate rigidity of nasal supporting structures. Inspiratory collapse at the external valve is visible on examination and is indicative of flaccid soft tissue in this location. Similarly, inspiratory collapse may compromise function at the internal nasal valve. The patient's nose should be observed for collapse on normal inspiration.

A positive Cottle maneuver, while not always reliable, is consistent with a diagnosis of nasal valve collapse. In the classic description, the patient's cheek is lateralized; this movement is translated to the nose, where lateralization of soft tissue of the nasal valve occurs. Alternatively, the author prefers to support the nasal sidewalls at the location corresponding to the internal nasal valve area with a small curette or the back end of a Q-tip, lateralizing the lateral nasal sidewall 1–2 mm. When this maneuver relieves nasal obstruction, the diagnosis of functional valve collapse is supported.

Nasal valve collapse is commonly overlooked and must be considered in the complete evaluation of the patient with nasal obstruction. Certain elements of the history may prompt the rhinologist to give special consideration to the possibility of nasal valve collapse. Patients may

describe relief when they lift the soft tissues of the cheek (and thereby the lateral soft tissues of the nose)—which is known as "the Cottle sign." Also, some patients find relief from prosthetic devices such as the BreatheRite Strips, nasal stents, and other devices that lateralize the nasal soft tissues. This history may suggest the nasal valve as a contributing factor.

A past history of rhinoplasty with gradually worsening nasal obstruction may be seen in patients with nasal valve collapse. Cephalic resection of the lateral crura during rhinoplasty and subsequent postoperative soft tissue contraction may lead to internal and/or external nasal valve compromise. Other commonly performed surgical maneuvers such as dorsal hump reduction can result in loss of support to the middle vault, with narrowing of the middle vault with internal valve collapse.

Some patients have no history of prior surgery but simply have congenitally weak nasal sidewalls or narrow nasal valves. It may be this patient category in which nasal valve collapse is most frequently overlooked. With age, the nasal sidewalls weaken and sagging of the nasal tip, or tip ptosis, frequently occurs. This changes the nasal airflow pattern and contributes to nasal obstruction. These patients may have other causes of nasal obstruction such as a deviated septum and rhinitis. Although the other contributing factors may have been of longstanding nature, the gradual addition of nasal valve collapse and tip ptosis in the aging patient may result in a description of recent onset of nasal obstruction.

PHYSICAL EXAMINATION

Physical examination of the nose begins with an external nasal examination. Evaluating the nasal skeleton from the top down assures a stepwise and complete examination. A narrow middle third of the nose may be an indication of internal nasal valve compromise. External nasal valve narrowing and collapse also should be recognized when present. A severely deviated caudal septum may contribute to passive narrowing at the external nasal valve, and collapse of the mobile alar sidewall may provide an active component.

Intranasal exam should be performed before and after topicalization with a vasoconstricting agent. When indicated by the patient history or by findings on anterior rhinoscopy, a nasal endoscopic examination is also performed. Examination may reveal a deviated septum, polyps, turbinate hypertrophy, internal and external valve collapse, sinusitis, and other abnormalities (TABLE 1). A CT scan may be indicated in some patients.

There are a number of surgical approaches available to treat septal deviation, inferior turbinate hypertrophy, and nasal valve collapse. Selection of the appropriate surgical intervention depends on proper identification of the degree, location, and character of the anatomic cause of the obstruction.

Table 1. Differential diagnosis of nasal obstruction

Cause	**Example**
Allergic	Allergic rhinitis
Congenital	Encephalocele (iatrogenic or posttraumatic), glioma, teratoma
Chronic rhinosinusitis	
Endocrine	Pregnancy, hypothyroidism, adrenal insufficiency, menstruation
Iatrogenic	Atrophic rhinitis, overresection, overnarrowing after osteotomies
Infection	Acute and chronic rhinosinusitis, septal abscess
Inflammatory polyposis	
Mechanical	Deviated septum, nasal valve collapse, synechiae, nasal polyps, inferior turbinate hypertrophy, middle turbinate hypertrophy (including concha bullosa), adenoid hypertrophy, choanal atresia, septal hematoma
Medicinal	Rhinitis medicamentosa
Neoplastic	Benign and malignant nasal tumors
Foreign body	
Nasal cycle	
Other	

METHODS – SEPTOPLASTY

The anatomy of the septum is well recognized by nasal surgeons (FIGURE 1-B). In this section, we will consider traditional septoplasty, endoscopic septoplasty, and septoplasty techniques to address the caudal septum. We prefer the traditional septoplasty approach (as opposed to endoscopic septoplasty) for broad deviations and for primary septoplasty. Endoscopic approaches are less invasive and advantageous for focal deflections and spurs, as well as for revision septoplasty. Caudal septal deflections require special attention.

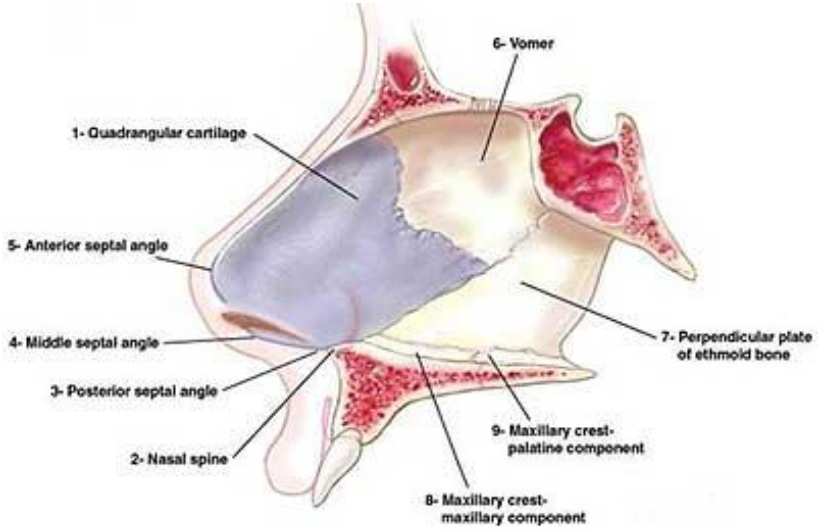

FIGURE 1-B – Anatomy of the nasal septum (side view)

To perform a traditional septoplasty, first we retract the columella with a small nasal speculum, but a columellar retractor, large 2-prong hook, or other suitable instrument may also be used. The purpose is to expose the caudal margin of the septum and to protect the columella from injury. Next we make a hemitransfixion incision extending from the anterior septal angle to the posterior septal angle along the caudal border of the cartilaginous septum with a 15 blade or 15-C blade. We use a modified Killian incision if less exposure is necessary. However, if we need access to the caudal septum or need to separate the upper lateral cartilages from the dorsal septum to place spreader grafts, or if we simply feel that we require the widest possible exposure, we will use a hemitransfixion incision.

The classic Killian incision extends posterior-inferiorly. Frequently, as dissection proceeds posteriorly, a tear occurs along the inferior aspect. When the cartilage isincised to allow submucoperichondrial dissection on the opposite side, at this location, the mucoperichondrium is at risk for tearing directly opposite the Killian incision. This puts the patient at high risk for a septal perforation. At this location, septal perforations are frequently symptomatic. The modified Killian incision avoids the risks of the classic Killian incision while bypassing the caudal septum (FIGURE 2). This incision placement also permits extension along the floor, which is useful if a floor tunnel becomes necessary (eg, when the patient has a severe spur along the maxillary crest).

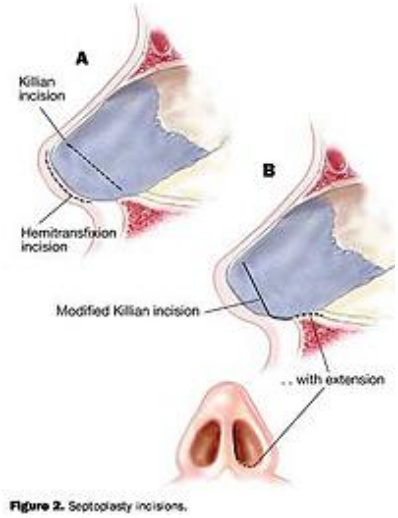

Figure 2. Septoplasty incisions.

Using a 15 blade, small sharp pointed scissors, or other suitable instrument, we then incise the perichondrium of the septum adjacent to the caudal septum on one side. We perform a submucoperichondrial dissection along the lower half of the septum to allow harvest of septal cartilage, if needed. If we plan to place a spreader graft by way of an endonasal approach, we are careful not to extend this dissection too high, so that later in the dissection we can make a precise tunnel for the spreader graft.

Next we elevate the mucoperichondrial flap on the opposite side. If we have used a hemitransfixion incision, we begin at the caudal septum. If we have used a modified Killian incision, we gain access to the opposite side by incising the cartilage just anterior to the offending (deviated) portion, taking great care to preserve a generous L-strut of at least 15 mm for continued nasal support (FIGURE 3).

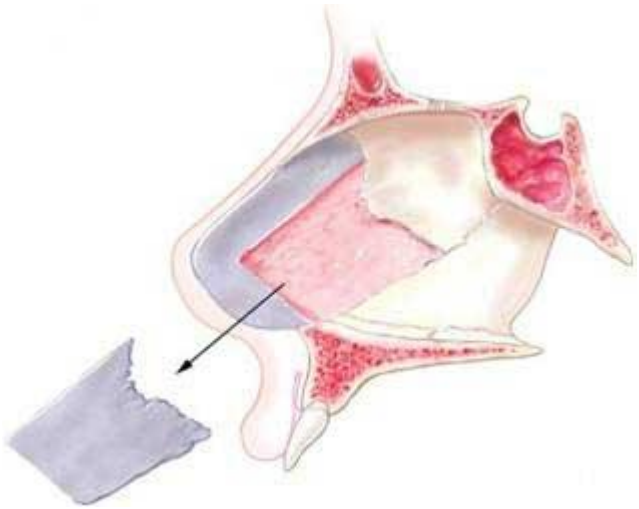

FIGURE 3. Maintain a generous L-strut.

In patients with a severely deviated caudal and dorsal septum, the offending portion may be excised and replaced with a straight piece of cartilage, typically harvested from the septum more posteriorly. Suture fixation to a stable segment of cartilage attached at the osseocartilaginous junction and nasal spine will allow reconstruction of an intact L-strut to support the lower third of the nose. The reconstructed caudal segments can be sutured between the medial crura to set nasal length, projection, rotation, and alar-columellar relationship.

Dr. Norman Pastorek and Dr. Daniel Becker described a modified swinging-door technique for treatment of the caudal septum. The septal cartilage along the maxillary crest is dissected free but not excised. Instead, the caudal septum is flipped over the nasal spine, which acts as a "doorstop" and secures the caudal septum in a straighter position (FIGURE 4).

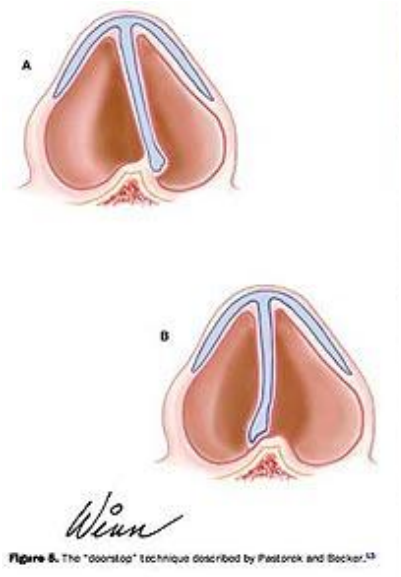

Figure 4. The "doorstop" technique described by Dr. Norman Pastorek and Dr. Daniel Becker.

METHODS – ENDOSCOPIC SEPTOPLASTY

Endoscopically guided septoplasty is useful in difficult revision nasal surgeries in which obstructing septal deviation persists. Indications for endoscopic septoplasty include an isolated septal deformity, or a posterior septal deformity in a patient with densely adherent septal mucosal flaps, typically found in cases of revision septoplasty.

If septal deviation persists posteriorly after a septo-plasty, persisting nasal obstruction may require revision septoplasty. Because the mucosal flaps are often densely adherent after a septoplasty, revision septoplasty involving a traditional approach may present technical difficulty, including significant risk of septal perforation. Endoscopic septoplasty is a relatively recent and important technique.

The endoscopic approach may be a useful adjunct in difficult revision cases in which complete elevation of a mucoperichondrial flap presents difficulties, such as a persistent posterior septal obstruction after prior septoplasty or after septal injury (such as hematoma or abscess) with loss of cartilaginous septum. In these cases, typical surgical dissection planes are obliterated and complete elevation of a mucoperichondrial or mucoperiosteal flap may be difficult. The ability to address a persisting deviation, elevating the mucosal flap directly over the offending deviation using endoscopic techniques greatly facilitates treatment.

METHODS – REVISION SEPTOPLASTY

Some patients may have persistent nasal obstruction even after septoplasty. Dr. Samuel Becker along with Dr. Stephen Park and others performed a careful review of patients who underwent revision septoplasty. In some cases, areas of the septum had re-deviated, or had been left unaddressed. In other cases, many patients had concomitant nasal valve collapse which was left untreated at the time of septoplasty. Careful evaluation of the nasal valve should be performed at the time pre-operative examination. Not all nasal valve collapse needs surgical correction; however, the nasal valve area should be examined prior to surgery to correct septal deviation.

METHODS – INFERIOR TURBINATE REDUCTION

Treatment of the inferior turbinates is a matter of some controversy. Some authors advocate inferior turbinate sacrifice as an almost routine treatment of nasal obstruction; others categorically advise against surgical reduction because of the risk of atrophic rhinitis. In our view, there should be a balanced approach. A thorough search to determine the cause of nasal obstruction is essential, and that cause should be addressed. The proper treatment of nasal obstruction is not simply turbinectomy. By the same token, it is unlikely that the inferior turbinates are immune from pathologic conditions; turbinate hypertrophy must be recognized. A graduated stepwise approach to the inferior turbinates is prudent. It is possible that atrophic rhinitis does develop in some patients after inferior turbinectomy, so we undertake this procedure with great caution. Also, newer techniques have been designed specifically to limit the incidence of atrophic rhinitis.

The advent of radiofrequency devices (Somnus Medical Technologies Inc., Sunnyvale, CA; Coblation Corp., California) to reduce the size of the inferior turbinates has been a significant advance providing a conservative procedure that may be performed with the patient under local or general anesthesia as an alternative to more aggressive approaches.

Radiofrequency (RF) volumetric tissue reduction uses radiofrequency heating to induce submucosal tissue destruction, leading to reduction of tissue volumes. The RF generator (Somnus Medical Technologies) is connected to a specialized single-use delivery tip and handpiece. The tip is a 22-gauge electrode, 4 cm long; the active portion is 1 cm, and the remaining 3 cm is insulated. Two thermocouples allow constant temperature feedback at the location of treatment and in the surrounding tissue, thereby limiting mucosal injury. Topical and infiltrative anesthesia is used. To avoid tissue shrinkage, some surgeons prefer not to use vasoconstrictive agents, which could increase the risk of mucosal injury. Under direct vision, we place the RF electrode in the anterior-inferior portion of the turbinate, with several millimeters of the inactive portion in contact with the mucosa to avoid mucosal injury. We then deliver the RF energy at a specified energy setting. Measure the temperature at the delivery site constantly, and modulate the rate of energy delivery to ensure a maximal temperature of less than 75°C. This allows the procedure to be performed with the patient under local anesthesia, without pain. Time and experience have shown that the recommended energy levels create a submucosal injury that causes favorable tissue shrinkage. Often a second lesion immediately posterior to the first is both safe and effective. Several authors have suggested that is reasonable to expect 70% to 80% subjective improvement in patients treated with this technique.

When more aggressive treatment of the inferior turbinates is warranted, a submucosal elevation of the turbinate with or without resection of the bulky bone of the inferior concha is preferred. With newer techniques using powered instrumention, the submucosal tissues of the inferior turbinate which provide the bulk of the turbinate can be removed in a fairly atraumatic fashion with a resultant decrease in the overall size of the turbinate. Another technique involves resection of the lateral aspect of the turbinate along with the bony concha. We tend to reserve this latter technique for patients with severe turbinate hypertrophy. All of these newer techniques, however, are designed to preserve the inferior turbinate's physiological functions of warming, lubricating, and air-conditioning are preserved.

TREATMENT OF NASAL VALVE COLLAPSE

Alar batten grafts are especially useful in addressing nasal valve collapse caused by a weak nasal sidewall. Specific aspects of the patient's history may be positive factors suggesting the need for alar batten grafts. A history of inspiratory collapse, benefit from using the Breathe-Rite Strips, and a history of benefit from "lifting the cheek" (Cottle sign) are positive factors. Prior history of rhinoplasty with subsequent gradual onset of nasal obstruction is also suggestive of nasal valve collapse.

On physical examination, inspiratory collapse may be subtle or obvious (FIGURE 5). A Cottle test is a critical objective finding and must be performed by an experienced clinician to have positive predictive value. Prior to topicalization of the internal nose, the back end of a Q-tip or some other small instrument is used to elevate the sidewall of the nose approximately 1–2 mm. If the patient reports definite benefit from this conservative elevation of the nasal sidewall, then alar batten grafts may be beneficial.

In older patients, elevation or "rotation" of a ptotic tip may also relieve nasal obstruction. In this situation, rhinoplasty with tip projection and rotation are considered in addition to repair on the nasal sidewall collapse. If the patient has had prior rhinoplasty and now has excessive collapse, retraction, and weakness of the nasal sidewalls on physical examination, alar batten grafts are indicated. At times the retraction may be so severe that composite grafts of skin and cartilage may be required.

FIGURE 5. This patient had a prior history of septoplasty and rhinoplasty and had obvious inspiratory nasal collapse on mild nasal inspiration. Her septum was straight. Her nasal obstruction was successfully addressed with ear cartilage harvest and alar batten grafts. Preoperative view is on the left. Postoperative view is on the right.

METHODS – ALAR BATTEN GRAFTS TO TREAT NASAL VALVE COLLAPSE

A.Cartilage Harvest

If septoplasty has not been performed, septoplasty may be done not only to correct any deviation that exists but also to harvest cartilage for batten grafting. A significant amount of cartilage must be obtained, but great care must be taken to maintain a generous L-strut for continued nasal support. In patients who have not had prior septoplasty, ample septal cartilage is typically available. When septal cartilage is not available, auricular cartilage is obtained. Auricular cartilage has a curvature that makes it ideally suitable for alar batten grafts. Although alloplastic material is available for alar batten grafts, the authors do not advocate its routine use because of the risk of infection and extrusion.

B. Alar Batten Graft

Alar batten grafts, typically of curved septal or auricular cartilage, placed to support the alar rim can correct internal or external nasal valve collapse. Alar batten grafts may be placed via a precise pocket. A graft is fashioned from harvested auricular or septal cartilage. Auricular cartilage has a favorable curvature and in this respect is preferred, but septal cartilage is

satisfactory and is used preferentially when it is available. When a cartilage graft has a curvature, the convex side of the graft is oriented laterally to correct the supra-alar pinching.

Through a limited marginal incision, a precise pocket may be fashioned using scissor dissection at the point of maximal supra-alar collapse. Marking the location of the precise pocket on the skin prior to infiltrative anesthesia is helpful. The graft is typically placed caudal to the lateral crura at the point of maximal lateral nasal wall collapse. Suture fixation is not necessary. The pocket is subcutaneous, but if the pocket is too superficial the graft may be palpable or visible (FIGURE 6).

a

b

c

FIGURE 6 - Precise pocket alar batten graft, surgical technique. (a) The site of the proposed graft may be marked on the skin prior to infiltrative anesthesia. (b) Auricular cartilage is harvested and fashioned into batten grafts. Alar batten grafts are most effective when they extend beyond the pyriform aperture. (c) The grafts are placed through an endonasal approach via a limited marginal incision. (Photographs reprinted with permission from revisionrhinoplasty.com).

The graft is non-anatomic and is typically placed caudal to the lateral crura, where there is maximal collapse of the lateral nasal wall and supra-alar pinching. For maximal support, the alar batten graft should extend over the bone of the pyriform aperture. If alar batten grafts are placed too far cephalic, excessive fullness over the middle vault will be noted. Alar batten grafts may also be placed via an external rhinoplasty approach. This approach may be preferable when other reconstructive work is required. In this setting the graft is typically secured with a suture applied medially from the graft to adjacent soft tissue or lateral crus. Because of the non-anatomic placement, there is often a slight cosmetic change. We inform all patients undergoing this procedure that the nasal sidewall is likely to have a more full, less "pinched" appearance (FIGURE 7).

In a review of 21 patients who had septoplasty with placement of alar batten grafts performed by Dr. Daniel Becker (16 of these 21 patients were referred to Dr. Becker by other otolaryngologists) all 21 of these patients noted improvement in their nasal breathing. The same review identified 7 patients who underwent ear cartilage harvest with alar batten grafts. This group is of great interest, because the only intervention for nasal obstruction was placement of batten grafts. All had undergone prior septoplasty and four out of the seven had undergone prior FESS and had persistent nasal obstruction. Five noted improvement, one noted partial improvement, and one noted no improvement. All patients who received alar batten grafts were informed that the nasal sidewall would have a more full, less "pinched" appearance. All patients who underwent alar batten grafts were satisfied with the aesthetic appearance of this area.

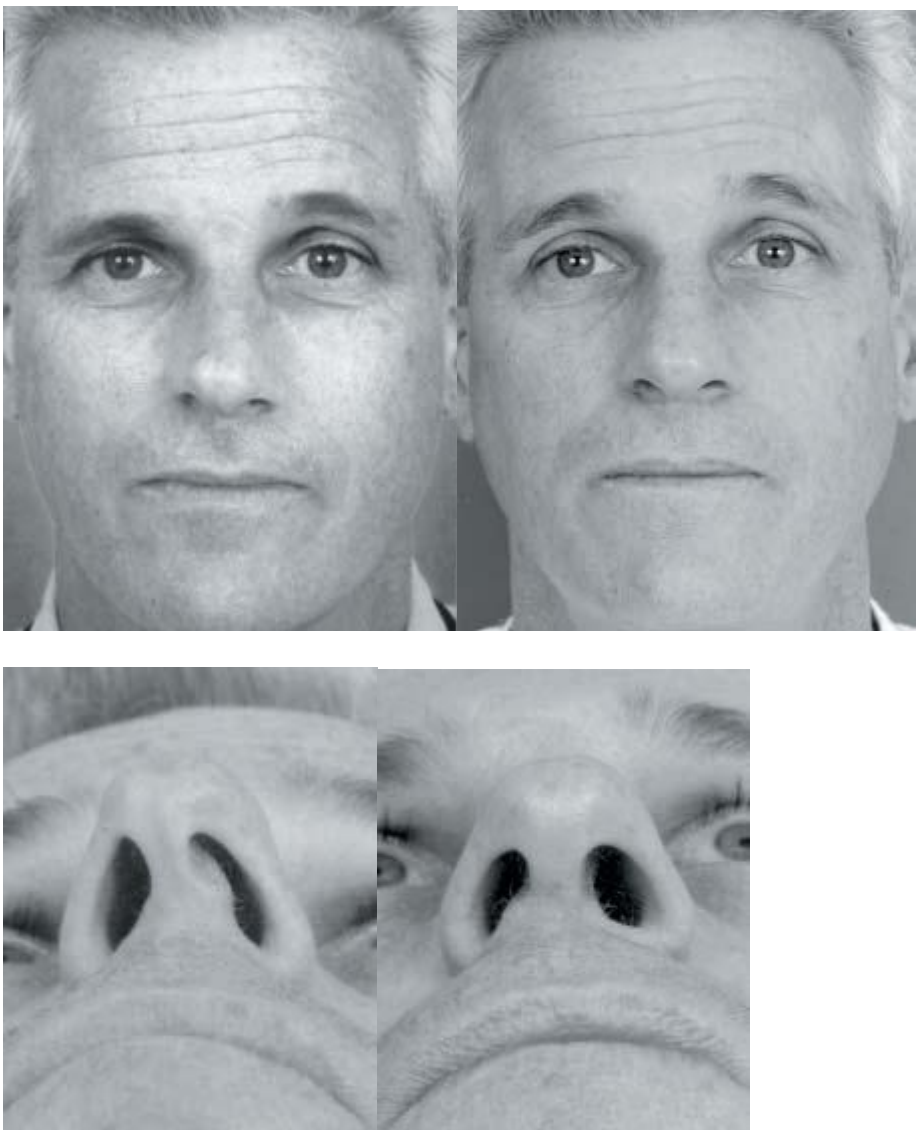

FIGURE 7. This patient had a caudal septal deviation causing passive external nasal valve collapse and also had an excessively concave lateral crura contributing to nasal obstruction. In this case the caudal septum was straightened and the right lateral crus was excised and "flipped" to achieve both aesthetic improvement and improvement in the nasal valve area. (a,b) preoperative; (c,d) postoperative. (Reprinted with permission from therhinoplastycenter.com.)

DISCUSSION

Careful evaluation of patients presenting with nasal obstruction should include a thorough history and physical examination, usually with nasal endoscopy. Identification of the correct source(s) of obstruction allows for an appropriate, targeted surgical intervention.