Saddle Nose Deformity

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The term saddle nose deformity is a nonspecific description of a nose with a depression over its dorsal surface. The actual depth of depression, the degree of nasal obstruction, and the physical findings may vary considerably from patient to patient. The literature is filled with a wide range of treatment recommendations for the saddle deformity. This vast array of treatment options corresponds with the wide spectrum of deformities that fall under this title and the difficulty surgeons often encounter when treating severe saddle deformities. The spectrum of deformity ranges from a patient who has a mild supratip depression and a normal airway to a patient who has a massive depression of the entire bonycartilaginous nasal complex associated with severe nasal obstruction. The treatment techniques for correcting saddle nose deformities obviously vary and range from simple onlay grafting to complex reconstruction that might require bone grafts with internal fixation, cartilage grafts, composite grafts, or soft-tissue flaps. In this chapter, we review the workup, analysis, classification, and the options available for treating the various types of saddle nose deformities.

HISTORY AND PHYSICAL EXAMINATION

A successful outcome in medicine and surgery always begins with a thorough history and physical examination. The surgeon must determine each patient's aesthetic concerns and also define the functional goals in terms of the nasal airway.

The etiology of the saddle nose deformity may be congenital, traumatic, iatrogenic, infectious, or pathologic. It is important to determine the etiology because the deformity may be one that progresses or fluctuates, and there may be an ongoing pathologic process that requires medical management. The most common cause of saddle deformity is trauma. Iatrogenic causes can be included within this group because the saddle is essentially the result of surgical trauma.

The patient's general health should be reviewed to rule out systemic causes of saddle nose deformity, such as relapsing perichondritis, Wegner's disease, syphilis, T-cell lymphoma (lethal midline granulomatous disease), or a paranasal sinus malignancy. These systemic diseases and malignancies are destructive processes that lead to perforation of the septum and loss of dorsal nasal support. Obviously, a diagnosis of this nature requires medical management before reconstructive surgery.

Reviewing the records of previous surgery(ies) may be helpful to determine the position of previous grafts and incisions. The surgeon should know the previous cartilage donor sites so that healthy cartilage can be obtained with minimal risk of septal perforation, ear deformity, or pneumothorax

During the examination, the surgeon must determine the status of the bony pyramid, the septum, the upper lateral cartilages and nasal valve region, and the lower lateral cartilages and nasal tip. Intranasally, the surgeon must pay particular attention to the nasal valve and its effect on the nasal airway. The general health of the tissue in this region is also assessed to determine whether there is a great deal of scar contracture or tissue thickening. In general, patients who have small saddle depressions in the supratip region have normal airways. However, even patients who have small external deformities may have significant airway obstruction if nasal valve collapse is present. It is important to determine the status of the nasal valve, because placing a dorsal onlay graft to correct the supratip saddle may not adequately address the nasal valve collapse and may actually exacerbate and stabilize the nasal obstruction.

One must determine whether the nasal valve collapse is secondary to loss of cartilaginous support or secondary to nasal stenosis caused by scar contraction of the inner nasal lining. In cases of nasal stenosis, the collapsed valve is fixed in position, and during examination the nasal airway will not improve with lateral traction on the cheek or manual rotation of the nasal tip superiorly. Many patients who have nasal stenosis have had previous surgery. Often, they have undergone multiple attempts at reconstruction in which numerous incisions have been used with inadequate grafting techniques that fail to open the nasal valve.

The septum is examined, and if a septal perforation is present, the surgeon must carefully inspect the margins of the perforation to assess the general health of the remaining septal cartilage and mucosa. The margins of the perforation are gently palpated with a cotton-tipped applicator to determine the size and stability of the dorsal and caudal struts, because they are vital support structures. The condition of the remaining septum and the size of the perforation will determine whether the perforation is repairable.

CLASSIFICATION

Once the history and examination is completed, we find it helpful to classify the saddle deformity into one of five broad types.

Type 1

A type 1 deformity is a mild supratip saddle with a normal airway. Supratip depression of 1 to 2 mm from the tip defining point is generally acceptable, but depressions beyond that are considered to be a mild saddle deformity. For these patients, the deformity is usually secondary to trauma or previous surgery, but occasionally it is congenital.

Type 2

In a type 2 deformity, there is moderate depression of the dorsal septum and upper lateral cartilages, with mild collapse of the nasal valve. In these patients, the collapse of the nasal valve will cause nasal obstruction, and a simple onlay graft may not improve the nasal airway.

Type 3

Type 3 deformity consists of moderate depression of the dorsal septum and the upper lateral cartilages with nasal stenosis. In these patients, the inner lining of the nose is also contracted; additional lining may be required along with cartilage grafts.

Type 4

In a type 4 deformity, there is depression of the cartilaginous and bony nose, with an intact but deviated septum. These patients require large onlay grafts of bone and cartilage, or both. The status of the nasal valve must be addressed, as is the case for the other types. The deformity in these patients is usually secondary to severe nasoethmoid-complex trauma and may be associated with traumatic pseudotelecanthus.

Type 5

The most severe deformity is a massive depression of the cartilaginous and bony nose without a septum. These patients will require large bone grafts that may need to be cantilevered to provide dorsal support, because the graft cannot be placed in an onlay fashion. In some patients, the inner mucosa and the external skin of the nose is deficient or contracted, and in some of these patients, a forehead flap may be necessary to provide additional skin to correct the saddle deformity.

Although this classification scheme is broad, it helps to clarify the extent of the deformity and assists in surgical planning. Accurate evaluation and planning will lead to a satisfactory cosmetic and functional result.

THERAPY

Once the classification has been determined, the surgeon has roughly established the level of surgical complexity that is necessary to correct the deformity. This information is helpful to both the surgeon and the patient in terms of perioperative and operative planning.

Type 1

For mild supratip saddle deformities, a simple onlay graft of septal or conchal cartilage placed into a small pocket through an intercartilaginous incision is generally recommended. For larger depressions that do not affect the nasal valve, we still prefer using layered autologous cartilage, although some surgeons prefer synthetic implants such as solid silicone or Gore-Tex. Dorsal augmentation of Asian or African-American noses are examples where synthetic implants are commonly used.

Type 2

For moderate-sized depressions associated with nasal valve collapse, the nose is approached using an open technique and a transcolumellar incision. Others may prefer to use an endonasal approach. In type 2 cases, the upper laterals are separated from the dorsal septum, and the mucosa is elevated from the septum bilaterally. In our technique, a single onlay spreader graft is designed from conchal or septal cartilage. It is cut into a trapezoid shape approximately 3 to 4 mm along the superior margin, 5 to 8 mm along the inferior margin, and 15 mm in length (Fig. 1). The onlay spreader straddles the depressed dorsal septum and is sutured to the margins of the upper lateral cartilages. This single spreader onlay graft serves to open the nasal valve and simultaneously elevate the depressed saddle deformity. Occasionally, bilateral medial osteotomies are done before placement of the onlay spreader graft to outfracture the nasal walls and help open the nasal-septal angle. Multiple trans-septal sutures are then placed beneath the onlay graft to reapproximate the mucosa to the septum and support the graft. This also prevents webbing of the nasal valve mucosa at the nasal-septal angle. Intraoperative improvement of the nasal-septal angle should be observed. If the dorsal profile is still undercorrected, a simple dorsal onlay graft can be placed over the onlay spreader graft. The single onlay spreader graft in the type 2 deformity is preferred over two separate sheen-type spreader grafts, because the dorsal septum is depressed in the saddle nose deformity, and placing separate spreader grafts on either side of the depressed septum will not increase dorsal projection. The single onlay spreader graft not only increases the dorsal projection, but also lateralizes and dorsally elevates the medial margin of the upper lateral cartilages.

Type 3

For cases of moderate depression with nasal stenosis, we use the same external approach and separate the upper lateral cartilages from the septum. The mucosa is mobilized, and if the stenosis improves or resolves, the reconstruction is done using the onlay spreader technique as described in type 2**.** However, if the stenosis remains, the nasal valve stenosis is opened by making an incision through the mucosa on either side of the septum. An elliptical composite graft of skin and cartilage is harvested from the posterior conchal bowl. The skin on the graft is vertically transected across the short axis, creating two islands of skin fixed to the cartilage. The composite graft is then straddled over the dorsal septum and sutured into position. The nose is packed with a soft sponge dressing for 3 to 5 days. In many of these patients, the nasal tip has also lost projection due to collapse of the septum and the septal angle. This problem is addressed in the standard manner using columellar struts and tip grafts.

In cases in which there is massive loss of the dorsal cartilaginous and bony support, a graft of sizable dimensions is required. Our first choice is autologous septum and conchal cartilage (sometimes bilaterally) and pieces of the vomer or perpendicular plate. However, these defects often require larger grafts, and we generally prefer using split calvarial bone or rib. If rib is selected, the graft is harvested at the bony-cartilaginous junction so that the graft is part cartilage and part bone. The cartilaginous portion is placed distally over the cartilaginous septum, which gives the nose a more natural texture on palpation. The bony portion is placed under a subperiosteal pocket to enhance fixation and prevent displacement of the graft. The bone grafts may be layered to provide additional volume, and occasionally the grafts are secured with a single lag screw placed through a percutaneous incision. The nasal valve may have to be addressed, as is the case for Types 2 and 3.

Some surgeons may prefer using implants in type 4 cases. Acceptable implants include Gore-Tex (expanded polytetrafluoroethylene), or Medpor (high density polyethylene poly-

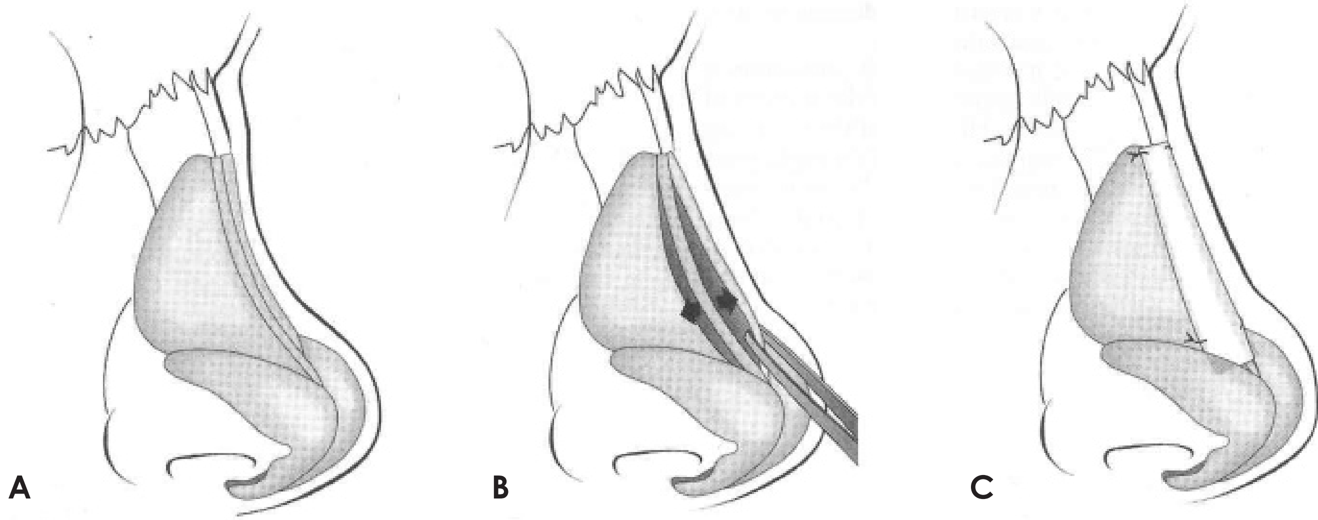

Figure 1.
Type 2 saddle nose deformity. **A**, Collapse of the nasal dorsum and narrowing of the upper lateral cartilages and nasal valve. **B**, The upper lateral cartilages are separated from the dorsal septum to open the nasal-septum angle and expand the nasal valve. **C**, placement of the onlay spreader graft stabilizes the nasal valve and projects the dorsal profile.

mer), and Mersilene mesh (polyethylene mesh). These grafts have pores that allow fibrous ingrowth and stabilization of the grafts, which reduces the incidence of infection and extrusion compared with solid silicone implants.

Type 5

This category is reserved for massive saddle nose deformities where there is complete loss of bony-cartilaginous support, and the dorsum of the nose is essentially parallel or flush with the plane of the anterior maxilla. The soft-tissue envelope of the nose is often contracted and atrophic, which makes using this tissue for reconstruction difficult. Many of the patients in this category are cancer patients who have undergone extirpation of large intranasal or paranasal sinus carcinomas. Postoperative radiotherapy is often part of their treatment protocols, which makes overlying tissues exceptionally fragile.

It is essential that structural support of the nose is recreated using bone grafts. Unfortunately, it is often impossible to place cantilevered bone grafts between the fragile skin and the atrophic inner lining of the nose without risking eventual graft exposure and extrusion. In these cases, the surgeon may be forced to transfer healthy soft tissue from distant sites such as the forehead to protect the grafts. The skin overlying the dorsum and nasal tip of the saddle deformity is de-epithelialized, and cantilevered bone grafts are placed over this surface and secured to the frontal bone using a microplating system. A full-thickness (including galea) forehead flap is transferred to cover the reconstructed framework of bone grafts. The galea is partially separated from the skin flap and wrapped around the undersurface of the bone grafts to fill in dead space and protect the grafts.

Occasionally, the surgeon may need to replace the inner lining of the nose with healthy tissue in addition to the overlying skin. In these cases, we have been using a number of techniques with variable success. If large amounts of tissue are necessary, a staged radial forearm flap is used with a skin graft, followed by de-epihelialization of the skin graft, bone grafting, and forehead flap reconstruction. If smaller amounts of inner lining are needed, a turbinate mucosal flap or staged melolabial flap is used.