Abstract

Septal deviations are common causes of disordered nasal breathing. The caudal septum is of special interest as it contributes to shape and support for nasal breathing and aesthetics. Caudal septoplasty involves correction of deviation while maintaining adequate support and tip projection. Here, the caudal septum’s contribution to the internal nasal valve area is highlighted and an explanation is given why this critical area is corrected to improve nasal breathing. In this report, we share our experience with a modification of the caudal end transplant using autologous posterior bony-cartilaginous septum in which the resection of the donor septum occurs posterocephalic to the internal valve area and a specific suture technique is employed to secure the transplanted septum to the dorsal strut and nasal spine.

INTRODUCTION

Septal deviations are one of the most common causes of disordered nasal breathing. Specifically, caudal septal deviations represent a unique challenge. This portion of the nasal septum serves multiple functions in regards to shape and support for nasal breathing and for facial aesthetics. The facial plastic surgeon is tasked with ensuring reduction, or total correction, of the offending deviation while maintaining adequate support and projection of the nasal tip [1]. Complicating matters is the caudal septum’s contribution to the internal nasal valve area and the attention that must be given to this critical area to improve nasal breathing. The internal nasal valve was initially described by Zuckerkandl and Mink, and further refined by other rhinologic surgeons such as Haight, Cole, and Kern to a three-dimensional area that serves as the greatest resistor to nasal airflow [2]. Consisting of the cartilaginous septum, valve angle, upper lateral cartilage, maxillary spine, lateral nasal soft tissues, nasal floor, and head of the inferior turbinate, this three-dimensional area acts as the primary upstream nasal resistor. Therefore, maintenance of a patent valve area is imperative to ensure normal nasal airflow. Preservation of an L-shaped dorsal and caudal strut approximately 10-15mm along with correction of the deviation has been the dictum of functional septoplasty, however, significant caudal septal deformity obviates the need for revised techniques to address this area of the septum [3,4]. Many previous techniques have been presented, all of which fall into two general categories: cartilage reshaping or contouring and caudal septal reconstruction [5]. While minor curvature and deviation of the caudal septum may be repairable with simple scoring, suturing, or reshaping, more significant deviations may require complete resection of the caudal septum with autologous or alloplastic transplants or grafting [4,6]. In this report we share our experience with a modification of the caudal end transplant using autologous posterior bony-cartilaginous septum via an open approach in which the resection of the donor septum occurs posterocephalic to the internal valve area. Special attention is paid to the suture technique employed to secure the transplanted septum to the dorsal strut and nasal spine.

METHODS

The face and nose are prepped and draped in the standard sterile fashion. Topical application of 4% liquid cocaine is applied to the intranasal mucosa via cotton pledgets and local injection mixed 50:50 of 1% lidocaine with 1:100,000 epinephrine and 0.5% bupivacaine with 1:200,000 epinephrine is administered to block the entire nose. Next, exposure is achieved via an inverted-V columellar incision extending to bilateral marginal incisions with extension of the incision on the deflected side nearer the nasal rim (Figure 1A). Exposure continues with a combination of dissection with Converse angled scissors and cotton-tipped applicators to fully reveal the nasal dorsum, upper lateral cartilages, and lower lateral cartilages. The interdorsal ligament is then divided sharply and the medial crura are retracted laterally to allow tension and excellent visualization by the surgeon during the sharp incision onto the nasal septum. By scraping the septum with the side of the #15 scalpel blade, the correct plane of dissection is identified and a blunt septal elevator is inserted and bilateral mucoperichondrial flaps are raised under the upper lateral cartilage on each side (Figure 1B). Switching back to the #15 scalpel blade, the upper lateral cartilages are separated...
from the cartilaginous dorsal septum sharply. Inferoanterior dissection exposes the anterior nasal spine which in many cases must be altered or removed to allow medialization of the caudal end (Figure 2A). Once the entire septum has been exposed any dorsal alterations, like rasping or shaving are done prior to further septal work. The septum is then addressed for removal of deviations, and harvesting of graft materials. First, and very importantly, identification of the internal nasal valve area is performed by inserting a blunt pointing device, in our case a cotton-tipped applicator, just posterocephalic to the valve area angling in the same oblique plane medially towards the septum. The cut downward on the dorsal septum to remove the deviated caudal end is placed cephalic to the valve angle (Figure 2B). At this point, using a straight scissor, a cut directed obliquely in the posteroinfior direction should be made so at least a 12 to 15 millimeter dorsal strut is left (Figure 3A). Once the oblique cut has been made, re-orient the straight scissor so a directly posterior cut is continued (Figure 3B). Once at the bony-cartilaginous junction, switch to a double action scissor as necessary to resect any posterior bony deflections. A septal elevator is used to free the cut septum and removal is completed with a duckbill grasper. Measurements of the space previously occupied by the deviated caudal septum are made while the resected piece is fashioned into an appropriately sized and shaped graft on a side table. Once the measurements have been transferred onto the cartilage along its straightest portion, cuts are made with a #15 blade on a carving block (Figure 3C). At this time the formed graft is placed into the pocket where the caudal septum was previously located. Measurements of the space previously occupied by the deviated septum are made while the resected piece is fashioned into an appropriately sized and shaped graft on a side table. Once the measurements have been transferred onto the cartilage along its straightest portion, cuts are made with a #15 blade on a carving block (Figure 3C). At this time the formed graft is placed into the pocket where the caudal septum was previously located.

Fixation of the caudal end transplant is difficult as incorrect suture techniques may lead to displacement of the newly placed graft, or the patient may be able to feel the suture ties postoperatively. First, fixation of the caudal graft occurs to the remaining dorsal strut preserved after initial exposure and removal of deviated septum posterocephalic to the valve angle as previously described. Using 5-0 polypropylene suture (PDS), this surgeon prefers to complete a figure-of-eight stitch starting by entering through the patient’s left upper lateral cartilage passing through the dorsal strut and exiting the contra lateral upper lateral cartilage. Regrasping the needle, it is passed back through the right upper lateral cartilage a small distance caudal to the first throw so it traverses the space between the dorsal strut and new caudal graft, again exiting the left upper lateral cartilage. Again regrasping the needle, it is passed distal to the edge of the upper lateral cartilage through the caudal graft and exits distal to the edge of the contra lateral upper lateral cartilage. The figure-of-eight is completed by again regrasping the needle and passing through the right upper lateral cartilage in the space between the dorsal strut and caudal graft and exiting the left upper lateral cartilage, where it is tied (Figure 4).

Further fixation is necessary and is accomplished by figure-of-eight suturing of the caudal end graft to the nasal spine in the midline via 5-0 PDS at the posterior septal angle and with 3-0 poliglecaprone (monocryl) suture on a large straight needle passed under the nasal spine. Importantly, at this step the suture tie should be placed on the side the septum the surgeon wants additional pull towards. Following fixation of the new caudal end, the bilateral mucoperichondrial flaps are reaproximated to the septum. A 4-0 plain gut suture on a small straight needle is passed in a whip stitch fashion to reduce dead space and prevent any fluid collection intraseptally postoperatively.

At this point, any additional tip work, lower lateral cartilage modifications, batten grafting, columellar struts, shield grafts and/or osteotomies should proceed as necessary to achieve the desired aesthetic and functional outcomes for the individual patient. Closure is facilitated with 4-0 chronic interrupted sutures along the marginal incisions and the columella inverted-V incision is reaproximated and closed with 6-0 nylon monofilament interrupted sutures. Intranasal silastic splints are placed and secured to the septum with 3-0 polypropylene suture. The nose is then taped and a thermoplastic splint is placed. Intranasal...
silastic splints, tape, and thermoplastic splint are all removed one week postoperatively. A preoperative photograph (Figure 5A) shows significant caudal septal deviation to the patient’s right side with nasal valve narrowing, while a postoperative photograph (Figure 5B) exhibits a medialized caudal septum with midline stabilization and improvement of the valve angle. These photographs represent the consistent results this surgeon achieves following the above described procedure.

**DISCUSSION**

The concept of the nose possessing an identifiable narrowing, or “valve” dates back to the late 19th and early 20th century when European anatomists and surgeons credited this anatomic area with controlling airflow [2]. Over the years this valve was better described anatomically and physiologically. Today, we understand this area to be a relatively narrow three-dimensional area approximately 50-70mm² located between 2-2.5 cm from the posterior margin of the nostril. Haight and Cole determined that nasal resistance increases from 1.0 to 6.0 cm H₂O/l/s in this approximately 5mm span leading them to conclude it as a significant upstream resistor to nasal airflow [7]. Under the influences of the Venturi effect, the medial cartilaginous septum and upper lateral cartilage tend to draw towards one another. Caudal septal deviations, or lack of upper lateral cartilage support, contribute to exaggerated movement secondary to the increased velocity of inspired air across this segment leading to worse nasal breathing and more patient complaints. Further experiments identified the significance of the inferior turbinate head size and its degree of congestion on the resistance to airflow, there by classifying it as the nasal valve area to emphasize contributions to resistance do not rest solely between the caudal septum and upper lateral cartilage [8].

Techniques to address the caudal septum have been well documented and reported. Importantly, addressing the caudal septum is highly patient-dependent with minor deviations commonly requiring only minimal scoring, suturing, repositioning, or a combination of these techniques. More significant deviations many times require more aggressive reshaping or temporary removal with remodeled graft to achieve functional an aesthetic improvement [9]. Our technique affords the surgeon a modification to well-known caudal end transplant techniques and ensures the nasal valve area is either improved by caudal end remodeling or left untouched during the course of surgical intervention. After resection of the deviated septum, known algorithms for graft choices are able to be followed [4]. Conveniently, our technique can be combined with extracorporeal septoplasty to correct the caudal end. However, different from the extracorporeal septoplasty, removing the caudal end posterocephalic to the valve area the bony-cartilaginous junction and a strong dorsal strut are left intact avoiding postoperative complications common to disarticulation of the keystone area or over-resection. Additionally, it is amenable to accepting autologous or alloplastic grafting materials and continues to allow the surgeon additional exposure and flexibility to complete other manipulations to the dorsum, tip, or alar cartilages. Use of various styles of suture fixation have been advocated by many surgeons, however, some utilize other methods of caudal fixation [3]. Surowitz et al., describes a technique in which they create a notch in the anterior septal reconstruction graft which engages into a osteotome-formed notch in the nasal spine [1]. While this technique is technically easy to do and offers secure fixation, it assumes an amenable nasal spine in which to insert the caudal graft material. In this senior surgeon’s experience suturing to the nasal spine allows for a strong fixation point while allowing a certain degree of flexibility of where to exactly place the new caudal graft. Therefore, we advocate for a suture technique as previously described.

**CONCLUSION**

Caudal septal deviation presents a unique challenge to the facial plastic surgeon. A wide array of both endonasal and open approach repair techniques have been presented to address the anterior nose’s form and function. Here we have presented a description of a modified technique to caudal end transplant in which the nasal valve area is clearly identified and dissection occurs posterocephalic to its position to maintain normal valve dimensions and postoperative function. Additionally, a specific description of suture fixation techniques offers strength and flexibility for positioning new caudal septal grafts.
REFERENCES


