Correction of Caudal Septal Deviation and Deformity Using Nasal Septal Bone Grafts

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Objectives: To describe our technique of using septal bone grafts for correction and stabilization of caudal septal deviation and to evaluate the effectiveness of this technique in the treatment of the deviated caudal septum.

Methods: A retrospective review of 81 patients who underwent open septorhinoplasty using septal bone grafts for correction of a caudal septal deviation or deformity and nasal obstruction. We reviewed medical records to determine postoperative outcomes in nasal obstruction and caudal septal position.

Results: Of the 81 patients, we included 66 with adequate follow-up information in the analysis. Follow-up duration ranged from 1 to 72 (mean, 8) months. Postoperative examination revealed a midline septum in 55 of the 66 patients (83%). Fifty-seven patients (86%) reported resolution of nasal obstruction; 49 (74%) had a midline septum and resolved nasal obstruction at the longest follow-up. Nine patients (14%) reported postoperative nasal obstruction, of whom only 3 required revision surgery.

Conclusion: Nasal septal bone grafts can be an effective tool in stabilizing severe cartilaginous deformities or deviations and correcting caudal septal deviation.


The crooked nose can represent one of the most challenging functional and aesthetic problems in facial plastic surgery. Deformities of the nasal septum often contribute to twisting of the nose, nasal obstruction, and decreased quality of life. The several configurations of a crooked septum include one that is straight but deviated from the midline, one that is C-shaped in a horizontal or vertical plane, and one that is S-shaped in the horizontal or vertical plane (Figure 1). The severity of a caudal septal deformity or deviation can result in varying levels of nasal obstruction. Convexity of the dorsal septum can narrow the internal nasal valve significantly, whereas deviations in the caudal septum can result in narrowing of the nasal vestibule. Straightening a deviated dorsal septum plays a central role in the successful management of a deviated middle nasal vault and tip. Specifically, correction of the severely deviated or deformed (S- or C-shaped) caudal septum during septoplasty can be a particularly challenging task, and inadequate correction is a frequent source of persistent postoperative nasal obstruction.

In a typical open septoplasty, septal cartilage is separated from the upper and lower lateral cartilages, and the deviated central portion of the cartilage is removed, leaving an adequate dorsal and caudal L-strut, typically 1.0 to 1.5 cm wide. We commonly harvest this central septal cartilage for autologous grafting material, but its availability can often be restricted in a severely deviated nose. For a deviated or twisted L-strut, a number of techniques have been described to straighten or stabilize the cartilage, including spreader grafts, scoring incisions, caudal septal repositioning, suture fixation to the nasal spine, and extracorporeal septoplasty for severe cases.1-6 For a septum that is straight but simply deviated from the midline, repositioning of the caudal septum with or without suture fixation to the nasal spine may be adequate in straightening the L-strut. More complex septal deformities, such as an S- or a C-shaped configuration, may require additional procedures, such as scoring incisions, spreader grafts, or even extracorporeal septoplasty with construction of an L-strut. Despite these numerous adjunctive techniques, correction of a twisted caudal septum without weakening or compromising nasal tip support is often quite challenging.

Deviated portions of the bony septum, including the perpendicular plate of the ethmoid bone and vomer, are often removed in a piecemeal fashion and discarded during septoplasty. In cases where the amount of septal cartilage available for...
grafting may be limited, use of the septal bone as an internal splint may allow more cartilage to be used for additional grafts. This bone is often quite thin yet sturdy enough to provide support to a weakened caudal septum without narrowing the airway. We sought to describe our technique of using septal bone grafts for correction and stabilization of caudal septal deviation or deformity and to evaluate the effectiveness of this technique in the treatment of the deviated or deformed caudal septum.

**METHODS**

Information concerning patients who undergo septorhinoplasty performed by the senior author (S.R.B.) at the University of Michigan Center for Facial Cosmetic Surgery is kept in a patient database. We retrospectively reviewed the data of 81 patients who underwent open septorhinoplasty using septal bone grafts for correction of caudal septal deviation and nasal obstruction from March 1, 1997, through August 31, 2011. All operations were performed by the same surgeon. Informed consent was obtained from all patients before surgery. The follow-up period ranged from 1 to 24 months. Patients in whom septal bone grafts were used for areas other than the caudal septum were excluded from this study. We reviewed medical records to determine the postoperative outcomes in nasal obstruction and caudal septal position. The presence or the absence of subjective nasal obstruction after septorhinoplasty was documented. Caudal septal position at each follow-up visit was documented by a single examiner (S.R.B.) to assess for persistent or recurrent deviation. Preoperative and postoperative photographs in standardized views (frontal, right and left lateral, right and left oblique, and basal views) were obtained.

Through a standard open rhinoplasty approach, the nasal septum is exposed under mucoperichondrial and mucoperiosteal flaps. If cartilage grafts are required or if the cartilage is deviated or deformed, septal cartilage is resected, leaving a cartilaginous L-strut at least 1 cm wide to maintain structural support of the dorsum and caudal septum. After separation of the quadrangular cartilage from the bony-cartilage junction, the bony perpendicular plate of the ethmoid and vomer segment is excised sharply dorsally and along the nasal floor using turbinectomy scissors. The bony segment is then gently disarticulated from its posterior attachment using Knight nasal forceps and removed en bloc as a single bone graft. Once harvested, the bone graft can be shaped to any configuration needed to address the septal deformity, but excessive trimming of the bone should be avoided to maximize strength of the graft. The bone graft, which acts like an internal splint to reinforce the septal cartilage, can be placed at various positions along the L-strut, depending on the location of the deflection or deformation. This splint can be used to support the dorsal (horizontal) or the caudal (vertical) portions of the L-strut or can straddle the dorsal and caudal portions (**Figure 2**). Holes are drilled using a heavy straight needle to enable suture fixation of the bone graft against...
the cartilage of the caudal septum. Care should be taken to avoid fracturing the bone graft when shaping and drilling holes. Quilting mattress sutures with 5-0 polydioxanone (PDS; Ethicon) are placed through multiple holes to secure the graft tightly to the L-strut and to straighten and stabilize the caudal septum in a midline position (Figure 3). When reapproximating the mucoperichondrial flaps, 4-0 polyglactin 910 (Vicryl Rapide; Ethicon) horizontally oriented mattress sutures are placed closely around, but not through, the bone graft to compress the flaps against the graft. Sutures are not placed through the bone graft to avoid excessive fracturing and destabilization of the graft. Osteotomies and tip surgery using septal cartilage grafts are performed when necessary to align the nose further.

RESULTS

Of the 81 patients who underwent open septorhinoplasty using a bone graft, we included 66 in the analysis (we excluded 15 patients with inadequate follow-up information). Patient variables, including age, sex, previous nasal surgery, and the length of the postoperative follow-up period, are shown in the Table. The mean age was 38 (range, 13-70) years, with 32 female and 34 male patients. Follow-up duration ranged from 1 to 72 (mean, 8) months.

Postoperative physical examination revealed an improved nasal airway with a midline septum in 55 of 66 patients (83%). Resolution of nasal obstruction was reported among 57 patients at the last follow-up visit. Forty-nine patients (74%) had a midline caudal septum on examination and resolved nasal obstruction at the last follow-up visit. Nine of 66 patients (14%) reported postoperative nasal obstruction, of whom only 3 required revision procedures owing to persistent caudal septal deviation and internal nasal valve obstruction in 2 and intranasal synechiae in 1. Revision operations were performed 6 to 12 months after the initial septorhinoplasty. The remaining 6 patients refused revision surgery or had milder symptoms of nasal obstruction.

COMMENT

Straightening a deviated or deformed caudal septum is a critical component in the successful correction of the deviated nose. Several authors have described procedures used to correct caudal septal deviations. In 1929, Metzenbaum1 was one of the first to describe a procedure to address this problem. He recognized the difficulty in treating anterior septal deviation and noted that posterior resection has minimal influence in correcting an anterior deviation. He also noted the importance of preserving the caudal septum for nasal tip support. He introduced the “swinging door” technique, in which a vertical wedge of caudal septum is resected on the convex side. The caudal septum is then repositioned in the midline. A number of variations of this technique have been reported subsequently, including suture fixation of the caudal septum to the nasal spine.2

Pastorek and Becker3 reviewed their experience with a modified swinging door technique. In the modified technique, septal cartilage is dissected free from the maxillary crest and flipped over the nasal spine, which acts as a “doorstop” and secures the caudal septum in a more midline position. A suture is placed to secure the cartilage to the spine. The authors recommended that scoring of the caudal septum be avoided if the swinging door technique is performed to avoid excessive weakening of the caudal septum that might result in loss of support of the nasal tip.

Repositioning the caudal septum over the nasal spine and excising the posterior portion of the caudal strut may be necessary when excessive caudal septum length contributes to the deviation. Sedwick and colleagues5 reported their results in 62 patients using this technique through a complete transfixion incision with suture fixation of the caudal septum to the nasal spine. They found that 82% of patients reported no postoperative nasal obstruction at long-term follow-up. They confirmed the position of the caudal septum using photographic views of the nasal base.

Many of these less complex techniques to align a deviated caudal septum are quite effective at correcting mild or moderate caudal deviation, as long as the caudal septum is straight. However, if the caudal septum is twisted into a convex-concave contour or S-shaped configuration, additional grafting to support and straighten the deformed septum may be required. When the caudal septum is twisted or weak, septal bone, such as the vomer and the perpendicular plate of the ethmoid bone, can be used as a permanent internal splint. Although the perpendicular plate of the ethmoid may be deviated from the midline, it is almost always straight and can serve as a thin, strong splint. The splint is placed on the surface

Figure 2. Septal bone grafts. A, Graft used to straighten deformities or deviations in the dorsal septum. B, Graft used to straighten the caudal septum. C, Graft used to straighten the anterior septal angle.

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of the bowed or twisted caudal septum after the septum has been scored to straighten it. The graft provides permanent internal reinforcement of the septum to ensure that the caudal septum remains straight. Septal bone is usually thin and relatively strong, which allows for stable grafting of the caudal septal strut without significant narrowing of the nasal airway.

Compared with central septal deviations, which can be safely excised, excisions involving the dorsal or caudal septal segments will affect the shape of the external nose directly and can weaken dorsal and tip support. In 1966, Dupont and colleagues described their experience using the vomer or the perpendicular plate of the ethmoid bone as a splint to reinforce a weakened L-strut after wedge resections of dorsal and caudal deflections. They reported permanent straightening of the septum in more than 60 patients who underwent vomer grafts during 5 years, with the persistence of the bone graft confirmed through late postoperative radiographs. More recently, Metzinger et al described the ethmoid bone sandwich graft, a technique for placing bilateral small bone grafts (Figure 3) to support the caudal septum in the midline.

Figure 3. Bone grafts used as splints to straighten caudal septum. A and B, Preoperative configuration. C, Scoring of the cartilage to straighten. D and E, Bone splint positioned on the left side. F, Second bone splint placed on the right side to assist with straightening.
Dini and colleagues\textsuperscript{11} reported using 1 or more bone grafts on alveolar deviations in all 23 study patients. In another study, Foda\textsuperscript{9} found that this technique was effective in correcting naso-alveolar and postoperative frontal view photographs, they next straighten a deviated nose. Using measurements from preoperative and postoperative frontal view photographs, Jang and colleagues\textsuperscript{10} described their technique of securing 1 or 2 septal bone grafts to the dorsal, caudal, or both regions of the L-strut to straighten the caudal septum, particularly in cartilage-depleted patients. Our study confirms that using a septal bone graft as a viable adjunctive tool to standard open septorhinoplasty techniques in the treatment of the deviated or deformed caudal septum.

Within the past decade, a few authors have used autologous septal bone to straighten deviated noses. Foda\textsuperscript{9} reported his experience with a bony splinting graft placed horizontally 5 mm below the dorsal edge of the septal cartilage. He found that this technique was effective in bringing the anterior septal angle back to the midline. One of us (S.R.B.) has also used this technique and has found it to be an effective method of straightening twisted dorsal cartilaginous septa. In another study, Dini and colleagues\textsuperscript{11} reported using 1 or more bone grafts obtained from the perpendicular plate of the ethmoid, vomer, and nasal crest to align the most deviated part of the L-strut. Their study demonstrated minimal absorption of the bone graft using 3-dimensional computed tomography performed at least 1 year after surgery.

In the present study, we found that autologous septal bone grafts are an excellent alternative to traditional cartilage grafts to support a deviated or a weak caudal septum. In addition, such bone grafts can be used to straighten dorsal septal deviations when spreader grafts are insufficient to straighten the dorsal segment. In our study, very few patients reported postoperative nasal obstruction, and even fewer required revision nasal surgery to correct persistent septal deviation. We believe this technique is a valuable tool in providing reliable long-term strength to the caudal septum, particularly in cartilage-depleted patients. Our study confirms that using a septal bone graft to straighten and stabilize the caudal septum is a viable option in the treatment of the deviated or deformed caudal septum.

Table. Characteristics of the 66 Study Patients

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<tr>
<td>Age, mean (range), y</td>
<td>38 (13-70)</td>
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<tr>
<td>Postoperative follow-up period, mean (range), mo</td>
<td>8.25 (1-72)</td>
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<tr>
<td>Sex, female, No. (%)</td>
<td>32 (48)</td>
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<td>Prior nasal surgery, No. (%)</td>
<td>21 (32)</td>
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Statistical analysis:

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Author Contributions: Dr Baker had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Acquisition of data: Lee and Baker. Analysis and interpretation of data: Lee. Drafting of manuscript: Lee. Critical revision of the manuscript for important intellectual content: Baker. Statistical analysis: Lee. Study supervision: Baker.

REFERENCES