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ORIGINAL RESEARCH

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Review of literature of saddle nose deformity reconstruction and presentation of vomer onlay graft

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Abstract

Objective: Saddle nose deformity is a well-described condition that most commonly results from trauma or prior surgery. For larger saddle nose deformity defects, bone grafts are a reconstructive option that provide adequate structure for repair. One new technique for repair of these deformities is a vomerian bone onlay graft. We aim to provide a review of literature on autogenous repair of saddle nose deformities, as well as introduce a new technique in which the vomer bone is used as an onlay bone graft.

Methods: Literature review and case series. Five cases in which vomer onlay grafts were used for repair of saddle nose deformity were reviewed between January 2013 and December 2015. Aesthetic outcomes and postoperative complications were evaluated at subsequent follow-up visits in clinic.

Results: In all cases where vomer bone was harvested, the vomer onlay graft provided adequate structure to traverse the saddle nose deformity. No postoperative complications were observed in an 18 month follow-up period.

Conclusion: Vomerian bone onlay grafts are a reconstructive option for saddle nose deformity and nasal dorsum defects. While septal cartilage is commonly used, and ethmoidal bone has been previously described as an option for composite graft reconstruction, vomer bone onlay grafting has not been well described in the literature. This method may be of use when previous nasal surgery has been performed and standard septal cartilage is not possible to harvest. The aesthetic outcomes following nasal dorsum reconstruction using onlay grafts are favorable, but long-term outcomes of these grafts require further study.

Level of Evidence: IV.

KEYWORDS

rhinoplasty, saddle nose deformity, vomer onlay graft

Shekhar K. Gadkaree and Rachel E. Weitzman contributed equally to this article.

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1 | INTRODUCTION

The saddle nose deformity is the loss of structural integrity of the lower two-thirds of the nose, resulting in functional and aesthetic impairment.[1] The major feature of this deformity is a combination of loss of septal support and disruption of the septum, upper lateral cartilages, the nasal bone-septal cartilage complex, and the contraction of the skin soft tissue envelope, leading to a deficiency of the middle nasal vault, which weakens nasal valve function.[1] Repair of saddle nose and similar deformities therefore represents one of the most challenging problems in nasal surgery, requiring long term structural support while avoiding sacrifice of aesthetics.

Over the past 60 years, diverse options have evolved for surgical reconstruction. For minor dorsal deformities with limited septal structural damage, cartilage or fascial overlays have been considered.[2,3] However, bone grafts extending from the native nasal bones to the cartilaginous dorsum have been increasingly utilized to provide increased structural support and allow for direct bone-to-bone healing.[4,5] We aim to provide a review of literature on autogenous surgical repair of saddle nose deformities, as well as introduce a new technique: the use of the vomerian bone dorsal onlay graft, contoured in a similar manner to a cranial bone graft.

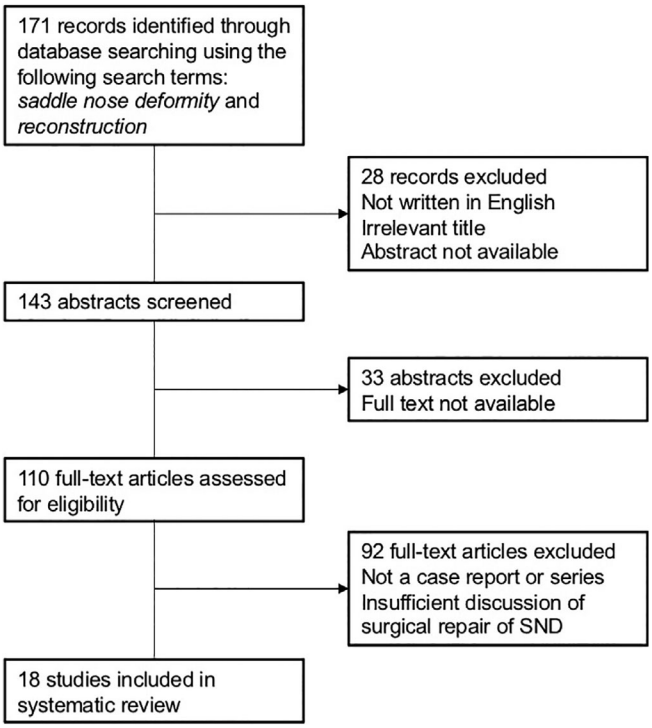

FIGURE 1 Study selection for systematic review. SND, saddle nose deformity

2 | MATERIALS AND METHODS

2.1 | Search strategy and article selection

PubMed was searched from inception through April 1, 2019. Keywords included "saddle nose deformity" cross-referenced with "reconstruction" (Figure 1). The following criteria were used to guide inclusion of studies: (a) patients carried a diagnosis of saddle nose deformity, (b) patients underwent autogenous surgical repair of the deformity with description of the technique for repair, and (c) studies reporting original data. Studies not written in English or lacking abstract or full text were excluded.

2.2 | Patient selection for case series

This study was reviewed by the local Institutional Review Board and approved under protocol 18-117H. Patients were selected intra-operatively as candidates for vomer onlay grafts based on previous surgical history of septoplasty, exposure and examination of the saddle nose deformity, and pre-operative facial analysis. Five cases were conducted between January 2013 and December 2015. Aesthetic outcomes and post-operative complications were evaluated at subsequent follow-up visits in clinic.

2.3 | Surgical technique

A hemi-transfixion incision is used to elevate mucoperichondrial flaps and gain access to the septal cartilage. If a septoplasty is being performed, the vomer should be completely spared up to the perpendicular plate of the ethmoid until it is ready to be harvested. In cases where a septoplasty is not being performed, the vomer can be approached through the same incision after dislocating the quadrangular cartilage from the vomer. Caution should be used to avoid harvesting bone at the face of the sphenoid. To be a suitable graft, vomer bone must be approximately 3 to 4 mm in thickness. Grafting the bone once harvested requires delicacy if the bone is particularly thin, but as a bone graft, it is generally durable and can be harvested with portions of the quadrangular cartilage for increased graft size. The bone is generally separated from the perpendicular plate of the ethmoid with heavy scissors and an osteotome is used to elevate it from the nasal floor. Most defects require starting grafts of at least 2 cm × 4.5 cm but this should be confirmed with specific measurements from the patient.

The vomerian bone is contoured using heavy scissors and an otologic drill with a diamond burr set to achieve a smooth contour mimicking the natural convex nasal dorsal shape (Figure 2). An inverted-V midcolumellar incision is used to elevated to elevate the skin and soft tissue over the nasal cartilage. After the tissue flap is elevated over the area of deformity, the native nasal bone is rasped to create an underlying surface more amenable for healing of the graft. The graft is then placed on the nasal bones, extending in a cantilever fashion across the area of the saddle nose deformity without additional fixation. The columellar incision is then closed using 6-0 nylon sutures. The nose is taped and splinted to hold the graft for 10 days.

3 | RESULTS

3.1 | Literature review

The initial database search identified 171 records, from which a total of 18 studies published between 1965 and 2019 met inclusion criteria for review. Of the initial 171 articles, 28 records were not published in English or did not have abstracts available for review. One hundred and forty-three abstract were screened, resulting in exclusion of an additional 33 manuscripts. One hundred and ten full-text articles were assessed for eligibility, from which 92 were excluded. Ultimately, 18 articles met inclusion criteria (Figure 1).

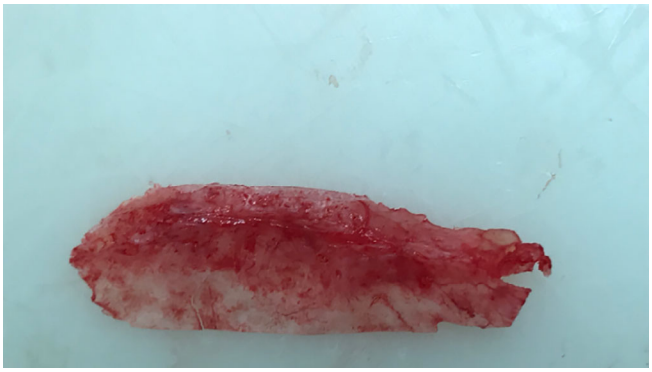

FIGURE 2 Harvested vomer bone graft. Intraoperative example of harvested vomer bone onlay graft after contouring to defect

The 18 articles represent case reports and case series of autogenous reconstruction of saddle nose deformity. Fourteen articles present cartilaginous grafts. Of these, 12 discuss costal cartilage and two discuss septal cartilage. Four articles present bone grafts, two of which discuss calvarial bone, one of which discusses iliac bone, and one of which discusses lower turbinate bone.

3.2 | Vomer only graft for saddle nose deformity reconstruction

Five patients underwent reconstruction using the vomer onlay graft for saddle nose deformity. In all cases where vomer bone was harvested, the vomer onlay graft provided adequate structure to traverse the saddle nose deformity. Desirable aesthetic results following repair of saddle nose deformity can be achieved using vomer onlay grafts (Figure 3). No postoperative complications including graft resorption, infection, extrusion, or hematoma were observed in an 18 month follow-up period.

4 | DISCUSSION

Saddle nose deformities require careful consideration prior to surgical correction. Autogenous cartilage is widely used as a graft material for reconstruction, as it balances rigidity and flexibility, causes little reaction at the recipient site, can resist traction forces of wound healing,

FIGURE 3 Preoperative and postoperative aesthetic outcomes using vomer onlay grafts. Preoperative and postoperative (follow-up of 12 months) aesthetic outcomes using vomer onlay grafts for saddle nose deformity correction

and is widely available.[6,7] In class I and II saddle nose deformities with minimal loss of dorsal support, nostril rounding, or columellar retraction, septal and conchal cartilage grafts have been proven to be effective.[8-10] Mao, et al. assessed 20 patients who underwent correction for traumatic saddle nose deformity, 12 of which with septal cartilage-bone grafts and 8 of which with conchal cartilage grafts.[2] The authors discuss the ease and low risk of harvesting from these sites, as well as adequate support and elasticity without septal perforations, infection, or donor site complications in their cohort.[2] Still, it is important to note the disadvantages of these approaches. Septal cartilage-bone grafts pose the potential risk of contour irregularities in noses with thin overlying skin and of saddling from over-aggressive harvest, while conchal cartilage grafts require an additional incision and dissection and may cause asymmetry of the dorsum.[2] In addition, previous literature has shown that when septal and conchal cartilage grafts are placed, on average 22% of the graft undergoes resorption.[11,12]

As a result, more advanced saddle nose deformities, including class III and IV, typically require more rigid support for reconstruction, such as costal cartilage grafts. In fact, Bilen and Kilinç revealed that costal cartilage graft as a single unit had more predictable and reliable reconstruction of saddle nose deformity than conventional dorsal grafts.[9,10,13] Used since the late 1800s, costal cartilage was the most frequently discussed graft material for reconstruction in our literature review, with 9 case series published. Although this was initially thought to be unstable and curl up on itself, Furlan demonstrated the ability to utilize costal cartilage to prevent bending of the graft in 8 patients.[14] This technique continued to yield positive outcomes in the 2000s, especially for revision septorhinoplasty in severe saddle nose deformity patients.[15-17] Furthermore, a retrospective study with a larger patient cohort of 91 patients who underwent rhinoplasty for correction of saddle nose deformity was performed by Hyun and Jang in 2013, demonstrating that costal cartilage graft should be considered to provide a strong and stable septal cartilage framework for class II to IV saddle nose deformities.[9,10,18] Since that time, new techniques employing costal cartilage grafts have been presented, ranging from L-shaped costal cartilage strut grafts to costal cartilage "sandwich" grafts to toothpick-shaped costal cartilage grafts.[19-23]

While septal, conchal, or costal cartilage grafts have been shown to provide some stability for saddle nose deformity reconstruction, superior outcomes may be achieved using bone grafts. Bone grafts have the potential to provide increased structural support and allow for direct bone-to-bone healing.[4,5] Gurlek et al studied three patients who underwent rhinoplasty with lower turbinate bone, which resulted in cosmetic and functional satisfaction. Because lower turbinate resection is required in patients with both saddle nose deformity and nasal airway obstruction, this technique both enlarges airway passage and provides for a cheap, safe, and ready-to-use support graft.[24] Still, when choosing graft material, it is important to determine whether the saddle nose deformity defect is solely due to a collapsed dorsum or whether other nasal sub-units are involved. Reconstruction can be more challenging if the nasal tip is displaced, as onlay grafts may have to be combined with other graft types to adequately achieve a favorable aesthetic outcome.[5] In these cases, iliac bone or split calvarial bone grafts may be considered. These grafts have been shown to be successful, but require a separate surgical site with significant morbidity.[4,5,25]

The vomerian bone onlay graft presented in this study represents a viable potential donor site for bone grafts to the nasal dorsum. The vomer bone is generally thickest at its superior border where the alar wing of the vomer articulates with the rostrum of the sphenoid. Advantages of this graft include that it can be harvested without a separate surgical site and can be quite similar in thickness to harvested split cranial bone. The main limitation is that it can be highly variable in thickness and may be difficult to harvest a graft of sufficient length for some deformities. Despite these limitations, the vomer bone graft is a useful reconstructive option for saddle nose deformities.

5 | CONCLUSION

Graft options for autogenous reconstruction of saddle nose deformity range from septal and conchal cartilage to costal cartilage to lower turbate bone, iliac bone, and split calvarial bone. When additional structural support is needed, bone grafts provide for a superior alternative to cartilage. We present the vomerian bone onlay graft as a reconstructive option for saddle nose deformity and nasal dorsum defects. Similar to cranial bone, there is the opportunity for bone to bone healing to the nasal bones, and this graft lacks the risk of the warping that can occur with costal cartilage. In addition, vomerian bone may also be used for smaller defects when septal cartilage is not available. The preliminary aesthetic outcomes following nasal dorsum reconstruction using onlay grafts appear favorable, but long-term outcomes of these grafts require further study.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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