Complications of Rhinoplasty

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KEYWORDS
- Rhinoplasty • Septorhinoplasty • Complications

KEY POINTS
- Meticulous history, physical examination, and standardized photographic documentation are central to preoperative evaluation and surgical planning for rhinoplasty.
- Photographic documentation is very useful to help illustrate preexisting preoperative asymmetries, and the surgeon must document these in the physical examination and discuss them with the patient.
- As with any surgery, any complications should be openly discussed with the patient.
- Appropriate preoperative counseling regarding all risks, benefits, and alternatives is critical.
- The surgeon must have a comprehensive understanding of nasal anatomy and effects of surgical maneuvers to help avoid complications.

OVERVIEW

Rhinoplasty is a very common surgical procedure among facial and general plastic surgeons. It may be performed for functional and aesthetic reasons. It is a highly technically challenging procedure, because the surgeon must pay careful attention to both form and function. An aesthetically pleasing nose without the ability to breathe is a surgical failure. Some complications may occur intraoperatively, whereas others may occur postoperatively during wound healing and contracture. Therefore, some complications may not become evident until months to years after surgery.

ASYMMETRIES

Asymmetries of the bony pyramid can occur for multiple reasons, including discrepancies in osteotomies between sides, asymmetric dorsal reduction, and persistence of preoperative asymmetries. A greenstick fracture, with failure to fully osteotomize, may result in either failure to fully mobilize the nasal bone or the nasal bone lateralizing from memory.

Asymmetries of the middle third are also often multifactorial. A septal deviation that was not causing asymmetry before dorsal reduction may become “unmasked” after dorsal reduction, and thereby cause asymmetries of the middle vault. Asymmetric dorsal reduction of the middle third can also occur. Palpation of the dorsum with moistened gloves allows careful assessment of the underlying anatomy after dorsal reduction.

Establishing symmetry at the tip is highly dynamic and requires an understanding of all major and minor tip support elements, as shown in Table 1.1 Careful attention to tip suture technique and proper suture placement will help minimize tip asymmetries. Preexisting asymmetries of the medial and lateral crura may not be evident until other tip dynamics are altered. Similar to the middle third, a septal deviation that was not causing any asymmetry preoperatively may become “unmasked” as a result of...
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surgical maneuvers, with resultant tip asymmetry or deviation. Contracture of the skin soft tissue envelope can also result in asymmetry of the tip over time.

Edema of the soft tissue envelope can make asymmetries and irregularities difficult to discern intraoperatively. Thus, careful marking before injection is paramount. Asymmetries can be minimized through judicious inspection from the top of the patient’s head and through careful palpation using sterile saline-moistened gloves.

THE BONY PYRAMID

Overresection of the Nasal Bones

Overresection of the nasal bones can be avoided through judicious dorsal reduction, as seen in Fig. 1. Notice that this patient also has a pollybeak deformity, which is discussed later. More bone may easily be removed, whereas replacement after overresection presents a more challenging scenario.

Open Roof Deformity

An open roof is a normal consequence of dorsal reduction. Failure to close an open roof with appropriate osteotomies will result in a “flat top” appearance to the bony pyramid, as seen in Fig. 2. Edema of the soft tissue envelope can mask an open roof deformity on visual inspection.

Fig. 1. Overresected nasal bones after prior rhinoplasty. Also note prominent pollybeak.

Fig. 2. Open roof deformity after prior rhinoplasty from failure to close with osteotomies.

Fig. 3. Rocker deformity with osteotomies continuing into frontal gone. Note superior aspect “rocking” laterally when bony base is medialized. (From Toriumi DM, Hecht DA. Skeletal modifications in rhinoplasty. Facial Plast Surg Clin North Am 2000;8(4):424; with permission.)
Again, careful palpation will make this readily apparent to the surgeon. Medial and lateral osteotomies are used to close an open roof deformity, narrowing the bony pyramid.

**Rocker Deformity**

Rocker deformity results from carrying osteotomies too far superiorly up into the frontal bone without appropriate back fracture. On medialization of the nasal bones, the superior portion is cantilevered, or “rocked,” laterally, as shown in Fig. 3.2 This deformity can be avoided through careful planning of one’s osteotomies. When performing an endonasal lateral osteotomy, the guarded portion of the osteotome is oriented laterally and the surgeon continually palpates during the osteotomization process. Should this complication be encountered, transverse percutaneous osteotomies may be performed to create the appropriate controlled back fracture.

**Stair Step Deformity**

Stair step deformity is caused by placement of the lateral osteotomy anterior to the ascending process of the maxilla, resulting in a palpable step-off. The lateral osteotomy should be placed along the ascending process (also known as the frontal process) of the maxilla in the standard high-low-high fashion, which is illustrated Fig. 4.2 Careful planning of the lateral osteotomies will help the surgeon avoid this complication. The guarded portion of the osteotome is oriented laterally, and the surgeon continually palpates during the osteotomization process. In addition to careful palpation, the surgeon must listen for the distinct sound made when the osteotomy is being placed in the correct location along the ascending process of the maxilla. Percutaneous perforating lateral osteotomies also lend a degree of safety. This problem is difficult to correct, and therefore stair step deformity must be avoided.

**THE MIDDLE THIRD**

**Pollybeak Deformity**

Pollybeak deformity results when the lower third of the dorsum is more projected than the tip.

Fig. 4. Appropriate placement of osteotomies is demonstrated. Note lateral osteotomy in high-low-high fashion, fading medial osteotomy, with controlled back-fracture connecting medial and lateral osteotomies. *(From Toriumi DM, Hecht DA. Skeletal modifications in rhinoplasty. Facial Plast Surg Clin North Am 2000;8(4):422; with permission.)*

Again, careful palpation will make this readily apparent to the surgeon. Medial and lateral osteotomies are used to close an open roof deformity, narrowing the bony pyramid.

Fig. 5. Inverted V deformity is noted with prominence of the bony base and narrowing of the middle third.
This is seen in Fig. 1. Overresection of the bony pyramid, underresection of the cartilaginous middle third (specifically the anterior septal angle), and supratip fibrosis deep to the soft tissue envelope can all result in pollybeak.\(^1\) The first 2 are preventable, whereas the third occurs postoperatively in the setting of wound healing. Additionally, loss of tip support with subsequent tip ptosis can result in a relative pollybeak. Palpation allows the surgeon to assess the dorsum and to determine if additional resection is necessary. Soft tissue pollybeak can be addressed with Kenalog injections to the affected area. The senior author prefers to use a very conservative Kenalog 10 mixed 1:10 or 1:5 with 1% lidocaine with 1:100,000 epinephrine. It is critical that all Kenalog be injected deep to the dermis to avoid dermal thinning. Overaggressive injection can itself cause divots from dermal or cartilaginous injury.

Fig. 6. Noted dorsal narrowing after cartilaginous dorsal reduction. (From Toriumi DM. Management of the middle nasal vault in rhinoplasty. Facial Plast Surg Clin North Am 1995;2(1):18; with permission.)

Fig. 7. Autospread technique is shown. Upper lateral cartilage is scored (A), subsequently folded on itself and suture repaired to the dorsal septum (B). (From Yoo S, Most SP. Nasal airway preservation using the autospreader technique: analysis of outcomes using a disease-specific quality-of-life instrument. Arch Facial Plast Surg 2011;13(4):232; with permission.)
Inverted V Deformity

The inverted V deformity results from accentuated visibility of the caudal margins of the nasal bones after dorsal reduction, as seen in Fig. 5. As illustrated in Fig. 6, dorsal reduction causes narrowing of the cartilaginous dorsal width. As a result, the upper lateral cartilages become displaced inferiorly and posteriorly, thereby accentuating the caudal margin of the nasal bones. This deformity is further exaggerated if the bony base is not appropriately narrowed after dorsal reduction. Repair of the upper lateral cartilages to the dorsal septum and use of spreader grafts will help prevent this. The senior author routinely uses the autospreader upper lateral turn-in flaps, which are shown in Fig. 7.

Saddle Nose Deformity

The saddle nose deformity may be the result of overresection of the quadrangular cartilage with insufficient dorsal strut. A postoperative saddle deformity is seen in Fig. 8. Inadvertent disarticulation of the keystone area, in which the quadrangular cartilage fuses superiorly with the perpendicular plate of the ethmoid, may also result in saddling. The keystone is shown in Fig. 9. Extracorporeal septoplasty is particularly prone to this and can be avoided using the anterior septal reconstruction technique.

Saddle nose deformity can be difficult to correct and is best avoided. A mild saddle deformity may be corrected with crushed cartilage camouflage dorsal onlay grafting. If disarticulation of the keystone is noted intraoperatively, rib cartilage graft may be used for reconstruction, provided the patient has previously consented.

TIP AND ALA Bossae

Bossae, as illustrated in Fig. 10, are the result of visible flexing and buckling of the alar cartilage. These deformities tend to become evident months to years postoperatively. Patients at risk for tip bossae are those with thin skin, strong alar cartilages, and tip bifidity. Bossae can be avoided through maintaining the strength and integrity of the alar cartilage, using structural grafting when necessary, and symmetric reconstitution of the domal subunit with tip sutures. Temporalis fascia or crushed cartilage may also be used in thin-skinned patients to help camouflage any irregularities.
Visible Grafts

In thin-skinned individuals, tip grafts can become visible over time as the skin soft tissue envelope contracts and thins. Therefore, avoiding tip grafts in very thin-skinned individuals is preferable, because this complication is often noted at a later date, after edema has decreased and the skin soft tissue envelope has begun contracting, and must be addressed with formal revision. The authors often use temporalis fascia as a camouflage graft in thin-skinned patients if grafts must be used.

Pinched Tip

A pinched tip may result from overaggressive cephalic resection of the lateral crura, which results in weakening of the remaining rim strip (Fig. 11). Care must be taken to avoid oversection during cephalic trim. The senior author preserves at least a 7-mm rim strip to avoid oversection during cephalic trim. Malpositioning of the lateral crura, with the caudal border placed significantly inferior to the cephalic border, may similarly result in a pinched tip, as described by Toriumi and Checcone and illustrated in Fig. 12. Lateral crural repositioning and lateral crural strut grafts may be used to facilitate appropriate orientation of the lateral crura.

Poorly Defined Tip

The poorly defined or amorphous tip can occur in thick-skinned individuals after tip deprojection and suture modification. Recognizing thick skin preoperatively and avoiding overaggressive deprojection in thick-skinned individuals is key. Judicious SNAS excision may be performed to help improve tip definition.

Nostril Asymmetries

Nostril asymmetries can occur from an unmasked septal deviation after caudal septal resection,
placement of a septal extension graft, or asymmetric tip modifications. It is important to recognize any preoperative nostril asymmetries and counsel patients appropriately in this regard. The authors routinely perform a nostril check before final closure to ensure appropriate symmetry.

**Alar-Columellar Disproportion**

Gunter and Friedman previously described the alar-columellar relationship and classification of related deformities. This article focuses on alar retraction, columellar retraction, and hanging columella. Fig. 13 shows both alar retraction and a hanging columella.

Alar retraction may result from overly tight closure of marginal incisions, especially as one approaches the nasal facets. Careful attention to closure of the marginal incisions can help avoid Alar retraction. Overaggressive resection during cephalic trim can result in contracture of the lateral crura superiorly with time and wound healing, thereby causing alar retraction. Lateral crural spanning sutures placed too tightly may result in alar retraction. The orientation of the lateral crura is also of importance. As described by Toriumi and Checcone, the caudal margin of the lateral crura should lie in a plane almost horizontal and oriented just inferior to the cephalic margin. This technique prevents cephalic positioning of the lateral crura and helps support the alar rim. Alar retraction may be corrected with the use of alar rim grafts in minor cases (Fig. 14), with placement of ear composite grafts in more severe cases (Fig. 15).

Columellar retraction may result from overaggressive resection of the caudal septum, medial crura, or excessive setback of the medial crura after placement of a tongue-in-groove suture. An overly resected caudal septum may be addressed with a caudal septal extension graft with or without tongue-in-groove repair of the medial crural footplates. Excessive setback after tongue-in-groove suture is best addressed through revision of the tongue-in-groove until the desired effect is achieved. Columellar struts or plumping grafts may also be helpful adjunctive measures in certain cases.

A hanging columella may result from placement of an overly large columellar strut graft, septal extension graft, or tip graft. Contributing anatomy includes the caudal septum, medial crura, intermediate crura, and membranous septum. Tip deprojection and decreased rotation may also contribute. Depending on the origin, a hanging columella can be addressed by selective resection of the caudal septum and tongue-in-groove suture technique.

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**Fig. 12.** Pinched tip may result from malpositioned lateral crura, with caudal margin positioned significantly inferior to cephalic margin. *(From Toriumi DM. New concepts in nasal tip contouring. Arch Facial Plast Surg 2006;8(3):162; with permission.)*

**Fig. 13.** Patient with both alar retraction and hanging columella after previous rhinoplasty.
COLUMELLA AND ALAR BASE

**Scar Formation**

Patients should be counseled about the potential for scar formation from the columellar incision in external rhinoplasty and with all alar base excisions. Unsightly columellar scars, hypertrophic scars, and keloids are very uncommon. Alar base excisions put the patient at risk for visible scar formation. The columellar incision is performed using an inverted V, so as to prevent scar formation.\(^\text{19}\) Meticulous attention to closure will help prevent columellar and alar base scar formation.

**AIRWAY**

Nasal obstruction can occur as a result of external nasal valve collapse, internal nasal valve collapse, septal deviation, and intranasal synechia formation. Weak lateral crura can be reinforced with lateral crural strut grafts.\(^\text{16}\) Spreader grafts may be used to widen the patency of the internal nasal

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**Fig. 14.** Placement of alar rim grafts. (From Kridel RW, Chiu RJ. The management of alar columellar disproportion in revision rhinoplasty. Facial Plast Surg Clin North Am 2006;14(4):326; with permission.)

**Fig. 15.** Auricular composite grafts may be used to address alar retraction. These grafts may be placed at the level of the scroll (A) or at the caudal margin of the lateral crura (B). (From Kridel RW, Chiu RJ. The management of alar columellar disproportion in revision rhinoplasty. Facial Plast Surg Clin North Am 2006;14(4):319; with permission.)
The senior author routinely uses autospreaders, as previously noted and illustrated in Fig. 7. Meticulous inspection of nostril symmetry, position of the caudal septum, and an understanding of the dynamics of the internal nasal valve will help minimize postoperative nasal obstruction. Recurvature of the lateral crura may also result in nasal airway obstruction, especially after maneuvers that narrow the nasal base, such as alar base excisions. Lateral crural strut grafts can be used to mitigate recurvature.

**SEPTUM**

**Septal Perforation**

Septal perforation is a known risk of any septal surgery and patients should be counseled in this regard. Prior septoplasty places the patient at a higher risk. Meticulous dissection of the mucoperichondrial flaps, with avoidance of lacerating the mucosa on both sides directly opposing one another will help minimize the risk of perforation. If bilateral opposing perforations occur intraoperatively, a crushed cartilage graft may be placed to allow mucosal healing.

**Septal Hematoma**

A septal hematoma is a risk of any septal surgery. These complications result when blood accumulates within any dead space between the elevated mucoperichondrial flaps. Septal hematomas predispose patients to infection and septal perforation. Use of transseptal whip sutures, placement of inferiorly based drainage incisions, and use of soft silastic removable intranasal splints will help minimize hematoma formation. Once a hematoma develops, it should be drained immediately.

**COSTAL CARTILAGE GRAFTS**

Costal cartilage grafts, including autologous and homologous, may become visible from warping over time. This deformity occurs from the intrinsic properties of cartilage. Concentric carving can mitigate this to some degree, but it is important to counsel patients regarding the risk of cartilage warping and subsequent irregularities or visibility of the graft.

Pneumothorax is a rare complication from autologous cartilage harvest. The risk of this is roughly 1% and can usually be managed without a chest tube. Should the surgeon encounter a pneumothorax, the injury is usually confined to the parietal pleura. Management consists of inserting a sterile red rubber catheter into the wound, placing the distal end of the catheter into sterile saline (as a water seal). Anesthesia then administers positive pressure ventilation and the wound is closed as the catheter is removed. Patients should receive a postoperative chest radiograph and be admitted for observation, with a repeat chest radiograph on the morning of postoperative day one.

Homograft costal cartilage has a theoretical risk of resorption over time. Kridel and colleagues found no significant difference between autologous and homologous cartilage with regard to resorption or infection. The senior author has been using homologous costal cartilage with good results in patients who are not candidates for autologous grafts because of age (ossification), severity of obstructive sleep apnea, other comorbidities, or patient preference. It is important to counsel patients regarding the theoretical risk of resorption, although this does not seem to manifest clinically.

**SUMMARY**

The dynamics of nasal aesthetics and function are very complex, and therefore the potential for complications are myriad. A thorough understanding of nasal anatomy and how various surgical maneuvers affect both form and function is imperative. Certain complications are within the surgeon’s control, such as those related to technique, whereas those related to patient wound healing are out of the surgeon’s control. Careful patient selection, history, physical examination, photo documentation, and patient counseling about appropriate expectations are important aspects of the surgery and should not be underestimated.

**REFERENCES**