Nasal Tip Bossae in Rhinoplasty

Etiology, Predisposing Factors, and Management Techniques

Grant S. Gillman, MD, FRCSC; Robert L. Simons, MD; David J. Lee, PhD

Objectives: To identify preoperative risk factors and surgical techniques that influence the risk of developing postoperative nasal tip bossae in rhinoplasty. A secondary objective was to review the characteristics, management techniques, and outcomes of those study patients with postoperative bossae.

Design: Univariate and multivariate analysis carried out in a case series.

Setting: Private facial plastic surgery practice.

Patients: All patients who underwent aesthetic nasal surgery that included surgical modification of the nasal tip, and in whom documentation was complete and photographic follow-up was available, were considered eligible. The study group consisted of 875 patients of whom 37 (4.2%) developed bossae postoperatively.

Main Outcome Measures: Potential risk factors for postoperative bossae included age, sex, previous nasal surgery, preoperative tip asymmetry, preoperative lobular bifidity, preoperative bossae, skin thickness, surgical tip technique, use of columellar struts, columellar battens, lobular crushed cartilage grafts, and tip shield grafts.

Results: In the univariate analysis, females, patients undergoing primary rhinoplasty, younger age groups (12- to 22-year-olds), thin skin, and widened interdomal distance (bifidity) were all noted to have moderate or strong associations with nasal tip bossae. In the multivariate analysis, the younger age group, thin skin, and bifidity were statistically significant and independently associated with nasal tip bossae, independent of the type of tip surgery. In addition, clinically relevant associations were noted in females and patients undergoing primary rhinoplasty. Recognition of risk factors, preventive measures, and treatment methods is recommended.

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Table 1 presents the demographic preoperative and postoperative characteristics of the patients within the database who underwent rhinoplasty involving modification of the tip cartilages, whose records were complete, and wherein photodocumentation was available for follow-up analysis. Mean follow-up within this group was 2.26 years. The overall incidence of bossae was 4.2% and of bossae requiring revision 2.1%.

Table 2 outlines the univariate analysis reflecting the demographic and surgical correlates of postoperative nasal tip bossae. Only those factors that proved to have either a moderate or strong association with nasal tip bossae in the univariate analysis are listed. As there were no cases of bossae in patients with thick skin, these variables were not included in the univariate analysis.

NASAL TIP bossae—knuckling or prominence of the nasal tip cartilage creating visible or palpable asymmetry—are a complication of rhinoplasty that each and every rhinoplasty surgeon may face at some time in his or her career. As such, there are numerous articles in the literature and surgical texts that admonish the student of rhinoplasty about surgical maneuvers that may predispose to nasal tip bossae. Few subjects are so frequently addressed despite an overwhelming paucity of objective scientific evidence.

In an effort to examine this problem in a more systematic fashion, a study was designed to consider a number of variables that might influence the risk of developing nasal tip bossae in the postoperative course. These variables included patient demographics, preoperative nasal tip characteristics, and a variety of surgical maneuvers carried out on or around the nasal tip that might increase or decrease the risk of nasal tip bossae.
MATERIALS AND METHODS

Patients were selected from a computerized rhinoplasty database in which information regarding patient demographics, preoperative analysis, operative techniques, postoperative results, and complications are recorded as completely as possible. No intentional bias whatsoever was used in choosing patients entered into the database. All 1657 cases entered into the database were operated on by the senior author (R.L.S.), in either a community hospital or an office-based surgical suite. The approach to the nasal tip in more than 95% of cases was endonasal, using cartilage delivery through intercartilaginous and marginal incisions.

All patients were entered into the rhinoplasty database in a randomized fashion, without any prior consideration given to this or any other study. Patient postoperative photographs were reviewed with respect to complications arising, including any and all bossae, no matter how subtle. Patients who were seen in consultation only, who lacked photographic documentation beyond the preoperative period, who underwent rhinoplasty without tip surgery, or whose records were incomplete were excluded from this study. There remained 875 patients who met inclusion criteria for this study, of whom 37 developed nasal tip bossae.

Age, sex, previous nasal surgery, preoperative tip asymmetry, preoperative lobular bifidity, preoperative bossae, skin thickness, surgical tip technique, use of columellar struts, columellar battens, lobular crushed cartilage grafts, and tip shield grafts were recorded.

Nasal tip bossae were defined as any palpable or visible irregularity, knuckling, prominence, or protuberance of the tip cartilage (Figure 1). Lobular bifidity was defined as a widened interdomal distance (≥4 mm between domal highlights) or visibly apparent shadowing or dimpling in the intercrural trough or groove when photographed using 2 light sources. A complete or intact strip procedure was considered one where the caudal margin of the lower lateral cartilage remained intact along its entire length, from the footplate of the medial crura to the pyriform aperture. A vertical dome division procedure (VDD) was one where the alar cartilage was vertically divided from its cephalic through its caudal margin at or around the apex of the lobular dome.

Using the SAS logistic regression procedure,1 first in a univariate mode, we examined the probability of the measured outcome (bossae) resulting as a function of the risk factors under study. Each variable identified as a moderately significant risk factor in the univariate model (odds ratio, >2) was then reevaluated using a multivariate mode. The multivariate analysis enabled us to control for the influence of the other significant risk factors identified in the univariate mode to determine if the variable in question might independently still predict for postoperative bossae in a multivariate mode.

Second, we studied particular subsets within our sample population to test certain clinical assumptions of interest to us. In this way, we compared outcome probabilities for (1) patients who underwent VDD with the 2 medial crura sutured together (as it is practiced today) vs a complete strip procedure; (2) thin-skinned patients having either of the tip procedures outlined in (1); and (3) patients with lobular bifidity having either of the tip procedures outlined in (1).

Patients who underwent a VDD without suturing the medial elements together, a technique no longer practiced, were not included in these later analyses. Finally, we reviewed the charts of those patients with nasal tip bossae to examine revision rates, techniques, outcomes, and patient satisfaction.

Figure 1. Left nasal tip bossa as seen at 12 months following complete strip procedure (A) and intraoperatively at time of revision (B).
plasty (OR, 7.6), lobular bifidity (OR, 31), thin skin (OR, 15.7), and VDD without an intercrural suture (OR, 5.4) when compared only with VDD with an intercrural suture.

No increased risk of bossae could be attributed to patients with preoperative asymmetry, the use of a columellar batten, or VDD techniques as compared with procedures with an intact caudal strip. In fact, the likelihood of patients in this series with an intact strip procedure developing bossae was higher (1.5 times) than that of patients with VDD, although the association is a weak one.

No bossae at all occurred in patients where crushed cartilage was used as a lobular graft or patients in whom a columellar strut was used. As such, the actual calculation of an OR in these patients is impossible. The same applies to patients with VDD, although the association is a weak one.

In Table 3, the significant factors identified in the univariate model (age, sex, history of previous rhinoplasty, preoperative bifidity, and skin type) were reevaluated in a multivariate analysis. This enabled us to examine the influence of each factor isolated from the effect of all other significant variables identified. The issue of VDD with or without the use of an intercrural suture, because it includes only a portion of the total study population, was by necessity excluded from the multivariate analysis.

The multivariate analysis revealed that patients aged 12 to 22 years were 3.7 times more likely to develop bossae than the older groups. A statistically significant increase was also noted with preoperative lobular bifidity (OR, 21) and thin skin (OR approximately 6). Although the risk associated with being female or with primary rhinoplasty was no longer statistically significant in this analysis, the OR of 2.4 and 4.2, respectively, reflects a moderately strong association, suggesting that these factors may still be of clinical significance.
Nasal tip bossae, a recognized complication of rhinoplasty, are irregular, knolblike protruberances of the alar cartilages that create visible or palpable asymmetry of the nasal tip. If conspicuous, such a complication can tarnish an otherwise aesthetically pleasing result—an event that is equally distressing to both patient and surgeon alike.

In a 1988 study, Kamer and McQuown found that bossae were the most common minor deformity for which revision surgery was indicated. Similarly, Parkes et al in their series in 1992 observed that deformities requiring revision most frequently involved the lower third of the nose, of which bossae were the most common cause.

Despite that bossae might be present in as many as 26% of revision rhinoplasties, surprisingly little effort has been made to study the cause of bossae in a statistically meaningful fashion. There are numerous publications wherein authors theorize as to the possible causes of such a complication, yet a search of the English-language literature from the last 35 years revealed just 1 scientific study on nasal tip bossae.

Proposed theories of factors that might increase the susceptibility to bossa development have included interrupted strip techniques in thin-skinned individuals, malposition of the alar cartilages at times associated with an increased angle of divergence between the medial crura, excessive horizontal cartilage excision weakening the lateral crura compounded by the forces of scar contracture, unrecognized asymmetry of the lobular cartilages, VDD without suture reconstitution of the intact lateral crural strip, the triad of thin skin, firm cartilage, and intralobular bifidity, and the use of retrograde or cartilage-splitting approaches.

In the 1 scientific study about nasal tip bossae, the authors compared surgical approaches to the nasal tip and examined preoperative tip symmetry. They found that the risk of bossae correlated with preoperative nasal tip asymmetry and was higher with the use of cartilage delivery techniques than with a cartilage-splitting approach. The latter was felt to reflect the fact that delivery techniques were more likely to be used where more tip alteration was required.

In the present study, we sought to identify whether there were features related to patient demographics, the preoperative tip characteristics, or surgical maneuvers used that might influence the risk of developing postoperative nasal tip bossae. To do so, data on 875 patients were evaluated using a logistic regression technique, first in a univariate and then in a multivariate mode. Thirty-seven patients (4.2%) developed bossae, only 18 of whom (2.1%) desired revision.

In the univariate analysis, moderate or strong associations with nasal tip bossae were identified for females, primary rhinoplasty, lobular bifidity, thin skin, and younger patients (ie, 12- to 22-year-olds). Each of these was then reevaluated in the multivariate analysis to isolate separate variables while controlling for the possible influence of the others. In this case, a statistically significant association was still seen for the younger group, lobular bifidity, and thin skin. While no longer statistically significant, the moderately high OR noted with primary rhinoplasty and females still suggests that these may nonetheless be of clinical significance.

Several authors have suggested that thicker, firmer, more resilient cartilage may be risk related to nasal tip bossae. While the quality of cartilage itself was not specifically registered in the database, it is likely that the effect of cartilaginous strength underlies the association of bossae with younger patients.

Our finding that a widened interlobular distance (bifidity) is associated with an increased susceptibility to tip

Table 4. Tests of Clinical Assumptions

<table>
<thead>
<tr>
<th>Measure</th>
<th>No. at Risk</th>
<th>No. With Bossae</th>
<th>Univariate Odds Ratio (95% CI)</th>
<th>Multivariate Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects (N = 833)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDD with suture</td>
<td>572</td>
<td>17</td>
<td>1.00 (Reference)</td>
<td>1.00†† (Reference)</td>
</tr>
<tr>
<td>Complete strip</td>
<td>261</td>
<td>14</td>
<td>1.85 (0.90-3.81)</td>
<td>3.50 (1.40-8.02)</td>
</tr>
<tr>
<td>Thin-skinned patients (n = 55)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDD with suture</td>
<td>33</td>
<td>9</td>
<td>1.00 (Reference)</td>
<td>1.00‡† (Reference)</td>
</tr>
<tr>
<td>Complete strip</td>
<td>22</td>
<td>4</td>
<td>0.59 (0.15-2.23)</td>
<td>1.02 (0.19-5.53)</td>
</tr>
<tr>
<td>Lobular bifidity patients (n = 81)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDD with suture</td>
<td>62</td>
<td>15</td>
<td>1.00 (Reference)</td>
<td>1.00‡† (Reference)</td>
</tr>
<tr>
<td>Complete strip</td>
<td>19</td>
<td>7</td>
<td>1.83 (0.61-5.49)</td>
<td>2.11 (0.66-6.76)</td>
</tr>
</tbody>
</table>

*CI indicates confidence interval; VDD, vertical dome division.
†Multivariate model controls for age and bifidity.
‡Multivariate model controls for age.

COMMENT

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bossae would seem to justify the growing interest that has evolved during recent years in the use of sutures between the 2 medial crura or interdomal suturing. Stabilization of the medial elements of the nasal tip in this fashion should help protect against the uncontrolled migration of cartilage in the domal region throughout the healing process and in so doing reduce the risk associated with presurgical lobular bifidity or domal separation (Figure 2).

Since ultimately the overlying skin–soft tissue envelope modulates the underlying anatomy of the nasal skeleton, it comes as no surprise that thinner skin, less able to camouflage any underlying irregularities, is associated with a higher risk of nasal bossae. It is noteworthy, however, that the effect of thin skin was seen irrespective of the type of tip surgery.

The postoperative shrinkage and redraping of skin around cartilage is recognized as a long-term phenomenon in the healing process. Furthermore, thinning of skin with increasing age occurs naturally in all people—a process to which the postsurgical patient is not immune. This underscores the need to meticulously inspect the domal cartilage at the time of the primary sur-

Figure 2. Preoperative view (A) demonstrating wide separation of domal highlights and shadowing of intercrural trough in patient who underwent intact strip procedure without interdomal sutures. Six-year follow-up (B) shows effect of scar contracture and buckling at domal region, with further separation of domal highlights and bossae.

Figure 3. Development of right nasal tip bossa and alar retraction in a patient who underwent horizontal excision of alar cartilage without suturing. Over time, progressive contracture, alar retraction, spread of medial crura, and buckling on the right results in tip bossa. Preoperative (A, B, C), 6-month (D, E, F), and 14-year (G, H, I) postoperative views.
gery to address any irregularities and excise or round any sharp edges. The use of a thinned crushed cartilage layer over the domal region may provide further camouflage in these patients.

It is interesting that VDD, often mentioned in association with bossae, was in fact 3.5 times less likely to result in bossa formation when used with sutures uniting the 2 medial crura than was an intact caudal strip procedure. While no scientific articles could be found that corroborated any association of VDD with bossae, articles by Anderson,17 Goodwin and Schmidt,10 and Simons4 have all previously alluded to a possible protective effect of vertically separating the alar cartilages at their angles.

The findings in this study support the theory that the pathogenesis of nasal tip bossae may be related to the unfavorable effect of postoperative fibrosis on the alar cartilage, to which those with thin skin, intralobular bifidity, and firm cartilage are most susceptible (Figure 3). Horizontal excision with intact caudal borders can lead to vectors of scar contracture that buckle and narrow intact alar rims, especially when there is preoperative weakness or separation in the interdomal area or no opposing fibrosis medially (Figure 4). The answer is not to transect all domes, but to be aware of the predisposing conditions and, when necessary, strengthen the interdomal area with sutures and/or vertical division (Figure 5).

The strengths of this study would include the large sample size and the statistical sophistication in that univariate and multivariate statistical techniques have not been previously used to identify risk factors for nasal tip

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**Figure 4.** Schematic representation of bossa formation. Vectors of rotation and contraction following cephalic resection of alar cartilage (A) create potential for separation of medial crura and buckling in domal region (B).

**Figure 5.** Patient who underwent vertical dome division without suturing the medial elements together who developed bilateral bossae during a 2-year period. Revised using delivery technique, shave excision, and suturing of medial crura together. Preoperative (A), 2-month postoperative (B), 2-year postoperative (C), and 6-month postrevision (D) views.
bossae. The apparent limitations on the other hand would include the retrospective nature of the medical chart data and the fact that patient evaluation was not carried out in a blinded fashion.

Should bossae develop in the postoperative rhinoplasty patient, treatment techniques might include direct shave excision, transdomal suturing, VDD, camouflaging onlay grafts, or cartilage grafting to reconstruct overly resected crura—all through either an endonasal or external approach. As always, however, an awareness of etiologic risk factors and preventive measures as outlined in this study is the safest and sagest treatment of all.

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REFERENCES

Quotable
Know that the secret of art is to correct nature.
Voltaire
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Corresponding author: Deborah Watson, MD, 4991 Concannon Ct, San Diego, CA 92130.

Reprints: Gregory Keller, MD, 2323 De La Vina, Suite 104, Santa Barbara, CA 93105 (e-mail: faclftr@aol.com).

REFERENCES


Correction

Error in Figure Orientation. In the original article titled, “Nasal Tip Bossae in Rhinoplasty: Etiology, Predisposing Factors, and Management Techniques,” published in the April-June 1999 issue of the ARCHIVES (1999;1:83-89), Figure 5, C and D, on page 88 were transposed incorrectly during processing for publication. Figure 5 is reprinted correctly here.

Figure 5. Patient who underwent vertical dome division without suturing the medial elements together who developed bilateral bossae during a 2-year period. Revised using delivery technique, shave excision, and suturing of medial crura together. Preoperative (A), 2-month postoperative (B), 2-year postoperative (C), and 6-month postrevision (D) views.