Reconstruction of Nasal Alar Defects in Asian Patients

Doo Hee Han, MD; Dennis Cristobal S. Mangoba, MD; Doh Young Lee, MD; Hong Ryul Jin, MD, PhD

Objectives: To present the aesthetic and functional outcomes of nasal alar reconstruction in Asian patients and to propose a working surgical algorithm.

Methods: Seventeen patients underwent nasal alar reconstruction at a university-based facial plastic surgery practice from March 1, 1998, through February 28, 2010. The male-female ratio was 10:7, with a median age of 59 years (range, 34–78 years), and the mean follow-up duration was 64 months.

Results: The defect was mostly caused by basal cell carcinoma resection (14 of 17 [82%]), followed by the resection of squamous cell carcinoma, trauma, and excision of a previous scar. The mean defect size was 1.71 cm (range, 1-4 cm). The full-thickness defects were noted for 8 patients, whereas 9 had partial-thickness defects. The choice of reconstruction method was primarily based on the size and depth of the surgical defect. Most of the defects 1 to 2 cm in diameter needed nasolabial flaps (10 of 17 [59%]), whereas full-thickness defects larger than 2 cm needed forehead flaps (3 of 17 [18%]) to reconstruct the external defect. Smaller defects less than 1 cm were reconstructed with composite grafts (2 of 17 [12%]), a bilobed flap (1 of 17 [6%]), or primary closure (1 of 17 [6%]). Seven of 8 full-thickness defects had the internal nasal lining reconstructed using a septal mucoperichondrial flap, and 1 case was reconstructed using a cutaneous turn-in flap. Reinforcement cartilage graft was used in 8 patients. No flap failure occurred except in 1 case, in which necrosis of the internal lining flap caused contraction of the external flap with resultant alar rim blunting. An elevation of the alar margin and alar groove blunting occurred in 3 cases. No functional problems emerged. Subjective surgical outcome on a 4-point satisfaction scale revealed that 5 patients (29%) were much satisfied, 10 patients (59%) were satisfied, 1 patient (6%) was fairly satisfied, and 1 patient (6%) was dissatisfied.

Conclusions: The choice of reconstruction method of nasal alar defect in Asian patients depends primarily on the size and depth of the defect. Staged local flaps, use of cartilage reinforcement grafts, and internal lining reconstruction using septal mucoperichondrial flaps are key elements for achieving optimal aesthetic and functional results.

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The purposes of this study are to describe our experience in nasal alar reconstruction and to present the aesthetic and functional results in Asian patients. We also propose a surgical algorithm that helps choose the optimal reconstruction method, depending on the characteristics of the alar defect.

Seventeen patients who underwent reconstruction of nasal alar defects from March 1, 1998, through February 28, 2010, at a tertiary referral center formed the study population. Patients with concurrent defects of more than half of the adjacent nasal subunits, such as tip or nasal sidewall, were excluded from the study. The male-female ratio was 10:7, with a median age of 59 years (range, 34-78 years). The minimum follow-up duration was 12 months, with a mean of 64 months.

A retrospective review and analysis of the medical records were performed. The location, origin, size, and depth of the alar defects, reconstruction methods, surgical results, and complications were analyzed. Clinical follow-up included a complete physical examination with rhinoscopic, endoscopic, and tactile assessment of the nose. For objective evaluation of the surgical results, preoperative and postoperative facial photographs were analyzed by 2 physicians from other departments, who were masked to the purpose of the study.

Postoperative photographs were taken at least 6 months after the initial surgery. Patients’ subjective aesthetic satisfaction was measured using a 4-point scale questionnaire. As a measure of functional outcome, the presence of persistent nasal obstruction and/or crusting was studied using medical record analysis. All evaluations were performed at least 6 months after surgery.

This study was approved by the institutional review board of Seoul National University Borame Hospital, and informed consent was obtained from all patients for the publication of the figures in this article.

Most defects (15 of 17 [88%]) resulted from resection of a malignant skin lesion arising from the nose, among which 14 cases were basal cell carcinoma (BCC) and 1 case was squamous cell carcinoma (SCC). One case resulted from full-thickness tissue loss secondary to trauma and another stemmed from excision of a previous post-herpes zoster scar. The mean size of the defect was 1.71 cm (range, 1-4 cm). Full-thickness defects were noted for 8 patients (6 BCC excisions, 1 trauma, and 1 scar excision), whereas 9 had partial-thickness defects (8 BCC and 1 SCC excisions).

Among the local flaps, the nasolabial flap was used most extensively (12 of 17 [71%]), generally for defects smaller than 2 cm. It was used alone (10 cases) or in conjunction with other flaps or a composite graft (2 cases). It was used to reconstruct 7 of 8 cases presenting with full-thickness defects and 5 of 9 cases with partial-thickness defects. Paramedian forehead flaps were used in 3 cases, all of which were full-thickness defects that were 3 to 4 cm in diameter. A composite graft from the cymba concha was used in 3 cases, which were partial-thickness defects of less than 2 cm. One partial-thickness defect of 1 cm involving only the supra-alar groove was reconstructed using a bilobed transposition flap. Primary closure with nasolabial extension was used in a small defect involving the supra-alar and alar-facial grooves (Table 1). Eight patients (47%) used cartilage reinforcement grafts. For internal lining reconstruction in full-thickness defects, 7 cases used a septal mucoperichondrial flap, whereas 1 case used a cutaneous turn-in flap. All nasolabial and forehead flaps were used as a staged flap.

Table 1. Summary of 17 Patients Who Had Reconstruction of the Alar Defect

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Origin of Defect</th>
<th>Depth of Defect</th>
<th>Defect Size, cm</th>
<th>Reconstruction Method</th>
<th>Cartilage Lining Complication</th>
<th>Objective Aesthetic Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/F/60 BCC</td>
<td>Partial</td>
<td>1.3</td>
<td>NLF</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>2/F/60 BCC</td>
<td>Partial</td>
<td>1.5</td>
<td>NLF</td>
<td>No</td>
<td>No</td>
<td>Alar groove blunting</td>
</tr>
<tr>
<td>3/M/55 BCC</td>
<td>Partial</td>
<td>1.5</td>
<td>NLF</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>4/M/30 BCC</td>
<td>Partial</td>
<td>1.5</td>
<td>NLF</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>5/M/70 SCC</td>
<td>Partial</td>
<td>2.0</td>
<td>NLF</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>6/M/40 BCC</td>
<td>Full</td>
<td>1.0</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
</tr>
<tr>
<td>7/M/60 BCC</td>
<td>Full</td>
<td>1.0</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
</tr>
<tr>
<td>8/M/50 BCC</td>
<td>Full</td>
<td>1.0</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
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<tr>
<td>9/M/69 BCC</td>
<td>Full</td>
<td>1.3</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
</tr>
<tr>
<td>10/F/70 BCC</td>
<td>Full</td>
<td>3.0</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
</tr>
<tr>
<td>11/M/78 BCC</td>
<td>Full</td>
<td>4.0</td>
<td>NLF</td>
<td>Yes</td>
<td>SMPF</td>
<td>None</td>
</tr>
<tr>
<td>12/M/50 Trauma</td>
<td>Full</td>
<td>3.0</td>
<td>FHF and NLF</td>
<td>Yes</td>
<td>CTIF</td>
<td>Flap contraction with elevated alar margin</td>
</tr>
<tr>
<td>13/M/72 Scar excision</td>
<td>Full</td>
<td>3.0</td>
<td>FHF, NLF, and composite graft</td>
<td>Yes</td>
<td>SMPF</td>
<td>Elevated alar margin</td>
</tr>
</tbody>
</table>
In 1 old-aged smoker who had a forehead flap for reconstruction after BCC excision (patient 11; Table 1), a transient discoloration with skin sloughing of the distal flap was observed. However, the flap survived, and no other complications emerged. One patient in whom an excised zoster scar was reconstructed using a combined nasolabial flap, forehead flap, and a conchal cartilage composite graft had a slight alar rim elevation (patient 13; Table 1). Another patient with a full-thickness defect of the ala reconstructed with a forehead flap for external covering and cutaneous turn-in flap for internal lining showed a contraction of the forehead flap due to necrosis of the internal lining (patient 12; Table 1). An alar groove blunting was noted in the patient undergoing BCC excision, which was reconstructed using a nasolabial flap (patient 2; Table 1).

Subjective aesthetic satisfaction measured through a 4-point satisfaction scale revealed that 5 patients (29%) were significantly satisfied, 10 patients (59%) were satisfied, 1 patient (6%) was fairly satisfied, and 1 patient (6%) was dissatisfied. The objective aesthetic outcome revealed an excellent result in 7 patients (41%), a good result in 5 patients (29%), a fair result in 3 patients (18%), and a poor result in 2 patients (12%). The functional evaluation showed that none of the patients presented with nasal obstruction or crusting.

REPRESENTATIVE NASOLABIAL FLAP CASE

A 70-year-old man presented with BCC involving the left alar-facial groove (patient 5; Table 1). The resulting full-thickness defect after a wide excision was 2 cm in diameter (Figure 1A). A staged, superiorly based nasolabial flap was planned to reconstruct the defect. The covering flap was designed as the exact same size of the surgical defect. The medial incision for the flap followed the course of the nasolabial fold, whereas the lateral incision was placed no higher than the level of the inferior defect margin. The flap elevation was started subcutaneously, going deeper in the plane while proceeding in a superior direction (Figure 1B). The elevated flap was rotated clockwise and transposed to reach the defect. Before flap closure, a nonanatomical conchal cartilage graft was placed along the alar margin to prevent nasal valve collapse or contraction of the flap (Figure 1B). The pedicle was divided after 3 weeks. While the flap was being divided, a small amount of subcutaneous tissue was removed to contour the flap. At 3 months postoperatively, the left ala showed a well-blended, good color-matched flap without any collapse or contraction of the alar wall (Figure 1C).

REPRESENTATIVE FOREHEAD FLAP CASE

A 78-year-old man presented with an exophytic BCC that involved the entire right alar subunit and had a resulting 4-cm, full-thickness defect after wide excision (patient 11; Table 1 and Figure 2A). The internal lining was reconstructed with a septal mucoperichondrial flap, and the conchal cartilage was grafted for support (Figures 2B and C). A staged paramedian forehead flap was planned to reconstruct the surgical defect. After making a template of the alar defect, it was transferred just below the hairline and centered on the pedicle of the supratrochlear artery (Figure 2C). The distal covering portion of the flap was elevated subcutaneously, leaving the frontalis muscle intact, whereas the pedicle portion was elevated in the subperiosteal plane. The flap was thinned to the subcutaneous plane as needed and mobilized to cover the defect (Figure 2D). The forehead donor site was closed primarily as much as possible, with the residual donor site defect left to heal by secondary intention for 4 to 6 weeks (Figure 2E). The vascular pedicle was divided after 3 weeks (Figure 2F). A 1-year postoperative photograph shows an excellent aesthetic result in the forehead and the ala (Figure 2G).

COMMENT

The round, 3-dimensional shape of the nasal ala and its anatomical position pose functional and aesthetic challenges in reconstruction. It is a unique structure
among the nasal subunits in many aspects. The alar lobule consists of 3 distinct layers: external skin, muscle, and vestibular skin lining. This structure has no actual cartilage but acts like a cartilaginous subunit because it lacks a discrete fat layer and because the muscular components interdigitate with external skin and the vestibular dermis. The shape is influenced by the volume of dilator muscles, and the alar groove is actually composed of organized collagen and elastin fibers.

Figure 2. Representative forehead flap case. A, A 4-cm, full-thickness defect of the right ala after excision of basal cell carcinoma. B, Elevation and mobilization of septal mucoperichondrial flap for internal lining. C, An auricular cartilage was grafted on the reconstructed internal lining for support, and a paramedian forehead flap design was marked. D, Immediately after the transfer of the paramedian forehead flap with partial closure of the donor defect. E, Before division of the forehead flap pedicle with a portion of the donor site left to heal by secondary intention; note the discoloration of the flap. F, After the flap pedicle division, the donor site defect decreased and the discoloration of the covering flap became mild. G, A 1-year postoperative photograph shows an excellent cosmetic result for donor and defect sites.
The major and challenging aesthetic issue in alar reconstruction in our series was preserving its natural grooves, especially the alar facial and the superior alar grooves. When obliteration occurred, a staged reconstruction of the groove was performed to make a distinction between the alar and adjacent subunits or the cheek. This reconstitution worked well in 2 patients in our series who had blunting of the alar facial groove with no problems reported afterward. To prevent the staged procedure to reconstruct the alar groove and avoid its obliteration, advancement of the cheek skin beneath the posterior free edge of the reconstructed ala was proposed as a 1-stage procedure by one of us (H.R.J.), making use of the natural tendency of the skin to tube itself to produce a natural alar groove. 11 Contrary to the alar grooves, the distinction between the ala and the tip or soft tissue triangle was not an aesthetic issue. This is partly because the distinction between the ala and the soft tissue triangle is not clear because of the thick sebaceous skin of the ala and weak underlying cartilage in Asian patients. Good matching of the texture and color of the skin was more important than the aesthetic subunit principle. 3 These differences in alar reconstruction between Asian and white patients are summarized in Table 2.

In terms of functional considerations, we had no patients with nasal obstruction due to alar collapse. We used a cartilage support graft from the concha in every case in which the defect was located near the alar margin and the size of the defect was larger than 1 cm. These support grafts helped to prevent alar collapse or alar rim retraction. 12,13 We concur with the idea that a support graft is needed even though alar tissue has no naturally occurring cartilage support to prevent collapse or retraction.

In choosing the reconstruction method for nasal defects, characteristics of the lesion, including size and depth, age of the patient and commensurate skin laxity, physical status, patient wishes, and surgeon’s experience, play important roles. 14,16 Among these factors, it was the size and depth of the alar defect that proved to be the most important factors in choosing an optimal reconstruction method to cover the defect in our series. From our series, we devised a working algorithm (Figure 3) to help decide the best surgical method to reconstruct the external defect based on how large and how deep the alar defect was, which produced consistently excellent and reproducible results. In partial-thickness alar defects, if the size is less than 1 cm, either primary closure or a conchal cartilage composite graft produced good to excellent results with no complications. For defects larger than 1 cm but not more than 2 cm, a nasolabial flap was the flap of choice. In full-thickness defects, a nasolabial flap was ideal to cover defects of 2 cm or less, but the forehead flap was the best reconstructive option for defects larger than 2 cm. Regardless of the flap choice for the external defect covering, the best option for the reconstruction of the internal lining appeared to be the septal mucoperichondrial flap whenever the nasal septum was preserved. A cutaneous turn-in flap that we used in the full-thickness defect of the ala failed and resulted in the contraction of the external forehead flap that we used for covering. This result verifies the importance of the successful inner layer reconstruction in full-thickness defects. 13,16

In conclusion, the major determining factors in choosing the reconstruction method of alar defects in Asian patients are the size and depth of the defect. The nasolabial and forehead flaps were the key flaps to reconstruct the defects. Staged local flaps, use of cartilage reinforcement grafts, and internal lining reconstruction using septal mucoperichondrial flaps are key elements for achieving optimal aesthetic and functional outcomes.

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Correspondence: Hong Ryul Jin, MD, PhD, Department of Otorhinolaryngology, Seoul National University Boramae Medical Center, 423 Shindae bang-2-dong, Dongjak-gu, Seoul 156–707, Korea (hrjin@paran.com).
Author Contributions: Drs Han and Mangoba contributed equally to this work. Study concept and design: Man-

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**Table 2. Nuances of Alar Reconstruction in Asian Patients Compared With White Patients**

<table>
<thead>
<tr>
<th>White Patients</th>
<th>Asian Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin skin and strong alar cartilage</td>
<td>Thick skin and weak alar cartilage</td>
</tr>
<tr>
<td>Better wound scar</td>
<td>Frequent wound buckling</td>
</tr>
<tr>
<td>Support graft necessary to prevent collapse of nasal valve or retraction of alar rim</td>
<td>Support graft necessary to prevent retraction of alar rim</td>
</tr>
<tr>
<td>Clear subunit distinction</td>
<td>Clear subunit distinction</td>
</tr>
<tr>
<td>Strict application of subunit principle necessary</td>
<td>Good matching of color and texture more important</td>
</tr>
</tbody>
</table>

**Figure 3.** An algorithm for choice of reconstruction method to cover the skin defect based on the size and the depth of the alar defect.
Acquisition of data: Lee and Jin. Analysis and interpretation of data: Han, Mangoba, and Jin. Drafting of the manuscript: Han, Mangoba, Lee, and Jin. Critical revision of the manuscript for important intellectual content: Han, Mangoba, and Jin. Statistical analysis: Lee. Study supervision: Han and Jin.

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REFERENCES