Asian Rhinoplasty with Rib Cartilage

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Abstract

An Asian rhinoplasty is one of the most popular procedures in plastic surgery. The anatomical characteristics of the Asian nose are quite different from those of other races, including low dorsum height, short columella, a thick soft tissue covering on the tip with flaccid lower lateral cartilage, and a sunken midface with relative protrusion of the mouth due to maxilla or premaxillary retrusion. For augmentation and lengthening of the nose, a silicone implant has been commonly used in Asian countries. However, many patients suffer from silicone-related complications, which induce soft tissue contraction and deform the already fragile nasal structure. Additionally, revision surgery is also increasing in frequency due to greater patient sophistication and higher expectation that the end rhinoplasty result to be more harmonious with the patient's overall facial structure. In these circumstances, a rhinoplasty using autologous rib cartilage, giving strong support and enough amount of the cartilage to correct deformed structure and midface skeletal retrusion. If properly performed with enough experience, a rib cartilage rhinoplasty will provide excellent and long-lasting results with low risk.

Keywords

- ▶ Asian nose
- ▶ autologous rib cartilage
- ▶ long-lasting results
- ▶ low risk

Most Asians have a short retruded columella, wide and flaring nostrils, a broad and ill-defined nose tip, a low dorsal profile, and protruded lips due to midface retrusion.^{1,2} To correct these features, a rhinoplasty has become one of the most popular cosmetic surgeries for Asians. Their distinct anatomy, different from that of Caucasians, includes thick skin and abundant sebaceous soft tissue under the nose tip, weak and thin alar cartilage, thin and limited amount of septal cartilage, wide and thick alar lobules, short and retracted columella, small and foreshortened nasal structure, and retruded midface structure with protruded alveolar arch.^{3,4}

In an Asian rhinoplasty, a silicone implant has been commonly used because of its placement under thick skin, easy sizing, and low cost. With the passage of time, implant-related complications such as external extrusion, infection, displaced implant, development of contraction, and skin thinning have occurred.^{5–7} Additionally, due to the development and global proliferation of media, social networking services (SNSs), and the Internet, the desires and expectations of today's patient are increasing in terms of beauty concepts. These factors drive many patients to have initial and perhaps

repeated surgeries to promote overall facial balance and proportion instead of simple nose implant surgery.⁸

Surgeons who perform an Asian rhinoplasty often treat patients who have been operated on several times—some more than three to five times—who have no remaining septal cartilage or even conchal cartilage to be harvested. In these circumstances, autologous costal cartilage is an excellent source of grafting material for Asian nose surgery, providing enough cartilage and a strong supporting structure as well as safety due to its autologous character. When an autologous rib cartilage rhinoplasty is performed properly by an experienced surgeon for a short nose or in complicated cases with a badly scarred, burnt-out nose, it will provide an excellent, reliable, and long-lasting result with low risk.³

Harvesting the Rib Cartilage

Cartilage is typically harvested from the sixth or seventh rib. If additional cartilage is required, the eighth or ninth rib also may be harvested. When harvesting cartilage, scar on the chest wall is a major patient concern; this will cause

complications in a patient's acceptance of a rib cartilage rhinoplasty. Therefore, in female patients, the incision is placed at the inframammary fold to decrease scar deformity.⁹ If a patient is to have breast augmentation later, the incision is designed on the anticipated new inframammary fold. The incision length depends on which rib is harvested. The incision length for the sixth rib is 2-cm incision at the middle of the inframammary fold; the seventh rib incision length is 3- to 3.5-cm lateral from the vertical line of the nipple-areola-complex. Medial extension of the incision beyond the vertical line from medial nipple-areola-complex aggravates scarring and is best avoided.¹⁰ In males, the incision is usually placed directly over the desired rib to facilitate dissection.

After skin incision, the dissection is performed along the muscle fascia plane widely from incision to the eighth rib up and down, and between the medial border of the seventh rib and the bony junction side to side using electrocautery. The oblique abdominis muscle and rectus abdominis muscle are split vertically and retracted superiorly and inferiorly with Army-Navy retractors. This dissection should be carried medially until the junction of the rib cartilage and sternum can be palpated. The most lateral extent of the dissection is demarcated by the bony junction.

After exposing the selected rib, a longitudinal incision is made through the perichondrium along the length of the central axis of the rib using electrocautery. Next, careful perichondrial dissection is continued circumferentially along the length of the cartilaginous portion of the rib until the posterior aspect of the rib is exposed. During elevation, perichondrial elevators are employed to release the posterior adherence between the rib cartilage and perichondrium. At this point, the perichondrial dissection under the rib cartilage should be performed under direct vision to avoid violating the perichondrium. The cartilaginous rib is incised from its medial attachment near the sternum and laterally at the bony rib junction. Next, perichondrium is harvested from the upper surface of the remaining ribs. The wound is evaluated for any obvious air leak. Skin closure is performed using dermal 2-0 and 3-0 Vicryl sutures. Steri-Strips are used instead of 6-0 nylon sutures.

Nasal Dissection

An inverted-V incision is made along the midcolumella and the incision is connected to bilateral marginal incisions. For secondary rhinoplasty, the previous incision line is used, and the uppermost incision line is chosen because of the survival of the columellar flap when there are multiple incision scars. The columella and dorsal skin flap are elevated to the level of the perichondrium of the lower lateral cartilage (LLC) with tenotomy scissor and Converse right-angle scissor. The dissection plane depends on the skin thickness. In thin-skin patients, the LLC is clearly separated from the skin flap, but in thick-skin patients some subcutaneous soft tissue is left on the LLC to remove subcutaneous soft tissue and make the tip more defined.

The LLC must be released from the upper lateral cartilage (ULC) to allow inferior displacement of the tip to lengthen a short nose. A two-pronged skin hook is used to pull LLC

caudally, and the ligamentous structure between LLC and ULC is dissected while attention is paid to prevent tearing the nasal mucosa.

The septum is approached by dissecting between the medial crura to expose the caudal septum. The caudal aspect of the septum is scored and sharp dissection is performed to identify the subperichondrial plane, and bilateral mucoperichondrial flaps are elevated to expose the septum. The ULC is then separated from the septum at the midline. Once the septum is exposed, any deviated septum or bony ridge that promotes nasal airway obstruction is removed.

The dorsum of the nose is made as flat as possible to give the maximum surface area for the dorsal onlay graft to contact. The cartilaginous dorsum is trimmed with a No. 15 blade or scissors, and any contour irregularity of the bony dorsum is removed with a drill or a diamond bur. The soft tissue between the medial crura is dissected down to the nasal spine, and the nasal spine is exposed to make a hole. The premaxilla pocket for maxillary or premaxilla grafts is prepared. Once all soft tissue work is finished, a 1.0-mm hole is drilled through the spine itself so the suture can pass.

Carving the Cartilage

We prefer the seventh rib because its most medial part is straight enough and approximately 2.5- to 3-cm long to make a columellar strut; the midrib portion is wide enough and thick enough to carve a dorsal implant; the lateral part is adequately curved for a maxillary or premaxillary graft (►Fig. 1A). The middle 5 to 6 cm of the harvested seventh rib is prepared for the dorsal graft and the bilateral spreader grafts. The bottom cortex of the rib cartilage—approximately 2 mm thick—is sliced for the bilateral extended spreader grafts (►Fig. 1B). The remaining main body is carved into a shape larger than needed for possible later adjustment. The dorsal graft is carved from the central core of the straight midsegment of the seventh rib (►Fig. 1C). The concave side becomes the bottom of the implant. If the cartilage is irregularly calcified or soft, cortical surface is preserved on purpose to prevent uneven absorption. After the dorsal graft is carved, some balanced cuts are made in several directions in the cartilage to prevent it from warping. If the graft still has a tendency to warp, it is reinforced with a centrally placed 0.035-inch threaded K-wire to decrease the warping and to provide a more stable and predictable result.¹¹

Columellar strut grafts are classified according to cartilage shape as a single graft or bilateral batten grafts. The single graft is sequentially carved: (3 mm) × (5–8 mm) × (25–30 mm) in size with a flared base that could be notched to accommodate the anterior nasal spine (►Fig. 1D). In case the strut shows some warping, a thin batten graft is added to the concave side. If the cartilage tends to curve severely, bilateral batten grafts—(1.5–2 mm) × (15 mm) × (30 mm) in size—are used and fixed to the distal septum as a strut.

The spreader grafts are shaped to measure 30 to 35 mm long and 3 mm wide. Bilateral spreader grafts are placed along either side of the septum extending from the keystone area to the septal angle, and then an additional 5 mm more

Fig. 1 (A) The harvested seventh rib cartilage. (B) The bottom cortex of the rib cartilage. (C) The carved dorsal graft. (D) Columellar strut graft with groove in center for anterior nasal spine. (E) A pair of extended spreader grafts is inserted into between upper lateral cartilage and septum on each side. (F) A pair of maxillary grafts. (G) Columellar strut graft over the premaxilla graft. Premaxillary graft with a groove in the center to be fixed to the strut graft. (H) The perichondrium used for prevention of graft visibility. (I, J) A curved ear cartilage is used for covering tip area with marginal beveling.

from the septal angle. Additional spreader grafts are used to balance both midvaults, if needed. The columellar strut is placed and fixed on the top of the anterior nasal spine or premaxilla graft for the lower part^{12,13} and between the

spreader grafts for the upper part in a tongue-in-groove fashion (► Fig. 1E).¹⁴

The remaining costal cartilage is used to make a maxillary or premaxilla graft. A pair of maxillary grafts is 8 to 10 mm

long, 4 to 6 mm wide, and 4 to 6 mm thick, and its border is tapered (►Fig. 1F). The premaxillary graft is shaped as a half-moon with a notch: The dimensions are 26- to 30-mm long, 5 to 10 mm wide, and 5 to 6 mm thick with its border also tapered (►Fig. 1G). Depending on the severity of the deficient premaxilla, a pair of maxillary grafts or a premaxilla graft is inserted into the premade pocket through around the anterior nasal spine without any fixation.

Graft visibility is a common long-term complication. In case the patient's skin is thin or a high dorsal graft is placed, rib perichondrium or temporalis muscle fascia may be used to prevent graft visibility (►Fig. 1H). Similar to the use of beveled or crushed ear cartilage for tip only (►Figs. 1I and J), a costal cartilage shield graft should be covered with perichondrium to prevent visibility. To prevent infection, carved cartilages are stored in antibiotic saline gauze when not used, as well as during nasal dissection. Also, nasal lining damage or a tear should be avoided at the keystone area or the distal septal septum. Accumulation of blood or fluid can be decreased by using a silicone drain inside the nose for approximately 4 days.

Discussion

In plastic surgery of the nose, silicone implants have historically been widely used to augment the dorsum, increase the length of the nose, and project the nasal tip in Asian countries. Solid silicone has been used, from bridge to tip, even for the columella. However, solid silicone can induce several problems: a shrink-wrapped appearance of the nose; a hard feel of the implant, which brings up the image of a piece of chalk laid on the bridge of the nose; skin discoloration affected by temperature fluctuation; and distal migration of silicone that leads to skin erosion and extrusion of the implant over the skin on the tip.^{5,15}

Although the silicone-implant-only approach has been fraught with complications, both the widespread use of the open rhinoplasty approach and Dr. Byrd's introduction of the septal extension graft,¹⁶ while enhancing the nasal tip shape and position through controlled elongation and tip projection, helped to evolve the simple single solid-silicone-implant technique into a two-piece technique: (1) augmenting the dorsum with silicone or Gore-Tex, and (2) using autologous ear and septal cartilage for tip-plasty.^{17,18}

However, Asian patients' septal and ear cartilages are thin and small, with flimsy lower lateral cartilage for tip support, while their soft tissue envelopment is composed of a thick, dense fibromuscular layer with abundant fatty tissue. These soft tissue characteristics do not make it easy to form nasal tip projection and refinement with septal or ear cartilage.¹⁹ Moreover, because the development of the nasal spine and the premaxilla of the nasal base is inadequate, if columella and midface retrusion is not well corrected, even with well-constructed and supported nasal work, the overall appearance will still result in mouth protrusion without facial balance.

Because Asian patients expect a facially harmonized look,⁸ many patients may undergo more than three revision surgeries to correct or offset improperly performed surgeries, the improper use of implants, or surgical complications.²⁰ In

many such cases, the use of rib cartilage is a good alternative in an Asian rhinoplasty.

With its superb strength supporting flaccid alar cartilage, rib cartilage allows a broad or wide nostril shape to transform into an oval-shaped nostril by lengthening of the short columella. It also allows nasal lengthening of a short nose with enough tip projection and a strong nasal framework. In addition, an abundant amount of harvested cartilage provides premaxilla, maxilla, and paranasal grafts for retruded nasal base reconstruction, along with various types of batten grafts and tip graft materials for many different types of correction.^{12,13}

In determining the overall harmony of the face and nose, facial convexity plays a crucial role. However, many Asians have poor development of the nasal spine and premaxilla with midface depression, forming a relative mouth protrusion.^{2,4} Therefore, if midface retrusion is not well improved after a rhinoplasty, the postsurgical results will be unnatural without any harmony of the overall facial appearance, even with a well-constructed nasal framework.^{8,21}

Particularly, Asian people today are striving for a sophisticated look. According to a recent survey, 37 popular Korean models and actresses have an average facial convexity angle of 168.5 ± 2.52 degrees (►Fig. 2), which is close to Westerners' average, 168 ± 4 degrees.^{22,23} Generally among Asian people, however, a facial convexity angle of 175 to 180 degrees is common due to nasal spine and midface retrusion (►Fig. 3).²¹ Because facial skeleton deformity correction is necessary for a harmonized face, rib cartilage plays an important role in various cases in Asian rhinoplasty from complicated and contracted cases to small and short primary cases and midface retrusion (►Table 1).²¹

There are many controversies in regards to using cadaver rib for rhinoplasty. Because donated cadaver rib is not live, autologous tissue, it is likely to face problems such as capsule formation due to unassimilated tissue, poor

Fig. 2 The angle of facial convexity. This angle is composed with connecting soft tissue glabella (G'), subnasale (Sn), and soft pogonion (Pg'). The angle will be increased in a midface retrusion. The gray line is the preferred Ricketts E-line in Asians because a small chin is preferred by Asians.

Fig. 3 A 37-year-old woman with a midface retrusion had secondary rib cartilage rhinoplasty. She was treated with premaxillary graft and extended columellar strut graft. The angle of facial convexity is changed from 179 degrees to 170 degrees. (Left) preoperative views. (Right) postoperative views.

Table 1 Indications of Asian rib cartilage rhinoplasties

Indications
Severe low-profile nose
Small nose
Retracted midface and premaxilla
Contracted nose
Short nose
Retracted alar deformity
Pinched tip deformity
Saddle nose deformity
Posttraumatic deformity
Cleft-lip nose deformity

support of the structure due to higher long-term absorption rate, risk of transmitting diseases such as hepatitis, human immunodeficiency virus (HIV), Creutzfeldt-Jakob disease, and the possibility of soft tissue loss if infection control is delayed.²⁴⁻²⁷

Although some state that a rib cartilage rhinoplasty should be reserved as a last resort, if a patient has a small and short nose or suffers from severe midface retrusion, rib cartilage is a desirable material for primary cases (→Fig. 4).²¹ Using just septal and ear cartilage in these cases will not produce satisfying results, and repeated revision surgeries can lead to soft tissue contraction, tissue deficiency of cartilage and nasal lining,²⁸ and ear shape deformity related to repeated harvesting of ear cartilage.

Fig. 4 A 43-year-old woman with a short nose and midface retrusion. She had a primary rib cartilage rhinoplasty. (Left) preoperative views. (Right) postoperative views.

A rib cartilage rhinoplasty can have high rates of complications from its improper performance and inadequate methods. With proper training and sufficient amount of experience, a rib cartilage rhinoplasty can produce a reliable and long-lasting good result with low risks.^{3,21}

Conclusion

For achieving successful results in Asian rhinoplasty, an appreciation of the Asian patient's anatomical characteristics,

a conceptual approach as well as an appreciation of recent trends of the ideal beauty should be fully understood. Rib cartilage rhinoplasty for Asians provides highly reliable and long-lasting good results if performed properly.

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