The Laryngoscope

How I Do It

Central Segment Harvest of Costal Cartilage in Rhinoplasty

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Objectives/Hypothesis: Our objective was to review our experience with a conservative central boat harvest of costal cartilage in patients undergoing rhinoplasty. It involves taking only the central portion of the rib for reconstruction. When cartilage harvest is performed in the above manner, donor site morbidity is minimized without limiting aesthetic results. The key seems to be preservation of intact costal cartilage on three sides, limiting harvest to the central portion only. This central portion is straight and much less prone to warping than the cartilage toward the periphery.

Study Design: A retrospective review of a single surgeon's experience.

Methods: All rhinoplasty operations performed by the senior author (Y.D.) from January 2000 to August 2009 that required the harvest of rib cartilage were reviewed.

Results: A total of 322 cases were identified in which rib cartilage was harvested via the described technique. In all cases sufficient cartilage volume was obtained for the intended purpose. Average operation time was 10 minutes. No drains were used, and only one patient developed seroma formation. Postoperative pain and scar were minimal. No major complications were noted, and on postoperative analysis there was no evidence of cartilage warping or displacement.

Conclusions: When harvesting costal cartilage for rhinoplasty, the above technique allows for sufficient graft tissue while decreasing donor site morbidity and minimizing warping.

Key Words: Rib harvest, costal cartilage, rhinoplasty, cartilage graft.

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INTRODUCTION

Cartilage grafting is often a critical component for rhinoplasty influencing both cosmetic and functional outcomes. In cosmetic rhinoplasty, cartilage may be used for augmentation or to improve tip definition and projection. Grafts may also be used to increase the functional capabilities of the nose primarily by improving nasal airflow.[1,2] Cartilage grafts are commonly used to provide stability and increase the cross-sectional area of the nasal valve. The basic removal or scoring of deviated cartilage from the septum can often alleviate nasal airway obstruction.[1–3]

Potential sites of cartilage harvest commonly include the septum, ear, and rib. Septal cartilage serves as the donor site of choice given the proximity to the operating field and no need for additional incisions.[1,2] Septal cartilage is fairly robust and provides an excellent primary source for cartilage grafts, especially in the previously nonoperated patient. When the septal cartilage exhibits bowing it may be ideal for alar rim grafts. However, septal cartilage is often insufficient to produce the volume of graft tissue needed for nasal reconstruction, especially in the previously operated patient.[3] Auricular cartilage either alone or to supplement septal harvest may be used during rhinoplasty with minimal donor-site consequence. Cartilage grafts from the ear have several drawbacks, including a lack of rigidity and the innate concavity of the tissue.

The use of rib cartilage serves as an alternative to the previously mentioned donor sites. Reasons for the recent popularity of costal cartilage in rhinoplasty include the robust nature of the graft tissue and the sheer volume available for harvest. It appears that rib cartilage is becoming the workhorse graft for primary and revision rhinoplasty.[1,2] Although costal cartilage is superior in terms of available volume and strength, donor site morbidity remains the primary deterrent. A separate incision must be made on the chest, which results in additional postoperative pain and scar formation. Harvesting costal cartilage has also been associated with clicking of the chest wall, tissue warping, cosmetic deformity, and entrance into the thoracic cavity resulting

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in pneumothorax.[4–9] Finally, warping has been an issue with standard techniques.

In this article we review our experience with conservative harvest of costal cartilage and provide the senior author's modification to previously described techniques.

TECHNIQUE

Patients are subjected to general endotracheal anesthesia with both the complete face and chest wall included in the sterile field. The nose is opened via a columella incision connecting bilateral marginal incisions. The soft tissue nasal envelope is raised in the submuscular plane to minimize blood loss and optimize visibility. Elevation of the soft tissue envelope begins at the columella and continues to the nasion. The upper and lower nasal cartilages are exposed and evaluated. At this time the septum is dissected from the lower lateral cartilages. Septal cartilage is harvested both for the purpose of removing obstructing septum and obtaining graft tissue. Sufficient cartilage is left in place to provide adequate dorsal and caudal support. After evaluating the septal cartilage available and the volume needed for satisfactory results, a decision as to whether further harvest is needed. If minimal cartilage is needed in addition to the septum we proceed to the ear. If the addition of ear cartilage is unlikely to meet volume demand for grafting, it is bypassed and rib cartilage is obtained. Imaging of the thorax is not routinely obtained prior to or after surgery.

We prefer the right side and have found this amendable to a second surgeon harvesting the rib while the primary surgeon tends to the rhinoplasty. A 3-cm incision is made just inferior to the inframammary crease in the female and below the inferior border of the pectoralis major muscle in the male patient (Fig. 1). Skin is incised with a scalpel, and dissection through the subcutaneous tissue, fat, and external oblique muscle is performed with cautery. Tactile appreciation for the straightest rib cartilage guides the direction of dissection. Typically, the seventh rib provides the graft. At this point the rib is identified and exposed from the lateral osseocartilaginous border to the medial junction of the rib and sternum. The osseocartilaginous border possesses a change in color from gray to white. A 27-gauge needle is used to evaluate the cartilage and minimize the harvesting of calcified tissue.

Fig. 2. Perichondrium elevated to expose the underlying rib cartilage.

The perichondrium is incised with a scalpel in the shape of a T. A periosteal elevator is then carefully used to lift the perichondrium (Fig. 2). A 15-blade scalpel is then used to make incisions both at the medial and at the lateral aspect of the proposed graft. The incisions should extend through the cartilage but not violate the underlying perichondrium. At this time an incision is made directly perpendicular to the rib at the midportion of the rib. The next incision is angled at 45° and moves in a cephalic-caudal direction. An elevator is then used to remove the graft. The initial harvest is usually the largest, shaped like a triangle (Fig. 3). It can now be carved for the ideal spreader or strut grafts. Further grafts are now harvested on an as-needed basis leaving the rib borders (three sides are intact) and underlying perichondrium intact. Only cartilage needed for the particular grafts are harvested to minimize discarded tissue

Fig. 1. Male patient with planned incision marked below the inferior border of the pectoralis major muscle.

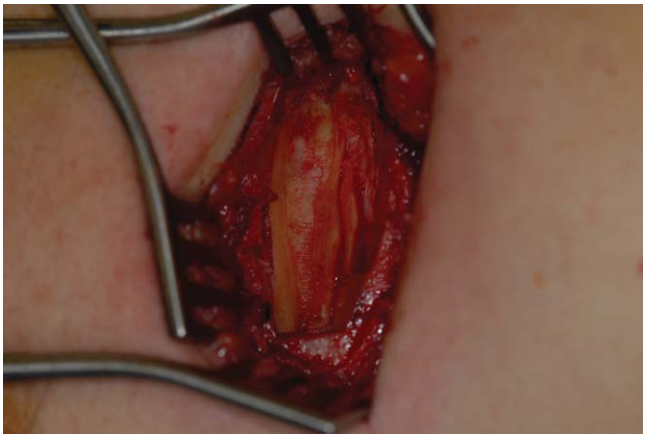

Fig. 3. In vivo rib cartilage harvest using the central harvest technique.

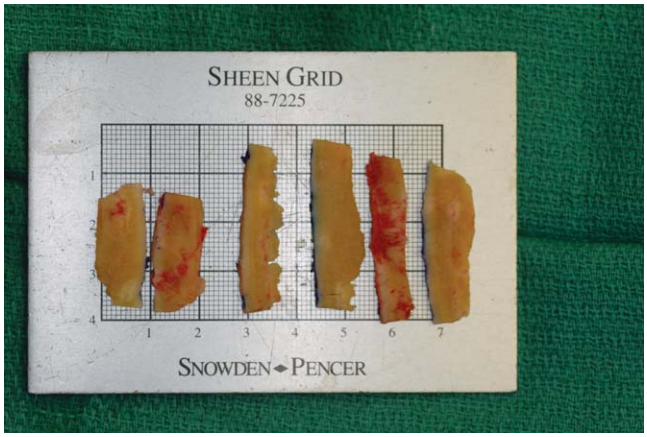

Fig. 4. Cartilage grafts harvested for rhinoplasty.

(Fig. 4). The overlying perichondrium is now approximated with 4-0 Vicryl suture. The wound is then closed in multiple layers with 3-0 Vicryl used to approximate the muscle. The deep dermis is closed with 4-0 Vicryl, and finally a 4-0 Monocryl is used for the epidermis. Drains are not typically used.

MATERIALS AND METHODS

All patients undergoing rhinoplasty requiring rib cartilage harvest by the senior author from 2000 to 2008 were included in this retrospective review. Outcomes evaluated included time of harvest, availability of graft material, incision size, and postoperative complications. Time of harvest was calculated from the beginning of the chest wall incision until the wound was closed.

RESULTS

A total of 322 cases were identified in which rib cartilage was harvested via the aforementioned technique. These cases included both functional and cosmetic rhinoplasty. In all documented cases both nasal septum and ear cartilage provided insufficient tissue for the intended purpose. With the addition of costal cartilage all surgical objectives were properly addressed to satisfaction. Average time for harvest of rib cartilage was found to be 10 minutes. Incision size averaged 3 cm with the observation that patients with larger body habitus occasionally required a larger incision. Only 15 patients required a second adjacent rib for harvest. No drains were placed during any of the operations, and only one patient developed formation of a seroma, which was drained in the office. All patients reported minimal pain at the donor site, which was alleviated by oral medication. All patients were discharged home the day of surgery. There was no bowing of the chest wall, neither during the acute postoperative period nor at 6-month follow-up. There were no instances of pneumothorax. On postoperative analysis and minimum of 12-month follow-up, there was no evidence of cartilage warping as evidenced by examination of the patients photos and surgeon examination.

DISCUSSION

Cartilage grafting for use in rhinoplasty is often necessary to obtain favorable results both for functional and cosmetic purposes. Of the three possible donor sites, which include the nasal septum, ear, and rib, it is the costal cartilage that provides superior volume and fortitude. Surgeons are occasionally apprehensive about harvesting costal cartilage because of the increased risk of complications at the donor site. Uppal et al. retrospectively reviewed their experience in 42 patients undergoing costal cartilage harvest for ear reconstruction.[5] In their study, donor site pain was by far the most common complaint, with three patients having continued pain at 1-year follow-up. They also reported chest wall clicking in three of the study patients.

Ohara et al. evaluated 18 patients undergoing microtia repair with costal cartilage.[6] Nine patients developed chest wall bowing identified on physical examination and radiographs. Cakmak et al. reviewed 20 rhinoplasty patients in which costal cartilage was used for nasal reconstruction.[2] Follow-up ranged from 8 to 32 months. Three patients developed minor tissue warping, and there were no cases of graft resorption. The authors concluded that autogenous costal cartilage serves as outstanding material for volume filling and support during rhinoplasty. Yotsuyanagi et al. reviewed their experience with costal cartilage harvest in 28 patients undergoing rhinoplasty.[10] The authors reported decreased donor site pain and morbidity with a conservative technique regarding harvest. Our much larger study supports their findings, but we recommend in vitro carving of the harvested grafts as well as preservation of the anterior perichondrium to aid in cartilage regrowth. Other authors have proposed replacing harvested cartilage not used in the rhinoplasty into the donor bed. Kawanabe et al. described a method in which this was done and noted satisfactory regeneration of the costal cartilage with no chest wall deformity and only minimal intraoperative complications.[11] With the technique described in this article, only the minimal amount of cartilage needed is harvested so as to not disrupt the adjacent tissue (Fig. 5). When cartilage harvest is performed in the above manner, donor site morbidity is minimized without limiting aesthetic results. The key seems to be preservation of intact costal cartilage on three sides, limiting harvest to the central portion

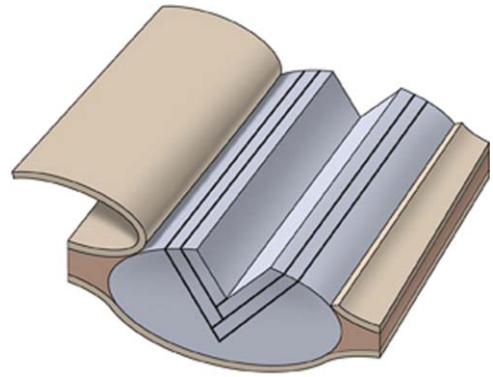

Fig. 5. Illustration depicting technique for costal cartilage harvest.

only. This central portion is straight and much less prone to warping than the cartilage toward the periphery. Older patients with calcification may at times be challenging, but we have been able harvest adequate amounts of cartilage in all patients. We do occasionally harvest full thickness rib grafts for severe saddle nose deformities, condylar reconstruction, and microtia repair. These were not included in this review.

CONCLUSION

When harvesting costal cartilage for rhinoplasty, the outlined technique can allow sufficient graft tissue while decreasing donor site morbidity. The outlined technique results in maximal efficiency of costal cartilage harvest for rhinoplasty.

BIBLIOGRAPHY

1. Moshaver A, Gantous A. The use of autogenous costal cartilage graft in septorhinoplasty. *Otolaryngol Head Neck Surg* 2007;137:862–867.
2. Cakmak O, Ergin T. The versatile autogenous costal cartilage graft in septorhinoplasty. *Archives Facial Plast Surg* 2002;4:172–176.
3. Marin VP, Landecker A, Gunter JP. Harvesting rib cartilage grafts for secondary rhinoplasty. *Plast Reconstr Surg* 2008;121:1442–1448.
4. Adams WP Jr, Rohrich RJ, Gunter JP, Clark CP, Robinson JB Jr. The rate of warping in irradiated and nonirradiated homograft rib cartilage: a controlled comparison and clinical implications. *Plast Reconstr Surg* 1999;103:265–270.
5. Uppal RS, Sabbagh W, Chana J, Gault DT. Donor-site morbidity after autologous costal cartilage harvest in ear reconstruction and approaches to reducing donor-site contour deformity. *Plast Reconstr Surg* 2008;121: 1949–1955.
6. Ohara K, Nakamura K, Ohta E. Chest wall deformity and thoracic scoliosis after costal cartilage graft harvesting. *Plast Reconstr Surg* 1997;99: 1030–1036.
7. Kline RM, Wolfe SA. Complications associated with the harvesting of cranial bone grafts. *Plast Reconstr Surg* 1995;95:5–13; discussion 14–20.
8. Thomson HG, Kim TY, Ein SH. Residual problems in chest donor sites after microtia reconstruction: a long-term study. *Plast Reconstr Surg* 1995;95:961–968.
9. Tanzer RC. Microtia: a long-term follow-up of 44 reconstructed auricles. *Plast Reconstr Surg* 1978;61:161–166.
10. Yotsuyanagi T, Mikami M, Yamauchi M, Higuam Y, Urushidate S, Ezoe K. A new technique for harvesting costal cartilage with minimum sacrifice at the donor site. *J Plast Reconstr Aesthet Surg* 2006;59:352–359.
11. Kawanabe Y, Nagata S. A new method of costal cartilage harvest for total auricular reconstruction: part ii. Evaluation and analysis of the regenerated costal cartilage. *Plast Reconstr Surg* 2007;119:308–315.