

Free Cartilage Grafts and Healing by Secondary Intention

A Viable Reconstructive Combination After Excision of Nonmelanoma Skin Cancer in the Nasal Alar Region

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Objective: To assess the feasibility and outcome of free cartilage grafts left to heal by secondary intention in the reconstruction of nasal alar skin defects.

Design: We describe the retrospective analysis of 13 patients who were treated in a single department with the use of free cartilage grafts in combination with secondary intention healing for reconstruction of the alar subunit and lateral nasal wall defects after Mohs surgery for cutaneous cancer. Outcome measures included patient and surgeon satisfaction, alar retraction, cartilage extrusion, nasal valve collapse, revision rate, and time to healing.

Results: All wounds healed uneventfully by secondary intention, and the results were gauged as at least satisfactory by the patient and the surgeon. In 3 patients, mi-

nor aesthetic faults were evident; in 1 patient, the underlying cartilage was prominent and a hypertrophic scar also developed; in 1 patient, there was some alar notching; and in 1 other patient, a hypertrophic scar developed. One patient had a functional complaint of nasal blockage on the side that was surgically treated.

Conclusions: Free cartilage implants in combination with secondary intention healing is a relatively simple, cost-effective, 1-stage technique. Our results demonstrate that this alternative reconstructive method is a viable option for small and deep defects of the alar subunit and the nasal sidewall of the nose. The donor site morbidity is limited to the ear.

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CANCER OCCURS MORE OFTEN on the skin of the nose than on any other organ of the body.¹ In a personal series of 1600 facial skin cancers, the nose was affected in 56% of cases. The majority of cutaneous nasal cancers were found on the most projected lower two-thirds of the nose, specifically on the alar and lateral nasal wall sites. Of the nasal skin tumors, 28% were located on the nasal sidewall, 21% were located on the ala, and 18% encompassed at least part of both of these nasal subunits. Although reports vary, basal cell carcinoma (BCC), squamous cell carcinoma, and melanoma of the nose have respective frequencies of 85%, 14%, and 1%.² In this aesthetically important area, there is a tendency toward narrow excision margins in an effort to simplify reconstruction, which may account for the high recurrence rate of nasal BCCs described in the earlier literature.³

Our policy is to perform a reconstruction only after pathologic margins are proved to be clear. Fifty-two percent of our facial skin cancers were treated using Mohs micrographic surgery, which, although seemingly time-consuming, allows same-day reconstruction.⁴ Other advantages include preservation of more tissue than conventional surgery, higher cure rates, and cost-effectiveness.^{5,6} When we use conventional surgical excision, we allow 3 to 4 days for the paraffin sections to be histologically examined before we reconstruct the defect.

NASAL ALAR RECONSTRUCTION

The reconstructive options for nasal alar skin defects after skin tumor excision includes (from simple to more complex) primary repair, healing by secondary intention, skin and composite grafts, and skin flaps. Free flaps have a specific indication for massive nasal defects.⁷ Primary clo-

sure is rarely an option owing to the relative immobility of the alar skin. All of the remaining methods have their advantages and disadvantages. The patient's age, general health, and aesthetic goals must be included in the decision-making process.

CARTILAGE GRAFTING

When considering reconstruction of defects of the alar subunit, with or without some extension to the nasal side wall, it is important to consider the possibility of alar retraction.⁸ Therefore, it is a wise surgical rule that any defect within 5 mm of the free alar margin has a nonanatomical cartilage batten graft placed in the free alar margin to prevent alar retraction. While additional cartilage is placed to prevent retraction, the added support in the alar region also aims to prevent external valve collapse. In the same sense, cartilage grafts in the supra-alar area or the lateral nasal wall help prevent internal valve collapse. Robinson and Burget⁹ emphasize the special attention that is required in reconstruction of the lateral nasal wall because of risk of nasal valve malfunction.

HEALING BY SECONDARY INTENTION

Healing by secondary intention is characterized by filling of the defect with granulation tissue, reepithelialization, and subsequent wound contraction. Studies by Zitelli^{10,11} showed that in properly selected circumstances, secondary intention healing offers functional and cosmetic outcomes equal or superior to that achieved with grafts or flaps. One of the most important factors in determining outcome is the location of the wound. The nose can be divided into aesthetic subunits that vary in contour.¹² Zitelli characterized the most favorable sites of healing by secondary intention on the nose as the medial canthal area and the alar crease—part of the NEET areas (concave surfaces of the nose, eyes, ears, and temples). Wounds on the lateral nasal wall may produce a satisfactory result, but wounds on the dorsum and tip invariably result in flattening of the convex contour. From an aesthetic point of view, a relatively small superficial wound in a concave anatomical area, in a fair-skinned individual, is considered an ideal indication.¹³

HEALING BY SECONDARY INTENTION OVER EXPOSED CARTILAGE

Up to the present time, the pervading paradigm has been that healing by secondary intention is considered unfavorable in cases in which there is exposed cartilage owing to possible desiccation necrosis. However, incidental reports describe favorable outcomes, eg, on the auricle.¹⁴ In areas with exposed auricular cartilage, small punch biopsy-like excisions of cartilage can be made to encourage the formation of granulation tissue from the opposite side of the cartilage. Snow et al¹⁵ have demonstrated that even exposed facial-scalp bone does heal well by secondary intention in the vast majority of cases.

In view of this background knowledge, the question can be raised, "Is it possible to leave a free carti-

lage graft to heal by secondary intention?" Or, in other words, "Is it really necessary to use a skin flap to cover a free cartilage graft?" Healing by secondary intention has not been described in those cases in which the cartilage was applied as a free graft. Traditional thinking suggests that a free cartilage graft would need to be covered with a vascularized skin flap to prevent necrosis.

METHODS

With our technique, free cartilage grafts are used in alar defects to buttress the alar side wall. They are partially buried in subcutaneous pockets. The fact that the cartilage is partially buried, at least theoretically, optimizes the blood supply to the graft. We attempt to leave the perichondrium attached to the outer surface of the graft to help prevent desiccation and to provide a more optimal framework for secondary intention healing.

The study included 7 women and 6 men (mean age, 68 years; age range, 32-89 years) who underwent resection of nonmelanoma skin cancer. All 13 cases are summarized in the **Table**. All patients had successfully undergone BCC clearance by means of Mohs surgery or standard excision with pathologic control.

The resulting defects were all relatively small (10-20 mm), with intact nasal lining. The defects encompassed a portion of the alar subunit and in most cases involved a part of the nasal sidewall of the nose. Typically, all nasal defects were reconstructed with a free cartilage implant that was left partially uncovered. **Figure 1** depicts a typical case of a defect located within the borders of the alar subunit (Figure 1A and B). A free autogenous conchal cartilage graft was used in all cases to replace any resected cartilage and to support the alar rim and the nasal valve (Figure 1C). The grafts were partially buried in subcutaneous pockets to heal by secondary intention (Figure 1D). In most cases, the graft was fixed to the nasal lining with absorbable mattress sutures.

All wounds were treated with a packing of fusidate sodium (Fucidine) ointment and a nonadherent fluid-permeable contact layer (Unitulle; Hoechst Marion Roussel Ltd, Mumbai, Maharashtra, India) directly applied to the wound, followed by a nonadherent absorbent layer (Telfa; Kendall Healthcare, Mansfield, Massachusetts) to take up wound exudates for 1 week (Figure 1E). After a checkup at an outside clinic, patients had to clean the wounds themselves on a daily basis. After the wounds were rinsed with tap water, fusidate ointment and a nonadherent dressing (Telfa) were applied until the wound was healed. The whole purpose was to create a moist postoperative wound environment, which has been shown to promote healing.^{10,16-18} Time for healing and photographic follow-up were registered.

RESULTS

The results of the combination of cartilage grafts and secondary intention healing are illustrated below with 2 typical cases. In all cases, there was complete and successful reepithelialization by secondary intention in 4 to 6 weeks. Both patients and physicians assessed the results as either good or satisfactory. Follow-up ranged from 6 to 49 months, with a mean of 17 months. There were aesthetic complications in 3 cases. In 1 case, the underlying cartilage was slightly prominent and a

Table. Patient and Wound Characteristics.

Patient No./ Sex/Age, y	Type of Tumor	Primary Tumor or Recurrence	Follow-up, mo	Ala	Sidewall	Tip	Defect Size, ^a mm	Cheek Advancement Flap
1/M/60	Micronodular BCC	Primary	49	Involved	Involved	Not involved	12	No
2/M/32	Solid BCC	Primary	12	Involved	Involved	Not involved	10	No
3/F/62	Solid BCC	Primary	12	Involved	Involved	Involved	15	No
4/F/60	Solid BCC	Primary	25	Involved	Involved	Not involved	10	Yes
5/F/39	Solid BCC	Primary	6	Involved	Not involved	Not involved	8	No
6/F/56	Solid BCC	Primary	9	Involved	Involved	Not involved	13	No
7/M/89	Solid BCC	Recurrence	11	Involved	Involved	Involved	17	No
8/M/64	Solid BCC	Primary	36	Involved	Involved	Not involved	10	No
9/M/89	Solid BCC	Primary	20	Involved	Involved	Not involved	Unknown	No
10/M/75	Infiltrating BCC	Primary	27	Involved	Involved	Not involved	20	Yes
11/F/37	Solid BCC	Primary	8	Involved	Involved	Not involved	12	No
12/F/72	Infiltrating BCC	Primary	6	Involved	Involved	Not involved	20	Yes
13/F/72	Solid BCC	Primary	12	Involved	Involved	Not involved	15	Yes

Abbreviations: BCC, basal cell carcinoma.

^aThe sizes of the defects were estimated on the basis of the size of the ala, which in most patients is 1 cm in width and 2 cm in length.

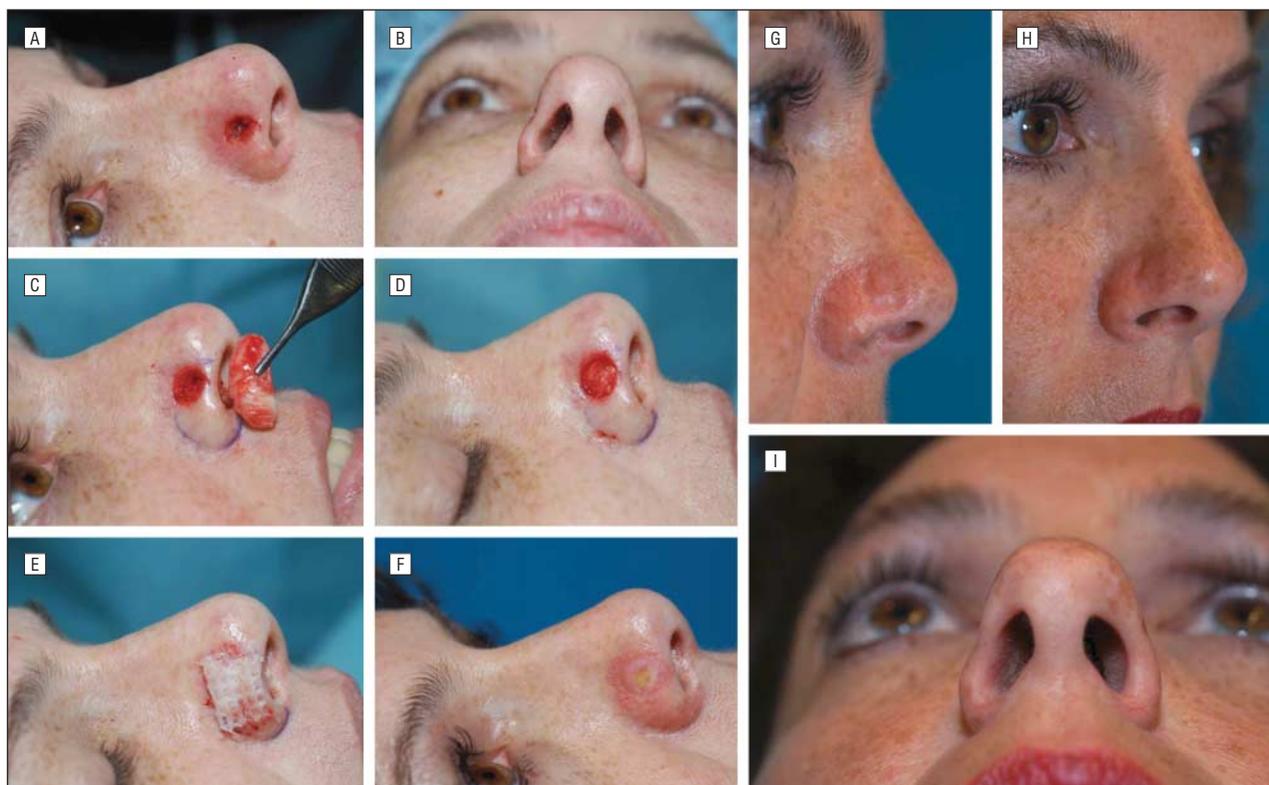


Figure 1. Free cartilage graft and healing by secondary intention. A and B, Original defect is evident mainly on the alar subunit. C, Free autogenous conchal cartilage graft is used to support the alar rim and nasal valve. D, The graft is partially buried in subcutaneous pockets and left to heal by secondary intention. E, The wound is covered with a dressing of fusidate sodium (Fucidine) ointment and a nonadherent fluid-permeable contact layer (Unitulle) directly applied to the wound. F, Almost full epithelialization is evident at 5 weeks. G-I, Aesthetic result after 7 months: there is still some redness of the scar.

hypertrophic scar developed (a minor cartilage graft revision was undertaken). Another case demonstrated alar notching (**Figure 2**), and a hypertrophic scar developed in a third case. There was also a patient with complaints of nasal blockage on the side that had been surgically treated, partly owing to a preexisting anterior septal deviation. None of these patients considered revision at that time.

CASE 1

A 43-year-old woman presented with an alar defect after complete tumor clearance, which was achieved with 2 Mohs sessions (Figure 1). Emotionally, she would not consider a nasolabial flap because she did not want a pedicle on her face for 3 weeks or a possible scar on her cheek. Despite her use of methotrexate for rheumatic ar-

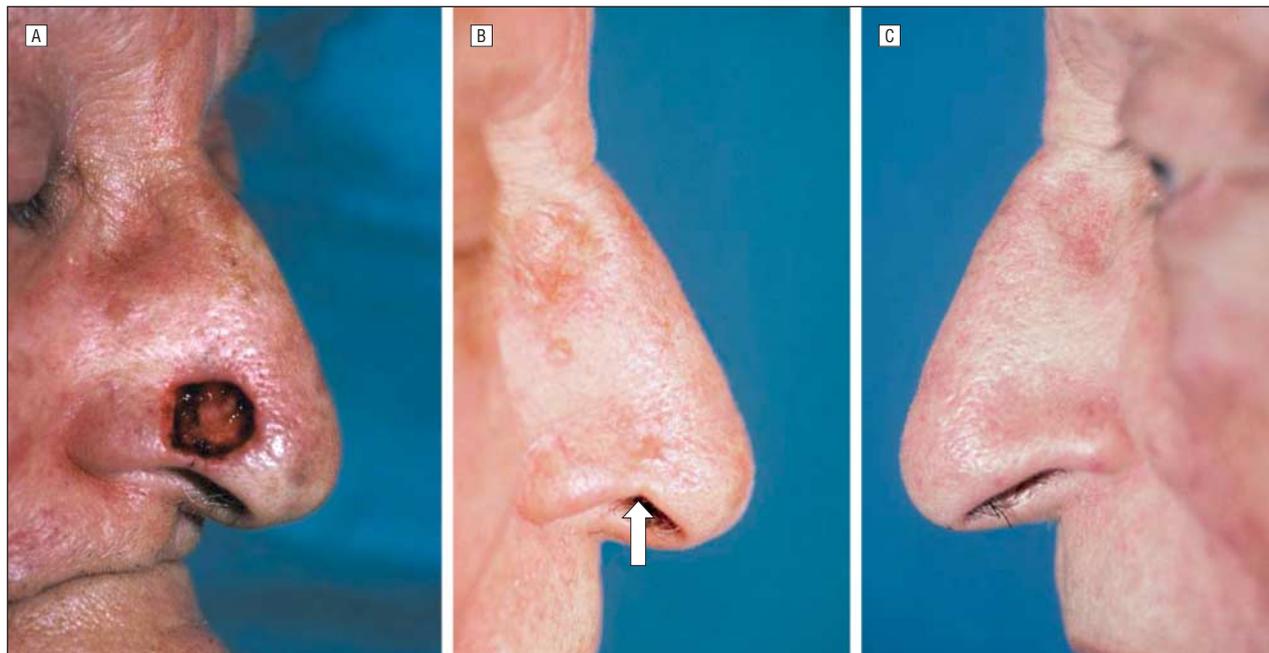


Figure 2. Free cartilage graft and healing by secondary intention. A, Original defect on the ala. B, Alar notching (arrow) of the reconstructed side of the nose. C, Untreated side of the nose.

thrititis, we opted for the simplest technique, which was secondary intention healing while supporting the free alar rim with a cartilage graft. Remarkably, there was little granulation tissue in the wound the first 12 days after surgery. Whether this was attributable to a lingering effect of methotrexate therapy, with a halftime of 3 to 10 hours, is not clear. However, normal healing took over, and full epithelialization was achieved at 6 weeks. After epithelialization, further improvement of the color, vanishing of skin differences, and retraction were noted. Some redness of the scar remained at 7 months. The patient was satisfied with the outcome.

CASE 2

An 89-year-old man presented with a recurrent BCC of the right side of the nose (**Figure 3**). Mohs excision was undertaken to ensure full tumor clearance. The resulting defect involved part of the ala, sidewall, and tip subunits. A part of the alar cartilage was resected, potentially leading to alar retraction. Because of the patient's age and health status, along with his disinterest in aesthetics, reconstruction was performed using autogenous conchal cartilage to support the nasal sidewall in combination with secondary intention healing. Full epithelialization was seen at 5 weeks. The patient and his physician were satisfied with the cosmetic outcome of the repair, and the patient defaulted from follow-up after 11 months.

COMMENT

Small superficial defects of the nasal alar region can be left to heal by secondary intention if the defects are small (<1 cm). Medium-size superficial defects can be covered by full-

thickness skin grafts. When subcutaneous tissue is missing, a subcutaneous hinge flap from the cheek, with or without cartilage, can be used in combination to fill in the defect. Covering can be obtained by secondary intention healing or a skin graft.¹⁹ Large (>1.5 cm) nasal alar defects do need cartilage support and covering. Traditionally, the external covering can be supplied by either a nasolabial flap or a forehead flap.¹⁹ Most often, an interpolated nasolabial flap is indicated for defects that are limited to the alar unit with minimal lateral nasal wall involvement. Otherwise, a forehead flap is indicated. Both an interpolated nasolabial flap and a forehead flap need a second stage to divide the pedicle. In addition to these covering options, the surgeon needs to plan for possible alar retraction. As previously stated, it is a general surgical assumption that any defect within 5 mm of free alar margin is in need of a nonanatomically placed cartilage batten graft to prevent alar retraction.^{8,20}

Historically, all cartilage grafts have been covered by a good vascularized layer (skin flap or subcutaneous hinge flap) to prevent desiccation necrosis.^{9,19} Herein, we present a series of 13 cases that were reconstructed using free cartilage implants partially left to heal by secondary intention. There were no cases of infection or cartilage loss. The majority of patients were satisfied with the aesthetic outcome, especially because there was little morbidity. However, there was a 23% risk of minor aesthetic faults in our series, which, if needed, can be repaired with minor revisions. This 1-stage procedure represents a cost-effective and patient-friendly method, particularly in cases in which the patients accept compromises regarding their cosmetic appearance.

It is important that the free cartilage graft is partially buried in subcutaneous pockets. The uncovered central part of the graft may yield part of its blood supply from the well-buried vascularized remaining portion of the car-

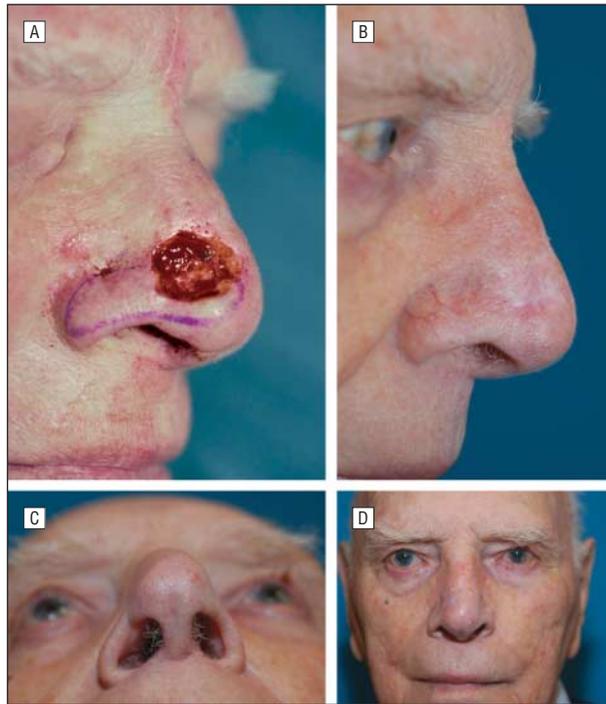


Figure 3. Free cartilage graft and healing by secondary intention. A, Original large defect on ala, sidewall, and tip of the nose. Also, some tip cartilage was resected. B-D, Aesthetic result after 11 months: the alar cartilage graft in the free edge of the ala, extending up to the nasal tip, has prevented alar retraction.

tilage. We leave the perichondrium attached to the outer surface of the graft to help prevent desiccation and to provide a bed for secondary intention healing. The perichondrium itself contains a vascular network,²¹ which may be responsible for the good survival rate.

Special attention is needed for proper placement of the cartilage graft. The graft is 2.0 to 2.5 cm in length and 0.75 to 1.50 cm in width and is usually obtained from the contralateral conchal cartilage. Laterally, the graft is secured in a soft-tissue pocket, which is created toward the alar base; medially, the graft is secured to the caudal aspect of the alar cartilage, just lateral to the dome. The inferior margin of the graft is placed so as to support a free alar margin. Great care is taken to obtain an adequate position and symmetry. It is important that the graft blends well into the surrounding tissues to prevent visibility. Mattress-type sutures (fast-absorbing polyglactin 910 [Vicryl] 4.0 or 5.0), tied in the nasal cavity, secure the graft in position and attach the vestibular skin to the graft to enhance blood supply.

Proper wound care is of paramount importance for optimal wound healing. The main goal is prevention of graft and wound desiccation. After 5 to 7 days of wound occlusion, our regimen for wound care includes cleaning once to twice daily with tap water, coating with ointment (fusidate), and covering with a nonadherent wound dressing (Telfa) to prevent excess crusting and desiccation.

In case of deep tissue defects, the cartilage graft not only serves to buttress the alar sidewall but also fills in the defect and creates a nice convexity of the ala. In contrast to subcutaneous hinge flaps, no additional incisions are needed and there is no chance of effacement of

the alar facial sulcus when the hinge point of the subcutaneous hinge flap is not properly placed. In particular, more medially located defects are difficult to cover with pedicled subcutaneous tissue that has been harvested from the medial cheek area.

Larger tissue defects, which possibly induce more wound contraction, may have a higher risk of alar notching and hypertrophic scar formation. These aesthetic faults should be weighed against the expectations of the patient and the morbidity of alternative reconstructions. Some older men and women are not particularly concerned about aesthetics and mainly wish for tumor clearance and good function. Therefore, when the skin of the alar rim is 4 to 5 mm intact and the defect of the ala and/or sidewall does not extend beyond 12 mm, a cartilage graft combined with secondary intention healing is a good option. In a case involving a large defect and an intact alar rim, there are several possibilities: a nasolabial or forehead flap or a cartilage graft buried with a subcutaneous hinge flap that is left to heal by secondary intention or covered with a full-thickness skin graft can be used. When the alar rim is not intact, a composite graft (defects <1 cm) or a cartilage graft covered with a forehead flap or a nasolabial flap can be used. We recommend using a free cartilage implant, placed in subcutaneous pockets of the ala, combined with secondary intention healing as an alternative, simple, effective 1-stage method of reconstructing relatively small but deep defects involving the alar subunit and the nasal sidewall of the nose, with little morbidity for the patient.

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