Subtotal Nasal Reconstruction in a 91-year-old Patient: Expanded Double Forehead Flaps and Costal Cartilage

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Summary: Nasal reconstruction in very elderly patients is challenging. We attempted subtotal nasal reconstruction with an expanded double forehead flap and autologous costal cartilage support in a 91-year-old woman presenting with subtotal nasal defects after sebaceous carcinoma resection. Only small parts of the bilateral alae and the columella base remained after resection, and the frontal area of the septum was also resected. We planned to use an expanded double forehead flap to reconstruct the whole external skin cover and lining of the nose. We chose a 200-mL tissue expander and injected 152 mL of saline over 15 weeks. The expansion course in this patient was slower than that in younger patients because of the limited expansibility of her forehead skin. However, the skin tolerated the repeated expansions well, and the double forehead flap was expanded to the planned size preoperatively. The nasal support grafts were composed of the L-strut and alar battens from the eighth and ninth costal cartilages, and were fixed using nonabsorbable sutures. Histological examination revealed cartilage matrix degeneration and a reduced number of living chondrocytes, yet no calcification or fragility. After 18 months of follow-up, the framework maintained its shape, and the dorsum was straight without warping. The autologous costal cartilage provided a natural nasal shape and nostrils. Thus, an expanded double forehead flap with careful tissue expansion and a rib cartilage graft can allow natural nose reconstruction without a microvascular technique in very elderly patients.

(Plast Reconstr Surg Glob Open 2021;9:e3868; doi: 10.1097/GOX.0000000000003868; Published online 15 October 2021.)

CASE PRESENTATION

A 91-year-old woman presented with subtotal nasal defects at 3 months post sebaceous carcinoma resection. Only small parts of the bilateral alae and columella base remained; the frontal area of the septum was also resected (Fig. 1). The patient could perform daily activities independently and had good mental health, with no history of major disease. She was not eligible to receive a free flap because of her age. Therefore, we planned a three-stage reconstruction 3 months after the resection, including tissue expander insertion and the use of a forehead flap in two stages due to her short forehead (4 cm). (See Video 1, which displays the patient’s entire treatment course.)

Stage 1

A rectangular tissue expander (size: 50 × 80 mm, capacity: 200 mL) was inserted with a 5-mL initial injection into

Disclosure: The authors have no financial interest to declare in relation to the content of this article. No funding was received for this article.

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a forehead pocket under the frontal muscle to avoid injuring the pedicle, the cutaneous branch of the supratrochlear artery. Expansion was initiated two weeks later with weekly injections with 5–15 mL of saline injected each week (total volume: 152 mL over 15 weeks). The weekly injection volumes were lower than expected because the patient experienced pain despite injection of small volumes. We stopped expansion because of presaging exposure after 15 weeks. Two weeks after the final injection, the expanded skin remained tense. A 4-week interval was maintained before the next operation to prevent recoil (Fig. 1).

**Stage 2**

A double forehead flap transfer was performed (Fig. 2). The flap was designed using a template. The nasal lining was reconstructed using the right forehead flap and hinge-over flaps of the remnant alae. The nasal support grafts were composed of an L-strut and alar battens from the eighth and ninth costal cartilages. The cartilage was carved in accordance with Gibson’s rules for balanced cross-sectional carving without intracartilaginous sutures. Carving with the scalpel was easy because of the absence of calcification, as visualized in the preoperative chest radiograph. Although the cartilage demonstrated less flexibility than that in younger patients, it showed no fragility. The L-strut was fixed to the columella base and inserted into the pocket between the nasal bone and the skin. The alar batten grafts were then fixed to the L-strut and alar base. The left forehead flap was transferred as the whole external skin cover, and the capsule was incised across the pedicle for flap elongation. Silicone stents were placed in both nostrils to prevent postoperative occlusion. The pedicle of the right flap for nasal lining was ligated at 14 days postsurgery.

**Stage 3**

Pedicle division was performed 28 days postsurgery. The donor site was partially covered with a split-thickness skin graft from the removed pedicle skin, leaving the rest of the forehead wound to heal secondarily.

Eighteen months after the last operation, the nose looked natural without warping, and donor-site morbidity was acceptable (Fig. 3). Although her nostrils were relatively small, she was able to breathe with her mouth closed. Histological examination of the costal cartilage harvested at stage 2 showed necrotic central chondrocytes and living peripheral chondrocytes (Fig. 4) with no endochondral ossification.

**DISCUSSION**

Double forehead flaps have gained popularity and are useful for subtotal nasal reconstruction. We considered a forehead flap, nasolabial flap, septal pivot flap, and
We describe two important clinical findings: forehead expansion in the 91-year-old patient took longer than in young patients, and forehead skin expansibility was limited. Moreover, the aged costal cartilage provided sufficient nasal support without warping after grafting.

Tissue expansion in very elderly patients is uncommon, and the existing reports only investigate younger patients. Weng reported the results of forehead expansion using 100- to 200-mL expanders in 43 patients, aged 6–56 years. The mean volume in their series was 240 mL, and full expansion required 2–3 months with an interval of 2–4 weeks between operations. The injected volumes per session in the current case (5–15 mL) were smaller than those in the previous series, necessitating more time for expansion. However, the time interval between operations was similar to that in younger patients. Aging of the dermis is characterized by reduced collagen content, vascularity, and thickness. Aged skin shows less distensibility and elasticity than the skin of younger patients and may not adapt to the mechanical stress of expansion as effectively. However, meticulous tissue expansion with adequate intervals can yield successful expansion in double forehead flap reconstruction in elderly patients.

The second important finding was that the patient’s costal cartilage provided sufficient nasal support without warping after grafting. Miranda reported a warping rate of 26% in 124 patients who underwent rhinoplasty. Fedok suggested that the costal cartilage will be less prone to warping in older patients; however, no studies on this have been reported. The speed of degeneration and ossification differs between individuals, with no absolute indicator for costal cartilage degeneration. The costal cartilage in this 91-year-old woman showed changes in the cartilage matrix and no histological calcification, making it easy to carve and preventing warping of the grafted costal cartilages. These findings may facilitate nasal reconstruction in similar elderly patients.

In summary, meticulous tissue expansion with small-volume injections can achieve successful expansion of aged skin in elderly patients. The patient’s costal cartilage showed no warping after grafting and provided sufficient nasal support. Careful planning of the expanded double forehead flap and nasal support with a costal cartilage graft allowed successful subtotal nasal reconstruction in this 91-year-old patient.

**ACKNOWLEDGMENT**

The authors thank Dr. Ichiro Itou and Dr. Hidetoshi Satomi (Pathology, Japanese Red Cross Society Nagano Hospital) for their help.
PATIENT CONSENT
The patient provided written consent for the use of her image.

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