

Simultaneous free flap and forehead flap for nasal reconstruction

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Abstract

Background: Reconstruction of total or near-total nasal defects is challenging and requires the re-creation of three nasal layers. Fasciocutaneous free flaps have been used effectively for restoring the vascularized nasal lining and staged forehead flap for nasal skin replacement, which is a long process. The aim of this study is to share our experience of combination of preliminary free tissue transfer with paramedian forehead flap reconstruction in the same stage of complex nasal reconstruction.

Methods: From December 2015 to July 2021, 10 patients underwent nasal reconstruction with free flaps including 4 medial sural artery perforator (MSAP) flaps, 5 anterolateral thigh (ALT) flaps and 1 radial forearm flap for lining and forehead flaps for skin coverage simultaneously for total or subtotal nasal defects. Nasal obstruction symptoms evaluation (NOSE) score was utilized to evaluate the functional outcome and the aesthetic results were evaluated with the last follow-up photos with score 1–5 by 5 plastic surgeon and 5 laypersons.

Results: The size of the free flaps ranged from 3 cm x 6 cm to 6 cm x 13 cm. After excluding one patient who expired before forehead flap division due to comorbidities, the average duration between combination surgery and the division of the forehead flap pedicle of the remaining patients was 5.7 months (range, 2–12). For patients without any postoperative events, the duration was 2.2 months (range, 2–3). One free flap had partial necrosis due to infection. The average follow-up duration was 29.6 months (range, 12–64). The NOSE score was 5.9 (range, 0–10) and the aesthetic score is 4.1 (range, 3–5) in average.

Conclusions: The combination of preliminary free tissue transfer for nasal lining restoration with a paramedian forehead flap for nasal skin replacement in the same stage may shorten the long process and achieve satisfactory reconstruction in complex nasal reconstruction.

1 | INTRODUCTION

The reconstruction of total or near-total nasal defects is challenging and requires the recreation of three nasal layers, including the nasal lining, cartilaginous framework, and external skin covering (Burget & Walton, 2007; Correa et al., 2013; Hsiao et al., 2016, 2017; Menick, 2002; Menick, 2009, 2010; Menick & Salibian, 2011; Moolenburgh et al., 2010; Ribuffo et al., 2012; Seth et al., 2013; Yen et al., 2018). Fasciocutaneous free flaps have been effectively used to restore the vascularized nasal lining when local flaps cannot provide adequate coverage (Burget & Walton, 2007; Hsiao et al., 2016; Menick, 2010; Menick & Salibian, 2011; Seth et al., 2013; Yen et al., 2018). There are many options for nasal lining reconstruction, including the radial forearm free flap which is the most frequently used, and other flaps includes the ulnar forearm flap, the temporo-parietal flap, the dorsal metacarpal flap, the dorsalis pedis, the preauricular skin flap, and the traditional or super-thin anterolateral thigh flap (Ramji et al., 2019; Swartz, 1988). A staged pedicled paramedian forehead flap is widely used for nasal skin replacement because it can provide the best color and texture match of the nasal tissues with a relatively inconspicuous scar located on the forehead instead of the center of the face (Correa et al., 2013; Hsiao et al., 2017; Menick, 2002, 2009; Ribuffo et al., 2012).

In general, major nasal reconstruction requires a preliminary stage in which the nasal lining is restored with free tissue transfer to provide a vascularized platform for further graft nourishment and survival (Burget & Walton, 2007; Hsiao et al., 2016; Menick, 2010; Menick & Salibian, 2011; Seth et al., 2013; Yen et al., 2018). No matter which free flap was utilized, the raw surface is often covered with skin grafts or artificial dressing materials to prevent pedicle exposure. Usually, approximately 3 months later, the skin graft is removed and the first stage of 3-stage forehead flap nasal reconstruction is performed. In general, it takes more than 6 months to complete the preliminary stage and 3-stage forehead flap nasal reconstruction. Besides, several additional refinement procedures are usually required to achieve better functional and aesthetic results, so it is common to take more than 1 year to get the final outcome, which is a long period of time.

The current problems include multiple stages, long duration of nasal reconstruction period, and the requirement of skin grafts or artificial dressings to temporarily cover the raw surface. The aim of this study is to share our experience of combining preliminary free tissue transfer for nasal lining restoration with paramedian forehead flap reconstruction in the same stage in complex nasal reconstruction, with the intention of shortening the long process, decreasing the requirement of skin grafts or dressing materials for coverage of raw surface of free flap, and achieving efficient and satisfactory reconstruction.

2 | PATIENTS AND METHODS

This retrospective study was performed at Chang Gung Memorial Hospital after obtaining approval from the Institutional Review Board. From December 2015 to July 2021, 10 patients underwent nasal

reconstruction with free flaps and forehead flaps simultaneously for total or subtotal nasal defects (Table S1). Among these patients, 6 were men, and 4 were women, with an average age of 50.1 years old (range, 11–77 years). The etiology of the nasal deformity included 6 malignancies (3 squamous cell carcinoma, 1 melanoma, 1 basal cell carcinoma, and 1 adenoid cystic carcinoma), 1 radiotherapy-related radionecrosis, 1 traumatic deformity and 2 congenital nasal deformity. All patients had composite nasal defects involved in both the nasal lining or nasal floor and multiple nasal subunits. The lining defect ranged from 2 cm x 3 cm to 5 cm x 10 cm. Free flaps, including 4 medial sural artery perforator (MSAP) flaps, 5 anterolateral thigh (ALT) flaps and 1 radial forearm flap, were utilized for nasal lining or floor reconstruction. The nasal skin defect ranged from 2.5 cm x 3 cm to 7 cm x 7 cm and were all restored with three-stage forehead flap.

3 | SURGICAL TECHNIQUE

All operations were performed under general anesthesia with two team approach. The nasal tumor or scar was removed or released first. The nasal anatomy was repositioned and the defect was recreated based on the aesthetic subunit principles described by Burget and Menick (Figure 1a). The free flap was harvested and transferred through subcutaneous tunnel over cheek (Figure 1b). The flap was inset or folded according to the lining defect, and revascularized with facial artery and vein for all patients (Figure 1c,d). Forehead flap was designed with assistance of a three-dimensional printing technique preoperatively to define its size and shape (Yen et al., 2019), and it was harvested and transferred to cover the nasal skin defect in the same stage (Figure 1e). We sometimes intentionally designed the forehead flap to be slightly larger to cover the exposed pedicle of free flap. Framework reconstruction with either rib cartilage or conchal cartilage was performed at the same time or in the later stages. The donor site of free flap was closed primarily in all patients and the forehead donor site was closed partially and left for secondary healing for the residual defect. Nasal stents were inserted to nares to keep the airway patent. At second stage about 1 month later, the intermediate stage of forehead flap was performed. The forehead flap was elevated and thinned, and the soft tissue of lining free flap was also debulked and repositioned (Figure 1f,g). The framework could be built or reinforced at this stage as well (Figure 1h). The pedicle of forehead flap was divided at the next stage about 1 month later, following with several refinement procedures to achieve the final results. We instructed the patients to wear nasal stents for at least 6 months to 1 year, to keep the airway patent and prevent stricture of nasal passage and nares, and they can gradually taper off depending on the airway status.

4 | OUTCOME ASSESSMENT

For functional outcome assessment, the nasal obstruction symptoms evaluation (NOSE) score was utilized to subjectively evaluate the



FIGURE 1 (a) Total nose defect. (b) The anterolateral thigh free flap was harvested. (c, d) The free flap was inset or folded according to the lining defect. (e) Paramedian forehead flap was utilized for restoring the nasal skin defect in the same stage. (f, g) The forehead flap was elevated and thinned, and the soft tissue of lining free flap was also debulked and repositioned in the intermediate stage. (h) The cartilage framework was reconstructed with costal or conchal cartilages

degree of nasal obstruction symptoms at least 1 year after surgery. The aesthetic outcome was evaluated with the latest follow-up photos with standard 6 views by 5 plastic surgeon and 5 laypersons. Each photo was scored from 1 to 5 according to the aesthetic results. The interrater reliability is calculated with intraclass correlation coefficient.

5 | RESULTS

The size of the free flaps ranged from 3 cm x 6 cm to 6 cm x 13 cm. The average operation time for the combination surgery was 9.5 h (range, 7–12). After excluding one patient who expired before forehead flap division due to comorbidities, the average duration between

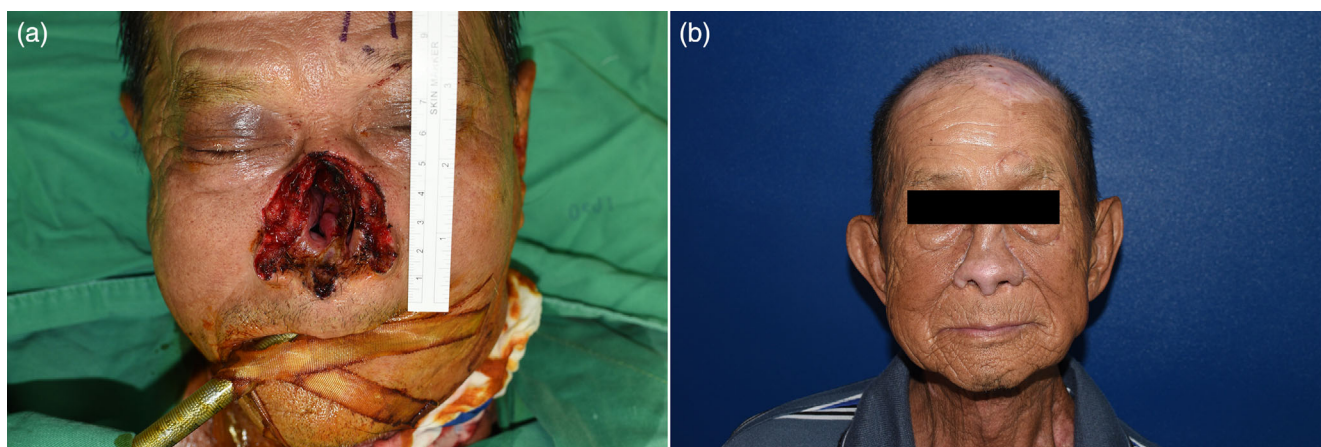


FIGURE 2 (a) The 77-year-old man had a total nasal defect after squamous cell carcinoma excision. An anterolateral thigh flap was used for nasal lining reconstruction, and paramedian forehead flap was used for external nasal skin coverage simultaneously. (b) 16-months follow-up

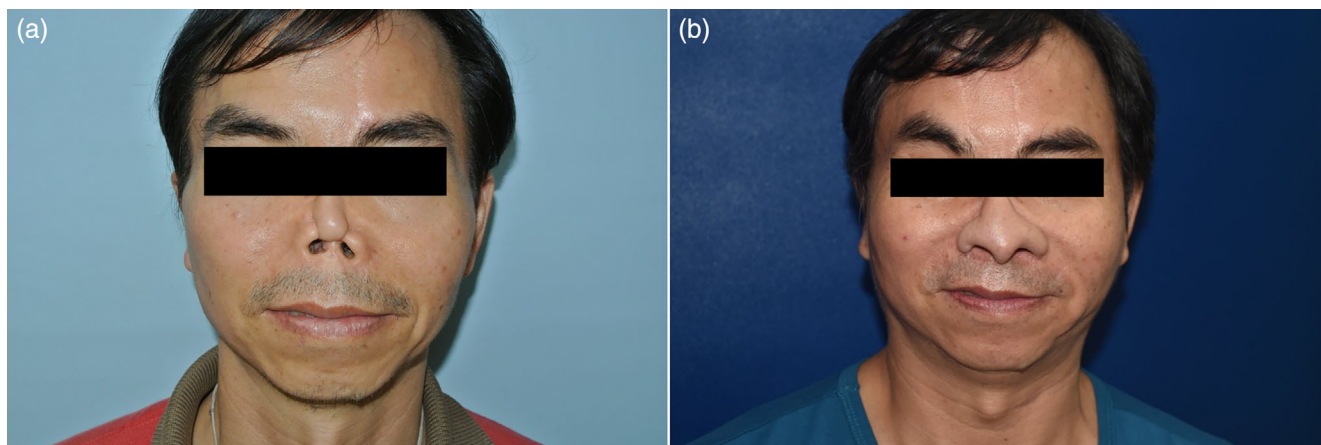


FIGURE 3 (a) The 55-year-old man had traumatic nasal deformity. An anterolateral thigh was utilized for nasal lining and the nasal skin was replaced with forehead flap in the same stage. (b) 18-months follow-up

free flap transfer with forehead flap reconstruction and division of the forehead flap pedicle of residual patients was 5.7 months (range, 2–12). Two patients postponed the staged operation due to the COVID-19 pandemic. One patient suffered from a wound infection after the first combined surgery and therefore underwent additional surgery for debridement and postponed the regular staged operation. One ALT flap had partial necrosis due to infection, and we advanced the original forehead flap as the lining salvage since the lining defect was relatively small. For the other five patients without any postoperative events, the forehead flap pedicle was divided by 2.2 (range, 2–3) months after the 1st combined surgery. In addition, there was no immediate take back surgery for all free flap reconstructions. The patients received an average of 4.2 (range, 3–8) surgeries from 1st combined surgery to division of forehead flap, and received further 2.2 (range, 0–8) refinement surgeries to achieve the final results, with a total of 6.4 (range, 4–11) surgeries. No obvious donor site morbidity was noted. The average follow-up duration was 29.6 months (range, 12–64). The average NOSE score was 5.9 (range, 0–10) after surgery.

The average aesthetic score is 4.0 (range, 3–5) by plastic surgeons and 4.2 (range, 3–5) by laypersons. The interrater reliability is 0.89 in plastic surgeons and 0.85 in layperson.

6 | CASE REPORTS

6.1 | Case 1

The 77-year-old man had a total nasal defect after squamous cell carcinoma excision (Figure 2a). The lining defect was 5 cm x 10 cm and skin defect was 7 cm x 7 cm. An anterolateral thigh (ALT) flap was used for nasal lining reconstruction, and paramedian forehead flap was used for external nasal skin coverage simultaneously. Because the patient refused to use rib cartilage, bilateral conchal cartilage were harvested for framework reconstruction including bilateral alar rim graft and columella hinge graft at second stage while debulking of the free flap. Figure 2b showed 16-months follow-up.

6.2 | Case 2

The 55-year-old man had traumatic nasal deformity (Figure 3a). The lining defect was 4 cm x 7 cm and skin defect was 7 cm x 7 cm after removing the scars. An anterolateral thigh (ALT) flap was utilized for nasal lining and the nasal skin was replaced with forehead flap in the same stage. Rib cartilage was used for framework reconstruction. Figure 3b showed 18-months follow-up.

7 | DISCUSSION

Total or subtotal nasal reconstruction demands restoring the three nasal layers, and the nasal lining reconstruction is usually the most difficult. Since the local flap is usually not sufficient in total nasal defect, the reconstruction choices of lining include free flap, double forehead, tissue expander, or skin graft. However, because of the large defect of both lining and skin in total nasal reconstruction, the two forehead flaps would result in huge donor site defect. Besides, the big forehead flap may not be easily folded as lining in primary stage of total nasal reconstruction. As for tissue expander, it would need several months to expand the forehead tissue before definite reconstruction surgery, which may prolong the whole reconstruction period. The skin graft over the raw surface of the forehead flap precludes placement of primary support and may lead to distorting contracture. Therefore, the free flap for lining and forehead flap for nasal skin remained the common method in total or subtotal nasal reconstruction.

Simultaneous reconstruction by pedicled paramedian forehead flap and free flap has rarely been reported. Seth et al. presented five patients undergoing a free anterolateral thigh fascia lata flap for total or subtotal rhinectomy defects (Seth et al., 2013). Among them, three were performed with forehead flaps simultaneously. The article focused on the application of the ALT fascia lata flap rather than the combination procedure.

In this series, we described 10 cases combining the preliminary stage of nasal reconstruction with a first-stage forehead flap for complex nasal reconstruction, which was the largest series so far. By restoring both the lining and skin cover or even the framework at a single stage, we reduced the overall long nasal reconstruction period. In our previous experience, it took approximately 4.2 (range 1–9) months from preliminary free flap reconstruction to forehead flap transfer. We either waited for the flap to become stationary or it took several operations to thin and reposition the lining free flap, and then approximately another 2 months elapsed until forehead flap pedicle division. With the combination of two major operations, we shortened the duration from 6.2 to 2.2 months from the first combination operation to the division of the forehead flap pedicle. In the intermediate stage of the forehead flap, we could not only thin and tailor the forehead flap and build or re-enforce the framework but also debulk, reshape and reposition the lining free flap. In this way, the total number of surgeries, cost, admission days and duration of nasal reconstruction decreased. In addition, the requirement of skin grafts or

large artificial dressings to temporarily cover the raw surface of free flaps decreased remarkably.

However, there are still some challenges and drawbacks of the combination procedure. First, combining two flap transfers requires a long operation time, which was 9.5 h on average in our series, and may increase the anesthesia risk for some patients with comorbidities. A two-team approach is mandatory to save time, and we may become quicker as we become more familiar with the combination procedure. We could also take advantage of the 3D printing technique for designing forehead flaps even before surgery to save time (Yen et al., 2019). Second, the initial thickness of the free flap sometimes hinders framework reconstruction, so cartilage support was built in the later intermediate stage in some situations. Third, we sometimes intentionally designed the forehead flap to be slightly larger than we needed to cover the exposed pedicle of the free flap, which increased the size of the donor site over the forehead and may have prolonged wound healing. If the raw surface could not be covered by a forehead flap, temporary dressings were necessary. In addition, in our series, all infection occurred in patients with a previous radiotherapy history, so we suggest delayed procedure or waiting for a longer time for staged surgery until the flap is stable.

8 | CONCLUSIONS

The combination of preliminary free tissue transfer for nasal lining restoration with a paramedian forehead flap for nasal skin replacement in the same stage may shorten the long process and achieve satisfactory reconstruction in complex nasal reconstruction.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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