

Forehead Flap For Nasal Reconstruction Our Experience With 40 Cases

Mohammad Shakeel¹, Mohamad Imran², AzharKhan³, Muzafar Ahmad⁴
Munaza Shafi⁵, Mudasar Ahad⁶,

¹Associate Professor ,MaxillofacialSurgery,Skims Medical College Srinagar
^{2,3,4,5.} Registrar ,Maxillofacial Surgery ,Skims Medical College

⁶Assistant Professor,Department Of Orthodontics ,Skims Medical College Srinagar

Abstract

Objectives: To assess the efficacy and efficiency of forehead flap in reconstruction of nasal defects.

Methodology: This study was carried out on 40 patients of either sex who required reconstruction of nasal defects of different etiologies.

Results And Conclusion: Forehead flap is a reliable technique for reconstruction of nasal defects of varied origin .

Keywords: Supratrochlear Artery, Forehead Flap, Pedicle, Local Flaps.

I. Introduction

Forehead flap is one of the commonly used pedicle flaps for reconstruction of nasal defects¹. Its use for reconstruction of nasal defects dates back to early days of civilization as mentioned in the Hindu holy book "Susruta Veda" in 800 B.C². The flap is based on supratrochlear/supraorbital vessel. This flap is commonly used to reconstruct the acquired and congenital nasal deformities.

Its qualities include abundant tissue availability, which allows resurfacing of the entire nasal subunit, its excellent match in color and skin texture. Above all it has robust vascularity and low donor site morbidity. Forehead flap has the advantage of being locally available and has potential to resurface large nasal cutaneous defects^{3,4}. This flap has consistent vascular anatomy, abundant blood supply & favorable arc of rotation. It can cover the soft tissue defects⁵ by providing a thin muscle bulk as well as intact mucosal lining⁶. In this paper, we describe our own experiences with different types of forehead flaps in the management of different nasal defects of varied origin.

II. Methods

The study included 40 patients with different nasal defects resulting from burns, bear maul injury, infection, excision of nasal and post-traumatic defects aged between 20 to 60 years, of either sex.

Patients under radiation therapy to the forehead region, previous surgery or trauma to the forehead region and medically compromised patients who cannot tolerate general anesthesia were excluded. Written informed consent obtained from all patients/parents/attendants, for inclusion in surgical procedure and use of the data for research purpose.

The following parameters were analyzed: the patient's age, sex, cause of injury that led to the reconstruction, the number of sub-units involved in the nose, the type of graft used, the surgical methods used for reconstruction of the nasal lining, the number of surgeries per patient and postoperative complications.

Surgical technique

Preoperatively the supraorbital and supra trochlear arteries were identified and marked by digital palpation. The defect was marked along with the anticipated skin resection and the measurements were transferred to the donor region using suture cover as template. The flap was harvested superficial to the frontalis muscle in the distal part and together with this muscle close to the periosteum, in the proximal part, in order to protect the vessels. After harvesting, the flap was thinned when needed to match the thickness of the tissue from the defect. The flap was sutured on the defect and the donor site closed near the midline.

III. Results

The study included 17 males and 23 females mostly in the age group of 41-50 years (Figure 1). The most common etiology of nasal defects was burn injury (n=15) followed by trauma (n=11), excision of navus (n=6), bear maul (n=5) and infection (n=3) (Figure 2). In most of the patients (n=16), only one nasal subunit was involved. (Figure 3). Full-thickness defects were present in 60% of the patients and all such cases were reconstructed using folded forehead flap. Structural support was necessary in 7 (2.8%) patients (Figure 4). Cartilage was harvested from the conchal bowl (29%) and costal cartilage (43%). The bone graft was required in

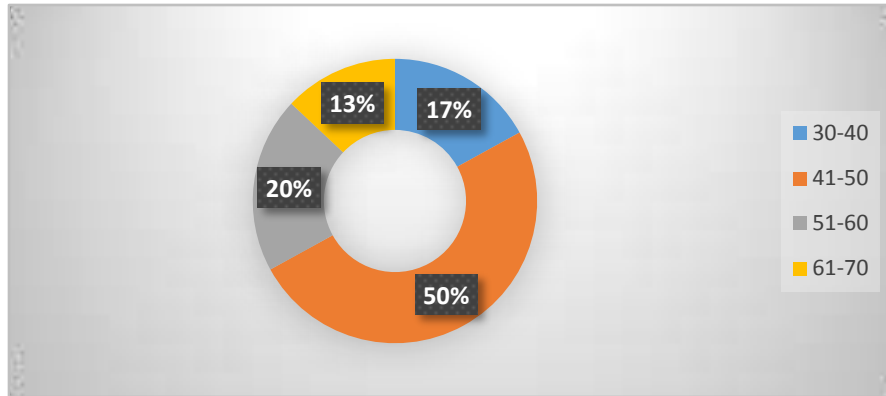


Figure 1.Age distribution of patients.



Figure 2.Etiology of nasal defects.

two patients which was obtained from rib in one patient and from iliac crest in another patient. A posterior incision was given to harvest the graft in all cases.

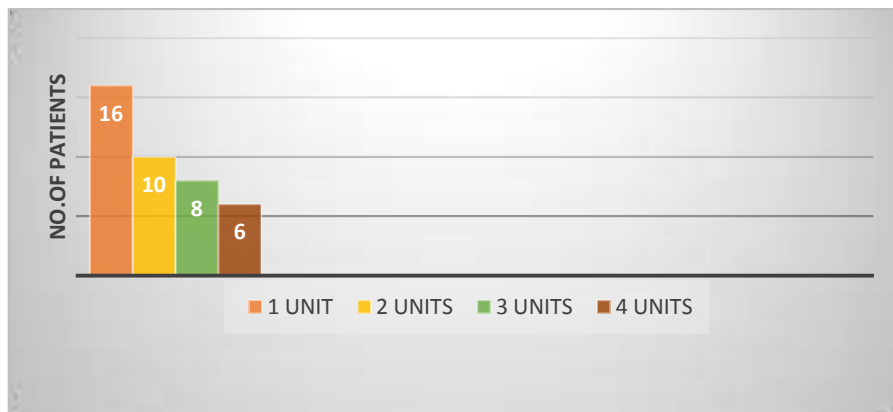


Figure 3.Nasal subunits involved.

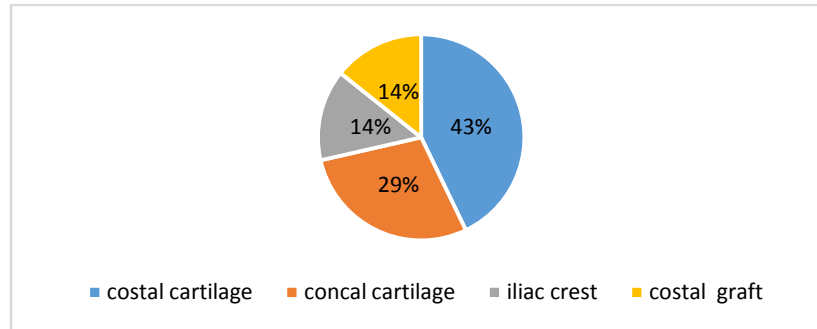


Figure 4. Grafts for nasal reconstruction

The flap pedicle was designed ipsilateral to the defect in 18 patients and contralateral in 22 patients. Closure of the forehead was most commonly accomplished by primary closure.

Complications (Figure 5) were few and were managed properly.

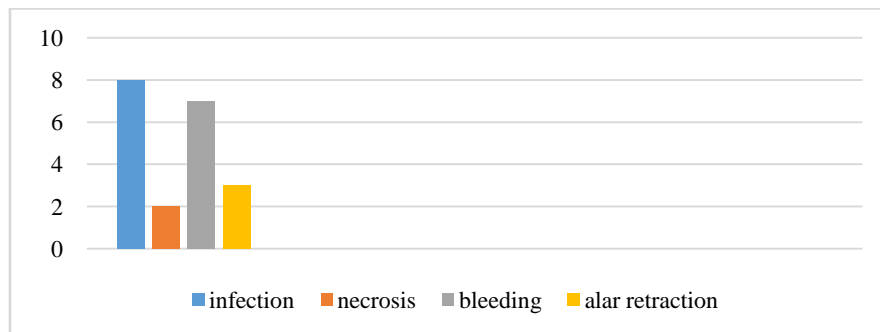


Figure 5. Complications

Immediately after surgery, some patients (n=7) had post op bleeding from the flap pedicle. It was managed with local hemostatic agents. One patient developed post operative infection on the cartilage donor site which was treated with oral antibiotic. Following the second stage, two patients had superficial and proximal necrosis due to aggressive thinning. Both were treated with wound care and healed uneventfully.

Complication after the third stage occurred in three patients, who developed alar retraction and were very much unsatisfied with the treatment and never returned back to us. Despite complications, almost all patients had excellent functional and aesthetic results.

IV. Discussion

The nose is one of the most difficult challenges for reconstruction after surgical defects. Closure options are individualized for each patient and defect. For large defects on the distal nose, however, options that achieve a good functional and aesthetic outcome are limited. When wounds are extensive, deep, and or involve missing cartilage or mucosal lining, no other repair can approach the consistency and predictability of the PFF.

The subunit principle is an important concept in reconstruction⁷. If a defect involves greater than 50% of a subunit, excising the residual skin and resurfacing the entire subunit may yield better aesthetic outcomes. This principle, however, is not absolute⁸. Excellent results may be achieved with partial subunit replacement. In this study, three patients had partial subunit resections (hemitip) with excellent results. Fourteen patients had complete subunit excision. Among those, seven (50%) also had partial excision of an additional subunit.

The PFF should be thought of as a robust surface covering that can provide soft tissue thickness but not structural support. Nasal lining and structural cartilage are the infrastructures that must be either intact, supplemented, and or restored prior to the PFF⁹. Options to restore small mucosal defects (<1cm) include a turnover hinge flap, turndown of a forehead flap extension, a full-thickness skin graft (FTSG), and bipedicle vestibular skin advancement flap. Larger lining restoration may require a turnover forehead flap, FTSG vascularized by an overlying PFF, or intranasal lining flaps (septal mucoperichondrial hinge flap, composite septal chondromucosal pivotal flap)^{10,11}. Intranasal mucosal flaps are difficult to perform without conscious sedation or general anesthesia. Other

options above, however, may be successfully executed under local anesthesia. Cartilage grafts are either structural (native cartilage present but additional needed for support) or restorative (replacing what was removed). Structural functions of cartilage include: 1) preventing tissue contraction and distortion, 2) bracing heavy flap tissue, 3) maintaining airway patency and augmenting the internal nasal valve, and 4) achieving contour support (i.e. nasal tip graft for better projection). Donor sites for cartilage grafts may include the antihelix (scaphoid fossa) and the conchal bowl from one or both ears^{12,13}.

Conchal cartilage is ideal for grafts that demand more curvature, substance, and rigidity and work better to avoid nasal valve or lobule collapse, and for columella and tip projection. Sculpting and beveling of the graft is often necessary to achieve the desired thickness, contour, shape, and tapered edges. This should be carefully done since cartilage is a fragile structure and may break during the process. Cartilage grafts may be safely harvested under local anesthesia¹⁴. Postoperative pain after forehead flap is variable. However, if cartilage grafting was performed then the auricular donor site is predictably more painful after surgery than the forehead flap donor site. For this reason, we routinely injected long acting local anesthetic (Bupivacaine) after closing the ear donor site in addition to postoperative analgesics.

Whether the forehead flap should be completed in two or three stages is a matter of debate. Folded PFFs that restore nasal lining absolutely require three stages. The first stage harvests the flap and folds it to provide both nasal lining and surface covering.

The second stage (3 weeks) retains the pedicle, but opens the PFF margin at the alar rim to debulk excess tissue and to insert cartilage support. The third stage (6 weeks) divides the pedicle and sculpts the flap further for completion. PFFs that are not folded to restore lining may also be staged in 3 sessions¹⁵.

The first stage incorporates cartilage support and PFF creation and inset. The second stage (3 weeks) elevates the flap partially and debulks excess tissue to improve contour. The third stage (6 weeks) then divides the pedicle. The main advantage of the three-stage PFF is the ability to sculpt a thin, supple contour in patients with delicate nose tips and ala. Two stage flaps in these patients often result in bulbous, thick contours. Disadvantages of the three-stage PFF are the delay in pedicle division and the extra procedure. However, the three-stage procedure is more reliable in smokers as the flap contains muscle and has a very

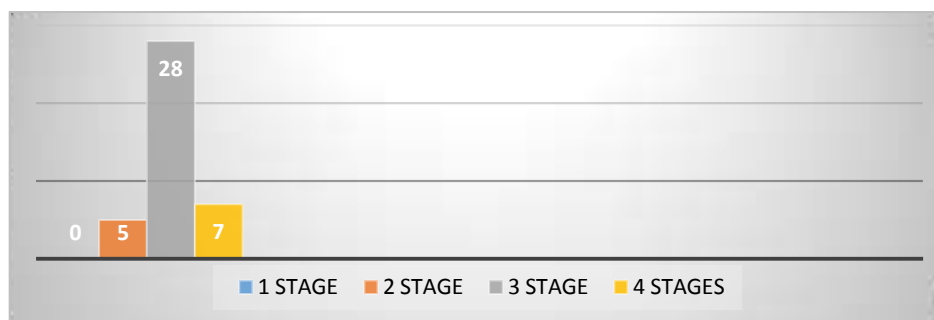


Figure 6. No. of surgical stages in a patient

robust blood supply. It may also be of benefit in cases where a profound underlying lining and cartilaginous reconstruction have been performed, as the frontalis provides an extremely rich anastomotic vascular network¹⁶.

Most of the patients (n=28) required three surgical stages in this study (Figure 6). Twenty four (24) patients were submitted to folded forehead flap, two required a more aggressive thinning, and one needed repositioning of the flap due to distal necrosis.

For most patients, the two-stage approach is safely performed by debulking the distal portion of the flap at the first stage. As long as a thin layer of subdermal fat is preserved, then the supra-trochlear artery is protected¹⁶. Thinning of the proximal portion of the flap is usually performed at the time of pedicle division and should be carefully done. In our study, five (5) patients underwent two stage surgery.

Pedicle side is an important consideration when designing the PFF. Traditionally, the pedicle has been designed contralateral to the defect to minimize its torsion. However, a narrow pedicle (1 to 1.5 cm) allows an ipsilateral design without concerns about significant torsion¹⁷. Moreover, the ipsilateral design increases the flap reach. We performed 18 ipsilateral and 22 contralateral flap designs without any difficulty in either procedure.

Attempting to completely close the forehead donor site is not advisable. The forehead is approximated as much as possible without tension. However, when significant tension is noted, the remaining wound should heal by second intention¹⁸. All our cases had primary closure of donor site without any complication.

Potential complications of the PFF include bleeding, pain, poor scarring, infection, dehiscence, distortion of free margins and flap necrosis¹⁹. In this study, despite the higher rate of complications compared to previous studies performed by dermatologic surgeons, complications were minor and treatable. Furthermore, all patients had optimal to excellent functional and aesthetic results.

V. Conclusion

The PFF is a valuable flap in the repair of large and deep nasal defects of different etiologies. Its reliable blood supply, color, and textural qualities and resultant contour warrant strong consideration for its application. Restoring the entire subunit should be considered. Optimal results, however, may be achieved with hemi subunit repair. With good surgical planning, measures for patient comfort, and meticulous technique, the PFF may be safely performed in an outpatient setting and can achieve unique restoration of the nose.

VI. Illustration Of Few Cases

Case 1. This is a 40 year old male with left alar defect due to burn injury. The defect was repaired with forehead flap in three stages (fig.7).

Case 2. A 55 year old lady with navus on the dorsal nose extending on lateral nasal wall on right side. Good results achieved with forehead flap (fig.8)

Case 3. A 26 year old female with navus at the root of nasal dorsum managed with forehead flap (fig.9).

Case 4. A 4 year old male child with burn injury of nose. Patient was managed with median forehead flap with good results (fig.10).



Figure 7. Composite defect of left nasal ala (a) preoperative pic (b) forehead flap in place (c) after pedicle detachment.



Figure 8. A big nevus on nasal dorsum (a) preoperative view (b) forehead flap in place (c) pedicle being detached (d) one week post pedicle detachment.

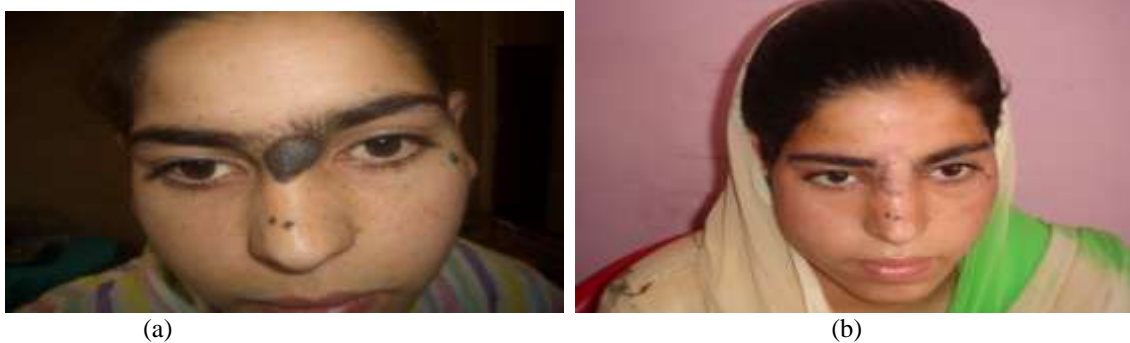


Figure 9. Navus at the root of nasal dorsum (a) preoperative picture (b) post operative picture

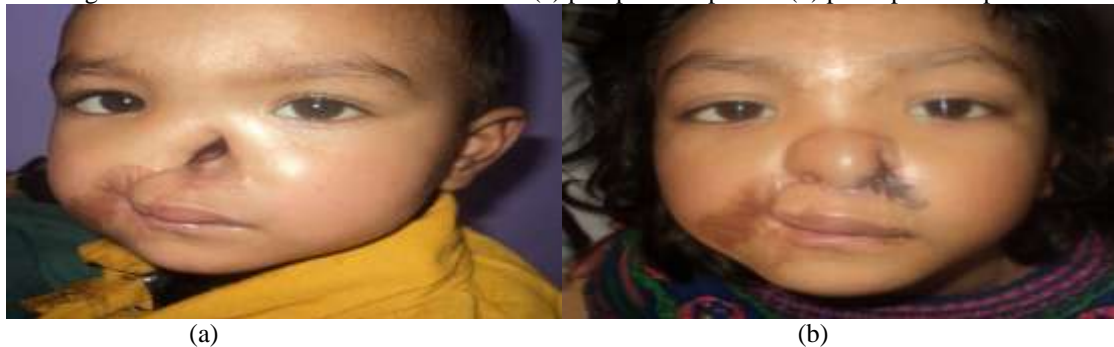


Figure 10. Burn injury with loss of most of the nasal structure (a) preoperative (b) one month postoperative picture.

References

- [1]. Anastassov GE, Schwartz S, Rodriguez E. Buccinator myomucosal island flap for postablative maxillofacial reconstructions: a report of 4 cases. *J Oral Maxillofac Surg*. 2002;60:816-21.
- [2]. Bishagratna KKL, ed. *Sushruta Sambita*. Calcutta, Bose, 1907-1916.
- [3]. Sadhotra LP, Singh M, Raju R. Reconstruction of complete palatal defect with a forehead flap: A case report. *Indian J Plast Surg*. 2003;36:120-122.
- [4]. Millard DR Jr. Total reconstructive rhinoplasty and a missing link. *Plast Reconstr Surg*. 1966;37:167-83.
- [5]. Shah AA, Malik WM. Head and neck reconstruction: a 3 years experience. *Ann King Edward Med Coll*. 1999; 5:19-21.
- [6]. Warraich RA, Cheema SA. Head and neck reconstructive options for soft tissue defects. *Ann King Edward Med Coll*. 2001; 7: 11-13.
- [7]. Burget GC, Menick FJ. The subunit principle in nasal reconstruction. *Plast Reconstr Surg*. 1985;76(2):239-47.
- [8]. Rohrich RJ, Griffin JR, Ansari M, Beran SJ, Potter JK. Nasal reconstruction beyond aesthetic subunits: a 15-year review of 1334 cases. *Plast Reconstr Surg*. 2004;114(6):1405-16; discussion 1417-9.
- [9]. Burget GC. Aesthetic restoration of the nose. *Clin Plast Surg*. 1985;12(3):463-80.
- [10]. Boyd CM, Baker SR, Fader DJ, Wang TS, Johnson TM. The forehead flap for nasal reconstruction. *Arch Dermatol*. 2000;136(11):1365-70.
- [11]. Baker S. Internal lining. In: Baker S, Naficy S, editors. *Principles of nasal reconstruction*. St Louis: Mosby, 2002 p. 31-46.
- [12]. Ratner D, Skouge JW. Surgical pearl: the use of free cartilage grafts in nasal alar reconstruction. *J Am Acad Dermatol*. 1997;36(4):622-4.
- [13]. Byrd DR, Otley CC, Nguyen TH. Alar batten cartilage grafting in nasal reconstruction: functional and cosmetic results. *J Am Acad Dermatol*. 2000;43(5 Pt 1):833-6.
- [14]. *Surg Cosmet Dermatol* 2014;6(1):1724.
- [15]. Cerci FB, Nguyen TH
- [16]. Sage RJ, Leach BC, Cook J. Antihelical cartilage grafts for reconstruction of Mohs micrographic surgery defects. *Dermatol Surg*. 2012;38(12):1930-7.
- [17]. Menick FJ. A 10-year experience in nasal reconstruction with the three-stage forehead flap. *Plast Reconstr Surg*. 2002;109(6):1839-55; discussion 1856-61.
- [19]. Burget GC, Menick FJ. Nasal support and lining: the marriage of beauty and blood supply. *Plast Reconstr Surg*. 1989;84(2):189-202.
- [20]. 17. Menick FJ. Aesthetic refinements in use of forehead for nasal reconstruction: the paramedian forehead flap. *Clin Plast Surg*. 1990;17(4):607-22.
- [21]. Nguyen TH. Staged interpolation flaps. In: Roher TE, Cook JL, Nguyen TH, Mellette Jr, JR, editors. *Flaps and grafts in dermatologic surgery*. New York: Elsevier, 2007. p. 91-105.
- [22]. Little SC, Hughley BB, Park SS. Complications with forehead flaps in nasal reconstruction. *Laryngoscope*. 2009;119(6):1093-9.