

Case Series

Forehead flap reconstruction for post traumatic nasal defects: functional and aesthetic outcomes

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ABSTRACT

The nose being the central unit is an important structure with a social and psychological significance. The reconstruction of nasal defects is complex as it involves the reconstruction of three separate structural layers which should be properly restored to maintain a functional nasal airway and an acceptable appearance. In this study, the aim was to reconstruct the 3D contour, border, outline and symmetry of the nose in post-traumatic defects with a forehead flap cover. A prospective study was conducted in the department of plastic and reconstructive surgery, over 3 years, 20 patients with post-traumatic nasal deformity were included in the study. The defects were categorized based on the subunits involved. The parameters recorded were age, sex, mode of injury, existing co-morbidities, habit of smoking and alcohol, any previous scar on the forehead, and history of previous surgery. Twenty patients underwent resection, out of which 13 (65%) were males and 7 (35%) were females using a para-median forehead flap cover. The most common mode of injury was road traffic accident in 12 (60%) cases, followed by animal/human bite in 5 (20%) cases and sharp cut injury in 3(15%) cases. (50%) patients required an intermediate stage after 3 weeks in which flap thinning was done with or without cartilage placement. Complications included suture dehiscence in one case for which re-suturing was done. 60% of patients were very satisfied with the results, and only 1 patient was unsatisfied. The forehead flap is a reliable choice for reconstruction in post-traumatic defects due to excellent color and texture match. Immediate reconstruction can be done in all the patients after adequate debridement under antibiotic coverage. Full thickness defects including the lining can be easily addressed by folding the flap.

Keywords: Post traumatic nasal defect reconstruction, Forehead flap, Three stage nasal reconstruction

INTRODUCTION

The nose being the central unit is an important structure with a social and psychological significance. Facial deformities, especially nasal defects, pose problems both from a functional standpoint and for social reintegration because their appearance is likely to trigger aversion.

The reconstruction of nasal defects is complex as it involves the reconstruction of three separate structural layers (the inner mucosal lining, middle osseous cartilaginous support, and external skin cover), which

should be properly restored to maintain a functional nasal airway and an acceptable appearance.

The technique of nasal reconstruction originated almost 3000 years ago in India, documented in the Susruta Samhita, for the reconstruction of the amputated nose which was a common way of social punishment.¹ The first written account of an Indian midline forehead rhinoplasty was published in the Madras Gazette in 1793 and one year later was republished in the Gentleman's Magazine of London an English surgeon, J.C. Carpeue discovered this technique, perfected it on cadavers for the

next 20 years and then published his account of two successful operations in 1816.^{2,3}

Burget and Menick later introduced the concept of aesthetic subunits principle of the nose, stating that the incisions should be located at the limits of these aesthetic units and if a defect of a central convex subunit, such as the tip or ala, is greater than 50% of the subunit, then rather than merely “patching the hole” the adjacent normal tissue should be discarded and the entire subunit should be resurfaced.⁴

One of the best applications of the paramedian forehead flap is in the reconstruction of the distal nose, where the sebaceous gland quality and tissue thickness closely resemble that of the forehead. The most common indication for transfer of a paramedian forehead flap is the reconstruction of large nasal defects, although their use has been reported for periocular reconstruction as well.⁵ The vertical paramedian forehead flap based on the supratrochlear artery, is the flap of choice for nasal reconstruction. It has robust vascular supply, reliable reach and minimum donor site morbidity. In this study, the aim was to reconstruct the 3D contour, border, outline and symmetry of the nose in post-traumatic defects with a forehead flap cover.

CASE SERIES

A prospective study was conducted in the Department of Plastic and Reconstructive Surgery, over 3 years. 20 patients with post-traumatic nasal deformity were included in the study.

The parameters recorded were age, sex, mode of injury, existing co-morbidities, habit of smoking and alcohol, any previous scar on the forehead, and history of previous surgery. The defects were categorized based on the subunits involved. All the patients were planned for immediate reconstruction.

Patients were educated and counselled about the stages of the procedure as some patients might be uncomfortable especially if the delay is anticipated. Bruising, swelling, infection, and the appearance of the anticipated scar were discussed. Previous case photos were used to counsel the patient and the goals of reconstruction were clearly explained. Those unwilling were excluded from the study.

Before surgery, the defect was measured and the flap was planned. The height of the anterior hairline and the amount of forehead laxity were checked. All patients were operated on under general anaesthesia. After debridement of the defect, a template was made using the foil of the suture packet or a similar item.

The pedicle of the supratrochlear was marked and the flap was marked on the same side after planning in reverse using a gauze to check the reach of the flap. For patients

with low anterior hairlines or those for whom the flap will be used in columellar reconstruction, the flap was designed with a lateral curve to avoid the use of hair-bearing skin. It was ensured that the flap should reach the inferior aspect of the defect with ease without any tension. Its point of rotation was centred inferiorly towards the medial canthus. Pedicle width at the level of the brow was narrowed down to about 1.2-1.5 cm. The flap was sutured distal to proximal in a single layer. The donor site was closed after undermining on both sides in layers. Any gap if remaining was grafted.

In patients where the defect was complex and the inner lining was lost, the flap was folded to make the lining take a few millimetres extra length of the flap which was incorporated in the fold. Cartilage grafts were used as a part of support in the intermediate stage in some cases.

After 3 weeks flap could be re-elevated and thinned and contouring done as per the satisfaction of both the surgeon and the patient and the division was carried out 3 weeks after the intermediate stage. The pedicle was untubed and unused portions were discarded, except for a triangle of skin at the base that was used to restore the medial aspect of the eyebrow from which the flap was harvested. The patients were discharged on post-op day 2 and called for follow-up on pod 7 followed by pod 14 and pod 21 for the second stage procedure. The patients were assessed for their level of satisfaction with the surgery after 3 months of final surgery.

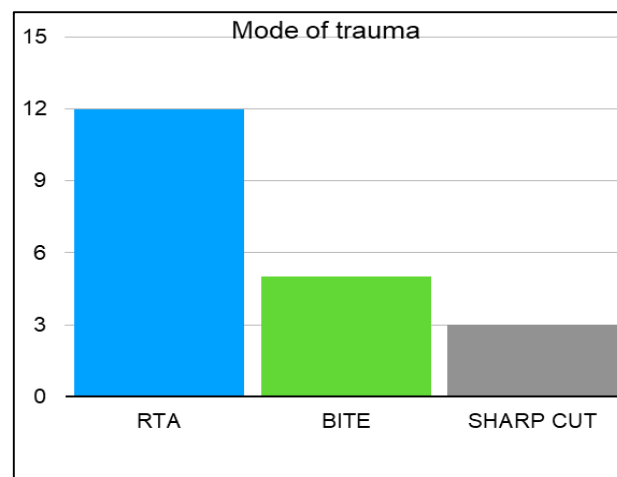


Figure 1: Distribution of patients as per mode of trauma.

Twenty patients underwent resection, out of which 13 (65%) were males and 7 (35%) were females using ipsilateral para median forehead flap cover (Table 1). The mode of injury was road traffic accident in 12 (60%) cases, animal/human bite in 5 (20%) cases and sharp cut injury in 3 (15%) cases (Figure 1). Of all the patients 5 patients consumed tobacco in the form of chewable or smoking. 30% patients had involvement of 5 subunits in which ala was the most commonly involved subunit

among all the patients (Table 2), 10 (50%) patients required only 2 staged procedures while in the other 50%, an intermediate stage was included after 3 weeks in which flap thinning was done with or without cartilage placement (Table 3). Complications included suture dehiscence in one case for which re-suturing was done, 60% of patients were very much satisfied with the results, 35% were satisfied and only 1 patient was unsatisfied (Table 4). She was a 31-year-old female who felt the flap cover was still thick compared to her skin. Ala and Columella were involved in almost all the cases.



Figure 2: A 48 year old man with defect involving bilateral ala, soft triangle, tip and columella. Three staged procedures done with intermediate stage of flap thinning.



Figure 3: A 42-year-old man with tip, columella, right ala and soft triangle defect. Reconstructed with a two-stage forehead flap.



Figure 4: A 21-year-old male with left alar defect. Reconstructed as a two staged procedure.

Table 1: Demographic data.

Demographic data	N (%)
No. of patients	20
Mean age of the patients	48±10.96 years
No. of males	13 (65)
No. of females	7 (35)
Mode of trauma	
Road traffic accident	12 (60)
Animal/human bite	5 (25)
Sharp cut injury	3 (15)
Smokers/ tobacco chewers	5 (25)

Table 2: No of subunits involved.

No. of subunits involved	N (%)
1	1 (5)
2	3 (15)
3	4 (20)
4	4 (20)
5	6 (30)
6	1 (5)
7	1 (5)

Table 3: Number of stages of procedure done.

Procedure	N
Two stage procedure	10
Three stage without cartilage support	6
Three stage with insertion of cartilage support in intermediate stage	4

Table 4: Level of satisfaction.

Levels	N (%)
Very satisfied	12 (60)
Satisfied	7 (35)
Unsatisfied	1 (5)

DISCUSSION

The face is divided into central and peripheral subunits. The central units the nose, lip, and eyelids are seen in the primary gaze and demand the highest priority of the repair.

The forehead and cheek are peripheral facial units. Because their borders are not visible in all views, their borders can only be incompletely compared to the contralateral normal side for symmetry or outline. As the peripheral units are less exact and constant, their repair is less demanding and of secondary importance⁶. Hence during reconstruction, the nose symmetry, contour and boundary hold paramount importance.

The location of the defect is of equal importance in planning for reconstruction. The nose is divided into 9 subunits out of which 3 are unpaired - dorsum, tip columella and 3 paired subunits-sidewalls, ala and soft triangle. The use of local flaps in the adversely located defects that are those closer than 0.5 to 1 cm of the nostril margin, will distort the tip and nostril rim as these flaps do not reach the infra tip lobule or columella. A regional flap will be needed to resurface these adversely located defects, even though the wound is not necessarily large, defects greater than 1.5 cm in size and deep defects where the underlying support or lining is missing.

Among the other factors to be taken into consideration is the skin quality. The nose is covered with thin, smooth, mobile skin at the superior half while at the inferior half starting at the alar groove, the skin is thick, densely adherent and sebaceous which converts to thin and adherent again at the infra tip lobule, columella and the soft triangle.

The forehead with its superior color, texture, size, reach, vascularity, lining applications, and forgiving donor site makes it the first choice for most nasal repairs. It is multi-laminar, composed of skin, subcutaneous fat, frontalis muscle, and a thin underlying areolar layer which separates it from the frontal periosteum. The forehead skin is supplied by the supratrochlear, supraorbital, superficial temporal, and dorsal nasal arteries (from the angular artery).

The supratrochlear artery which is one of the terminal branches of the ophthalmic artery exits the superior medial orbit between 1.7 and 2.2 cm lateral to the midline, along with the supra trochlear nerve and continues vertically upwards to supply the forehead and the scalp as far posteriorly as the vertex of the head along with supra supraorbital artery. The supratrochlear artery exits the orbit through the orbital septum and passes between the orbicularis oculi and the corrugator supercilii, then traverses vertically upwards into the frontalis muscle. At the mid-forehead level, it lies in a superficial subdermal plane after passing through the muscle.⁷

The forehead flap is an axial pattern, interpolated flap based on the supratrochlear artery and drained by its corresponding vein.⁸ The flap is elevated in a distal to proximal direction including deep tissue at the most inferior 2 cm, where the vessels course deep to the frontalis muscle, and more superficial tissue superior to that point because the vessels run in a subdermal plane towards the vertex of the scalp.⁹ A central nasal defect can be resurfaced on the pedicle of either side, but a unilateral nasal defect is resurfaced with the ipsilateral pedicle to decrease the distance between its pivot point and the defect unless precluded by an old scar within its territory. One important aspect in planning is the flap size which should be adequate as a large flap will distort the symmetry and malposition of the landmarks while a small flap to preserve the donor site will pull the neighboring structures inwards. It should always be kept in mind that the forehead is a forgiving site while the nose is not.

The donor site, the forehead being a peripheral subunit can be left to heal by secondary intention or grafted. Wound contraction and re-epithelialization close any superior residual defect. There is no eyebrow distortion and the Medialization of the eyebrow is usually not significant because the proximal pedicle is narrow. These patients should be followed closely to monitor for any breathing difficulties or prolapse which might necessitate the use of a supportive cartilage framework. Due care should be taken to ensure administration of pre and post-operative antibiotic cover to prevent complications. The author prefers not to use any cartilage support in the first stage to allow any infection if present to be settled in 3 weeks.

Although forehead skin matches the nose in colour, texture, and thickness, a forehead flap is thicker than nasal skin. As most Indian noses have a wide alar base and boxy tips,¹⁰ a staged procedure is seldom needed as patients are happy with the results of the flap as a two-stage procedure. Flap thinning in the second stage is commonly required in patients with thin skin and narrow alar bases. The thick skin of the forehead can be thinned at distal 1.5-2 cm in the first stage itself, taking due care in the smokers for inset in columella and tip. Cartilage support was required in patients with bilateral loss which was harvested either from the nasal septum or concha. The thick forehead skin also acts as a support precluding the need for cartilage graft in unilateral cases. The pedicle of the flap should only be divided after the patient and surgeon are satisfied with the results of the reconstruction.

CONCLUSION

The forehead flap is a reliable choice for reconstruction in post-traumatic defects due to excellent color and texture match. Immediate reconstruction can be done in all the patients after adequate debridement under antibiotic coverage. Full thickness defects including the lining can be easily addressed by folding the flap. The cartilaginous

framework if required can be inserted as a part of the intermediate stage which offers the advantage of resolution of infection. Flap division should only be planned when the patient and surgeon both are satisfied with the result.

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REFERENCES

1. Converse JM. Corrective and Reconstructive Surgery of the Nose. In: Converse JM, Ed., Reconstructive Plastic Surgery (2nd Ed.), Saunders, Philadelphia. 1977.
2. Gentleman's Magazine. London, UK. 1794; 891.
3. Carpue JC. An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead. London, UK: Longman, Hurst, Rees, Orme and Brown. 1816.
4. Brenner MJ, Moyer JS. Skin and Composite Grafting Techniques in Facial Reconstruction for Skin Cancer. Facial Plastic Surg Clin N Am. 2017;25:347-63.
5. Tripathy S, Garg A, John JR, Sharma RK. Use of Modified Islanded Paramedian Forehead Flap for Complex Periocular Facial Reconstruction. J Craniofac Surg. 2019;30(2):e117-9.
6. Plastic Surgery, Craniofacial Head and Neck Surgery and Pediatric Plastic Surgery. 4th ed., vol. 3. Elsevier Health Sciences. 2012.
7. Zito PM, Hohman MH, Mazzoni T. Paramedian Forehead Flaps. In: StatPearls. Treasure Island (FL): StatPearls Publishing. 2023.
8. Oleck NC, Hernandez JA, Cason RW, Glener AD, Shamma RL, Avashia YJ et al. Two or Three? Approaches to Staging of the Paramedian Forehead Flap for Nasal Reconstruction. Plast Reconstr Surg Glob Open. 2021;9(5):e3591.
9. Shumrick KA, Smith TL. The anatomic basis for the design of forehead flaps in nasal reconstruction. Arch Otolaryngol Head Neck Surg. 1992;118(4):373-9.
10. Mehta N, Srivastava RK. The Indian nose: An anthropometric analysis. J Plast Reconstr Aesthet Surg. 2017;70(10):1472-82.

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