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To study efficacy and complication of forehead flap in nose reconstruction

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Abstract
Aim: To analyse efficacy and complication of forehead flap in nose reconstruction.
Material and Method: The prospective observational study was conducted in the Department Of General Surgery in Subharti Medical College and Hospital from November 2018 To August 2020 among 30 patients undergoing nasal reconstruction with forehead flap. Two stages surgical techniques were used in each patient in order to achieve an acceptable aesthetic result. The forehead consists of multiple layers; skin, subcutaneous tissue, frontalis muscle with fascia and a thin areolar layer. The forehead flap was transferred in two stages, where the flap was thinned during the first stage to improve the aesthetic result, possibly jeopardizing its vascularity and decreasing chance for flap necrosis. During the period of follow up, patients were examined for functional as well as cosmetic outcome. Data was analysed using SPSS version 24.00.
Results: With regard to checking vitality of the flap, color of flap remained normal in 27 patients, only in two patients, it was seen slight bluish and in one patient, it was pale in immediate post-operative period. 16 (53.33%) patients were fully satisfied with the donor site esthetic and 23 (76.67%) patients were fully satisfied with their mouth opening. Necrosis was revealed in 6.67% of the subjects.
Conclusion: We conclude that large nasal defects can be restored with good cosmetic and functional results in patients with this technique. However, the ability to endure the forehead flap procedure should be carefully evaluated and discussed with the Patient.

Keywords: forehead, flap, nose, reconstruction

Introduction

Large nasal defects often provide a significant challenge to the reconstructive surgeon. The nose is characterized by several unique qualities, including complex topography, many mobile free margins, adjacent aesthetic sub- units, and varying skin properties with respect to thickness, texture, colour, and sebaceous content. A thorough understanding of anatomy, reconstructive options, tissue movement, patients and defect considerations is necessary for optimal functional and aesthetic surgical reconstruction [1].

The paramedian forehead flap still represents the golden standard for cover; however, several surgical steps of thinning and refinements have to be included to achieve pleasant results. As foreign materials are associated with an increased risk of infection, the framework should be reconstructed with autogenous grafts from rib or ear cartilage, which have to be fixed firmly to guarantee stable projection and correct axial positioning of the nose [2]. The forehead region contains an intricate array of anastomosing vessels. The forehead flap is a multistage procedure, and patients should receive preoperative counselling concerning their appearance between the first and second stages of the procedure. Thorough preoperative planning, including assessment of the defect, hairline height, and forehead laxity, is important. Patients should be given wound care instructions, and realistic goals about the final outcome of their nasal reconstruction [3]. The forehead flap is an invaluable tool for nasal reconstruction, but there are certain limitations. Potential complications with the use of the forehead flap for nasal reconstruction, which are similar to those involved in any flap reconstructive procedure, include bleeding, pain, poor scarring, infection, dehiscence, distortion of free margins, and flap necrosis. The most significant risk factor for developing major complications is the presence of a full-thickness nasal defect. These characteristics have increased odds of necrosis, notching, incomplete obstruction, and alar asymmetry, and nearly statistical significance for association with total obstruction. Full-thickness defects are significantly more involved, requiring multiple complex maneuvers with flaps and grafts to address all three layers of the nose (skin, structure, and internal lining). Skin only defects provide a recipient which further nourishes the skin paddle of the forehead flap along with the primary supply through the pedicle [4-6]. Full-thickness defects, on the other hand, invariably utilize structural grafting, which lacks an intrinsic blood supply. The result is a more tenuous flap that is susceptible to necrosis, collapse, and retraction. Complications would be expected at the distal portion where the vascular perfusion is marginal and the flap may have been thinned. Full-thickness defects are also unique in terms of their need for fastidious, long-term follow-up. Due to the specific risk of recurrence along the internal lining mar- gin, these patients require regular examination of the nasal mucosa in addition to dermatologic evaluation [7, 8]. The forehead flap is a valuable tool in the reconstruction of nose but there are certain limitations associated. To study the efficacy and limitations of forehead flap in nose reconstruction, we designed this study and examined the outcomes of our patients who underwent forehead flap reconstruction for nose.

Material and Method

The present study was conducted in the Department Of General Surgery in Subharti Medical College and Hospital from November 2018 To August 2020 among 30 patients undergoing nasal reconstruction with forehead flap who were admitted in IPD of Department Of General Surgery in Subharti Medical College and Hospital Meerut U. Patients were enrolled in the study after obtaining written informed consent and approval from Institutional Ethical Committee.

Inclusion criteria

1. All patients of nasal trauma, carcinoma of nose admitted in subharti hospital and followed up subsequently.
2. Patients presenting with Congenital/ acquired nasal deformities admitted in subharti hospital and followed up subsequently.

Exclusion criteria

1. Patients who were lost during follow up
2. Forehead burns/scar
3. Any Previous forehead surgery.

Surgical Procedure

Two stages surgical techniques were used in each patient in order to achieve an acceptable aesthetic result. The forehead consists of multiple layers; skin, subcutaneous tissue, frontalis muscle with fascia and a thin areolar layer. The forehead flap was transferred in two stages, where the flap was thinned during the first stage to improve the aesthetic result, possibly jeopardizing its vascularity and decreasing chance for flap necrosis. Before surgery all important landmarks and reference points were identified and marked for example the hairline, frown lines, location of the supratrochlear vessels, Ouline of the defect, nasal and lip subunits. Then templates were made using the intact side of the nose to make a precise symmetric reconstruction of the nose. The template resembling the defect is placed just under the hairline and the vascular pedicle is drawn downwards into the medial eyebrow. The pedicle was based on the supratrochlear vessels and was 1.2 cm wide. This way the flap design was made.

a. First Stage

The first stage is usually performed under locoregional anesthesia (mepivacaine, 1% or 2%) with sedation, except in cases requiring reconstruction of full-thickness nasal defects, when general anesthesia is used. The flap was incised and elevated from distal to proximal. Distally, the frontalis muscle and subcutaneous tissue was excised, this was done for 1.5 to 2 cm. Then more downwards the dissection went through the muscle and over the periostium. When reaching the brow, all of the skin borders were incised and the flap was carefully released. As soon as the flap reaches the defect without tension further incision of the flap was stopped and the flap was inset into the area of the defect. This was done using a single layer of fine suture. At the end of the operation, the pedicle is care-fully wrapped in petrolatum gauze and is covered with mupirocin ointment. When a full-thickness reconstruction is performed, we pack the nasal fossa, which not only aids hemostasis but also provides internal support to the tissues during the healing process. Patients remain in hospital for 24 to 48 hours for pain control and to perform surgical wound care. Dressings are reviewed every 12 hours during the initial days, with special attention being paid to the pedicle. Oral antibiotic prophylaxis is administered with cloxacillin, 500 mg by mouth every6 hours for 1 week.

b. Second Stage

The second stage was done three to four weeks later, when the flap was well healed at the recipient site. At this stage the pedicle were divided, the inferior forehead was reopened and the proximal pedicle was replaced the medial brow by an inverted V. The nose side of the pedicle was elevated superiorly with 2 mm of subcutaneous fat. If needed the recipient site can be altered to reach a better aesthetic result. The scar was eventually sculpted between the nasal subregions to create a satisfying aesthetical result (cases figure 2a-c).

Follow-up

The follow-up of our cases were done from 6 months to 1 year. The patients were follow up at 2nd week, 4th week, 12th week, 6th month and 1 year. During the period of follow up, patients were examined for functional as well as cosmetic outcome.

Complications

Major complications were defined as

1. Any degree of flap necrosis,
2. Complete, ipsilateral nasal obstruction, or
3. Alar notching.

Patients were considered to have one of these complications, if it was mentioned once in a follow-up note at any time postoperatively, regardless of duration or eventual outcome. Other adverse outcomes recorded included infection, alar base asymmetry, minor epidermolysis, and partial nasal congestion.

a. Pre-operative b. During Surgery **c.** 3 Month Post surgery

Fig 1

Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician and analysed using SPSS version 24.00 for windows; SPSS inc, Chicago, USA. For each assessment point, data were statistically analyzed using factorial ANOVA.

Results

During this time period, 30 patients underwent nasal reconstruction with forehead flap. Out of 30 patients, 18 were females and 12 were males. Maximum subjects belonged to age group of 41-50 years whereas minimum subjects were in the age group of 30-40 years. Co-morbid conditions like diabetes, hypertension and others was

reported among 3.33%, 23.33% and 6.67% of the subjects respectively. Most common etiology reported among subjects was cancer (46.67%) followed by trauma (33.33%) and burn (20%) as shown in graph 1.

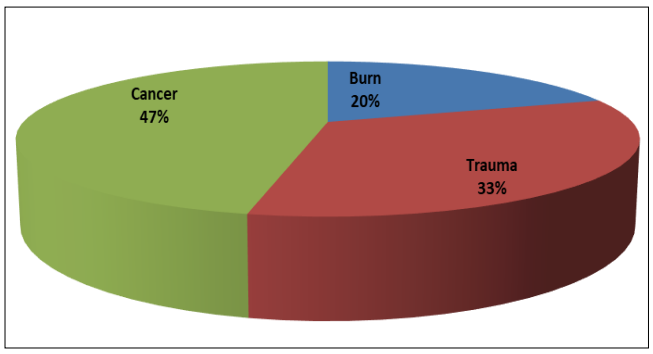

Fig 2: Etiology distribution among the study subjects

Defect at distal and proximal site was reported among 3 and 27 subjects respectively. Superficial (cutaneous) defect was found among 21 subjects whereas deep (cartilage or mucosa) defect was reported among 9 subjects. The average size of the defect was 22.91±6.82mm (table 1).

Table 1: Site and depth of the defect

Site	N	%
Proximal (dorsum, lateral wall of the nose)	3	10
Distal (tip, ala)	27	90
Depth		
Superficial (cutaneous)	21	70
Deep (cartilage or mucosa)	9	30
Size, Mean±SD (in mm)	22.91±6.82	

In most of the patients (43.33%), only one nasal subunit was involved. Four nasal subunit involvement was found among only 13.33% of the subjects as shown in table 2.

Table 2: Nasal subunits involved

Subunits	N	%
1 Unit	13	43.33
2 Unit	7	23.33
3 Unit	6	20
4 Unit	4	13.33

With regard to checking vitality of the flap, color of flap remained normal in 90% of the patients, only in 6.67% of the patients, it was seen slight bluish and in 3.33% of the patient, it was pale in immediate post-operative period (table 3).

Table 3: Post-operative color of flap among the study subjects

Color	N	%
Bluish	2	6.67
Pale	1	3.33
Normal	27	90

In our study 53.33% of the patients were fully satisfied with the donor site esthetic, 26.67% were moderately satisfied and 20% patients were unsatisfied with donor site esthetics in their last follow-up visit. Mouth opening may be altered where forehead flap has been used. In this study 76.67% of the patients were fully satisfied with their mouth opening, 13.33% patients were moderately satisfied and 10% of the patients were unsatisfied with their mouth opening in their last follow-up visit (table 4).

Table 4: Treatment outcomes (degree of satisfaction)

Degree of Satisfaction	Donor Site Defect		Flap Esthetic		Mouth Opening	
	N	%	N	%	N	%
Fully Satisfied	16	53.33	25	83.33	23	76.67
Moderately Satisfied	8	26.67	3	10	4	13.33
Unsatisfied	6	20	2	6.67	3	10

Major complications such as necrosis, obstruction and alar notching was revealed in 6.67%, 3.33% and 12.33% of the subjects respectively whereas minor complications like infection and alar asymmetry was reported among 6.67% and 10% of the subjects respectively (table 5).

Table 5: Complications among the study subjects

Complications	N	%
Major		
Necrosis	2	6.67
Obstruction	1	3.33
Alar notching	4	12.33
Minor		
Infection	2	6.67
Alar asymmetry	3	10
Post op Bleeding	7	23.33

Discussion

This study was carried out to see the viability of forehead flap after reconstruction of the nasal defects and to restore the function & physical form as close to nature as possible. As forehead flap is local flap of maxillofacial region and easily done in one stage surgery. While donor site defects are also acceptable after the skin grafting. This study determined the efficacy and efficiency of forehead flap in nose reconstruction. Co-morbid conditions like diabetes, hypertension and others were reported among 3.33%, 23.33% and 6.67% of the subjects respectively in the present study. Deleterious habits like smoking and alcohol others was reported among 26.67% and 16.67% of the subjects respectively in this study. N. Blázquez-Sánchez *et al* in their study reported diabetes in 27% of patients, cardiovascular risk factors in 49%, and smoking or drinking in 19.5% [9]. In our study, most common etiology reported among subjects was cancer (46.67%) followed by trauma (33.33%) and burn (20%). Similarly in a study by Mohammad Ilyas Shaikh *et al* [10], out of 30 patients, 25 had oncological resection, and 2 had post traumatic defects including firearm injury and 3 patients were presented with post infectious defects. Among 2 post traumatic patients 1 patient with history of firearm injury and 1 with road traffic accident were included. According to Mohammad Shakeel *et al* [11], 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). With regard to checking vitality of the flap, color of flap remained normal in 27 patients, only in two patients, it was seen slight bluish and in one patient, it was pale in immediate post-operative period. Later, these flaps appeared normal with good vascularity, except one flap remained bluish and showed the partial necrosis at the end of 1st postoperative week in the present study. In a study by Mohammad Ilyas Shaikh *et al* [10], the flap was very safe among 30 patients,

27 patients had normal color, which meant that these flaps had normal blood supply. However, in 2 patients, flap color was bluish and in 1 patient color of flap become pale. Out of these three flaps only one flap showed partial necrosis and two flaps appear normal after 1st postoperative week and the reconstruction was fairly good, which is similar to our study. In our study, donor site aesthetic was much concern for all the patients, as it looks far from to the others and survived with social compromise. In our study out of 30 patients, 16 (53.33%) were fully satisfied with the donor site esthetic, 8 (26.67%) were moderately satisfied and 6 (20%) patients were unsatisfied with donor site esthetics in their last follow-up visit. Mouth opening may be altered where forehead flap has been used. It may be due to obstruction of coronoid process after the transposition of the forehead flap below the zygomatic arch, or damage to the temporalis and postoperative healing and fibrosis. In this study out of 30 patients, 23 (76.67%) patients were fully satisfied with their mouth opening, 4 (13.33%) patients were moderately satisfied and 3 (10%) patients were unsatisfied with their mouth opening in their last follow-up visit. Blázquez-Sánchez *et al* [9] in their study found that this type of flap has good cosmetic and functional result that can be achieved in the majority of cases. This is due in part to the use of skin from the forehead to create the flap; the texture, color and flexibility of this skin are very similar to the skin of the external nose. In a study by Mohammad Ilyas Shaikh *et al* [10], out of 30 patients, 15 were fully satisfied with the donor site esthetic, 9 were moderately satisfied and 6 patients were unsatisfied with donor site esthetics in their last follow-up visit. 24 patients were fully satisfied with their mouth opening, 4 patients were moderately satisfied and 2 patients were unsatisfied with their mouth opening in their last follow-up visit. These results were in accordance with to our study Major complications such as necrosis, obstruction and alar notching was revealed in 6.67%, 3.33% and 12.33% of the subjects respectively whereas minor complications like infection and alar asymmetry was reported among 6.67% and 10% of the subjects respectively indicating the success of flap in our study. Stewart C. Little *et al* [8] in their study found that thirty-three (16.1%) developed a major complication at some point in their postoperative course, with 11 (5.4%) having some degree of flap necrosis, 10 (4.9%) nasal obstruction, and 20 (9.8%) alar notching. Smokers had higher odds of developing flap necrosis. Neither the presence of diabetes, increased age, nor vascular disease was significantly associated with higher rates of major complications.

The limitations of our study stem from its small size of the sample. Further studies are necessary to analyze the factors associated with possible complications, such as measures of the subjective evaluation by the patient (perception of changes in quality of life with the results).

Conclusion

Reconstruction with forehead flap provides natural building material precisely fitted to reconstruct nasal defects to a condition as near to normal as possible. In this study co-morbid conditions like diabetes, hypertension and others were very few, so it did not impact the outcome of the study. If a patient desires optimal aesthetic appearance with the best chance for function preservation, a staged forehead flap is the best option. If this technique is accurately planned, large nasal defects can be restored with good cosmetic and functional results in patients. However, the ability to endure the forehead flap procedure should be carefully evaluated and discussed with the patient.

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