ORIGINAL ARTICLE

Forehead flap: reliability and versatility

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Abstract:

Objectives: To determine the reliability and versatility of forehead flap in terms of frequency of complications and uses.

Study design: Cross-sectional observational study

Settings: This study was performed from January, 2014 to December, 2018 in the departments of Plastic and Burns Hayatabad Medical Complex, Peshawar and Khyber Teaching Hospital, Peshawar.

Material and Methods: After approval from the ethical committee, the data was collected of all patients in whom forehead flap was performed, was collected from hospital's record. The data were analyzed and organized to assess the demographics, etiologies of defects covered, type of flap used and frequency of complications. The results were projected in the form of tables and figures.

Results: A total of 26 patients, including 17 (65.4%) male and 9 (34.6%) female patients with age ranging from 10 years to 70 years (mean 47+ 1.89) met the inclusion criteria. Nose was the most common site of defects with the main etiology of surgical excision of malignancies. The paramedian variant of forehead flap was performed in 69.2% which was used as island in 15.4% cases. We observed insignificant partial necrosis of the forehead flap in 3.8% case. In 76.9% case the donor forehead defect was closed primarily.

Conclusion: The forehead flap is a very reliable flap for nasal and upper facial defects with good aesthetic results and low complication rates.

Keywords: forehead flap, squamous cell carcinoma, basal cell carcinoma, trauma

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Introduction:

Indian subcontinent is the birth place for nasal reconstruction with forehead flap due to a large population of nasal amputees who were punished for their crimes 3,000 years ago which was described in 7th century medical document of "Sushruta Samita". This document was translated in Arabic in 8th century AD as "Kitab Shah Shun al-Hindi" and "Kitab-i-Susurud".[1] The western world came to know about the technique through J.C Carpue who after reading about it in Gentlemen's Gazette in 1794, started to practice it after extensive cadaveric dissections. The flap were later modified by Millard in 1960's and Menick in 1970's.[2]

The color and texture match makes reconstruction with forehead flap the procedure of choice for different areas of the middle and upper face. The versatility of blood supply allows the surgeons to design the forehead flap according to the needs and perform complicated reconstructions.[3-7] Forehead flap can be used as interpolation or islanded for the reconstruction of nasal defects. It can be used as transposition or interpolation flap for the coverage of mid and upper face.[8]

The forehead is supplied by interconnected network of arteries supplied by supratrochlear, supraorbital and superficial temporal arteries. The supratrochlear exits into the forehead from

Table-1: Distribution of the study population on the basis of etiology

Etiology	Number of patients (n)	Percentage (%)
Malignancy	19	73.1%
Bites	4	15.4%
Other Trauma	3	11.5%
Total	26	100%

Table-2: Distribution of study population on the defect location

Defect location	Number of patients (n)	Percentage (%)
Nose	15	57.7%
Forehead	4	15.4%
Cheek	2	7.7%
Upper lid/medial canthal	3	11.5%
Lower lid/cheek	2	7.7%
Total	26	100%

Table-3: Type of forehead flaps used in the study population

Type of forehead flap	Number of patients (n)	Percentage (%)
Interpolation	12	46.2%
Transposition	10	38.5%
Island	4	15.4%
Total	26	100%

Table-4: Comparison of frequency of necrosis in the different variations of forehead flaps

Type of forehead flap	Frequency of necrosis		Total
	Nill	Insignificant partial necrosis	
Interpolation	12 (100%)	0 (0%)	12 (100%)
Island	3 (75%)	1(35%)	4 (100%)
Transposition	10 (100%)	0 (0%)	10 (100%)
Total	25 (96.15%)	1 (3.84%)	26 (100%)

P valve 5.720, calculated with chi square test

superio-medial orbital rim about 1.7-2.2cm lateral to the midline and runs around 2cm lateral to the midline forehead to the scalp. Supratrochlear artery is the main pedicle for the median and paramedian forehead flaps. Taking into consideration the precise arterial anatomy the skin paddle can be as narrow as 1cm to 1.2cm to increase the reach of the flap. The width can be as much as 4.5cm to close the donor primarily.[2] The forehead flap cover a wide range of mid-face defects when based on superficial temporal artery's frontal branch.

This article is aimed at sharing our experience with forehead flap reconstruction of nose and mid-facial defects with the objective to assess the reliability in terms of flap survival rate and versatility in term of range of defects coverage.

Material and methods:

Our study is performed from January, 2014 to December, 2018 in the department of Plastic and Burns surgery. After approval from the ethical committee, the patient's record was systematically searched to obtain data regarding the demographics, defects size, etiology, defects location, co-morbidities, flap type used, number of stages the procedure performed and complications observed. The flap necrosis was classified as insignificant partial necrosis: when treated without any secondary procedure, significant partial necrosis: when some secondary procedure performed to completely cover the defect and complete necrosis. Data was organized and analyzed with the help of Statistical Package for Social Sciences (SPSS 17). Results were projected in the form of tables and figures.

Results:

A total of 26 patients were included in the study including 17(65.4%) male and 9(34.6%) female patients with age ranging from 10 years to 70 years (mean 47+ 1.89). Most of patients presented with cutaneous malignancies 19(73.1%), followed by bites (table 1). The location of the defects was mainly nasal (57.7% cases), out of which 4(26.7%) cases were compound nasal reconstruction including skin, mucosal and cartilage support (table 2).

On the basis of blood supply, paramedian was the most commonly used flap (69.2%) followed by standard forehead flap (figure 1) based on superficial temporal artery's frontal branch. On the basis of movement to the defect, interpolation was most common (46.2%) followed by transposition flaps (table 3). In four cases (15.4%), the paramedian flaps were used as islanded (figure 2). In 13 cases (50%), the reconstruction was performed in single stage followed by two staged procedures (figure 3) in 46.2% cases. In one case, it took three staged procedure to complete a composite hemi-nasal reconstruction for a nose lost to dog bite. Out of the total 26 patient, we observed insignificant partial necrosis in one case (3.8%) who previously re-

Figure. 1: standard forehead flap reconstruction of left lower lid, cheek and nasal reconstruction, a: defect after excision of SCC of left lower lid, cheek and nose, with removal lower orbital rim b: one week post-operatively after reconstruction with standard forehead flap, based on frontal branch of left superficial temporal artery

Figure. 2: Islanded forehead flap reconstruction for a squamous cell carcinoma (SCC) defect of the nose, a: markings for wide local excision of SCC nose, b: surgical defect created with exposed nasal cartilages, c: islanded paramedian forehead flap designed on the right trochlear artery performed, d: One month post-operatively

Figure. 3: Left para-median interpolation flap for post SCC nose defect reconstruction, a: defect on the dorsum of the nose, b: coverage with interpolated, para-median forhead flap, c: One week post-operatively after flap division.

ceived radiotherapy to peri-orbital area and we used islanded, paramedian flap for nasal reconstruction. On comparison with interpolation and transposition flaps, islanded flap has statistically significant complication rates in terms of necrosis with p value of 5.720, calculated with chi-square test with 95% confidence interval. In 76.9%(20) cases, we were able to close the donor area primarily while in the rest of the cases we needed skin grafting.

Discussion:

After the establishment of forehead flap as workhorse flap for the reconstruction of nose and upper two thirds of the face, it was modified in various ways to increase its uses, improve the blood supply and aesthetic outcome. In this study, we exploited the versatile blood supply of forehead flap to design and use it for the reconstruction of different defects. In this study we tried to determine the versatility and reliability of forehead flap in terms of its uses in reconstruction and frequency of complications.

The age for which we used forehead flap ranged from 10 years to 70 years which is different from various previous studies as in our study it is used for pediatric population as well.[2,3] Most of our study population consists with males (65.4%). It can be due to increased sun exposure during working outdoors for living and also greater exposure to different trauma and disputes as well. Apart from 73.1% cases with reconstructive defects due to malignancies extirpation, 15.4% cases were presented with wounds on nose and upper 2/3 of face due to human or dog bites. Huang AH et al.[9] also reported two cases of acute nasal reconstruction with forehead flap after dog bites in their study. In 23.1% cases we used standard forehead flap based on frontal branch of superficial temporal artery for the reconstruction if different upper 2/3 facial defects due to its ideal color match, lack of hairs and availability of extra tissue to obliterate maxellectomy defects after de-epithelization. Adrian Frunza et al.[10] also used standard forehead flap in their patient after inftra-orbital squamous cell carcinoma excision and maxillectomy with good aesthetic results. Sheikh MI et al.[11] also used the standard forehead flap successfully

in their series of 30 patients with maxillofacial defects with involvement of the oral cavity. In 15.4% cases, the forehead flap was used as and islanded flap to reconstruct the nasal defects in single stage. Gouveia MP et al.[12] used an islanded glabellar flap for reconstruction of medial canthal area with good result in one of their cases. Island forehead flap is a very good modification to decrease the number of surgeries and cost for nasal reconstruction with good success rate. The frequency of necrosis was 3.8% which was observed in a patient with co-morbidity of radiotherapy in the past to the peri-orbital area. The frequency of flap necrosis is almost in the same range observed by Little SC et al.[13] in their series as 5.4%.

Conclusion:
Forehead flap is very versatile and reliable reconstructive option not only for the nose but also for upper two third of face including maxellectomy defects with good success rate which decreases the morbidity of the patients. Forehead flap can be used as single stage, island flap to reconstruct nasal defects with acceptable frequency of complications. In most of the cases the donor forehead defect can be closed primarily which improves the aesthetic results of reconstruction.

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Role and contribution of authors:
Dr Amir Taimur Khan, collected the data, referenes and wrote the initial menuscript.

Dr Mansoor Khan, collected the references and helped in introduction writing.

Dr Hidayat Ullah, critically review the article and made the final changes

Dr Muhammad Tahir, helped in collecting the data, and references and also helped in discussion writing.

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