

Research Article

Reliability of Loco Regional Flaps in Reconstruction of Large Scalp and Forehead Defects

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Abstract

Background: Scalp and forehead reconstruction is required after trauma, burns, oncological resection, and cutaneous infections. The scalp is a unique part of the human body, and its inherent anatomy presents challenges in the reconstruction of large defects. The goals of scalp reconstruction are well-vascularized soft tissue coverage, intact calvarium and an aesthetically pleasure appearance. The use of locoregional flaps for reconstruction allows for rapid recovery and shorter operative time.

Methodology: This retrospective observational study was conducted at the Department of Plastic Surgery and Burns Unit, Services Institute of Medical Sciences, Lahore. Twenty-five patients requiring scalp and forehead reconstructions were studied between January 2020 and January 2022. Demographic data, defect etiology, location and size of the defect, comorbidities, and type of flap used for reconstruction were also documented. The primary outcomes assessed were wound healing, operative time and length of hospital stay. The secondary outcome was complications (early and late). Data were analyzed using SPSS version 26.0.

Results: Among the 25 patients, 17 were male and 8 were female. The mean patient age was 40 ± 12 years. Seven patients underwent scalp rotation-advancement flap, 2 underwent scalp rotation along with forehead advancement flap, 3 underwent scalp rotation along with trapezius myocutaneous flap, 10 underwent transposition flap, and 3 underwent double transposition flap. The most common etiology of the defect was tumor extirpation ($n=13$), followed by trauma ($n=7$), radionecrosis ($n=3$), and electric burn ($n=2$) (Figure 2). The temporal site was the most common site of the defect ($n=8$). The mean scalp defect (area) was $90 \pm 31 \text{ cm}^2$. The mean operative time was 137 ± 9.6 minutes and the mean hospital stay was 5.96 ± 0.8 days. Wound healing on the 7th postoperative day was $94 \pm 0.9\%$. Two patients developed small hematoma. One patient developed a distal flap necrosis.

Conclusion: Locoregional flaps can be a reliable option for reconstruction of large scalp and forehead defects.

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Introduction

Large complex defects of the scalp and forehead are difficult to treat. Severe trauma, extensive burns, oncological resections, and cutaneous infections are the main etiological factors.^{1,2} Poor elasticity of the scalp is the main reason for difficult closure requiring a complex approach.³ Reconstructive options for large defects can

be loco regional flaps or free tissue transfer. Free tissue transfer has the advantage of a large surface area and a two-team approach but requires microvascular expertise, longer operative time, and possible intensive care unit (ICU) care.^{4,5} Using loco regional flaps for reconstruction allows rapid recovery and shorter operative time. Therefore, these flaps can be promising alternatives to free tissue transfer.⁶⁻⁸

Due to the Covid-19 pandemic in Pakistan, there is a significantly increased burden on the healthcare system; hence, all surgical procedures were modified, keeping in mind the risks and benefits for patients and the safety of healthcare workers. Therefore, locoregional flaps were employed for soft tissue coverage of large defects on the scalp and forehead. These flaps have the advantages of reliability, shorter operative time, in turn leading to decreased risk of pulmonary complications, and reduced need for ICU care.

The purpose of this study was to analyze the outcomes of using loco regional flaps for the reconstruction of large scalp and forehead defects, with emphasis on flap reliability, operating time, hospital stay, and intra-and postoperative complications.

Methodology

This retrospective observational study was conducted in the Department of Plastic Surgery and Burns Unit, Services Institute of Medical Sciences, Lahore. The medical records of patients requiring scalp and forehead reconstruction from January 2020 to January 2022 were reviewed retrospectively.

Our inclusion criteria were patients of both genders aged 14–60 years with scalp defects of up to 50% with exposed bone. Patients having defects of more than 50%, and polytrauma were excluded from the study.

Demographic data, defect etiology, location and size were recorded on proforma, as well as the presence of any comorbidities such as diabetes, hypertension, ischemic heart disease, cancer, and chronic infection. For each patient CT scan was performed, and a neurosurgical opinion was taken in every case regarding the viability or involvement of the calvarial bone. Thorough debridement of the necrotic bones was performed, where necessary. In the case of malignancy clearance was confirmed using frozen sections. The various flaps used for scalp reconstruction were noted the flap type was chosen according to the site & size of the defect. The donor site was covered with split-thickness skin graft. The stitches were removed on the 10th postoperative day. Patients were followed up at 1 week at 2 weeks, and then at 3 months.

The primary outcomes assessed were wound healing, operative time and length of hospital stay. Wound healing was assessed in terms of the percentage on 7th postoperative day. Operative time was calculated in minutes the (skin incision to skin closure). Hospital stay was calculated in terms of the number of days from the time of admission to the time of discharge.

The secondary outcome was the incidence of complications. Postoperative complications were reviewed and categorized as early and late complications. Early complications include hematoma, seroma, infection, ischemia, venous congestion, and pulmonary complications. The late complications reviewed were partial flap loss and poor aesthetic results.

Data were analyzed using SPSS version 26.0. Quantitative data such as age, operating time, length of hospital stay, wound healing, and patient satisfaction are presented as means and standard deviations. Qualitative data such as sex and etiology were presented as frequencies and percentages.

Results

Among the 25 patients included in this study, 17 (68%) were males and 08 (32%) were females. The patients ranged in age from 14 to 60 years, with a mean age of 40 ± 12 years, 17 out of 25 patients had comorbid condition. Table 1 describe the patient characteristics. The frequencies and details of the various flaps used for scalp reconstruction are shown in figure

Table 1: Patient characteristics

Age	n ±SD
Mean Age (Years)	40±12
Gender	n (%)
Male	17 (68)
Female	08 (32)
Co-Morbidities	n (%)
Diabetes	5 (20)
Hypertension	7 (28)
Chronic infection	3 (12)
Ischemic heart disease	2 (08)

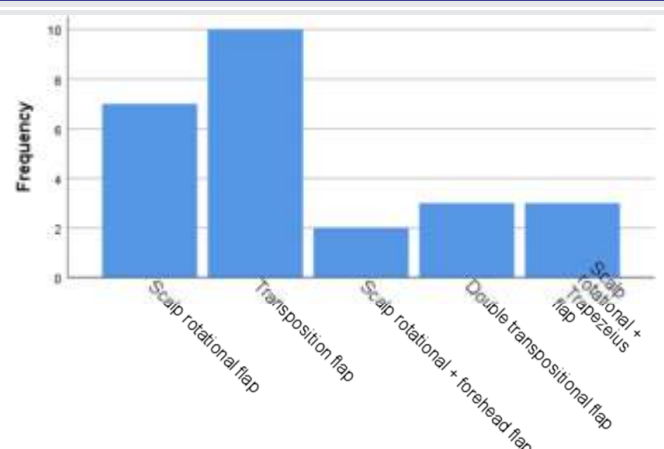


Figure 1. Types of Flaps Used for Reconstruction

The most common aetiology of the defect was tumour extirpation (n=13), followed by trauma (n=7), radio necrosis (n=3) and electric burn (n=2). The most common

site of the defect was the temporal region ($n=8$, 32%), followed by the parietal ($n=6$, 24%), frontal ($n=5$, 20%), occipital ($n=4$, 16%), and combined ($n=2$, 8%) regions. Table 2 shown the details of defect characteristics.

The defect sizes on the scalp and forehead ranged from 40 cm² to 150 cm², with a mean size of 90 ± 31 cm². The mean operative time was 137 ± 9.6 minutes and the

Table 2: Defect Characteristics

I-Aetiology	n (%)
Tumor extirpation	13 (52)
Trauma	07 (28)
Radionecrosis	03 (12)
Electric burn	02 (08)
II-Site	n (%)
Frontal	05 (20)
Temporal	08 (32)
Parietal	06 (24)
Occipital	04 (16)
Combined	02 (08)
III-Depth	n (%)
Skin and galea	09 (36)
Pericranium	12 (48)
Calvarial involvement	04 (16)

mean hospital stay was 5.96 ± 0.8 days. Wound healing on the 7th postoperative day was $94 \pm 0.9\%$. There were no intraoperative complications. Two patients (8%) developed small hematomas, both of which were managed conservatively. One patient (4%) developed distal flap necrosis of approximately 1 cm (a late complication), which was managed by excision and secondary suturing (Table 3).

Table 3: Primary And Secondary Outcomes

I-Primary Outcomes	Mean \pm S.D
Mean operation time (minutes)	137 ± 9.6
Wound healing (%)	94 ± 0.9
Mean hospital stay (days)	5.96 ± 0.8
II-Secondary Outcomes (complications)	n(%)
Hematoma	2(8%)
Distal flap necrosis	1(4%)

Discussion

Reconstruction of a large scalp defect is difficult. According to the reconstructive ladder, skin grafting is the basic rung.⁹ Netolitzky first demonstrated the use of skin grafting of calvaria after the presence of granulation tissue in 1871.¹⁰ In 1908, Robinson reported successful skin grafting on an intact periosteum before the presence of granulation tissue.¹¹ However, a well-vascularized surface and intact periosteum are limitations of skin

grafting.

For extensive defects, a choice is made between loco-regional and free flap coverage. Local flaps were first reported by Messner in 1894. Kazanjian (1944) demonstrated that galea scoring allowed for further advancement of the local flaps.¹² McLean and Buckne (1972) reported distant pedicle flaps and microvascular free tissue transfer.¹³

In our study, we opted for locoregional flaps for large defects. Local flaps are fasciocutaneous flaps that provide good color, texture, and depth match in addition to short operating time, shorter hospital stay, and fewer complications. Zayakova et al. demonstrated that local flaps are a sufficiently good technique for scalp reconstruction when the defects are large with denuded periosteum calvaria or with bone loss.¹⁴ They also accounted for complications; however, they did not consider the operating time and hospital stay. Whereas, in our study, we considered the length of hospital stay, operating time and complications as well.

The main patterns of local flaps include rotation, transposition, and rotation with advancement. The scalp is a well-vascularized tissue that provides flexibility for pedicle formation. These flaps can be based on any one of the five large arteries of the head: superficial temporal, supraorbital, supra trochlear, postauricular, and occipital. Depending on the size and location of the defect, flaps can be planned in different shapes. Flaps raised should be large enough to cover the defect, without tension. In certain cases, we used galeal scoring combined with a small back cut, to gain flap length.¹⁵ E Raposio et al. have previously demonstrated that galeotomies are a useful adjunct to decrease the amount of closing tension when performing scalp reduction procedures. Galeal incisions are typically made parallel to the blood vessels to avoid damage to them.

For extensive defects, local flaps can be combined with regional flaps.¹⁶ J Zenga et al. described the lower trapezius flap as a reliable reconstructive option for posterior scalp and high cervical defects. In our review, scalp rotation and trapezius musculocutaneous flaps were combined to cover the large posterior scalp defects. The disadvantages of this technique are scarring, which leads to unsatisfactory aesthetic outcomes and increased donor-site morbidity.

Although free tissue transfer is an excellent option for extensively covering large defects, we prefer loco regional flaps because of the short operative time, short hospital stay, and lower risk of anesthesia-related complications.^{17,18} Kentaro Tanaka et al. established an operative mortality index after head and neck reconstruction

with free tissue transfer¹⁷. Their review demonstrated a 30-day postoperative mortality rate of 0.88% and in-hospital mortality rate of 1.84%. However, in our review, no in-hospital or postoperative mortalities were recorded.

Previously published data have suggested that for patients with significant medical comorbidities, there is an increased risk of complications if the operating time exceeds 10 h. Singh et al. 1999, reported a complication rate of free flap reconstruction up to 28% when anaesthesia time was over 10 hours. The median hospital stay in their study was 16 days, which further increased by 7.5 days ($p < 0.001$) with the development of complications.¹⁹ Whereas in our study, the mean operating time was 137 ± 9.6 minutes, which is significantly less than the time required for free flap reconstruction. Furthermore, the mean length of hospital stay in our study was 5.96 ± 0.8 , which reduces the risk of postoperative complications common in hospital settings, especially during the COVID-19 outbreak. No intraoperative complications were observed in this review. Two patients developed small hematomas that were conservatively managed. Both the number and severity of complications compared favorably with those of free flaps.

The limitation of this study was its retrospective design. Additionally, no comparison of locoregional flaps with free flaps was performed during the study.



Figure 3. (A) Dermatofibrosarcoma at the anterior aspect of the scalp and forehead. (B) Defect after excision and burr hole (C) Raising the scalp rotation flap. (D) Final closure. (E) 3rd month postoperatively (F) Donor site.



Figure 4. (A) Post-electric burn scalp defect with osteomyelitis. (B) Defects after debridement and craniotomy. The scalp rotation flap was raised based on the defect. (C) Final appearance in 3rd month. (D) Donor site.

Conclusion

It is reasonable to suggest that locoregional flaps can be an alternative to free tissue transfer for the reconstruction of large scalp and forehead defects.

Conflict of interest

None

Funding Source

None

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