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# 2 YEARS EXPERIENCE IN SCALP DEFECTS: DEMOGRAPHIC PROFILE AND TECHNIQUES OF RECONSTRUCTIVE PROCEDURES

**KEY WORDS:** Scalp Reconstruction, Scalp Defects, Bi-pedicle Flaps, Tissue Expansion

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**ABSTRACT**

Scalp defects are a challenge that a surgeon faces in the developing world. The scalp is exposed to the various aggressive factors in the environment as it forms a protective shield to the cranial bones and underlying structures. There is a whole array of scalp deformities or defects resulted due to road traffic accidents, burns, malignancy, congenital malformations, pressure sores to name a few out of which traumatic deformities are the most common ones. In spite of the various protocol algorithm for scalp reconstruction, each case is unique and requires special address by the surgeon. No algorithm is perfect for reconstruction of scalp defects. In this paper we are describing the variety of scalp defects encountered in our center for the past 2 years and how each case deserves special attention and planning for their reconstruction.

## INTRODUCTION

The scalp is one of the most resilient structure in the human body. It has a rich blood supply, protects the brain and skull, not as elastic as skin in the rest of the body and provides an aesthetic appeal to the person as a whole due to its hair bearing characteristics. Scalp deformities usually involves scalp loss. Multiple reconstructive procedures are devised to repair scalp defects with minimal disturbance to its surrounding structure. The aim of this study is to evaluate the various demographic profile of patients presenting with scalp defects, their etiology, planning of reconstruction and the various procedures which would be most appealing aesthetically to the patients.

## METHODOLOGY

We conducted a retrospective study of the scalp defects operated in our department over 2 years period (2015-2017). The demographic profile, etiology, type of reconstructive procedures and outcome were noted. The patients were followed up for a period of 6 months. Many of the debilitating scalp avulsion injury and extensive scalp loss due to burns underwent multiple stage reconstruction. Few post traumatic scalp avulsion were stabilized primarily with skin graft and were planned for reconstruction. The reconstructive techniques were designed for each case based on the age of the patient, time of presentation, the size of the defect, condition of the locally available scalp tissue, co-morbidities of the patient and etiology leading to scalp defect. The defects were either triangulated, rectangular or circular and areas calculated accordingly. After planning, a reconstructive procedure was finally allotted to the patient which would give the best outcome surgically and aesthetically. All operations were performed under general anaesthesia.

## STATISTICAL ANALYSIS

Statistical analysis was done using Microsoft Excel 2016 compatible for Windows 10. Data analysed included age, gender, etiology and location of scalp defects, area of scalp loss and the reconstructive procedures used and their outcome.

## RESULTS

A total of 31 cases(6 females and 25 males) were included in our study after a written informed consent obtained from each of the patients. Table 1 shows the demographic profile of the patients with scalp defects due to traumatic and non-traumatic causes along with the various procedures they underwent and results after surgery. The age of patients in our study ranged from 45 days to 78 years. Traumatic injury contribute to the majority of cases which are seen mostly in the younger age group while scalp malignancy contribute to the morbidity of the older population. We classify the scalp defects as simple and complex. The simple scalp defects are those involving only the scalp layers sparing the calvaria, while the composite defects includes both the calvarial and skin defects.

The reconstructive procedures performed included transposition flap, rotation flap, split thickness skin graft, advancement flap, bi-pedicle flap, double hatchet flap, Limberg flap, tissue expanders followed by rotation flap. The site of scalp deformity affected the most is the Frontal and the Parietal region. The size of the scalp defects were 2.25 $cm^2$ to 113 $cm^2$.

The defects upto 5 cm could be closed primarily, from 6 cm upto 22cm were reconstructed using either transposition or rotation flap. The decision of the type of flap was done based on the condition of the surrounding scalp. In most of the cases due to traumatic defects, rotation flap was not possible due to scarred adjoining tissues or the incision line would have crossed over to the forehead. In one case with traumatic scalp deformity, the rotation flap was performed with the base towards the forehead. There was a complication of secondary raw area which did not heal. Hence a secondary procedure of a forehead flap was done. Other cases, transposition flap along with a split thickness skin graft (STSG) of the secondary raw area were used for reconstruction. In three cases, STSG was used to give a cover to the defect since the patients were not fit physiologically for an immediate flap cover but subsequently they underwent definitive reconstruction. A Limberg flap was used in a single case of occipital defect due to pyogenic granuloma. Another case of post craniotomy of size 35 $cm^2$ temporo-parietal defect was reconstructed using a bi-pedicled flap, the secondary raw area was covered with an STSG. Large size defects of 75 $cm^2$ to 115 $cm^2$ could not be reconstructed with the local tissue available. Hence tissue expanders were used to expand the scalp to a certain degree which would give an adequate coverage post rotation of the flap. Most of the cases healed well requiring no furthur intervention except for those cases which require secondary calvarial reconstruction.

## DISCUSSION

Deformities of part or all of the scalp present the problems of providing protective covering for cranial bones and underlying structures, return of soft tissue thickness, restoring the body contour and also to establish hair loss. Several factors need to be considered when selecting the ideal flap for each individual scalp defect. The size of the defect, anatomic involvement, and overall health of the patient must all weigh in during the decision making process[1].The new tissue must also be able to withstand the shear forces that may be applied to it in the future, heal in a timely

fashion to allow adjuvant treatments to begin, and withstand future radiation or trauma[2].

Few important principles should be applied when using local scalp flaps for reconstruction, the edges of the wound must be carefully trimmed avoiding injury to hair follicles, excessive tension should be avoided in the flap extremities, since localized ischemia with involution of the hair follicles could result in alopecia. Prior local anesthetic infiltration with epinephrine reduces bleeding at the wound edges, and facilitates dissection of the loose areolar plane. "dog ears" is the most common

**TABLE 1: Patients with scalp defects. Their demographic profile and reconstructive procedures.**

| No | AGE IN YEARS | SEX | ETIOLOGY | TYPE OF DEFECT | SIZE OF DEFECT (cm)$^2$ | SITE | REGION | PROCEDURE DONE | Result |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.12 | Female | Traumatic | scalp defect | 20 | R | Fronto parietal | STSG allograft | no complication |
| 2 | 2 | Male | Traumatic | scalp defect | 13.5 | R | Temporo parietal | Rotation Flap | no complication |
| 3 | 4 | Female | Traumatic | Composite defect | 12 | L | Temporo parietal | Rotation Flap | no complication |
| 4 | 5 | Male | Traumatic | Composite defect | 6 | L | Fronto parietal | Rotation Flap | no complication |
| 5 | 5 | Male | Traumatic | scalp defect | 7 | R | Parietal | Rotation Flap | no complication |
| 6 | 8 | Male | Traumatic | scalp defect | 9 | L | Parietal | Rotation Flap | no complication |
| 7 | 10 | Male | Naevus Sebaceous Scalp | scalp defect | 2.25 | R | Parietal | WLE with primary closure | no complication |
| 8 | 13 | Male | Naevus Sebaceous Scalp | scalp defect | 3 | midline | Mid-Occipital | WLE with primary closure | no complication |
| 9 | 13 | Male | Naevus Sebaceous Scalp | scalp defect | 5 | R | Occipital | WLE with primary closure | no complication |
| 10 | 13 | Male | Post Burns Alopecia | scalp defect | 76 | R > L | Fronto temporo parietal | Tissue Expander followed by rotation flap | no complication |
| 11 | 15 | Male | Decompressive Craniectomy due to Right MCA infarct in young | Composite defect with exposed Titanium mesh | 4 | R | Parietal | Primary closure | Mesh re-exposure |
| 12 | 16 | Male | Naevus Sebaceous Scalp | scalp defect | 5 | L | Temporal | WLE with primary closure | no complication |
| 13 | 22 | Female | Post traumatic scalp avulsion with Alopecia | scalp defect | 113 | R > L | Fronto temporo parietal | Tissue Expander followed by rotation flap | no complication |
| 14 | 24 | Male | Traumatic with calvarial osteomyelitis | Composite defect | 8 | R | Frontal | Sequestrectomy with transposition flap | no complication |
| 15 | 24 | Male | Traumatic | scalp defect | 12 | L | Parietal | Rotation Flap | no complication |
| 16 | 26 | Female | Traumatic | scalp defect | 35 | L | Temporo parietal | Bipedicle flap | no complication |
| 17 | 30 | Male | Traumatic | scalp defect | 6.6 | R | Frontal | STSG | no complication |
| 18 | 35 | Male | Traumatic | Composite defect | 19.63 | R | Parietal | Split calvarial bone graft with primary closure | no complication |
| 19 | 36 | Male | Recurrent dermatofibrosis | scalp defect | 20 | midline | Frontal | WLE with transposition flap | no complication |
| 20 | 41 | Male | Traumatic | scalp defect | 14 | L | Parietal | Transposition flap | no complication |
| 21 | 48 | Female | Squamous cell carcinoma | scalp defect | 9 | R | Parietal | WLE with transposition flap | no complication |
| 22 | 49 | Male | Traumatic | scalp defect | 15 | L | Vertex | Transposition flap | no complication |
| 23 | 57 | Male | Traumatic | scalp defect | 9 | L | Frontal | STSG | no complication |
| 24 | 59 | Male | Pyogenic granuloma | scalp defect | 11.25 | R | Occipital | Excision with Limberg flap | no complication |
| 25 | 60 | Female | Squamous cell carcinoma | scalp defect | 17.5 | R | Occipital | WLE with transposition flap | no complication |
| 26 | 62 | Male | Traumatic | scalp defect | 22 | R | Temporo parietal | Rotation Flap | Donor raw area |
| 27 | 62 | Male | Post rotation flap with forehead defect | Forehead defect | 4 | L | Frontal | Left Paramedian forehead flap | no complication |
| 28 | 62 | Male | Basal Cell Carcinoma | scalp defect | 3 | L | Frontal | WLE with primary closure | no complication |
| 29 | 64 | Male | Basal Cell Carcinoma | scalp defect | 4 | R | Frontal | WLE with advancement flap | no complication |
| 30 | 70 | Male | Basal Cell Carcinoma | scalp defect | 4 | midline | Vertex | WLE with double hatchet flap | no complication |
| 31 | 78 | Male | Seborrheic keratosis | scalp defect | 3.25 | R | Frontal | WLE with primary closure | no complication |

complication of local flaps but these dog ears should not be resected at same surgical procedure which results in reduced vascularity and increased tension in the flap.

**Figure 1: Traumatic scalp defect in (a) Left temporo-parietal region of 35cm2 reconstructed using a (b,c,d)Bi-pedicled flap.**

From our experience small scalp defects of an area of less than 5cm$^2$ can be closed primarily after excision of the lesion. In the literature[3], various authors have mentioned that primary closure is possible when the defect is less than 3cm, which is in contrast to our findings. In cases of larger defects created by the excision of skin cancers, traumatic avulsions or burns the reconstructive dilemmas become even more challenging. Defects which are in a range of 6cm$^2$ to 22 cm$^2$ could be reconstructed using local flaps like a transposition or rotation flap with skin grafting of the secondary raw area. But if repetitive surgeries are performed, the mobility of flaps becomes poor because scarring occurs in the scalp areas[4]. As majority of our cases are due to traumatic scalp defects of patients of head injuries where a craniotomy scar was already present, the flap design is difficult because surgical incisions have been made previously, which limits the availability of local flaps.

**Figure 2**: 13 years old boy with Post-Burn Alopecia(a). Tissue expansion(b,c) was done of the normal scalp over 6 month time and rotation flap was done to cover the defect after excision of the alopecia segment.(d) Showing aesthetic outcome after reconstruction

A free flap can also be used to reconstruct such complex scalp defects but it might be disadvantageous, as the operation time is long and the donor site morbidity is relatively high [5]

In one 26years old female of traumatic scalp defect with previous craniotomy, the defect of size 35cm$^2$ in the temporo-parietal region was reconstructed using a bi-pedicled flap(Figure 1). The advantages of bi-pedicle flap include versatility and a lack of functional and morphological complications at donor sites. In addition, it receives its blood supply from major arterial branches of the scalp in an axial pattern and from the occasional perforators arising from the calvarium. This ensures that a bipedicle flap receives sufficient blood supply[6]

For larger defects of 76 cm$^2$ to 113 cm$^2$ , we used tissue expanders. Using a tissue expander followed by a rotation flap gives the patient the best aesthetic outcome with a hair bearing scalp (Figure 2)

Multiple algorithms have been proposed for a stepwise approach to the management of large scalp and forehead defects all with similar features. These can provide a framework and allow the surgeon to make generalized plans when approaching a patient for scalp reconstruction[7].

## CONCLUSION

Important tenets for successful management of scalp defects are adequate debridement, preservation of blood supply, thorough planning for reconstruction, durable coverage and individualization of cases.

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