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An Analytical Study on different modalities of treatment for scalp defect: 2-year experience in a tertiary care centre

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Introduction

The scalp is one of the most resilient structures in the human body. It has a rich blood supply, protects the brain and skull, is 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 involve scalp loss. Multiple reconstructive procedures are devised to repair scalp defects with minimal disturbance to the surrounding structures. The aim of this study is to evaluate the demographic profile of patients presenting with scalp defects, their etiology, planning of reconstruction, and the various procedures that provide optimal aesthetic outcomes.

Methodology

A retrospective study was conducted on patients with scalp defects operated on in our department over a two-year period from 2021 to 2022. Demographic profile, etiology, reconstructive techniques, and surgical outcomes were documented. All patients were followed up for a period of six months.

Several cases of extensive scalp avulsion injuries and scalp loss due to burns required multiple staged reconstructive procedures. Some post-traumatic scalp avulsion cases were initially stabilized using split-thickness skin grafts and later planned for definitive reconstruction.

Reconstructive techniques were selected individually for each patient based on age, time of presentation, size of the defect, condition of the surrounding scalp tissue, patient co-morbidities, and etiology of the defect. Defects were categorized geometrically as triangular, rectangular, or circular, and the surface area was calculated accordingly. After detailed planning, the most suitable reconstructive procedure offering optimal surgical and aesthetic outcomes was selected. All procedures were performed under general anesthesia.

Statistical Analysis

Statistical analysis was performed using Microsoft Excel 2016, compatible with Windows 10. Data analyzed included patient age, gender, etiology, location of scalp defects, area of scalp loss, reconstructive procedures performed, and postoperative outcomes.

Results

A total of 31 patients, including 6 females and 25 males, were included in the study after obtaining written informed consent. The age of the patients ranged from 45 days to 78 years. Traumatic scalp defects constituted the majority of cases and were predominantly observed in younger patients, while scalp malignancies contributed significantly to morbidity in older individuals. Scalp defects were classified as simple or composite. Simple defects involved only the scalp layers while sparing the calvarium, whereas composite defects involved both scalp and calvarial bone loss. The frontal and parietal regions were the most frequently affected sites.

The reconstructive procedures performed included rotation flaps, transposition flaps, advancement flaps, bi-pedicled flaps, double hatchet flaps, Limberg flaps, split thickness skin grafts, and tissue expansion followed by a rotation flap. Defects measuring up to 5 cm were closed primarily. Defects ranging from 6 cm to 22 cm were reconstructed using either rotation or transposition flaps, depending on the condition of the surrounding scalp tissue.

In many traumatic cases, rotation flaps were not feasible due to scarring of adjacent tissues or unfavorable incision lines extending into the forehead. In such cases, transposition flaps combined with split-thickness skin grafting of the secondary raw area were utilized. Some patients who were physiologically unfit for immediate flap coverage were initially treated with skin grafts and later underwent definitive reconstruction.

Large scalp defects ranging from 75 cm^2 to 115 cm^2 could not be reconstructed using local tissue alone. Tissue expanders were therefore used to generate adequate scalp tissue before rotation flap reconstruction. Most patients healed well without requiring further intervention, except in cases requiring 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, restoration of soft tissue thickness, restoring the body contour, and also establishing hair loss. Several factors need to be considered when selecting the ideal flap for each /scalp defect. The size of the defect, anatomic involvement, and overall health of the patient must all weigh in during the decision making 1 process. 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 2 future radiation or trauma. A 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 are the most common complication of local flaps, but these dog ears should not be resected during the same surgical procedure

Table 1: Patients with scalp defects: demographic profile and reconstructive procedures

o	Age (yrs)	Sex	Etiology	Type of Defect	Size (cm^2)	Site
	0.12	Female	Traumatic	Scalp defect	20	Right fronto-parietal
	2	Male	Traumatic	Scalp defect	13.5	Right temporo-parietal
	4	Female	Traumatic	Composite defect	12	Left temporo-parietal
	5	Male	Traumatic	Composite defect	6	Left fronto-parietal
	5	Male	Traumatic	Scalp defect	7	Right parietal
	8	Male	Traumatic	Scalp defect	9	Left parietal
	10	Male	Naevus sebaceous scalp	Scalp defect	2.25	Right parietal
	13	Male	Naevus sebaceous scalp	Scalp defect	3	Midline occipital
	13	Male	Naevus sebaceous scalp	Scalp defect	5	Right occipital
0	13	Male	Post-burn alopecia	Scalp defect	76	Right>Left fronto-temporo-parietal
1	15	Male	Decompressive craniectomy	Composite defect	4	Right parietal
2	16	Male	Naevus sebaceous scalp	Scalp defect	5	Left temporal
3	22	Female	Post-traumatic avulsion with alopecia	Scalp defect	113	Right>Left fronto-temporo-parietal
4	24	Male	Traumatic with osteomyelitis	Composite defect	8	Right frontal
5	24	Male	Traumatic	Scalp defect	12	Left parietal
6	26	Female	Traumatic	Scalp defect	35	Left temporo-parietal
7	30	Male	Traumatic	Scalp defect	6.6	Right frontal
8	35	Male	Traumatic	Composite defect	19.63	Right parietal
9	36	Male	Recurrent dermatofibrosis	Scalp defect	20	Midline frontal
0	41	Male	Traumatic	Scalp defect	14	Left parietal

1	48	Female	Squamous cell carcinoma	Scalp defect	9	Right parietal
2	49	Male	Traumatic	Scalp defect	15	Left vertex
3	57	Male	Traumatic	Scalp defect	9	Left frontal
4	59	Male	Pyogenic granuloma	Scalp defect	11.25	Right occipital
5	60	Female	Squamous cell carcinoma	Scalp defect	17.5	Right occipital
6	62	Male	Traumatic	Scalp defect	22	Right temporo-parietal
7	62	Male	Post-rotation flap forehead defect	Forehead defect	4	Left frontal
8	62	Male	Basal cell carcinoma	Scalp defect	3	Left frontal
9	64	Male	Basal cell carcinoma	Scalp defect	4	Right frontal
10	70	Male	Basal cell carcinoma	Scalp defect	4	Midline vertex
11	78	Male	Seborrheic keratosis	Scalp defect	3.25	Right frontal

which results in reduced vascularity and increased tension in the flap.

A free flap can also be used to reconstruct such complex scalp defects, but it might be disadvantageous, as the operation time is 5 long and the donor site morbidity is relatively high. In one 26-year-old female with a traumatic scalp defect with previous 2 craniotomies, the defect of size 35cm in the temporo-parietal region was reconstructed using a bi-pedicled flap. The advantages of the 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

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. 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 7 for scalp reconstruction.

Conclusion

Successful management of scalp defects depends on adequate debridement, preservation of blood supply, thorough planning for reconstruction, durable soft tissue coverage, and individualized patient-centered care.

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