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Scalp flap—a utility and reconstructive option for head and neck surgeons

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Abstract

Regional scalp flaps are invaluable in resurfacing defects resulting from resections in the area of the upper face, orbit and scalp itself. The tissue lies adjacent to the defect, is easy to harvest, and can be termed as a 'durable one-stage' procedure. Scalp defects posterior to the vertex lend themselves to resurfacing by a posterior flap based on the occipital arteriovenous system. Anterior scalp defects including upper face and orbit can be resurfaced by an anterior scalp flap based on the superficial temporal arteriovenous system. While large areas can be resurfaced and the donor site effectively camouflaged, this flap finds less of an acceptance amongst patients with defects in the upper facial region when compared to the scalp defects. We recount our experience with these flaps and describe the high points of the reconstructive procedure and the results obtained in ten consecutive cases carried out over a three year period at the Department of Head and Neck Surgery, Kidwai Memorial Institute of Oncology, Bangalore, India. The short healing time and minimal morbidity make this reconstructive option an attractive one for the practising Head and Neck Surgeon.

Key words: Surgical flaps, scalp

Introduction

Scalp flaps definitely deserve a mention in the repertoire of the reconstructive options available for the practising Head and Neck Surgeon. Quite often, owing to the non-availability of the services of a reconstructive surgeon, defects resulting from major ablative surgery need the attention of the Head and Neck Surgeon himself. Therefore, it is desirable for him to be familiar with simple yet dependable reconstructive procedures in this region.

A little ingenuity and sound anatomic knowledge of the vascular pattern in areas adjacent to the defects can help resurface major tissue loss with minimum morbidity. The scalp is one such 'good neighbour', with an abundant blood supply which can provide adequate tissue for reconstruction of defects in the upper third of face (Shah, 1987), lateral neck (Tiwari, 1988) and the scalp itself (Wackym *et al.*, 1990). Design of the scalp can be planned so as to combine resection and reconstruction in a one-stage procedure and to facilitate timely administration of post-operative irradiation (Conley, 1976; Wackym *et al.*, 1990).

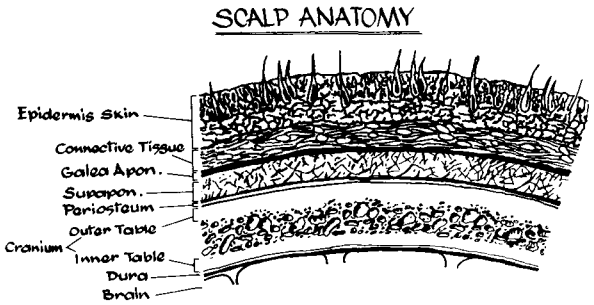

FIG. 1
Diagrammatic picture of scalp anatomy.

Anatomic considerations (Figs. 1 and 2)

The special anatomic features of the scalp distinguish it from other skin coverings of the body and also predetermine its utility for use in regional flap transposition. It is thick, somewhat insensitive, inelastic and hairbearing.

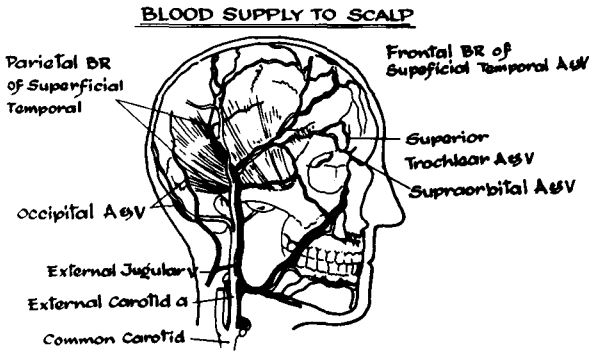

FIG. 2
Diagrammatic representation of blood supply to the scalp.

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TABLE I
ANTERIOR SCALP FLAPS

Defect	Axial random	Resection	Size (cms)	Cosmesis	Take (%)	Complication
1. Orbit + temple	A	Composite	12 × 8	Fair	100	Nil
2. Orbit + zygoma + cheek	A	Composite	12 × 7	Good	100	Nil
3. Orbit + zygoma	A (Contralat)	Composite	12 × 7	Good	100	Infection STSG
4. Orbit + temple	A	Composite	9 × 8	Good	95	Rim necrosis flap
5. Frontal region + bilateral upper eyelids	A	Composite	14 × 10	Fair	100	Infection STSG

The hair bearing area of the scalp consists of hair follicles, sweat glands, fat, fibrous tissue and lymphatics that are interspersed with numerous arteries and veins. This thick padding is supported by a tough aponeurotic layer called the galea which is fused anteriorly with the frontalis muscle and in the posterior region with the occipitalis muscle. Beneath the galea is a sub-aponeurotic space containing loose fibrous tissue creating the facility for the sliding movement of the scalp on this potential space (Conley, 1976; Wackym *et al.*, 1990). Deep down is the periosteum of the skull—referred to as the pericranium. Laterally the temporalis muscle provides an additional barrier between the galea and the pericranium. Three principal arteries provide a rich blood supply to each side of the scalp (Conley, 1976). Two of these—the occipital and superficial temporal—are branches of the external carotid artery, while the supraorbital artery is a branch of the internal carotid artery. The lymphatic network of the scalp is also different in that there are no barriers in the scalp, which contains many medium calibre channels both subdermally and subcutaneously. The lymphatics drain towards the parotid glands, pre-auricular area, the upper neck and the occipital region (Lesavoy, 1981).

Materials and methods

Ten scalp flaps were used to reconstruct head and neck defects following major ablative surgery at the Kidwai Memorial Institute of Oncology, Bangalore, India during the period 1988 to 1990. Five upper facial lesions and five posterior scalp lesions were subjected to one-stage excision and reconstruction using scalp flaps. Those based on the anterior branch of superficial temporal artery are designated anterior scalp flaps (Table I) while those based posteriorly will be referred to as posterior scalp flaps (Table II).

Surgery—high points

Oncological clearance (with frozen section control) was understandably the first priority. 'Oncosurgical' excision of scalp neoplasm always included the pericranium on the deep surface of the tumour. In the present study no underlying skull bone needed to be included in the specimen to accomplish negative cut margins. In contrast, almost all facial excisions were composite in nature with inclusion of parts of the periorbital skeleton to consolidate oncological clearance. Since the defects were adjacent to the donor site, no extra measures such as a change in patient position during surgical procedure was necessary. Scalp flaps were raised in a plane superficial to the pericranium, taking care to identify and protect the predominant vessel system. This identification was not possible in two posterior scalp flaps, while the rest were based on a well-defined occipital arterio-venous system. No testing for patency of dominant vessels was carried out intraoperatively using either a transcutaneous Doppler or postoperatively using intravenous fluorescein and Wood's lamp. Both the random posterior scalp flaps had to be augmented with skin mobilized from the nape of the neck. A tension free closure was possible in all reconstructions except one posterior scalp flap which was associated with a postero-lateral neck dissection. Drainage of the orbito/fronto-ethmoidal complex is facilitated by means of a silicon tube exiting through the nares and secured to the columella by means of a non-absorbable suture. Posterior scalp defects after resurfacing seldom required any form of drainage. Meticulous intra-operative haemostasis and post-operative compression bandage was all that was required to facilitate a successful 'take'. This bandage also encompassed the split thickness skin graft (STSG) surfaced donor site and was removed for first inspection only 5–6 days post-surgery. All patients received prophylactic antibiotics which were continued peri-operatively along with anti-inflammatory analgesics.

Results

All five anterior scalp flaps used to resurface orbital and peri-orbital defects (Table I) had an axial vascular pattern based on the anterior branch of the superficial temporal artery. The defect size ranged from 72 to 140 sq. cms, with an average size of 91 sq. cms (Table I). Five posterior

TABLE II
POSTERIOR SCALP FLAPS

Defect location	Axial/ random	Resection	Size (cms)	Cosmesis	Take (%)	Complication
1. Posterocentral	A	Scalp	10 × 6	Excellent	100	Nil
2. Posterocentral	A	Scalp	9 × 6	Excellent	100	Nil
3. Posterolateral	R	Scalp + Post neck dissection	8 × 9	Good	90	Rim necrosis
4. Posterolateral	R	Scalp + Pinna + RND	8 × 10	Fair	100 90	STSG Infection
5. Posterolateral	A	Scalp	14 × 10	Good	100	Nil

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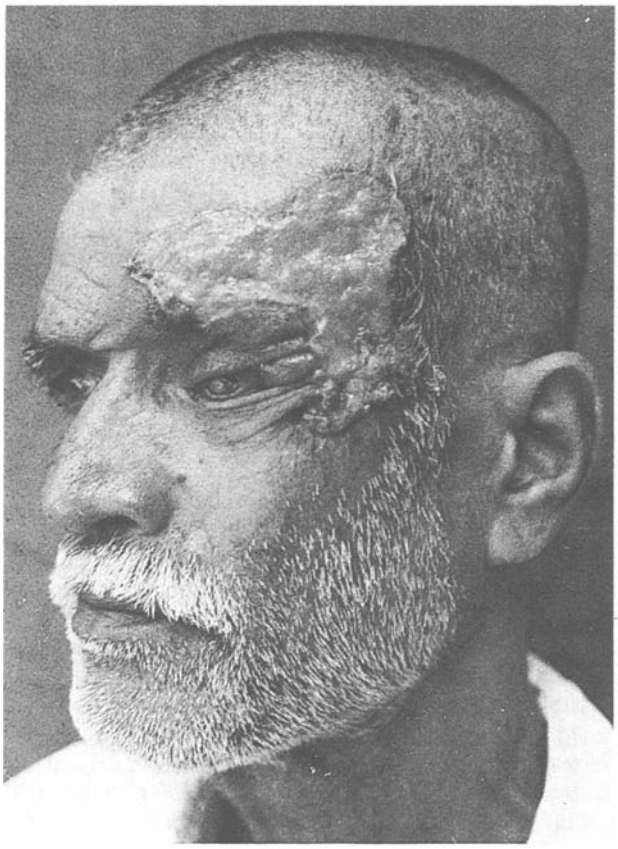

FIG. 3
Squamous cell carcinoma temporal region invading orbit, pre-operative photograph.

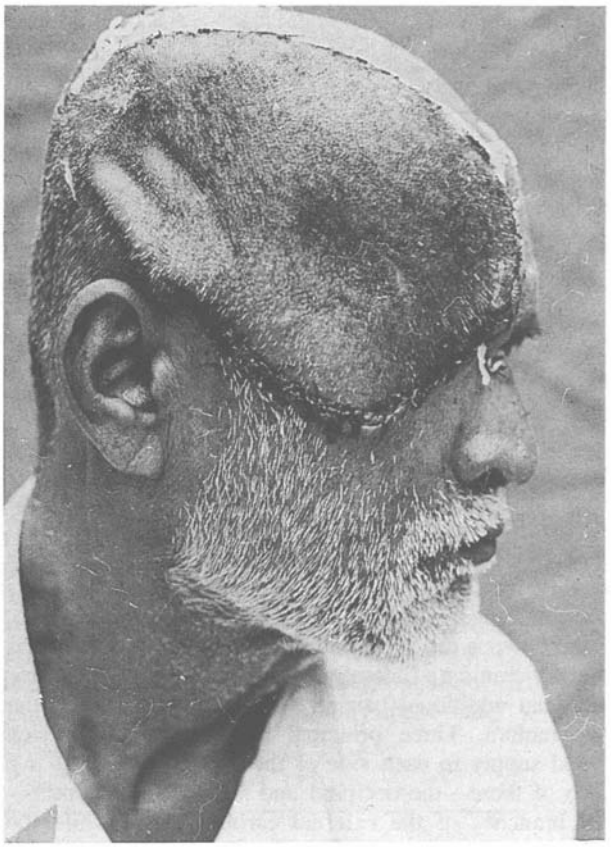

FIG. 4
Anterior scalp flap covering temporo-orbital defect, post-operative photograph.

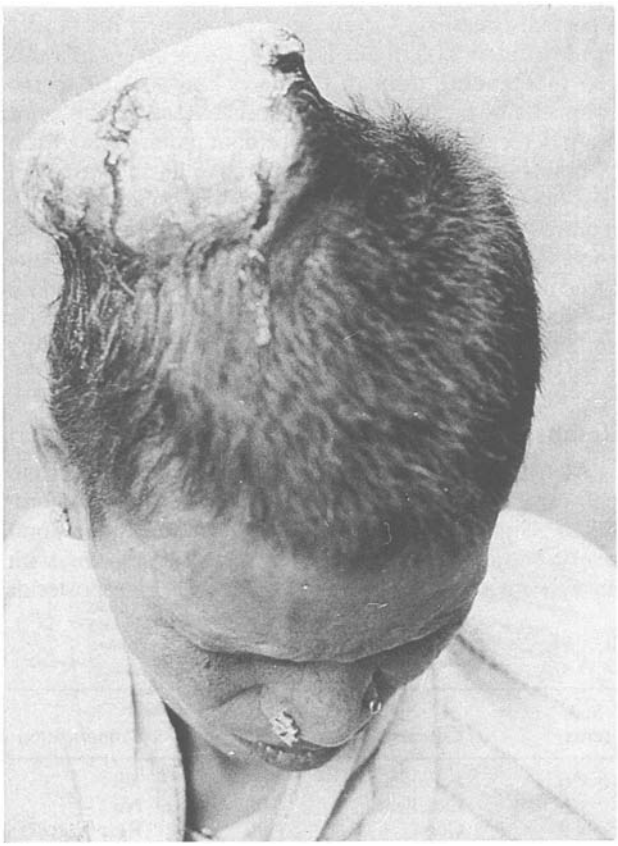

FIG. 5
Squamous cell carcinoma occipitoparietal region, pre-operative photograph.

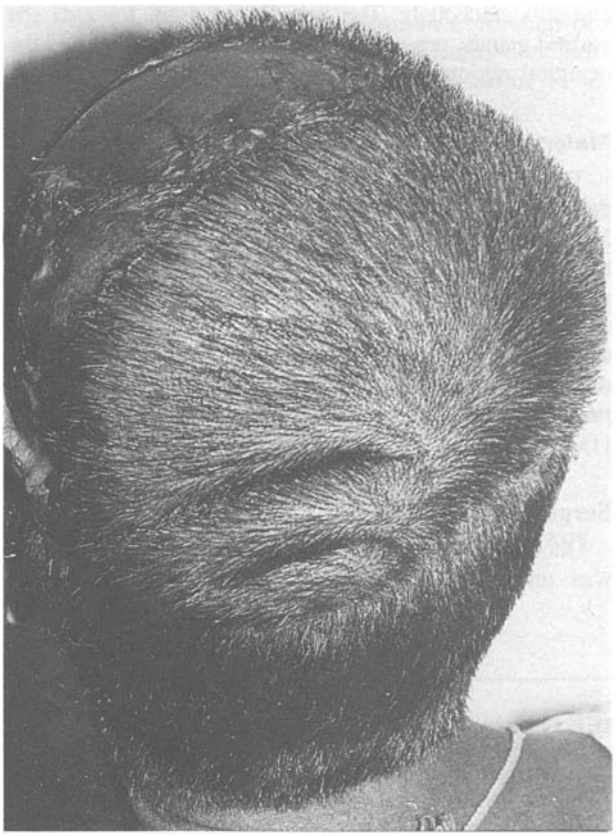

FIG. 6
Posterior scalp flap covering occipitoparietal defect, donor site resurfaced with STSG.

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FIG. 7

Final result. Anterior scalp flap with satisfactory cosmesis due to effective camouflage of donor site.

scalp flaps (Table II) were used to resurface defects ranging from 54 to 140 sq. cms (average 72 sq. cms). In all cases there was no compromise on tumour resection and this was confirmed at final histopathology. All except one patient (with radio-recurrent lesion) received post-operative irradiation within a period of four weeks. After initial surgical salvage the radio-recurrent lesion developed two satellite lesions at the flap edge which were subsequently resected successfully 9 months and 20 months following initial surgery. In all lesions, except 1, resection and reconstruction was achieved in a single stage. In one anterior scalp flap based on the contralateral superficial temporal artery, the pedicle was returned to improve cosmesis after six weeks. The 'take' rate was 100 per cent in all except one anterior and one posterior scalp flap. Both developed minimal peripheral necrosis at the suture line which healed by secondary intention. While one breakdown was attributable to inadequate drainage of the exenterated orbit, the other, posterior, flap had its vascularity compromised by a concomitant postero-lateral neck dissection. Only three donor sites in scalps resurfaced by STSG exhibited minimal infection which settled down within 2–3 weeks of surgery. Post-operative irradiation was never postponed owing to delayed healing. While cosmetic results could be graded as excellent in 4/5 posterior scalp defects (Figs. 5 and 6) the same could not be applied to anterior facial defects (Figs. 3 and 4). All scalp donor sites could be effectively camouflaged by adopting appropriate hairstyling (Fig. 7).

Discussion

While the scalp flap for surface lesions seems a logical choice, very often the major defects resulting from ablative resections deter the head and neck surgeon for want of a simple yet durable flap. Scalp neoplasms often require inclusion of the pericranium on the deep surface of the tumour to enhance oncological clearance. This pericranium constitutes an effective anatomic barrier before the tumour erodes the skull bone and becomes 'intracranial'. Fortunately, such an occurrence is a rarity, seen only in deeply infiltrative lesions which were not encountered in this study. A simple transposition of adjacent scalp designed to fit into the surgical defect can resurface this bare bone (sans pericranium) which seldom accepts a Thiersch graft. The donor area by contrast is amenable to resurfacing with a STSG owing to deliberate preservation of pericranium during harvest of the flap. Scalp surgery inevitably results in considerable blood loss and the surgeon should be prepared to combat this using bipolar coagulation and adequate blood replacement. Scalp flaps for scalp neoplasms are largely acceptable to the patients because of the compatible contour and texture, and because it is possible to camouflage the STSG resurfaced donor site by appropriate hairstyling (Conley, 1976; Shah, 1987; Wackym *et al.*, 1990).

However when these flaps are used for areas such as the upper one third of the face and lateral neck (Tiwari, 1988), the colour and texture mismatch seldom finds acceptance with the patients, who resent the transfer of thick hair-bearing areas into a non-hairy cosmetically important zone. Modern depilatory measures alleviate the concern of patients, albeit temporarily. Despite this obvious disadvantage, the easy access, harvest, and transfer of large areas of durable tissue has convinced some head and neck surgeons to retain it in their repertoire of reconstructive options (Conley, 1976; Shah, 1981; Tiwari, 1988). While an axial pattern flap based on the superficial temporal or occipital artery is preferable and scientific, very often a posteriorly based scalp flap with a broad pedicle and not well defined arterio-venous system 'takes' admirably despite unfavourable conditions prevailing at the recipient site. Ipsilateral posterior neck dissection frequently compromises flap viability and therefore in such a situation the pedicle has to include the contralateral occipital artery to avert flap necrosis. Beneath the scalp flap the temporalis muscle can sometimes be used to obliterate dead space resulting from orbital tumour exenteration and to prevent unsightly 'hollows' (Fig. 7). It is important for the surgeon to meticulously clean and drain all mucosa if the fronto-ethmoidal complex has been breached.

Considerable tension can be withstood by thick scalp flap without compromising viability. However, if the surgeon's planning is accurate, very little tension need be applied, since the scalp tissue contracts minimally after incision (Tiwari, 1988). When uncontoured defects result from composite resections of the orbit or scalp, this flap can be depended upon to reinforce and resurface the dura (Shah, 1987; Wackym *et al.*, 1990) at an early date thereby facilitating early delivery of post-operative radiotherapy to consolidate oncological control.

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