ORIGINAL ARTICLE

# Reconstruction of Scalp Defects with Free Flaps

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***SUMMARY*:** We present our experience of reconstruction of six cases with large scalp defects. All repairs were performed for defects which resulted from tumour resections. Out of these six cases, three were of squamous cell carcinoma (SCC), two of basal cell carcinoma (BCC) and one case was of Haemangiopericytoma. The defects involved scalp with bone exposure in three patients. Resection of the outer table of the skull was done in one case. Extensive defect involving both inner and outer tables with exposed duramater occurred in one case, whereas in one of the cases the duramater had to be repaired. The average size of the defect ranged from 7 x 18 cm up to 15 x 25 cm. The flaps utilised for reconstruction included two radial forearm flaps, three latissimus dorsi muscle flaps with partial thickness grafts and one myocutaneous rectus abdominis flap. All flaps survived completely. No significant donor or recipient site complication occurred. Average hospital stay was 11 days (range 8 days to 14 days).

Our experience confirms that in cases of complex or large scalp defects requiring reconstruction and where there is inadequacy of local tissue, microvascular transfer of well vascularized tissues with adequate bulk and size is the preferred option for single stage, successful reconstruction.

***Key Words: Scalp, Tumour, Free flaps***

Among the causes of scalp defects, trauma and tumour resection are the major contributors. Other causes include infection, congenital malformations and radiation induced necrosis [1,2,3,4,5]. In cases where pericranium is intact, split thickness skin graft is the simplest and best choice in acute settings, where direct primary closure of the wound is not possible, as commonly is the case due to inherent tightness and lack of elasticity of the scalp [3,4].

In more extensive defects in which either the pericranium is lost or there is loss of calvarial bone, locoregional or distant flaps become necessary to provide adequate coverage of the defects [3,6]. Various local flaps based on the major scalp vessels namely superficial temporal and occipital arteries are described. In case of inadequacy of local tissue [15,16], free flaps are the best options. Another technique available is the use of tissue expanders to pre-expand the local tissue for reconstruction in cases of planned non tumour cases or secondary replacement of previous graft or scar tissue [1,2,3,4,7,8]. In the presence of number of these options available to us we retrospectively assessed our patients whose scalp defects were repaired with free flaps. We also assessed our results, patient satisfaction, justification of use of free tissue transfer and the efficacy of this treatment modality

## Patients and Methods

A retrospective study was carried out in the Department of Plastic and Reconstructive surgery, Combined Military Hospital, Rawalpindi between 1995 to 2001.

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A total of six patients were operated for tumours of the scalp (Table 1). Both male and female patients were included in the study. Out of these three were females and rest were males. Age of the patients ranged between 25 years to 72 years (median age 49 years). Only the cases involving scalp were included and the cases involving mid-face and neck region were excluded from the study. Out of these six cases, three were of SCC, two BCC and one case was of Haemangiopericytoma scalp.

All the cases were assessed thoroughly, with history, clinical examination and relevant laboratory investigations. Pre-anaesthetic assessment was performed in all elective cases and due consideration was given to concurrent illnesses and other co-morbid conditions. Proper preoperative staging workup was done including Plain radiographs of the skull, X-Ray chest, ultrasound examination of the abdomen, CT scan/MRI scan wherever indicated, along with clinical assessment of nodal status and preoperative fine needle aspiration cytology. All cases were histopathologically confirmed with incisional biopsy before definitive surgery.

The scalp defects ranged in size from 7 x 18 cm to 15 x 25 cm. The defects involved exposure of bone in three cases. Outer table of the skull was removed in one case. In two cases both the inner as well as outer table of the skull had to be removed to achieve adequate tumour-free margins and in one of these cases duramater was resected and was repaired by a neurosurgeon.

The flaps utilized for primary reconstruction were radial forearm[2], latissimus dorsi muscle with split thickness skin graft[3] (Figures 1a, b, c, d and e) and rectus myocutaneous (Figures 2a, b, c and d). The superficial temporal artery was the main recipient vessel in four of the cases. In two cases facial artery and external jugular vein were used. Donor areas were either closed primarily or covered with split thickness skin grafts.

## Results

All the free flaps survived completely, with no significant problems with flap and wound healing. The donor sites on trunk for latissimus dorsi and rectus abdominis flaps were closed primarily. There was no incidence of seroma formation. Radial forearm flap donor defects were skin grafted and healed primarily without complications.

Our average operative time was 7.5 hours ranging from 7 hours to 10 hours including resection and reconstruction. Drains under the flaps were removed on fifth post operative day with no problems subsequently. All wounds healed within two weeks time with aesthetically acceptable results. Total hospital stay on the average was 11 days, ranging from 8 to 14 days. None of the cases needed any secondary procedure or re-exploration. Four out of six cases received postoperative radiotherapy. The mean follow up time was 33 months ranging from 10 to 48 months. No tumour recurrence was observed during minimum follow-up of 10 months.

## Discussion

A large number of procedures are described in the literature for the reconstruction of scalp defects. Both size and depth of the defect are considered to be important factors in deciding for the best option for reconstruction [1,2,3,4,5]. In retrospective assessment of our cases the causative factor was tumour resection which entailed wide local excision for adequate disease control [3,8,13]. This led to fairly large defects which were not amenable to coverage with the available local tissue. This is evident from the defects created post resection, which were between 7 x 18 cm to 15 x 25 cm in our cases. Thus in our study one of the important determinant for selection of free flap for reconstruction was size of the defect along with peculiar sites like fronto-parietal and temporo-parietal regions in three of the five cases and 3/4th of the vertex in two, where local scalp rotation advancement flaps could

not be sufficient [2,3,4]. None of the pedicled flaps like latissimus dorsi, trapezius, pectoralis major, temporalis or supraclavicular flaps could reach this far for primary closure of the defects.

One consideration for our selection of free flap was the need of postoperative radiotherapy in three of the cases for local tumour control. This is another advantage of the well vascularized free tissue, transferred to the region, that withstands radiation very effectively. Such large defects and the relative resistance of transferred tissue to the effects of radiation are in accordance with the findings mentioned in a series of microsurgical scalp reconstructions for cancer from M. D. Anderson cancer centre , Texas, USA[3]. With our previous experience with relatively small to moderate sized defects which were closed with local scalp flaps, we experienced significant wound healing problems such as partial wound dehiscence, wide scars or at times need for further flap advancements as secondary procedures. This is due to the inherent tightness and relative lack of elasticity of the scalp tissue which invariably closes under tension[3,4]. With the use of free tissue this problem can easily be avoided and thus prevent any delay in wound healing or need for any secondary procedure.

Whereas in the hair bearing scalp local tissue is always the preferred alternative to avoid patches of alopecia, in malignant cases such as ours, the primary goal is early and adequate disease control and an accelerated convalescence time to get the benefit of other treatment modalities like chemotherapy and radiotherapy. This important feature far outweighs the morbidity related with the primary illness in older age group as was the case in our study[3,8]. The use of expanded local tissue is a very attractive alternative, but it needs at least 6-8 weeks for adequate tissue to be generated and will cause significant delay in treatment of a malignant disease which may by that time become unresectable or have metastasized. Another role of tissue expanders can be subsequent replacement of scar tissue or even the flap to improve the local aesthesis and restore hair bearing skin[3,4,5,8,13].

For indications such as osteomyelitis and post irradiation osteoradionecrosis, free flaps definitely have a superior edge. The richly vascularized free flap tissue brings a very good source of blood supply to these diseased and relatively avascular zones thus improving healing and providing a very favourable final outcome. We consider the above reason to be an important indication for utilising free flaps for scalp defects as has been presented in a study published by F. C. Wei et al from Taipei, Taiwan[4], in which the size of the defect did not seem to be the most important determinant.

## Conclusion

We conclude with the remarks that for large scalp defects, factors like size, depth and infection / radionecrosis are the key factors which most of the time dictate the need of free tissue transfer for single stage reconstruction of scalp defects. They definitely prove superior to other alternatives like skin graft or loco regional pedicled flaps, which at times are not adequate, possible or feasible.

| No | Sex | Age | Diagnosis | Flap | Special features | Complication |
|---|---|---|---|---|---|---|
| 1 | M | 55y | SCC | Rectus abdominis myocutaneous | Whole calvarium & dura exposed | None |
| 2 | F | 69y | SCC | Radial forearm | Bone exposed | None |
| 3 | M | 72y | BCC | Latissimus dorsi + SSG | Outer table removed | None |
| 4 | F | 65y | BCC | Radial forearm | Bone exposed | None |
| 5 | F | 25y | Hemangio-pericytoma | Latissimus dorsi + SSG | Whole calvarium & dura exposed | None |
| 6 | M | 62y | SCC | Latissimus dorsi + SSG | Anterior scalp | None |

**Fig 2A. Large SCC involving frontal sinus and orbit.**

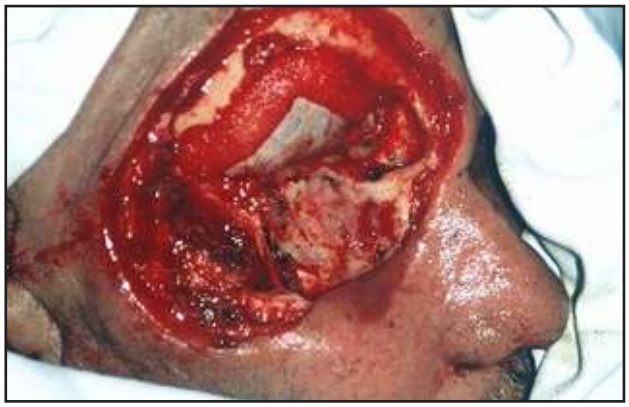

**Fig 2B. After complete orbital resection including Ant. Cranial fossa floor.**

**Fig 2C. Reconstruction with Rectus abdominis free flap.**

**Fig 2D. Stable flap cover at 4 months.**

**Fig 1A. Giant Hemangiopericytoma of the scalp.**

**Fig 1B After resection including involved skull and coverage with whole Lat. Dorsi free flap. This was covered with a skin graft.**

**Fig 1C. Well Vascularized flap with good graft take on day 10.**

**Fig 1D.Well Vascularized flap with good graft take on day 10.**

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