Journal of Experimental and Clinical Medicine
http://dergipark.ulakbim.gov.tr/omujecm

Clinical Research

J. Exp. Clin. Med., 2016; 33(4): 225-228
doi: 10.5835/jecm.omu.33.04.009

Free flap reconstruction of scalp after malignant tumor resections

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ARTICLE INFO

Article History
Received 13 / 07 / 2016
Accepted 12 / 11 / 2016

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Keywords:
Free flap
Reconstruction
Survival
Tumor

ABSTRACT

The incidence of malignant scalp tumors which require radical excision increases with age. Reconstructing a multilayer scalp defect is a challenge for the reconstructive teams because of the soft tissue variability and paucity of available tissue. There is a wide range of options for treating scalp defects, from primary closure to free tissue transfer. In this study, nine patients who underwent reconstruction of large scalp defects after malignant tumor resection by using free tissue transfer were evaluated and reported. Eight patients died within two years after the surgery due to local recurrence (%88.9), and only one patient is still alive without any problems with a mean follow-up of 32 months. Many free tissue transfers have been reported on, with varied results. In the postoperative period, local and systemic complications can be seen, which do not correlate with age. Local tumor recurrence is another serious problem. Tumor complications and recurrences are the factors which affect the survival rates in patients. In this study we report on the scalp defect reconstruction after tumor resection with results and survival rates.

1. Introduction

Reconstructing a multilayer scalp defect is sometimes a challenging problem for surgeons (Hierner et al., 2007; van Driel et al., 2010). Primary closure, secondary closure, local flaps, dermal regeneration templates, tissue expansion, and regional flaps are the nonmicrosurgical treatment options for scalp reconstruction (van Driel et al., 2010). However, defects that include the dura mater require a more intricate approach. After tumor excision, medium and large-sized scalp defects including dura defects need to be reconstructed with free flaps (Wang et al., 2007; Shonko et al., 2011; Simunovic et al., 2016). Free tissue transfer needs an experienced team approach with long-time operations. The main advantages of free tissue transfer are large and healthy tissue support from distant donor areas.

Malignant skin tumors may originate from the surface epithelium or its cutaneous supplements.

Aggressive malignant scalp tumors rarely occur, and these tumors can grow rapidly and infiltrate the underlying cranium and dura if neglected (Wang et al., 2007; Soma et al., 2008). During the postoperative period, local and systemic complications can be seen; these are not correlated with age (Badhey et al., 2016; Simunovic et al., 2016). Local tumor recurrence is another serious problem. As in all tumor cases, complications and recurrence are the factors that affect the survival rates in patients.

In this study we aimed to report on the reconstruction of scalp defects after advanced malignant tumor resections from the scalp, and on the survival rates of patients.

2. Materials and methods

In this retrospective review, nine patients who underwent reconstruction of large scalp defects, including dura defect after malignant tumor resection using free tissue transfer, were evaluated and reported. Demographic and medical data of nine consecutive patients who underwent microsurgical free flap reconstruction of a complex scalp defect between January 2008 and June 2016 were noted (Fig. 1). Flap choice, complications, recurrences, and survival rates were analyzed (Table 1).

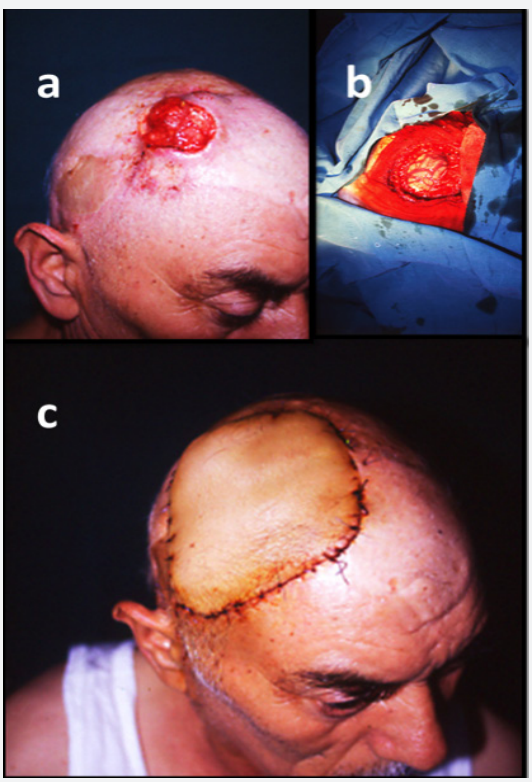

Fig. 1. **a:** Preoperative view of the defect area; **b:** Intraoperative view of the defect area after tumor extirpation and duraplasty procedure; **c:** Postoperative 14. day after lateral arm flap reconstruction

3. Results

The most commonly used free flaps were latissimus dorsi, radial forearm, lateral arm, and rectus abdominis flaps, respectively. Patients ranged in age from 50 to 72 years (mean age 64). Seven of the nine patients (78%) were men, while two were women (22%). In eight patients (88.9%), squamous cell carcinoma (SCC) was observed, while one patient (11.1%) had basal cell carcinoma (BCC). The mean surface area of the defect was 81 cm^2. In one patient, donor site dehiscence was noted (88.9%). Partial graft loss had occurred in another patient who had received rectus muscle for reconstruction (88.9%). There was a complication rate of 22% (2 complications in 9 patients). These two complications were managed with local wound care. Eight patients died within two years after surgery due to local recurrence (88.9%). Only one patient is still alive without any recurrence or metastasis, with a mean follow-up of 32 months (11.1%). Early complications did not cause any mortality immediately after surgery. Results were summarized in Table 1.

2. Discussion

Skin that tans poorly and burns easily has the greatest risk for SCC as well as BCC. The incidence of SCC increased with cumulative sun exposure (Karagas et al., 1999). While SCC is more locally aggressive, BCC has the potential to reach deep tissues. In this retrospective study we included only those cases with dural invasion and/or brain parenchymal invasion and hence those in which duraplasty was performed.

Intracranial invading BCC and SCC are difficult to treat, and recurrence is not rare. In this study all cases were locally advanced tumors that were either neglected by the patient or their extent was underestimated by the patient and/or the doctor.

Intracranial invasion can be revealed by neuroradiography or by the surgeon during surgery. In seven patients we detected tumor invasion with preoperative radiological evaluation via CT scan and MRI, which is mandatory for demonstrating tumor infiltration of the cranial vault or intracranial extension. In two cases invasion was found during surgery to have a tumor involving the middle part of the sagittal sinus.

There are various types of reconstruction options for deep scalp defects. These flap options have their individual advantages and disadvantageous. We did not prefer scalp flap reconstruction for large and deep defects as it has several disadvantageous. The scalp has little elasticity, and galeal relaxation incisions perpendicular to the line of desired advancement can provide only a maximum of one to two cm of flap expansion for the entire scalp, and the axial blood supply may be compromised (Lesavoy et al., 1993). Scalp flaps also tend to alter the orientation of hair follicles, which can lead to bizarre results. Tissue expansion is also not

Table 1. Demographics, tumor characteristics, flap type, early postoperative complications and survival time of the study group

Patient	Age/year	Sex	Tumor type	Invasıon deepness	Defect size/cm	Flap	Early complication	Survıval
1	58	M	SCC	Dura Invasion	11*11	Latissimus	No complication	1 Year
2	60	M	SCC	Brain Parenchyma Invasion	7*6	Lateral Arm	No complication	6 Months
3	72	M	SCC	Dura Invasion	11*8	Radial Forearm	No complication	6 Months
4	71	F	SCC	Dura Invasion	6*6	Lateral Arm	No complication	Alive
5	67	M	SCC	Sagittal Sinus Invasion	10*10	Latissimus Dor.	Donor SiteDehiscence	7 Months
6	68	M	SCC	Dura Invasion	12*10	Rectus Abd.	No complication	6 Months
7	62	M	SCC	Sagittal Sinus Invasion	13*9	Rectus Abd.	Partial Graft lysis	2 Years
8	50	M	BCC	Dura Invasion	7*7	Lateral Arm	No complication	11 Months
9	69	F	SCC	Dura Invasion	8*7	Lateral Arm	No complication	18 Months

M: Male; **F:** Female; **SCC:** Squamous cell carcinoma; **BCC:** Basal cell carcinoma

convenient for acute reconstruction. The latissimus dorsi is the work-horse flap due to its ease of harvesting a large surface area with a reliable pedicle. We used free latissimus dorsi, radial forearm, and rectus abdominis flaps for large defects. In smaller surface area wounds we preferred the lateral arm flap. We observed that it supplied a thorough flap for full-thickness skull and scalp wounds. During late reconstruction, tissue expanders may be used to replace hairless skin with hair-bearing scalp.

Some authors argue that free latissimus dorsi muscle transfer yields a layer that is thick enough to offer sufficient protection (Earley et al., 1990). Others state that bone replacement is necessary to avoid complications of pain, headaches, dizziness, and possible seizures (Chavoin et al., 1980; Stueber et al., 1985; Chicorilli et al., 1986; Wei et al., 1987). If the case did not require convex reconstruction, we observed that a fasciocutaneous or musculocutaneous flap offers a distended layer that is thick and rigid enough for the patients' daily activities. We did not use any alloplastic material when we performed cranioplasty, because such material will act as a barrier between the dura graft and the above vascularized tissue with an increased risk of infection.

Few published series describe exactly the rate of recurrence in patients in whom duraplasty is performed after dura repair. There is some controversy among published series about the recurrence rate after resection of the intracranial invaded scalp tumors. One case reported a patient with extensive cerebral invasion of a basal cell of the scalp who died four years later with a cerebral cortex invasion (Schoeder et al., 2001). Another case of intracranial invasion of BCC of the scalp after performing dura and anterior sagittal sinus resection with duraplasty survived well without recurrence (Mathieu and Fortin, 2005; Ibrahim et al., 2016). The series reported no recurrence or mortality. Soma et al. (2008) reported a series of 25 patients with aggressive scalp carcinoma with intracranial extension, but did not report exactly how many patients had dura resection. In an earlier report which presents five patients showing intracranial invasion, four of them died with a mean survival time of 13 months after initial treatment (Sakamoto et al., 1989). In our case, although the majority of patients died as a result of their disease, all patients healed without flap complications. All patients died of local recurrences.

A postoperative treatment strategy is not well-established in the limited number of published series. Irradiation of 40 Gy is effective for tumor of the scalp, but not for those extending into the dura mater or deeper (Sakamoto et al., 1989). In our series, all patients received different amounts of radiation postoperatively according to histologic parameters, invasion deepness, and patient condition. In a previous study it was shown that postoperative radiation treatment is well-tolerated when free tissue transfer is used (Hussussian and Reece, 2002). In our study, we did not encounter a serious flap problem which needed a second surgery after radiation therapy. Only one patient with rectus muscle transfer presented with a graft loss in the early postoperative period.

Free flap reconstruction is a reliable option with low complication rates for large defects including dura mater. However, mortality rates are very high in advanced scalp tumor patients with dural invasion due to local recurrence.

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