Full-Thickness Scalp Defects Reconstructed with Outer Table Calvarial Decortication and Grafting: A 13-Year Review

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ABSTRACT

Objectives:
To identify outcomes for patients with full-thickness scalp defects reconstructed with outer table calvarial decortication and grafting.

Study Design:
Retrospective cohort review.

Methods:
The Washington University Clinical Investigation Data Exploratory Repository Database was utilized to identify patients treated in the past 13 years by three staff surgeons with this reconstructive technique. Medical records and outcomes were reviewed.

Results:
Twenty-four patients (18 male, 6 female) were identified to have undergone 25 separate full-thickness scalp reconstructions as described above. Average age was 73 years (range 49-86) with an average follow-up of 423 days (range 27-994). Average defect size was 42 cm2 (range 1.8-145) with the most common location being the scalp vertex (n=14). Acellular dermis was the most commonly used graft (n=22), followed by split thickness skin graft (n=2) and full thickness skin graft (n=1). 84% (21/25) of the reconstructions had a successful reconstruction with an average healing time of 107 days (range 27-233). All four patients with reconstruction failures had a prior history of scalp radiotherapy.

Conclusions:
For select patients (i.e. anticipated high surgical morbidity, tight scalp location, significant comorbidities, uncertain margin status, or aggressive pathology) reconstruction of full thickness scalp defects can be successfully performed with outer table calvarial decortication and grafting. However, prolonged wound care is required. Prior scalp radiotherapy predicts failure for using this technique.

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INTRODUCTION

Reconstruction of full-thickness scalp defects is critical to avoid calvarial desiccation, sequestration and sepsis.[1] When a surgeon is faced with a scalp defect caused by malignancy, several factors must be considered during a planned reconstruction including the defect location, tumor pathology, margin status and the patient's comorbidities. For medium to large full-thickness defects (including periostium) of the scalp with calvarial bone exposure, a large local flap or free tissue transfer may be the best reconstructive option.[2] However, the patient's comorbidities or previous treatment may preclude these reconstructive options. In these cases, alternative methods of reconstruction may need to be considered.

Skin grafting is a quick, easy and reliable form of reconstruction for scalp defects. Grafts, however, require a bed to provide a nutrient blood supply. Previous authors have described utilizing a single-stage approach for repair of these wounds by removing the outer table with immediate application of the split-thickness skin graft and a wound VAC.[3] Repair of these full-thickness defects have also been described using acellular and artificial dermis in case-reports.[4,5,7,8] In this clinical report, we describe the repair of 25 full-thickness scalp repairs in which there was left exposed calvarial bone. The outer table of the cavarial bone was removed and the bleeding diploe was grafted. We identify that for select patients (i.e. anticipated high surgical morbidity, tight scalp location, significant comorbidities, uncertain margin status, or aggressive pathology) reconstruction of full thickness scalp defects can be successfully performed with outer table calvarial decortication and grafting.

METHODS

Institutional review board approval was obtained for completion of the study. The Washington University Clinical Investigation Data Exploratory Repository Database was utilized to identify patients treated in the past 13 years by three staff surgeons with this reconstructive technique. Medical records and outcomes were reviewed.

RESULTS

Twenty-four patients (18 male, 6 female) were identified to have undergone 25 separate full-thickness scalp reconstructions as described above. **Table 1** includes a summary of pertinent patient data. Average age was 73 years (range 49-86) with an average follow-up of 423 days (range 27-994). Average defect size was 42 cm2 (range 1.8-145) with the most common location being the scalp vertex (n=14). Acellular dermis was the most commonly used graft (n=22), followed by split thickness skin graft (n=2) and full thickness skin graft (n=1). 84% (21/25) of the reconstructions had a successful reconstruction with an average healing time of 107 days (range 27-233). All four patients with reconstruction failures had a prior history of scalp radiotherapy.

DISCUSSION

Reconstruction of full-thickness scalp defects including periostium can usually be approached in an algorithmic manner.[1,2,6] However, for a defect that cannot be closed primarily, a complex reconstruction may be precluded by multiple comorbidities, uncertain margin status or aggressive malignant pathology. In these cases a simple, quick and effective surgical plan may be required. In our patient group, 84% of the scalp reconstructions were successful when applying this simple and quick method. For patients without a history of head and neck radiation, this methodology can be very effective, as all of the patients grafted without a history of prior head and neck radiation had successful take of their grafts. However, among the seven patients who had head and neck radiation pre-reconstruction, four (57%) of these repairs failed. As an interesting case-control, one patient underwent this reconstruction successfully on the scalp vertex followed by post-operative radiation. He later developed a scalp vertex recurrence and underwent a similar-sized resection and reconstruction with decortication and a graft, which then failed. This reflects important intrinsic changes to wound healing that radiation induces in the tissues.[9] Thus, we advise caution in applying this reconstructive method to patients with a previous history of head and neck radiation.

Another particular issue for patients treated with this reconstruction is a prolonged wound care time. This required patience on the part of the patient and provider, multiple office visits, and consistent attention to prevent wound infections or breakdown. Patients must be counseled that they may expect about 3 months of wound care to this area. Often the patient's multiple comorbidities (vascular, endocrine, etc.) predispose to this prolonged wound healing time. We counsel our patients to apply antibiotic ointment to the site daily and cover with Xeroform gauze. This will be graduated to a petroleum-based ointment and dry gauze as the wound epithelializes.

The location of the defects varied, but was most frequently over the vertex of the scalp. This is likely because the skin of the vertex is tighter and less amicable to a primary closure than other areas of the scalp. Additionally, acellular dermis was very commonly used in this series, as has been described in previous reports.[4] Use of this graft precludes the need for a second surgical site. Additionally, with the use of this 'off-the-shelf' product, the procedure can often be done without the need for general anesthesia. This can be important to avoid in the patient with multiple comorbidities for which general anesthesia may carry elevated risk of morbidity.

CONCLUSIONS

For select patients (i.e. anticipated high surgical morbidity, tight scalp location, significant comorbidities, uncertain margin status, or aggressive pathology) reconstruction of full thickness scalp defects can be successfully performed with outer table calvarial decortication and grafting. However, prolonged wound care is required. Prior scalp radiotherapy predicts failure for using this technique.

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Figure 1: Patient demonstrating decorticated calvarial bone after removal of a vertex lesion which required galeal resection.

Figure 2: Patient photo showing granulating wound bed several weeks after placement of alloderm onto initially decorticated bone.

Figure 3 – Patient with split thickness skin graft sewn into place onto vertex wound, before placement of xeroform bolster.

Figure 4 – Patient in office immediately after remove of bolster, 1 week out from split thickness skin graft.

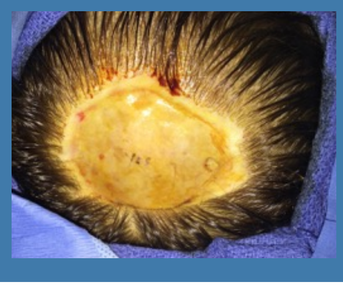

Figure 5 – Patient with fully healed split thickness skin graft several months out from incipient surgery, presenting for scar revision.

Age	Gender	Length of follow-up (days)	Graft used	Size (cm^2)	Location	History of H&N radiation	Comorbidites	Smoking Status	Defect Etiology	Days to healing	Wound revisions/complications
63	F	188	STSG	48	Scalp vertex	None	Rheumatoid arthritis on mulitple medications	None	Melanoma	149	Additional decortication with revision of STSG
80	M	605	STSG	15	Right temporal scalp	Yes	Aggressive BCCa with perineural involvement	History of use	BCCa	Graft failure	Failure of graft with revision with rotation scalp flap
86	M	259	Alloderm	36	Center forehead	None	Multiple skin cancers	History of use	Sarcamatoid carcinoma	90	Revision for margin status but healing of revised graft
70	M	707	Alloderm	16	Scalp vertex	Yes	Warfarin, heavy ETOH use, hx of scalp SCCa, poor treatment compliance	Yes, active	BCCa	Graft failure	Persistent post-operative infection with poor patient compliance, complete revision with new STSG
77	M	233	Alloderm	52.5	Scalp vertex	None	VRE, DVT, Parkinson's, history of multiple cardiac stents	None	Pleomorphic undifferentiated carcinoma	233	None
50	M	27	Alloderm	36	Parietal scalp	None	Hx of forehead basal cell carcinoma	None	Leomyosarcoma	27	None
82	M	428	Alloderm	80	Left vertex scalp	None	DVT, CAD, CLL, CHF (on warfarin), history of wound infections	History of use	SCCa	98	Postoperative wound infection
	*Second procedure		Alloderm	80	Left parietal scalp	Postop XRT after first surgery	Above plus on active chemotherapy	History of use	SCCa	Graft Failure	Development of recurrent disease with second procedure failing to heal
77	F	568	Alloderm	35	Scalp vertex	None	Parkinson's, CAD, CHF	None	SCCa	106	Postoperative wound infection
71	M	743	Alloderm	80	Scalp vertex	None	CAD (s/p CABG, stents), RCC, previous reconstruction with positive margins	None	Recurrent SCCa	127	None
68	M	65	Alloderm	16	Scalp vertex	None	Stroke, HTN, HLD	History of use	SCCa	65	None
84	F	222	Alloderm	1.8	Left parietal scalp	Yes	CHF, warfarin, afib, HTN, SCCA and BCCA of scalp, carotid stent on anticoagulation	None	SCCA	84	None
75	M	99	Alloderm	18	Right parietal scalp	None	Stroke, MI, HTN, anticoagulated	Yes, active	SCCa	99	None
78	F	994	Alloderm	72	Scalp vertex	Yes	Stroke, MI, CHF, diabetes, anticoagulated	None	Recurrent BCCa	Graft Failure	Failure of graft healing through hyperbaric oxygen treatment
81	M	358	Alloderm	7.29	Scalp vertex	Postoperative rads	CAD, valve replacement, anticoagulated	Histroy of use	Recurrent SCCa	85	None
64	F	944	FTSG	24	Forehead	None	HTN	None	BCCa	124	None
74	M	365	Alloderm	145	Scalp vertex	Postoperative rads	Neoadjuvant chemotherapy, atrial fibrillation	None	Angiosarcoma	65	Staged STSG
82	M	391	Alloderm	14	Forehead	None	Active lymphoma chemotherapy, vascular disease, IDDM, HTN	History of use	SCCa	113	Contact dermatitis from wound care
49	F	636	Alloderm	20	Scalp vertex	None	GERD, HLD	Yes, active	Melanoma	82	None
78	M	128	Alloderm	100	Left parietal scalp	None	PVD on warfarin	Yes, active	SCCa	128	None
61	M	443	Alloderm	20.25	Occipital scalp	Yes	None	Yes, active	SCCa	142	Later development of locoregional recurrent disease
71	M	514	Alloderm	22.5	Scalp vertex	Yes	Recurrent SCCa, lung tx immunosuppression, previous surgery, renal dz	None	Recurrent SCCa	198	Later development of locoregional recurrent disease
69	M	787	Alloderm	42	Scalp vertex	None	Previous skin cancer	None	Melanoma	62	None
85	M	204	Alloderm	20	Occipital scalp	None	Multiple skin cancers, diabetes, HTN	None	SCCa	72	Post-operative MI
82	M	262	Alloderm	25	Scalp vertex	None	Recurrent disease, CLL immunosuppression	None	Recurrent SCCa	107	Mild traumatic wound breakdown

Table 1 – Patient characteristics, follow-up, defect location, etiology, reconstruction type and outcome.