

Salvage of a large exposed cranial implant on irradiated necrosed scalp using free latissimus dorsi and forehead flaps – a case report

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Summary

Scalp necrosis following a cranioplasty and subsequent exposure of the implant is a dreaded complication and needs to be treated promptly. Conventionally, implant removal is often advised to prevent delayed infection. We present a case of a scalp necrosis following cranioplasty using a titanium mesh for a patient who had undergone glioma excision and radiation therapy. Using a latissimus dorsi free muscle flap, we salvaged the implant. Patient had a persistent dural leak which was addressed by a pedicled extended forehead flap and suction drain under the latissimus dorsi flap. We successfully stopped the cerebrospinal fluid leak and covered the defect adequately concluding that muscle flaps are very useful to salvage exposed implants.

Key words

scalp reconstruction – cranial implant – latissimus dorsi flap

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Introduction

Cranioplasty is commonly performed after decompressive craniectomy done for refractory intracranial hypertension [1]. Cranioplasty is done with an autologous bone, a titanium mesh or polymethylmethacrylate [2]. Necrosis of the scalp skin is a complication caused by poor blood supply to the flap [3]. It is more prevalent in irradiated tissue due to vessel damage and skin atrophy [4]. In such cases, when the implant is exposed or infected, the principles of surgery dictate removal of the prosthesis [5]. However, complications such as leak of cerebrospinal fluid (CSF), decreased protection of the brain become imminent with removal of cranioplasty implant along with aesthetic deformity of the cranium [6].

In this paper, we present a case of 42-year-old female patient with a large area of scalp necrosis and CSF leak following cranioplasty with a titanium

mesh. After thorough examination and consideration of all other options, we reconstructed the cranial defect using a free latissimus dorsi (LD) flap and an extended forehead flap.

Case report

A 42-year-old female patient was diagnosed with a right frontal glioma and underwent right fronto-temporal craniotomy and tumor excision on 9th November 2019. On post-operation day 1, the patient developed cerebral edema with a midline shift. Hence the patient was taken up for emergency right fronto-temporo-parietal decompressive craniectomy after which the patient's general condition improved. The tumour biology was confirmed to be that of a high grade diffuse glioma (astrocytoma) on histopathology. Repeat MRI images revealed residual disease. Patient received adjuvant chemoradiation starting in January 2020

with temozolamide injection and concurrent radiation of 60 Gy in 30 fractions over 6 weeks was delivered. This was followed by another cycle of temozolamide injections in April 2020. Two months after the last dose of chemotherapy, the patient developed sudden onset hemiparesis. Imaging revealed residual disease and hence the patient underwent right frontal re-exploration and tumour excision on 22nd June 2020. Following this, cranioplasty was done 6 weeks later on 5th August 2020, using a large titanium mesh to cover the exposed dura in the right fronto-temporo-parietal area. Seven days following the cranioplasty procedure, the patient was found to have black discoloration of the scalp flap overlying the implant placed. The patient was therefore referred to the plastic surgery department with a large area of scalp necrosis on the right fronto-temporo-parietal area of 12 × 9 cm. (Fig. 1).



Fig. 1. Necrosed scalp skin.

The patient also had a CSF leak through a suture line. The patient and her relatives were informed about the risk of infection and need for surgery and the consent was obtained.

The patient was taken up for thorough debridement of the scalp necro-

sis which led to a large full thickness defect (Fig. 2).

The implant was removed temporarily and debridement of non-viable tissues was done. Deeper tissue below the implant was sent for microbiological culture studies which later revealed

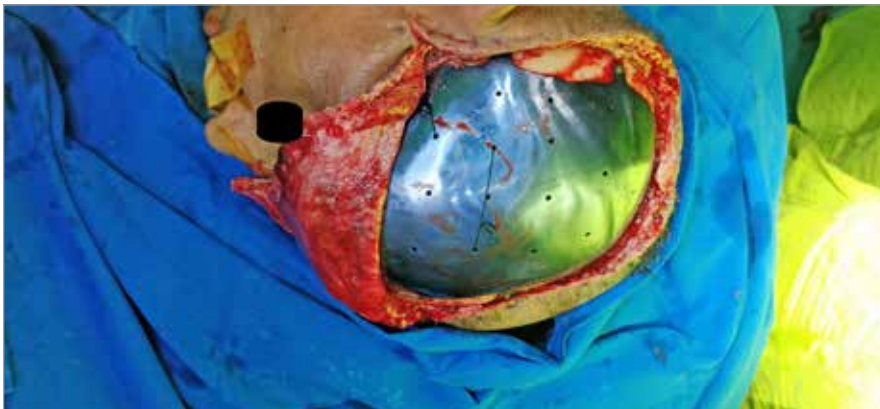


Fig. 2. Exposure of the implant after debridement of necrosis.



Fig. 3. Latissimus dorsi flap with arterial and venous anastomosis.

Staphylococcus species invasion. The implant was placed in a solution of vancomycin and saline and washed thoroughly. The implant was placed back on the dura and secured to the native skull bone using screws.

A free LD muscle flap was raised based on the thoracodorsal artery. A large fan-like muscle was used to cover the majority of the implant, however, it could not cover a small portion on the anterior aspect which had native skin over the implant. The facial artery and external jugular vein (EJV) were chosen as recipient vessels as the superficial temporal artery territory was breached by previous unicoronal incision. A long saphenous vein graft was used to form an arteriovenous (AV) loop between the facial artery and EJV. The loop was then divided and arterial and venous anastomosis was done (Fig. 3).

A split thickness skin graft was harvested from the right anterolateral thigh and the muscle flap was covered with a split skin graft primarily (Fig. 4).

Post-operatively, the patient was treated with intravenous vancomycin, low molecular weight heparin – enoxaparin sodium – Clexane 40 mg subcutaneously once daily followed by oral low dose aspirin 75 mg once daily. The patient was also hydrated adequately with intravenous fluids apart from oral diet and was given anti-convulsants (levetiracetam). The LD flap survived completely and the graft over the flap had a 100% uptake. Both donor sites healed well. However, the patient developed dural leak which manifested as a fluctuant swelling underneath the muscle flap. Conservative approach was attempted but it later led to external leak through the native skin on the frontal region leading to a wound of 1.5 × 1.5 cm and to the exposure of the small area of implant which was not covered by the flap (Fig. 5).

An extended pedicled forehead flap based on the left supraorbital and supratrochlear arteries was planned and

performed 2 weeks after the initial flap surgery. A 10 mL suction drain was placed under the LD flap; however, the drain was not kept in negative suction to avoid sudden decompression of CSF. The drain reduced the pressure from the dural leak and with simultaneous forehead flap contracted the LD flap to contour well to scalp. The drain was removed 5 days post-operatively as the drainage reduced, without any adverse effect. With both flaps surviving, the CSF leak was successfully stopped and the implant was salvaged (Fig. 6).

The patient was advised for flap division after 3 weeks; however, the patient refused another procedure for personal reasons and was satisfied with the functional results obtained.

Discussion

Exposure of a cranial implant should be promptly treated aggressively to avoid delayed infection. Following cranioplasty, there is a 1–24.4% incidence of implant infection depending on the type of implant and other various factors [7]. Irradiation of tissue has also sequelae such as skin atrophy, desquamation, and chronic ulceration leading to skin necrosis [8]. In addition, multiple surgical insults to the scalp will compromise vascularity and lead to necrosis. According to traditional surgical practices, exposed implants need

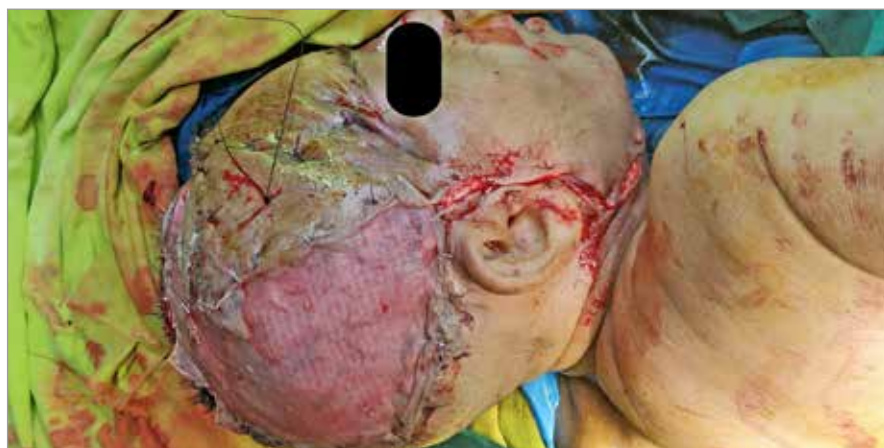


Fig. 4. Split skin graft over the latissimus dorsi flap.

to be removed surgically. Contamination of the biofilm on the implant is of particular concern because it can cause infection [9]. In our case, the patient had already undergone four surgical procedures and radiation for the tumour which jeopardized the vascularity of the scalp flap used for cranioplasty. The usage of tissue expanders for local flaps were not an option due to limited quality of the skin and presence of an exposed implant. Removal of the implant could have resulted in sinking flap syndrome, affecting perfusion, CSF flow and paradoxical herniation [6]. We decided to perform a thorough debridement and flap cover over the implant. Muscle flaps have many advantages like bacterial elimination, better establishment of blood flow and rapid

collagen deposition. Other muscle flaps to be considered were the gracilis muscle flap or vastus lateralis muscle. The shape and size of these muscles would not have adequately covered the defect in question [10]. A latissimus dorsi muscle flap provides cover of a broad area of a large muscle. Given the size of an exposed implant, we felt it wise to use LD flap for this particular case. The use of a saphenous vein graft to form an AV loop between the facial artery and the external jugular vein is a previously described method of ensuring robust tension free anastomosis [11]. The authors have prior experience using AV loops for various free flaps with shorter vascular pedicles. The flap was unable to cover one small area of the implant over which a native skin scalp was present



Fig. 5. Scalp skin breakdown following cerebrospinal fluid leak and exposure of the implant.



Fig. 6. Pedicled extended forehead flap with a drain under the latissimus dorsi flap.

and this particular area ulcerated again due to CSF leak. The extended forehead flap was used effectively to cover this defect as well. By placing a suction drain under the LD flap simultaneous with the forehead flap, the LD flap contracted and contoured well to the scalp. Special care was taken not to keep the drain in a state of negative pressure to avoid the sucking force on the CSF; the drain was rather allowed to function by the force of gravity only, which did not have any adverse effects on the patient.

Mikami et al [12] conducted a case series with a similar exposed titanium mesh prosthesis after cranioplasty where all eight implants had to be removed when reconstructing the scalp.

A case report by Hwang and Chang [5] described a salvaged medpor implant by transposition flap and antibiotic irrigation of the implant post-operatively.

In our study using a muscle flap, the risk of further infection was reduced and the implant was successfully salvaged. One point to be improved could be planning the flap in a better fashion to cover the entire flap and avoid a second flap. A suction drain under the free LD flap also reduced the dural leak and contracted the flap.

Conclusion

Cranial implant exposure is a dreaded complication after cranioplasty that may require removal of the said implant. The

use of a free muscle flap is an excellent choice for scalp reconstruction to salvage the underlying prosthesis.

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Role of authors: Dr George Taliat assisted in the procedure and made design, drafting and editing of the manuscript.

Dr Kumaraswamy M Kumar performed the procedure and made conceptualization, final approval and editing of the manuscript.

Dr Shanthakumar Shivalingappa performed the procedure and made final approval and editing of the manuscript.

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