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Case Report Open Access

Single-Unit Elevation of the Scalp, Skull, and Dura: A Modification of the Classic Osteoplastic Flap

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Introduction

Wound healing and infection is a concern for all surgeons, especially in cases of repeat surgical intervention. The osteoplastic flap is a technique that was previously used frequently in cranial surgery but since the introduction of cranial plating systems, it is now used only rarely. A retrospective study showed that although the infection rates of osteoplastic flaps were similar to free flaps, the need for another surgery for surgical washout and bone flap removal was lower (but not statistically significant) in the osteoplastic flap group [1]. This was possibly due to continued vascularization and viability of the bone flap. This was demonstrated by Shelef et al. [2], using a SPECT scan that showed bone viability remained after osteoplastic flaps vs. free flaps [2]. More recently in the neurosurgical literature, there have been descriptions of osteoplastic flap use in decompressive surgeries for TBI, in order to spare patients a second cranioplasty operation [3-5]. We present a case from our institution of the use of an osteoplastic flap in a unique circumstance that required a technical modification of the classic procedure, by elevating the dura while still attached to the bone flap. To our knowledge, this is the first report of a three-layer cranial access flap including the dura.

Clinical course

The patient in question has been followed by the plastic surgery and neurosurgery services for many years. He initially presented with a 15 × 15 cm dermatofibrosarcoma protuberans of the right frontal and orbital regions. He underwent resection and skin grafting, followed by chemotherapy and radiation to the region. Ten years later he developed a cystic right frontal lobe brain mass, which was resected and found to be a cavernous malformation. This resection was complicated by wound necrosis, necessitating bone flap removal, scalp rotation, and repeat skin grafting to the region. After a one-year healing period, he returned for a synthetic flap cranioplasty, which again required a fasciocutaneous scalp rotation for tissue coverage. This was once again complicated by wound necrosis and infection, and the synthetic flap was removed, requiring yet another scalp rotational advancement and skin grafting. The patient ultimately healed from these surgeries, but has a large area of extremely thin and tenuous grafted skin healed directly to the underlying skull and dura. Two years after his last operation, he presented with a large recurrence of the frontal lobe cavernous malformation. It was felt he would benefit from surgical resection. Due to his prior healing challenges, it was not felt that it would be safe to undermine the healed skin grafts, which directly overlie the region of the brain lesion and which were healed directly to the dura through his skull defect. It was therefore decided to utilize an osteoplastic flap, with a modification to include dural elevation as a single unit with the bone and scalp.

Technique

A curvilinear frontotemporal incision was drawn approximately 1.5 cm outside the margins of the skin-grafted region. This was opened sharply. Raney clips were utilized, rather than electrocautery, to minimize blood supply disruption to the wound edges. A small burr hole was created at each end of the incision, and these were connected with a high-speed craniotome. Prior to out fracturing of the bone flap, a scalpel was used to open the dura inside one of the burr holes, and a small pair of thin Potts scissors was used to cut the dura along the kerf of the craniotome to reach the other burr hole. The bone flap was then out fractured with a periosteal dissector, and the scalp, bone, and dura were all elevated away from the surface of the brain as a single unit. The cavernous malformation was resected in standard fashion. The flap was then closed over the surface of the brain. No attempt was made at primary dural closure. A dural substitute material underlay was placed on the surface of the brain just beneath the osteoplastic flap. No bone plates were used to secure the flap given his tenuous skin graft and concern for breakdown. The scalp and skin were closed in multiple layers using absorbable sutures in the deep layers and non-absorbable sutures in the skin. His recovery was unremarkable and at 8-week follow-up the wound had healed well, with no evidence of breakdown or infection (Figures 1 and 2).

Figure 1: (Left) Showing the osteoplastic flap with the skin, muscle, bone, and dura elevated as one piece. (Middle) Showing the closure of the wound. (Right) 8 week follow up with well-healed incision.

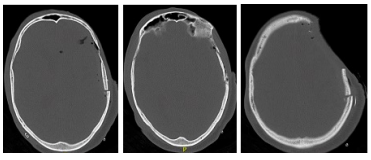

Figure 2: Post-operative CT with good alignment of the bone flap. On the far right, the bony defect through which the dura was adhered to is demonstrated.

Conclusion

While it is uncommon to elevate all layers of tissue in a single fasciocutaneous osteoplastic flap for intracranial surgery, this historical technique with modern modification was quite helpful in this unique circumstance. Without any primary dural closure, there was concern for CSF leak and resultant risk of meningitis and wound breakdown. However, this did not occur, likely thanks to the extra layer of dural substitute material used as onlay graft. Also, leaving the bone unsecured entails risk of the bone settling into the cranial cavity. However, by not disrupting the attachments of the bone to the overlying soft tissue, this risk was minimized. The patient in our case needed this osteoplastic flap modification due to his history of multiple surgeries complicated by wound breakdown and infection. Some studies have shown that a standard osteoplastic flap maintains vascularity and bone viability. This is important as it may indicate that infections can be treated with systemic antibiotics. Rasmussen et al. [1], showed that there was no difference in the infection rates between the osteoplastic and free flaps, however, there was a trend towards not needing surgical intervention for the osteoplastic flaps. A future study could be to evaluate the ability of osteoplastic flaps to heal infections with systemic therapy alone. Also, a study evaluating which patients would be at risk for wound breakdown/infection (i.e., ones who need radiation), and having their initial surgery done with an osteoplastic flap could help decrease the need for repeat surgical interventions as a result of wound infections/breakdown.

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