Cranioplasty following a decompressive craniotomy

- Comparison of Complications in Early and Late Cranioplasty Following Decompressive Craniectomy Due to Traumatic Brain Injury: Systematic Review and Meta-Analysis
- Bone Graft Expansion in Cranioplasty Using a Split-Bone Technique
- Pre- and post-cranioplasty hydrocephalus in patients following decompressive craniectomy for ischemic stroke: a systematic review and meta-analysis
- Masquelet induced cranial membrane under silicone layer during cranioplasty: Toward a natural technique for regeneration of meninges after decompressive craniectomy
- Optimal timing for early cranioplasty following craniectomy: A propensity-matched national database study of 3241 patients
- A Randomized Controlled Trial Comparing Subcutaneous Preservation of Bone Flaps with Cryogenic Preservation of Bone Flaps for Cranioplasty in Cases of Traumatic Brain Injury
- Addressing Temporal Muscle Atrophy and Enhancing Cranioplasty Outcome: A Technical Note
- Predictors of complications following alloplastic cranioplasty in trauma patients: A multi-center retrospective study

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Cranioplasty (CP) after decompressive craniectomy (DC) for trauma is a neurosurgical procedure that aims to restore esthesis, improve cerebrospinal fluid dynamics [1], and provide cerebral protection. In turn, this can facilitate neurological rehabilitation and potentially enhance neurological recovery. However, CP can be associated with significant morbidity. Multiple aspects of CP must be considered to optimize its outcomes. Those aspects range from the intricacies of the surgical dissection/reconstruction during the procedure of CP, the types of materials used for the reconstruction, as well as the timing of the CP in relation to the DC [2].

Timing

An early cranioplasty procedure may improve the outcome in selected cases. Prospective, large-scale studies are necessary to outline the actual complication rate, and the neurological outcome, and define the optimal timing for a cranioplasty [3].

Surgical objectives

a) separate the temporal muscle from where it has scar redon to the dura

b) avoid CSF leak by not violating the dura(or pseudo-dura) or by closing any opening that is identified

c) repair the bone defect with a bone flap

d) replace the temporal muscle outside the bone graft and, if necessary, tack it into position

Risks

see Cranioplasty complications.

Surgical details

The following pertains in particular to decompressive craniectomy defect which extends from the parietal and frontal regions to include varying amounts of bone overlying the middle fossa.

● re-incise the previous skin incision, being careful to stay on bone where possible, and, where the the incision is not over bone by using e.g. a hemostat under the skin to prevent the scalpel from intra-cranial penetration

● starting at a point near the superior most aspect of the defect, begin to separate the scalp flap from where it is scarred to the dura or pseudodura for a short distance (a couple of centimeters or so) inside the bone edges. This is usually easier if a barrier (e.g. Silastic sheet) was placed at the time of the craniectomy. A Langenbeck periosteal elevator may work in areas where the planes separate easily, a #10 scalpel used with the sharp side of the blade pointing up may be used where scarring is more tenacious

● work around the defect in both directions towards the base of the flap, which is where the caudal aspect of the temporalis muscle crosses the edge of the defect to the outside of the skull

● as long as the tissue is thin (i.e., scar only, no temporalis muscle) use monopolar (Bovie) cautery along the bone as close as possible to the bone edge to expose the bone

● when you get to the point where the anterior and posterior aspect of the temporalis muscle pedicle is identified, you can begin to separate the muscle from where it is scarred to the dura/ pseudodura and lift it off the dura along with the scalp

● during the process, some or all of the temporalis muscle will be detached from the dura and the overlying scalp (some surgeons intentionally detach it completely). Later in the case, the muscle may be tacked down to the bone flap (e.g. through perforation holes) or to the underside of the scalp

● the cup end of a Pennfield #1 dissector may be used to free the scar tissue off the bone edge around the entire defect. The dissector need only expose down to the deep edge of the inner table, without separating the scar from the inner table (which could facilitate epidural bleeding/hematoma formation)

● if the flap is not already perforated, on the back table, the flap is multiply drilled to provide a route of drainage for epidural blood

● the bone flap is placed in the defect. If it is riding up at any point, the soft tissue and any irregularities may be corrected with a drill and/or rongeur

● the flap is secured in position, usually with titanium plates and screws

● a subgaleal drain is brought out through a separate stab incision and closure is performed in the

usual manner

1)
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3)
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