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Early vs. Delayed Cranioplasty Following Decompressive Craniectomy in Adult Patients

Introduction/Background

Cranioplasty is an increasingly common procedure performed in neurosurgery following decompressive craniectomy.

- After a traumatic brain injury, the brain has the tendency to swell caused by excess fluid within the cells or within the intracellular or extracellular tissues of the brain.
- The persistence of the brain swelling can cause increased intracranial pressure (ICP) furthering the damage of the brain leading to death or severe disability.
- Decompressive craniectomy (DC) is performed to alleviate the swelling of the brain. However, the exposure of the brain is a risk for complications, such as infection.

Methods

HISTORY

A 21 y/o female without any significant past medical history, status post high-speed motor vehicle collision with multiple fatalities on 09/28, has undergone emergent decompressive craniectomy. Cranioplasty was done on 12/01.

PHYSICAL EXAM & IMAGING RESULTS

Pre – Cranioplasty

Gen: In NAD. Eyes open mostly to pain. Does not track.

GCS: E4 M2 V1T

Cranial Nerves: PERRL, left gaze preference.

Motor: extensor posturing in BUE, no movement in BLE noted

Sensory: Response to noxious as above

Post - Cranioplasty

Gen: NAD, eyes open spontaneously, tracks and makes eye contact

GCS: E4 M2 V1T

Cranial Nerves: PERRL, brisk, FS, +cough

Motor: BUE with extensor posturing to noxious stimuli, weak triple flexion to BLE

Sensory: Intact to noxious stimuli

Pre - Cranioplasty

11/30 CT w/o contrast: worsening severe hydrocephalus w/ increase cerebral edema and midline shift, evolving left frontal lobe hemorrhage, and postsurgical changes following left craniectomy w/ reduced fluid collections.

10/22 MRI w/o contrast: stable left frontal hematoma w/ persistent midline shift, unchanged intracranial hemorrhages, signs of axonal injury and subacute infarcts, and a slight increase in the left subgaleal collection.

Post - Cranioplasty

12/09 CT w/o contrast: stable postsurgical changes w/ decreased pneumocephalus and subdural hematoma thickness, unchanged intracranial hemorrhage, and stable shunt position and ventricular size.

12/02 MRI w/o contrast: post-CP and shunt placement w/ increased rightward midline shift, evolving left frontal hematoma, stable subdural collection, increasing subgaleal fluid, and signs of diffuse axonal injury and prior traumatic hemorrhages.

12/11 CT w/o contrast: stable postsurgical changes w/ slight decrease in pneumocephalus and subdural hematoma and unchanged hydrocephalus and ventricular shunt positioning.

ASSESSMENT & PLAN

- **TBI s/p DC**
- **Grade 2 DAI**
- **Acute ICH**
- **Traumatic SAH**
- **Bilateral carotid dissections- s/p R ICA stent, L ICA stent on 12/11**
- **S/P Cranioplasty**
- **Hydrocephalus, s/p VPS placement (12/01/24)**

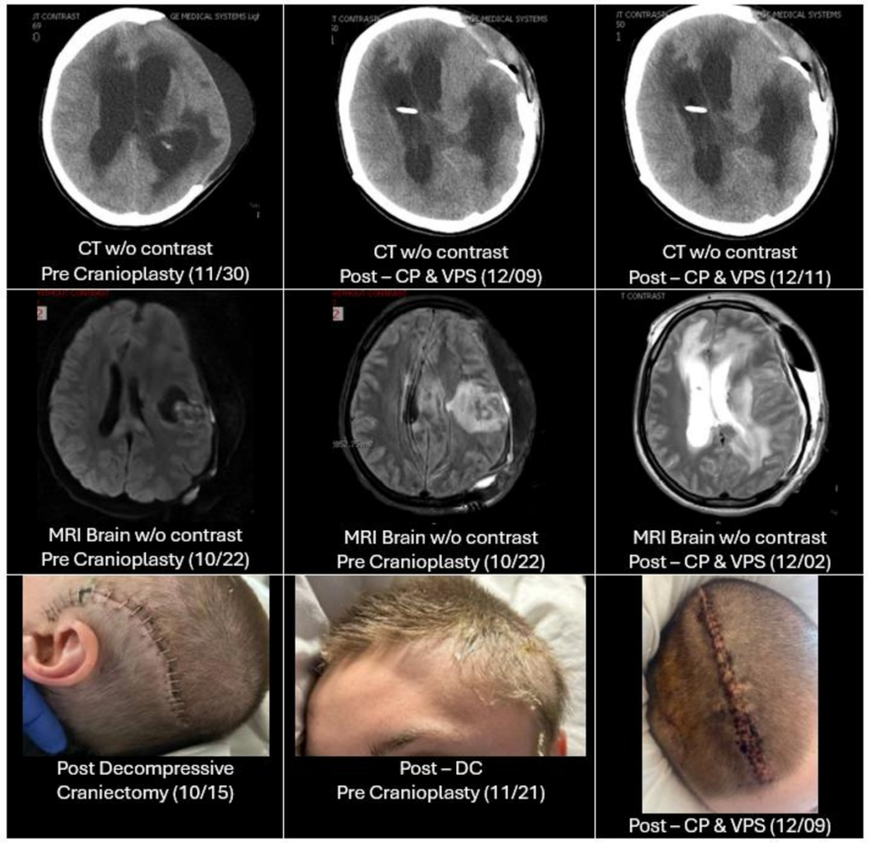
- Neuro checks q4h
- HOB > 30
- continue ASA and Brilinta for stent patency
- PT/OT/ST

Timeline

Accident: 21 y/o F s/p MVC with GCS 8 points on scene.

Surgery: GCS 4 points on arrival. Same-day emergent decompressive craniectomy.

Surgery: Week 9 GCS 7 points prior to cranioplasty and right VPS placement.



Results

Patient GCS of 7 post CP. The rest of physical exam remains the same from pre-CP procedure showing that timing CP does not have any impact on neurological outcomes of patient.

Study 1: A case series study by Bjornson et al. in 2019, a random of 90 patients who had undergone CP post-DC showed that those who underwent the procedure earlier than 3 months enhanced neurological outcomes.

Study 2: In a systematic review and meta-analysis by Malcom et al. in 2016, the study that included a total of 528 patients who underwent CP, where neurological outcomes were measure in various ways, has concluded that CP improved neurological function, and that earlier CP enhances this effect.

Study 3: A narrative review by Mee et al. in 2022, it has been concluded that CP procedures post-DC emphasized that CP has no direct effect on the underlying brain injury, and that neurological outcomes are not guaranteed to show improvements.

Conclusion

The timing of CP after DC in a complicated patient is yet to be established. Multiple factors, such as the complexity of comorbidities, risk for infection, and the actual damage of the brain injury plays an important role in weighing out the risk and benefits of the surgical procedure. Studies claim that early CP post-DC is beneficial as it increases the chance of having normal neurologic outcomes. However, in the case encountered, it was observed that early CP post-DC maintained the patient's "new normal" neurological outcomes. Thus, timing of CP is not a guaranteed improvement for all patients.

References

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