

# Decompressive Craniectomy in Traumatic Brain Injury

*Is it a no-brainer?*

*Nepean WTET summary 1/12/20*

## Background and Rationale

- Of those hospitalized with severe TBI (GCS3-8) 60% die or have severe disability. It is a significant contributor to morbidity and mortality, particularly amongst the young
- The main goal in management of TBI is to minimise secondary brain injury, this includes maintaining optimal cerebral perfusion and blood flow. When cerebral oedema peaks, raised intracranial pressure may limit blood flow and thus cause a mismatch in cerebral oxygen demand-supply. Intracranial hypertension is independently associated with worse neurological outcome
- Where simple measures prove ineffective (reducing metabolic demand by increasing sedation/paralysis, treating seizures and avoiding fever; optimising blood flow by tight PaO<sub>2</sub>/PaCO<sub>2</sub>/CPP control and reducing impedance to venous return -position/peep/obstruction to neck veins etc; reducing intracerebral volume – CSF drainage, osmotherapy) surgical decompression may be indicated. As a therapy it has had a fluctuant course...

## Advantages and Disadvantages

- Advantages
  - Good physiological rationale, rapidly reduces ICP (effective), theoretically simple to do
  - Avoids complications associated with prolonged thiopentone use +/- hypothermia
  - May be life-saving if significant pressure effect not amenable to medical therapy
  - May need neurosurgical intervention anyway for other indication, so minimal extra burden
  - May reduce ICU LOS
- Disadvantages
  - Requires access to neurosurgical services (may be limited / delay – can't be done in ICU)
  - May replace death with severe disability (considered by some an outcome worse than death)
  - Complications; infection, seizures, hygroma, paradoxical herniation
  - Economic cost; not only initial decompression, but return to OT at a later date. If severe disability, costs associated with care needs may be significant over lifetime

## Key studies

- **DECRA 2011 NEJM**
  - MC RCT: Severe non-penetrating TBI (defined as GCS 3-8, or Marshall class 3 on CT suggesting moderate diffuse injury) in 15-59y/o. Excluded if not for escalation, fixed dilated pupils or mass lesions requiring operative intervention. Spontaneous (not stimulated) increase in ICP >20mmHg for >15mins (continuous or intermittent within a 1h period) despite optimum first-tier interventions (sedation, optimized PaCO<sub>2</sub>, use of mannitol / hypertonic saline, NMBA and EVD) within first 72h of injury. Randomised to decompressive

craniectomy (large bifrontotemperoparietal craniectomy with bilateral dural opening; replaced at 2-3m) plus standard care (BTF guidelines – included mild hypothermia to 35°C as tier two) vs standard care alone. Rescue decompression at 72h or beyond allowed in control group. Stratified by center. N=155

- Primary outcome; initially unfavourable outcome (composite of death, vegetative state or severe disability; score 1-4 on GOS-E) by blinded assessors by telephone questionnaire at 6m after injury. This was revised after interim analysis to be functional outcome at 6m by ordinal logistic regression (could reduce sample size & allow completion); GOS-E at 6m was worse in the surgical group (median score 3 vs 4, OR 1.83, 95% CI 1.05-3.24, P=0.03) and higher risk of unfavourable outcome (OR 2.21, 95% CI 1.14-4.26, P=0.02). Similar death rates
- 18% in standard care group underwent delayed decompression. Shorter duration mechanical ventilation and shorter ICU LOS with surgical group

● **RescueICP 2016 NEJM**

- MC RCT; Aged 10-65y/o TBI with abnormal CTB and ICP monitor in situ with raised ICP (>25mmHg) for 1-12h despite tier one and two measures (included mannitol/hypertonic saline, hypothermia >34°C and ventriculostomy but not barbituates). Operative patients could be included as long as they had not had a craniectomy. Excluded; unsurvivable injury, bleeding diathesis and bilateral fixed dilated pupils. If entering stage randomised to surgery (large unilateral frontotemporoparietal craniectomy or bifrontal at surgeons discretion) <4-6h post randomisation vs medical (continue stage 1 and 2, barbituates permitted). N=409
- Primary outcome; GOS-E at 6m; lower mortality but higher rates of vegetative state and severe disability (lower and upper) in surgical group compared to medical group
- 37.2% of medical group underwent decompressive craniectomy

**Summary (my practice)**

- These trials were conducted before Eurotherm (and POLAR) trials – tier 2 strategies included hypothermia which differs from current management. Also DECRA included osmotherapy as a tier one strategy for ICP management (usually considered tier 2)
- Definition of intracranial hypertension varied across trials (ICP >20 vs >25mmHg); BTF discusses treating ICP >22mmHg (NB latest BTF 2016 guidelines preceded RescueICP - ?revision to decompression as 2a recommendation)
- Decompressive craniectomy for severe TBI needs to be considered on a case-by-case basis, in conjunction with MDT (neurosurgeons/intensivist) and with an honest discussion with family. When performed it should be done early, and a large decompression performed (to include dura). I am more likely to consider it in younger subgroup with fewer features consistent with worse prognosis. This is predominantly to do with improved neuroplasticity seen in the younger age group

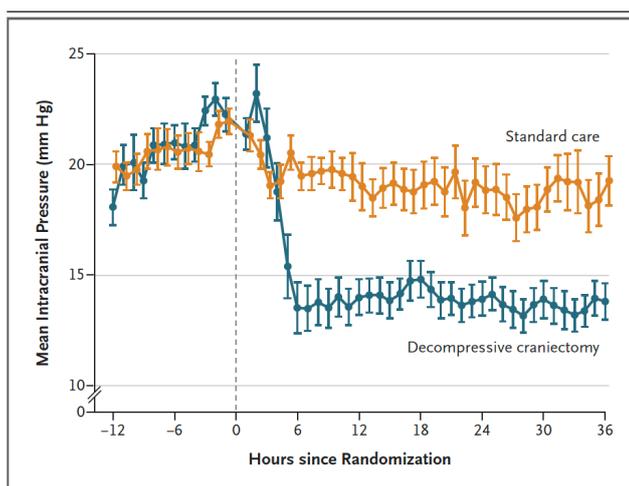


Figure 1. Intracranial Pressure before and after Randomization.

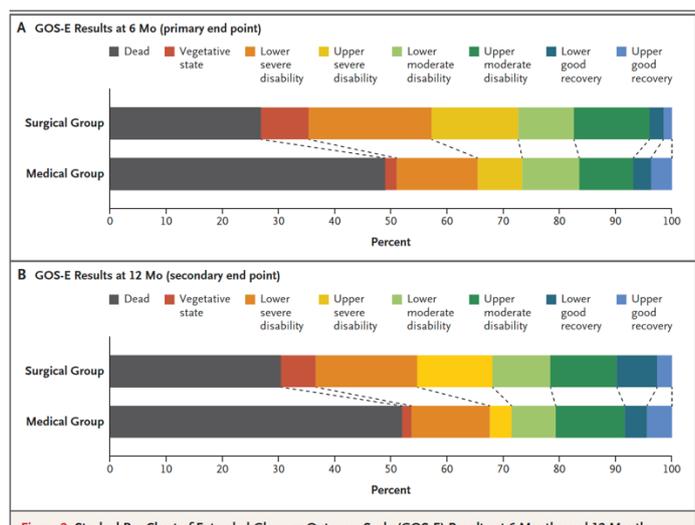


Figure 2. Stacked Bar Chart of Extended Glasgow Outcome Scale (GOS-E) Results at 6 Months and 12 Months.