High intracranial pressure (ICP) is the most frequent cause of death and disability after severe traumatic brain injury (TBI). It is usually treated with general maneuvers (normothermia, sedation, etc.) and a set of first-line therapeutic measures (moderate hypocapnia, mannitol, etc.). When these measures fail, second-line therapies are initiated, which include: barbiturates, hyperventilation, moderate hypothermia, or removal of a variable amount of skull bone (secondary decompressive craniectomy).

Sahuquillo and Dennis assessed the effects of secondary decompressive craniectomy (DC) on outcomes of patients with severe traumatic brain injury in whom conventional medical therapeutic measures have failed to control raised ICP.

The most recent search was run on 8 December 2019. They searched the Cochrane Injuries Group's Specialised Register, CENTRAL (Cochrane Library), Ovid MEDLINE(R), Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid OLDMEDLINE(R), Embase Classic + Embase (OvidSP) and ISI Web of Science (SCI-EXPANDED & CPCI-S). They also searched trial registries and contacted experts.

They included randomized studies assessing patients over the age of 12 months with severe TBI who either underwent DC to control ICP refractory to conventional medical treatments or received standard care.

They selected potentially relevant studies from the search results, and obtained study reports. Two review authors independently extracted data from included studies and assessed the risk of bias. They used a random-effects model for meta-analysis. They rated the quality of the evidence according to the GRADE approach.

They included three trials (590 participants). One single-site trial included 27 children; another multicenter trial (three countries) recruited 155 adults, the third trial was conducted in 24 countries, and recruited 408 adolescents and adults. Each study compared DC combined with standard care (this could include induced barbiturate coma or cooling of the brain, or both). All trials measured outcomes up to six months after injury; one also measured outcomes at 12 and 24 months (the latter data remain unpublished). All trials were at a high risk of bias for the criterion of performance bias, as neither participants nor personnel could be blinded to these interventions. The pediatric trial was at a high risk of selection bias and stopped early; another trial was at risk of bias because of atypical inclusion criteria and a change to the primary outcome after it had started. Mortality: pooled results for three studies provided moderate quality evidence that risk of death at six months was slightly reduced with DC (RR 0.66, 95% CI 0.43 to 1.01; 3 studies, 571 participants; I2 = 38%; moderate-quality evidence), and one study also showed a clear reduction in risk of death at 12 months (RR 0.59, 95% CI 0.45 to 0.76; 1 study, 373 participants; high-quality evidence). Neurological outcome: conscious of controversy around the traditional dichotomization of the Glasgow Outcome Scale (GOS) scale, we chose to present results in three ways, in order to contextualize factors relevant to clinical/patient decision-making. First, we present results of death in combination with vegetative status, versus other outcomes. Two studies reported results at six months for 544 participants. One employed a lower ICP threshold than the other studies, and showed an increase in the risk of death/vegetative state for the DC group. The other study used a more conventional ICP threshold, and results favoured the DC group (15.7% absolute risk reduction (ARR) (95% CI 6% to 25%). The number needed to treat for one beneficial outcome (NNTB) (i.e. to avoid death or vegetative status) was seven. The pooled result for DC compared with standard care showed no clear benefit for either group (RR 0.99, 95% CI 0.46 to 2.13; 2 studies, 544 participants; I2 = 86%; low-quality evidence). One study reported data for this outcome at 12 months, when the risk for death or vegetative state was clearly reduced by DC compared with medical treatment (RR 0.68, 95% CI 0.54 to 0.86; 1 study, 373 participants; high-quality evidence). Second, we assessed the risk of an 'unfavorable outcome'

evaluated on a non-traditional dichotomized GOS-Extended scale (GOS-E), that is, grouping the category 'upper severe disability' into the 'good outcome' grouping. Data were available for two studies (n = 571). Pooling indicated little difference between DC and standard care regarding the risk of an unfavorable outcome at six months following injury (RR 1.06, 95% CI 0.69 to 1.63; 544 participants); heterogeneity was high, with an I2 value of 82%. One trial reported data at 12 months and indicated a clear benefit of DC (RR 0.81, 95% CI 0.69 to 0.95; 373 participants). Third, we assessed the risk of an 'unfavorable outcome' using the (traditional) dichotomized GOS/GOS-E cutoff into 'favorable' versus 'unfavorable' results. There was little difference between DC and standard care at six months (RR 1.00, 95% CI 0.71 to 1.40; 3 studies, 571 participants; low-quality evidence), and heterogeneity was high (I2 = 78%). At 12 months one trial suggested a similar finding (RR 0.95, 95% CI 0.83 to 1.09; 1 study, 373 participants; high-quality evidence). With regard to ICP reduction, pooled results for two studies provided moderate quality evidence that DC was superior to standard care for reducing ICP within 48 hours (MD -4.66 mmHg, 95% CI -6.86 to -2.45; 2 studies, 182 participants; I2 = 0%). Data from the third study were consistent with these, but could not be pooled. Data on adverse events are difficult to interpret, as mortality and complications are high, and it can be difficult to distinguish between treatment-related adverse events and the natural evolution of the condition. In general, there was low-quality evidence that surgical patients experienced a higher risk of adverse events.

AUTHORS' CONCLUSIONS: Decompressive craniectomy for the treatment of high intracranial pressure in closed traumatic brain injury holds the promise of reduced mortality, but the effects of long-term neurological outcomes remain controversial and involve an examination of the priorities of participants and their families. Future research should focus on identifying clinical and neuroimaging characteristics to identify those patients who would survive with an acceptable quality of life; the best timing for DC; the most appropriate surgical techniques; and whether some synergistic treatments used with DC might improve patient outcomes [1)].

1)
Sahuquillo J, Dennis JA. Decompressive craniectomy for the treatment of high intracranial pressure in closed traumatic brain injury. Cochrane Database Syst Rev. 2019 Dec 31;12:CD003983. doi: 10.1002/14651858.CD003983.pub3. Review. PubMed PMID: 31887790.