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Decompressive craniectomy for severe traumatic brain injury Indications

The skull is a rigid, non-expandable compartment, therefore increased intracranial volume may lead to uncontrolled intracranial hypertension with subsequent cerebral ischemia and tissue death. The most common cause of this condition is traumatic brain injury (TBI) and stroke. However, it can also occur in the context of hydrocephalus, tumors, infections, hemorrhage, and certain encephalopathies. At the beginning of the 20th century, neurosurgeons such as Kocher and Cushing systematically described techniques for removing cranial bone flaps to treat pathologies that caused an increase in intracranial pressure ¹⁾

After traumatic brain injury, secondary decompressive craniectomy is most commonly undertaken as a last-tier intervention in a patient with severe intracranial hypertension refractory to tiered escalation of ICP-lowering therapies. Although decompressive craniectomy has been used in a number of conditions, it has only been evaluated in randomized controlled trials after traumatic brain injury and acute ischemic stroke. After traumatic brain injury, decompressive craniectomy is associated with lower mortality compared to medical management but with higher rates of vegetative state or severe disability. In patients with stroke-related malignant hemispheric infarction, hemicraniectomy significantly decreases mortality and improves functional outcome in adults <60 years of age. Surgery also reduces mortality in those >60 years, but results in a higher proportion of severely disabled survivors compared to medical therapy in this age group. Decisions to recommend decompressive craniectomy must always be made not only in the context of its clinical indications but also after consideration of an individual patient's preferences and quality of life expectations ².

Overall, there are no widely accepted indications for craniectomy ³⁾ Some indications for decompressive hemicraniectomy are the unilateral lesions, such as unilateral swelling, contusions, extradural or subdural hemorrhage, midline shift, generally is required bifrontal decompression for diffuse cerebral edema with no obvious midline shift

The role and indications of primary decompressive craniectomy (DC) remain controversial. In medically refractory intracranial hypertension after severe traumatic brain injury, secondary decompressive craniectomy is a last resort treatment option to control intracranial pressure (ICP). Randomized controlled studies have been extensively performed on secondary decompressive craniectomy and its role in the management of severe traumatic brain injuries. Indications, prognostic factors, and long-term outcomes in primary decompressive craniectomy during the evacuation of an epidural, subdural, or intracerebral hematoma in the acute phase is still a matter of ongoing research and controversy to this day. Prospective trials have been designed, but the results are yet to be published. In isolated epidural hematoma without underlying brain injury, osteoplastic craniotomy is likely to be sufficient. In acute subdural hematoma (ASDH) with relevant brain swelling and preoperative CT signs such as effaced cisterns, overly proportional midline shift compared to a relatively small acute subdural hematoma, and accompanying brain contusions as well as pupillary abnormalities, intraventricular hemorrhage, and coagulation disorder, primary decompressive

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craniectomy is more likely to be of benefit for patients with traumatic brain injury. The role of intracranial pressure monitoring after primary decompressive craniectomy is recommended, but prospective trials are pending. More refined guidelines and hopefully class I evidence will be established with the ongoing trials: randomized evaluation of surgery with craniectomy for patients undergoing evacuation of acute subdural hematoma (RESCUE ASDH Trial), prospective randomized evaluation of decompressive ipsilateral craniectomy for traumatic acute epidural hematoma (PREDICT-AEDH), and pragmatic explanatory continuum indicator summary (PRECIS)⁴.

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