Shunt-dependent hydrocephalus after decompressive craniectomy

- Post-traumatic hydrocephalus after decompressive craniectomy: a multidimensional analysis of clinical, radiological, and surgical risk factors
- Pre- and post-cranioplasty hydrocephalus in patients following decompressive craniectomy for ischemic stroke: a systematic review and meta-analysis
- Chronic, Shunt-Dependent Hydrocephalus in Aneurysmal Subarachnoid Hemorrhage: Incidence, Risk Factors, Clinical Phenotypes, and Outcome
- Characteristics of Post-traumatic Shunt-dependent Hydrocephalus After Decompressive Craniectomy: Are Computed Tomography Scoring Systems Predictors?
- Clinical impact of craniectomy on shunt-dependent hydrocephalus after intracerebral hemorrhage: A propensity score-matched analysis
- Shunt-Dependent Post-Traumatic Hydrocephalus: Predictors and Long-Term Functional Outcomes
- Pretreatment and Posttreatment Factors Associated with Shunt-Dependent Hydrocephalus After Aneurysmal Subarachnoid Hemorrhage: A Systematic Review and Meta-Analysis
- Prediction of Shunt-Dependent Hydrocephalus after Primary Supratentorial Intracerebral Hemorrhage with a Focus on the Influence of Craniectomies

---

The incidence of posttraumatic hydrocephalus (PTH) has been reported to be 0.7-51.4%, and De Bonis et al., have frequently observed the development of PTH in patients undergoing decompressive craniectomy (DC) [1].

Risk Factors

Hydrocephalus after decompressive craniectomy risk factors.

Treatment

Cranioplasty and ventriculostomy followed by a second stage placement of a ventriculoperitoneal shunt are associated with fewer complications in the treatment of hydrocephalus after DC [2].

Patients undergoing simultaneous cranioplasty/shunt implantation may be at a higher risk of infectious complications than those undergoing staged operations [3].

Prevention

Hydrocephalus after decompressive craniectomy prevention

Case series

Lee et al. retrospectively enrolled 458 patients with supratentorial intracerebral hemorrhage who underwent surgical hematoma evacuation between April 2005 and December 2021 at two independent stroke centers. Multivariate analyses were performed to characterize risk factors for postoperative shunt-dependent hydrocephalus. Propensity score matching (1:2) was undertaken to compensate for group-wise imbalances based on probable factors that were suspected to affect the development of hydrocephalus, and the clinical impact of craniectomy on shunt-dependent hydrocephalus was evaluated by the matched analysis.

Overall, 43 of the 458 participants (9.4%) underwent shunt procedures as part of the management of hydrocephalus after ICH. Multivariate analysis revealed that intraventricular hemorrhage (IVH) and craniectomy were associated with shunt-dependent hydrocephalus after surgery for ICH. After propensity score matching, there were no statistically significant intergroup differences in participant age, sex, hypertension status, diabetes mellitus status, lesion location, ICH volume, IVH occurrence, or IVH severity. The craniectomy group had a significantly higher incidence of shunt-dependent hydrocephalus than the non-craniectomy group (28.9% vs. 4.3%, $p < 0.001$; OR 9.1, 95% CI 3.7-22.7), craniotomy group (23.2% vs. 4.3%, $p < 0.001$; OR 6.6, 95% CI 2.5-17.1), and catheterization group (20.0% vs. 4.0%, $p = 0.012$; OR 6.0, 95% CI 1.7-21.3).

Decompressive craniectomy seems to increase shunt-dependent hydrocephalus among patients undergoing surgical intracerebral hemorrhage evacuation. The decision to perform a craniectomy for patients with intracerebral hemorrhage should be carefully individualized while considering the risk of hydrocephalus [4].

Posttraumatic hydrocephalus in pediatric patients after decompressive craniectomy [5].

2017

Currently, many neurosurgeons perform simultaneous cranioplasty and shunt implantation on such patients, but the safety of this combined procedure remains controversial.

Yang et al. retrospectively evaluated 58 patients treated via cranioplasty and shunt implantation after DC. Twenty patients underwent simultaneous procedures (simultaneous operation group) and 38 underwent staged procedures (staged operation group). They collected and analysed demographic data, information on disease histories, and clinical findings.

The overall complication rate was 19%. The two groups did not significantly differ regarding the all-complication (30% vs. 13%), bleeding complication (0% vs. 5%), or treatment failure (15% vs. 3%) rates. However, the rate of surgical site infection/incision healing problems (25% vs. 3%) and the re-operation rate (20% vs. 3%) were significantly higher in the simultaneous operation group.

Patients undergoing simultaneous cranioplasty/shunt implantation may be at a higher risk of infectious complications than those undergoing staged operations [6].

A total of 60 patients who underwent DC were studied. Fifteen patients (25%) underwent placement of a ventriculoperitoneal shunt for PTH. The majority of patients underwent unilateral decompressive hemicraniectomy (n = 46, 77%). Seven patients (12%) underwent bifrontal DC. Unilateral and bilateral hemispheric hygromas were noted in 31 (52%) and 7 (11%) patients, respectively. Interhemispheric hygromas were observed in 19 patients (32%). The mean duration from injury to first CT scan showing hemispheric subdural hygroma and interhemispheric hygroma was 7.9 ± 6.5 days and 14.9 ± 11.7 days, respectively. The median duration from injury to shunt placement was 43.7 days. Multivariate analysis showed that the presence of interhemispheric hygroma (OR 63.6, p = 0.001) and younger age (OR 0.78, p = 0.009) were significantly associated with the need for a shunt after DC.

The presence of interhemispheric subdural hygromas and younger age were associated with shunt-dependent hydrocephalus after DC in patients with severe TBI [7)].

2016

Fotakopoulos et al. conducted a retrospective study (2009-2013) that included 126 patients with severe TBI and DC. The collected data were demographics, the craniectomy size, the presence or absence of hydrocephalus, the need for changing the opening pressure of the valve of the cerebrospinal fluid (CSF) shunt or replacing all or parts of the CSF shunt, and the interval between cranioplasty and shunt placement. They excluded patients with additional intraventricular hemorrhage and those with bilateral or bifrontal DC.

Ten of the 126 patients (7.9%) developed PTH and were treated with a CSF shunt. There was no statistical correlation between development of PTH and age or sex, but a statistically significant correlation between development of PTH and the size of DC.

The study suggests that PTH development is multifactorial and shows that PTH is not that rare. They showed a correlation between craniectomy size and the incidence of PTH [8)].

2014

63 consecutive patients that underwent DC because of traumatic brain injury, middle cerebral artery infarct or intracerebral hemorrhage. Hydrocephalus was diagnosed in 23/63 patients. The 23 patients were divided into two groups. The first group (A) consisted of 11 patients in whom a ventriculoperitoneal shunt was placed simultaneously or before cranioplasty. In the second group (B) of 12 patients, we performed cranioplasty and a ventriculostomy with monitoring of intracranial pressure was placed simultaneously. After 3 to 5 days, a ventriculoperitoneal shunt was placed with the most appropriate opening pressure.

In group A, nine out of the eleven patients experienced complications, mainly hygromas or hematomas that required reoperation. In group B, none of the patients was reoperated. The use of programmable valves allowed for non-invasive revision of the opening pressure when required.

Cranioplasty and ventriculostomy followed by a second stage placement of a ventriculoperitoneal shunt are associated with fewer complications in the treatment of hydrocephalus after DC [9)].

2013

The aim of a study was to investigate the risk factors for hydrocephalus after decompressive craniectomy (DC) for hemispheric cerebral infarction. This study selected 28 patients who underwent DC for malignant hemispheric cerebral infarction. The patients' clinical and radiologic findings were retrospectively reviewed. Fourteen of the 28 patients were male and 14 were female, with an age range from 34 to 80 years (mean, 63.5 years). Eighteen patients (64.3%) underwent DC within 48 hours of stroke onset. The superior limit of DC was <25 mm from the midline in 16 patients (57.1%). Twenty-two patients underwent cranioplasty, and the interval from DC to cranioplasty was within 60 days in 14 patients. Pre- and post-cranioplasty hydrocephalus were observed in 13 and nine patients, respectively. Two patients required shunt procedures for post-cranioplasty hydrocephalus. Patients with DC whose superior limit was <25 mm from the midline had a significantly increased risk of developing not only pre-cranioplasty but also post-cranioplasty hydrocephalus (p=0.008, p=0.010, respectively). In addition, the presence of pre-cranioplasty hydrocephalus was significantly associated with the development of post-cranioplasty hydrocephalus (p=0.001). The presence of pre- and post-cranioplasty hydrocephalus was significantly associated with a poor outcome (p=0.031, p=0.049, respectively). DC with a superior limit <25 mm from the midline should be avoided to prevent the development of hydrocephalus [10].

2010

From January 2006 to December 2009, 41 patients underwent DC after closed head injury. Study outcomes focused specifically on the development of hydrocephalus after DC. Variables described by other authors to be associated with PTH were studied, including advanced age, the timing of cranioplasty, higher score on the Fisher grading system, low post-resuscitation Glasgow Coma Scale (GCS) score, and cerebrospinal fluid (CSF) infection.

They also analyzed the influence of the area of craniotomy and the distance of craniotomy from the midline. Logistic regression was used with hydrocephalus as the primary outcome measure. Of the nine patients who developed hydrocephalus, eight patients (89%) had undergone craniotomy with the superior limit <25 mm from the midline. This association was statistically significant (p = 0.01 - Fisher's exact test). Logistic regression analysis showed that the only factor independently associated with the development of hydrocephalus was the distance from the midline. Patients with craniotomy whose superior limit was <25 mm from the midline had a markedly increased risk of developing hydrocephalus (OR = 17). Craniectomy with a superior limit too close to the midline can predispose patients undergoing DC to the development of hydrocephalus. They therefore suggest performing wide DCs with the superior limit >25 mm from the midline [11].

1), 11)
De Bonis P, Pompucci A, Mangiola A, Rigante L, Anile C. Post-traumatic hydrocephalus after decompressive craniectomy: an underestimated risk factor. J Neurotrauma. 2010 Nov;27(11):1965-70. doi: 10.1089/neu.2010.1425. PubMed PMID: 20812777.
2), 9)
Pachatouridis D, Alexiou GA, Zigouris A, Michos E, Drosos D, Fotakopoulos G, Voulgaris S. Management of hydrocephalus after decompressive craniectomy. Turk Neurosurg. 2014;24(6):855-8. doi: 10.5137/1019-5149.JTN.8871-13.1. PubMed PMID: 25448200.
3), 6)
Yang XF, Wang H, Wen L, Huang X, Li G, Gong JB. The safety of simultaneous cranioplasty and shunt

implantation. Brain Inj. 2017 Sep 12:1-5. doi: 10.1080/02699052.2017.1332781. [Epub ahead of print] PubMed PMID: 28898108.

4)

Lee SH, Ko MJ, Lee YS, Cho J, Park YS. Clinical impact of craniectomy on shunt-dependent hydrocephalus after intracerebral hemorrhage: A propensity score-matched analysis. Acta Neurochir (Wien). 2024 Jan 25;166(1):34. doi: 10.1007/s00701-024-05911-8. PMID: 38270816.

5)

Carballo-Cuello C, de Jesus O, Fernandez-de Thomas RJ, Garcia M, Vigo-Prieto J, de Jesus-Espinosa A. Posttraumatic hydrocephalus in pediatric patients after decompressive craniectomy. World Neurosurg. 2020 Jan 29. pii: S1878-8750(20)30171-6. doi: 10.1016/j.wneu.2020.01.153. [Epub ahead of print] PubMed PMID: 32006735.

7)

Vedantam A, Yamal JM, Hwang H, Robertson CS, Gopinath SP. Factors associated with shunt-dependent hydrocephalus after decompressive craniectomy for traumatic brain injury. J Neurosurg. 2017 Jun 16:1-6. doi: 10.3171/2017.1.JNS162721. [Epub ahead of print] PubMed PMID: 28621627.

8)

Fotakopoulos G, Tsianaka E, Siasios G, Vagkopoulos K, Fountas K. Posttraumatic Hydrocephalus after Decompressive Craniectomy in 126 Patients with Severe Traumatic Brain Injury. J Neurol Surg A Cent Eur Neurosurg. 2016 Mar;77(2):88-92. doi: 10.1055/s-0035-1558411. Epub 2015 Sep 9. PubMed PMID: 26351868.

10)

Takeuchi S, Takasato Y, Masaoka H, Hayakawa T, Yatsushige H, Nagatani K, Osada H, Otani N, Wada K, Nawashiro H. Hydrocephalus after decompressive craniectomy for hemispheric cerebral infarction. J Clin Neurosci. 2013 Mar;20(3):377-82. doi: 10.1016/j.jocn.2012.03.035. PubMed PMID: 23266079.

From:
https://neurosurgerywiki.com/wiki/ - **Neurosurgery Wiki**

Permanent link:
https://neurosurgerywiki.com/wiki/doku.php?id=shunt-dependent_hydrocephalus_after_decompressive_craniectomy

Last update: **2024/06/07 03:00**