Hydrocephalus after aneurysmal subarachnoid hemorrhage prognosis

- Post-traumatic hydrocephalus after decompressive craniectomy: a multidimensional analysis of clinical, radiological, and surgical risk factors
- Subarachnoid hemorrhage, part 2 : Treatment, complications and long-term sequelae
- Impact of acute hydrocephalus after aneurysmal SAH on longitudinal cognitive outcome- post-hoc analysis of the MoCA-DCI study
- Predicting patients with poor functional outcome after spontaneous aneurysmal subarachnoid hemorrhage: the predicting subarachnoid hemorrhage long-term outcome score
- Serum uric acid is associated with shunt dependent hydrocephalus of aneurysmal subarachnoid hemorrhage patients
- Risk factors for surgery-related cerebral infarction after aneurysmal subarachnoid hemorrhage
- Effect of shunt-dependency on long-term outcome after aneurysmal subarachnoid hemorrhage: a post-hoc analysis of the EARLYDRAIN prospective patient cohort
- Aging Leads to Poor Outcome after Subarachnoid Hemorrhage through Exacerbating Early Brain Injury

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Hydrocephalus after aneurysmal subarachnoid hemorrhage is a significant complication that affects patient outcomes. The prognosis depends on multiple factors, including the severity of the hemorrhage, patient characteristics, and the need for long-term cerebrospinal fluid diversion.

Factors Affecting Prognosis

1. Severity of aSAH (Hunt and Hess or WFNS Grade)

- Patients with higher initial clinical grades (e.g., **WFNS Grade IV–V**) tend to have worse outcomes, as they are more likely to develop significant hydrocephalus requiring intervention.

2. Fisher Grade and Blood Distribution

- **Higher Fisher grades** (i.e., extensive cisternal blood or intraventricular hemorrhage) are associated with a greater likelihood of acute and chronic hydrocephalus.

3. Timing and Type of Hydrocephalus

- **Acute Hydrocephalus** (within 72 hours): Linked to poorer early outcomes but can be managed with external ventricular drainage (EVD).
- **Subacute or Chronic Hydrocephalus** (developing over weeks to months): More likely to require permanent **ventriculoperitoneal (VP) shunting**, influencing long-term prognosis.

4. Need for CSF Diversion

- Patients who require **permanent VP shunt placement** generally have higher rates of disability but can achieve functional independence if the shunt is effective.

5. Complications of Hydrocephalus

- **Cognitive decline**: Even after successful shunting, patients may experience **memory deficits, executive dysfunction, and gait disturbances**.
- **Infections (e.g., ventriculitis)**: Can worsen prognosis and require prolonged management.
- **Shunt dependency and malfunctions**: Long-term issues that require continued neurosurgical follow-up.

Long-Term Functional Outcomes

- Patients who **recover well from aSAH** and receive **timely hydrocephalus treatment** have a reasonable chance of functional recovery (**Modified Rankin Scale 0–2**).
- Those with **poor-grade aSAH, delayed treatment, or additional complications** have a higher likelihood of long-term disability.
- Persistent **cognitive and gait dysfunction** is common in chronic hydrocephalus, even after shunt placement.

Key Prognostic Indicators

Factor	Better Prognosis	Worse Prognosis
WFNS Grade	I–III	IV–V
Fisher Grade	I–II	III–IV
Hydrocephalus Type	Reversible (EVD weaned)	Chronic (VP shunt needed)
Age	<60 years	>60 years
Comorbidities	Minimal	Multiple (HTN, diabetes, etc.)
Treatment	Early CSF diversion	Delayed CSF diversion

Conclusion

Hydrocephalus after aSAH can significantly impact **mortality and functional recovery**. However, early **recognition and intervention with EVD and/or VP shunt placement** can improve outcomes. Patients with **high-grade SAH, extensive blood burden, and delayed intervention** have worse prognoses, while those with **successful CSF management and fewer complications** may recover to an independent functional status.

Hydrocephalus leads to prolonged hospital and ICU stays, well as to repeated surgical interventions, readmissions, and complications associated with ventriculoperitoneal shunts, including shunt failure and shunt infection. Whether variations in surgical technique at the time of aneurysm treatment may modify rates of shunt dependency remains a matter of debate [1)].

Shunt dependency

The indication for and the timing of a permanent shunt operation in patients following acute hydrocephalus (HC) after subarachnoid hemorrhage (SAH) remains controversial because risk factors for chronic HC fail to predict permanent shunt dependency. The amount of cerebrospinal fluid (CSF) drained via an external ventricular drain (EVD) may predict shunt dependency.

Results suggest that the daily amount of external CSF drainage volume in the acute state of SAH might influence the development of HC [2].

CSF IL-6 values of ≥10,000 pg/ml in the early post-SAH period may be a useful diagnostic tool for predicting shunt dependency in patients with acute posthemorrhagic hydrocephalus. The development of shunt-dependent posthemorrhagic hydrocephalus remains a multifactorial process [3].

Reliable prognostic tools to estimate the case fatality rate (CFR) and the development of chronic hydrocephalus (CHC) in aneurysmal subarachnoid hemorrhage (SAH) are not well defined.

Graeb Score or LeRoux score improve the prediction of shunt dependency and in parts of CFR in aneurysmal SAH patients therefore confirming the relevance of the extent and distribution of intraventricular blood for the clinical course in SAH [4].

1)
Winkler EA, Burkhardt JK, Rutledge WC, Rick JW, Partow CP, Yue JK, Birk H, Bach AM, Raygor KP, Lawton MT. Reduction of shunt dependency rates following aneurysmal subarachnoid hemorrhage by tandem fenestration of the lamina terminalis and membrane of Liliequist during microsurgical aneurysm repair. J Neurosurg. 2017 Dec 15:1-7. doi: 10.3171/2017.5.JNS163271. [Epub ahead of print] PubMed PMID: 29243978.
2)
Hayek MA, Roth C, Kaestner S, Deinsberger W. Impact of External Ventricular Drainage Volumes on Shunt Dependency after Subarachnoid Hemorrhage. J Neurol Surg A Cent Eur Neurosurg. 2016 Jul 22. [Epub ahead of print] PubMed PMID: 27448196.
3)
Wostrack M, Reeb T, Martin J, Kehl V, Shiban E, Preuss A, Ringel F, Meyer B, Ryang YM. Shunt-Dependent Hydrocephalus After Aneurysmal Subarachnoid Hemorrhage: The Role of Intrathecal Interleukin-6. Neurocrit Care. 2014 May 20. [Epub ahead of print] PubMed PMID: 24840896.
4)
Czorlich P, Ricklefs F, Reitz M, Vettorazzi E, Abboud T, Regelsberger J, Westphal M, Schmidt NO. Impact of intraventricular hemorrhage measured by Graeb and LeRoux score on case fatality risk and chronic hydrocephalus in aneurysmal subarachnoid hemorrhage. Acta Neurochir (Wien). 2015 Jan 21. [Epub ahead of print] PubMed PMID: 25599911.