External ventricular drainage to ventriculoperitoneal shunt conversion

- Prediction of Permanent Shunt Dependency in Patients with Intraventricular Hemorrhage: Outcomes of Early External Ventricular Drainage Weaning Protocol
- Short Efficacy Evaluation of External Ventricular Drains Versus Ventriculosubgaleal Shunt in the Management of Neonatal Posthemorrhagic Hydrocephalus: A Retrospective Single-Center Cohort Study
- Outcomes of Combined Endoscopic Surgery and Fibrinolytic Treatment Protocol for Intraventricular Hemorrhage: A Randomized Controlled Trial
- Ventricular empyema associated with severe pyogenic meningitis in COVID-19 adult patient: Case report
- Conversion of external ventricular drainage to ventriculo-peritoneal shunt: to change or not to change the proximal catheter?
- The initial neurosurgical interventions for the treatment of posthaemorrhagic hydrocephalus in preterm infants: A focused review
- Cerebrospinal fluid shunt infection caused by Corynebacterium sp: case report and review
- Indications for pediatric external ventricular drain placement and risk factors for conversion to a ventriculoperitoneal shunt

Pediatric population

Soleman et al. investigated the occurrence rate of early shunt infection and malfunction in pediatric patients after converting an external ventricular drainage (EVD) to a ventriculoperitoneal shunt (VPS) without replacing the ventricular catheter.

Data was retrospectively reviewed for 17 pediatric patients (11 male (64.7%), mean age 7.5 years, range 0.25-15 years) who underwent 18 consecutive direct conversions of tunneled EVD to VPS without replacing the ventricular catheter between 2008 and 2017. In each case, the EVD was inserted in sterile fashion within the operating room and tunneled subcutaneously 5-7 cm away from the insertion site. Primary outcome measure was the occurrence of early (within 30 days) VPS infection or malfunction. The mean follow-up time was 56.8 months (±35.7 months).

The mean period of EVD before VPS placement was 9.0 days (±3.6 days, range 2-18 days). Five patients had shunt infections/malfunctions. One patient (5.6%) had an early shunt infection after 30 days. One patient had a late shunt infection after 9 months. One patient had an early shunt malfunction after 9 days. Two patients (11.1%) had late shunt malfunctions after 6.5 months and 9 years. There were no other incidents of shunt-related complications or shunt-related mortality.

In the pediatric population, the conversion of a tunneled EVD to a VPS without replacing the ventricular catheter can be safely done. Cranial entry is spared, while the rates of shunt infection and malfunction do not increase significantly [1].

Traumatic brain injuries and neoplasms represent the most common indications for EVD placement in the pediatric population. While patients with neoplasm were much more likely to need conversion to a

VPS for long-term cerebrospinal fluid diversion, the majority of EVDs in patients with head injuries were successfully weaned [2)]

Adults

Hydrocephalus remains a common sequela of intraventricular hemorrhage (IVH) despite adequate drainage, including endoscopic surgery, intraventricular fibrinolysis, and external ventricular drainage (EVD). Moreover, the appropriate timing for conversion from EVD to ventriculoperitoneal shunt (VPS) is uncertain.

Noiphithak et al. retrospectively reviewed medical records of patients who were diagnosed with primary IVH and secondary IVH from spontaneous intracerebral hemorrhage during the period 2018-2021. Predictors associated with shunt dependency were identified using a logistic regression model. The cutoff point of each variable was selected by receiver operating characteristic curve analysis. Furthermore, shunt complications were reported as a safety measure of our early EVD weaning protocol.

The analysis included 106 patients. After IVH treatment, 15 (14%) patients required ventriculoperitoneal shunt, whereas 91 (86%) patients were shunt-free. The diameter of posttreatment temporal horn and the degree of IVH reduction were the significant predictors of shunt dependency. Moreover, patients with IVH reduction of >45% and temporal horn diameter of <9 mm had a lower probability of shunt dependency. Shunt failure was found in 2 (13.3%) patients.

This study showed that a large temporal horn diameter and a lower degree of IVH removal were predictors of shunt dependency in patients with IVH. In addition, early conversion from EVD to ventriculoperitoneal shunt is safe and feasible [3)].

In adult patients with aneurysmal subarachnoid hemorrhage, conversion of an external ventricular drainage to a ventriculoperitoneal shunt can be safely done using the same external ventricular drainage site. In this defined patient population, cerebrospinal fluid protein and RBC cerebrospinal fluid cell count do not seem to affect shunt survival adversely. Thus, conversion of an EVD to VP shunt should not be delayed because of an elevated protein or RBC count [4)]

Earlier EVD weaning and shunt placement can effectively treat subarachnoid hemorrhage-induced hydrocephalus in patients with severe subarachnoid hemorrhage. This procedure resulted in no shunt-related infections and a 6.1% revision rate. There were fewer adverse effects of IVH and protein on shunt performance. Therefore, weaning from an EVD and conversion to a permanent VP shunt need not be delayed because of IVH or proteinaceous CSF [5)]

1)
Soleman J, Benvenisti H, Constantini S, Roth J. Conversion of external ventricular drainage to ventriculo-peritoneal shunt: to change or not to change the proximal catheter? Childs Nerv Syst. 2017 Nov;33(11):1947-1952. doi: 10.1007/s00381-017-3544-5. Epub 2017 Jul 24. PMID: 28741225.
2)
Walker CT, Stone JJ, Jacobson M, Phillips V, Silberstein HJ. Indications for pediatric external ventricular

drain placement and risk factors for conversion to a ventriculoperitoneal shunt. Pediatr Neurosurg. 2012;48(6):342-7. doi: 10.1159/000353608. Epub 2013 Aug 13. PMID: 23941907.

3)

Noiphithak R, Phumichard T, Ratanavinitkul W, Rukskul P. Prediction of Permanent Shunt Dependency in Patients with Intraventricular Hemorrhage: Outcomes of Early External Ventricular Drainage Weaning Protocol. World Neurosurg. 2023 Nov;179:e575-e581. doi: 10.1016/j.wneu.2023.09.008. Epub 2023 Sep 7. PMID: 37689359.

4)

Rammos S, Klopfenstein J, Augspurger L, Wang H, Wagenbach A, Poston J, Lanzino G. Conversion of external ventricular drains to ventriculoperitoneal shunts after aneurysmal subarachnoid hemorrhage: effects of site and protein/red blood cell counts on shunt infection and malfunction. J Neurosurg. 2008 Dec;109(6):1001-4. doi: 10.3171/JNS.2008.109.12.1001. Erratum in: J Neurosurg. 2009 Jan;110(1):196. Augsburger, Lori [corrected to Augspurger, Lori]. PMID: 19035711.

5)

Kang DH, Park J, Park SH, Kim YS, Hwang SK, Hamm IS. Early ventriculoperitoneal shunt placement after severe aneurysmal subarachnoid hemorrhage: role of intraventricular hemorrhage and shunt function. Neurosurgery. 2010 May;66(5):904-8; discussion 908-9. doi: 10.1227/01.NEU.0000368385.74625.96. PMID: 20404694.