

Posthemorrhagic hydrocephalus of prematurity case series

In the [literature](#), there is a scarcity of data on the early disease process, when [neurosurgeons](#) are typically consulted for recommendations on treatment.

McClugage et al. sought to evaluate functional outcomes in premature infants at 2 years of age following treatment for posthemorrhagic hydrocephalus. Their goal was to determine the relationship between factors identifiable at the time of the initial neurosurgical consult and outcomes of patients when they are 2 years of age.

The authors performed a retrospective chart review of premature infants treated for [intraventricular hemorrhage of prematurity](#) ([Papile-Burstein classification](#) grade III and IV) between 2003 and 2014. Information from three time points (birth, first neurosurgical consult, and 2 years of age) was collected on each patient. [Logistic regression](#) analysis was performed to determine the association between variables known at the time of the first neurosurgical consult and each of the outcome variables.

One hundred thirty patients were selected for analysis. At 2 years of age, 16% of the patients had died, 88% had [cerebral palsy](#)/developmental delay (CP), 48% were nonverbal, 55% were nonambulatory, 33% had epilepsy, and 41% had visual impairment. In the logistic regression analysis, IVH grade was an independent predictor of CP ($p = 0.004$), which had an estimated probability of occurrence of 74% in grade III and 96% in grade IV. Sepsis at or before the time of consult was an independent predictor of visual impairment ($p = 0.024$), which had an estimated probability of 58%. IVH grade was an independent predictor of epilepsy ($p = 0.026$), which had an estimated probability of 18% in grade III and 43% in grade IV. The IVH grade was also an independent predictor of verbal function ($p = 0.007$), which had an estimated probability of 68% in grade III versus 41% in grade IV. A higher weeks gestational age (WGA) at birth was an independent predictor of the ability to ambulate ($p = 0.0014$), which had an estimated probability of 15% at 22 WGA and up to 98% at 36 WGA. The need for oscillating ventilation at consult was an independent predictor of death before 2 years of age ($p = 0.001$), which had an estimated probability of 42% in patients needing oscillating ventilation versus 13% in those who did not.

[IVH](#) grade was consistently an independent predictor of [functional outcomes](#) at 2 years. Gestational age at birth, sepsis, and the need for oscillating ventilation may also predict worse functional outcomes ¹⁾.

2016

The Nationwide Inpatient Sample (NIS) and the Kids' Inpatient Database (KID), were combined to generate data for the years 2000-2010. All neonatal discharges with ICD-9-CM codes for preterm birth with IVH alone or with IVH and hydrocephalus were included.

There were 147,823 preterm neonates with IVH, and 9% of this group developed hydrocephalus during the same admission. Of patients with Grade 3 and 4 IVH, 25% and 28%, respectively, developed hydrocephalus in comparison with 1% and 4% of patients with Grade 1 and 2 IVH, respectively. Thirty-eight percent of patients with PHH had permanent ventricular shunts inserted.

Mortality rates were 4%, 10%, 18%, and 40%, respectively, for Grade 1, 2, 3, and 4 IVH during initial hospitalization. Length of stay has been trending upward for both groups of IVH (49 days in 2000, 56 days in 2010) and PHH (59 days in 2000, 70 days in 2010). The average hospital cost per patient (adjusted for inflation) has also increased, from \$201,578 to \$353,554 (for IVH) and \$260,077 to \$495,697 (for PHH) over 11 years.

The number of neonates admitted with IVH has increased despite a decrease in the number of preterm births. Rates of hydrocephalus and mortality correlated closely with IVH grade. The incidence of hydrocephalus in preterm infants with IVH remained stable between 8% and 10%. Over an 11-year period, there was a progressive increase in hospital cost and length of stay for preterm neonates with IVH and PHH that may be explained by a concurrent increase in the proportion of patients with congenital cardiac anomalies ²⁾.

A retrospective review was undertaken of the medical records of all premature infants surgically treated for posthemorrhagic hydrocephalus (PHH) between 1997 and 2012 at Children's Hospital Los Angeles.

Over 14 years, 91 preterm infants with PHH were identified. Fifty neonates received temporizing measures via a VR that was serially tapped for varying time periods. For the remaining 41 premature infants, VP/VA shunt placement was the first procedure. Patients with a temporizing measure as their initial procedure had undergone CSF diversion significantly earlier in life than those who had permanent shunting as the initial procedure (29 vs 56 days after birth, $p < 0.01$). Of the infants with a VR as their initial procedure, 5/50 (10%) did not undergo subsequent VP/VA shunt placement. The number of shunt revisions and the rates of loculated hydrocephalus and shunt infection did not statistically differ between the 2 groups.

Patients with initial VR insertion as a temporizing measure received a CSF diversion procedure significantly earlier than those who received a permanent shunt as their initial procedure. Otherwise, the outcomes with regard to shunt revisions, loculated hydrocephalus, and shunt infection were not different for the 2 groups ³⁾.

2015

Wang et al. analyzed retrospectively collected data for 89 preterm patients diagnosed with grades III and IV IVH and PHH from 1998 to 2011.

Sixty-nine out of 89 patients (77.5 %) underwent [ventriculoperitoneal shunt](#) placement, and 33 (47.8 %) required at least one shunt revision and 18 (26.1 %) required multiple revisions. The mean \pm standard deviation follow-up time for shunted patients was 5.0 ± 3.3 years. The majority of early failures were due to proximal catheter [malfunction](#), while later failures were mostly due to distal catheter problems. There was a significant difference in the number of patients requiring revisions in the first 3 years following initial VP shunt insertion compared after 3 years, with 28 revisions versus 10 ($p < 0.004$). In 8 out of 10 patients who underwent shunt revisions after 3 years, evidence of [obstructive hydrocephalus](#) was found on imaging either in the form of an isolated fourth ventricular cyst or aqueductal stenosis.

The results suggest that in a distinct subset of patients with PHH, obstructive hydrocephalus may

develop, resulting in long-term dependence on CSF diversion. Further study on the factors associated with long-term shunt dependence and revision requirements within the PHH group is warranted ⁴⁾.

2014

A retrospective analysis of all adult patients presented to King Fahd University Hospital between 2004 and 2011 with intraventricular hemorrhage (IVH) a total of 31 patients were included in the study, 14 patients (45.16%) developed HCP. Seventy-four percent of HCP patients (10 out of 14) had Graeb score of ≥ 6 and/or had IVH affecting all ventricles, while 76% of the patients without HCP (13 out of 17) had a Graeb score of < 6 and/or had IVH only in the lateral ventricles (8 out of 17) or lateral ventricles and either third ventricle or fourth ventricle (5 out of 17). Statistical analysis showed that HCP is significantly associated with both Graeb score of 6 or greater number of IVH affecting all ventricles and 3 versus 1-2 affected ventricles; (OR (95% CI, p value), respectively, 19.3(2, > 20), p value < 0.05 ; 8.5 (1.6, > 30), p value < 0.05 .

HCP following IVH is present in approximately half of all IVH cases. It was found that patients with higher grades of IVH and/or a greater number of affected ventricles had a greater risk of developing HCP ⁵⁾.

1)

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