Newborn Critical Care Center (NCCC) Clinical Guidelines

Post-Hemorrhagic Hydrocephalus Guidelines for Management

BACKGROUND

Intraventricular hemorrhage (IVH) remains a serious complication of premature infants, affecting approximately 20–30% of infants born < 29 weeks estimated gestational age.[1-3] In preterm newborns, the vulnerable subependymal germinal matrix is immature at this step of brain development and highly sensitive to hemodynamic fluctuations.[4-6] The invasion of bleeding in the ventricular system is responsible for post-hemorrhagic hydrocephalus (PHH) due to the obstruction of cerebrospinal fluid (CSF) circulation and to the inflammatory response of the ependyma causing a loss of compliance and finally a decrease of CSF reabsorption.[7]

PHH resulting in increased intracranial pressure (ICP) can be a complication of any grade IVH but is more common with grade III and/or IV. The signs and symptoms of increased ICP are bulleted below:

- Rapidly enlarging head circumference (> 1.5 cm in < 7 days)
- Increased splaying of the cranial sutures
- Progressively full and/or tense fontanelle
- Worsening of apnea and/or bradycardia episodes
- Lethargy
- Feeding intolerance
- Progressive ventricular dilatation or thinning of cortical mantle on serial HUS

Consult Neurosurgery for all patients with PHH and evidence of increased ICP (pager 123-8022)

PPH MANAGEMENT STRATEGIES

Approximately 15% of preterm infants who suffer severe IVH will require permanent CSF diversion.[8] Ventricular access devices (VADs), external ventricular drains (EVDs), ventriculosubgaleal (VSG) shunts, or lumbar punctures (LPs) are treatment options in the management of PHH. VSG shunts reduce the need for daily CSF aspiration compared with VADs. The routine use of serial lumbar puncture is not recommended to reduce the need for shunt placement or to avoid the progression of hydrocephalus in premature infants.[9] There is insufficient evidence to recommend a specific weight or CSF parameter to direct the timing of shunt placement in premature infants with PHH.[9]

However, VP shunts should be performed late on premature infants as clearance of ventricle from blood products takes at least 5 weeks. Higher rates of infection and obstruction rates occur with earlier placements. It is not used as a first intervention for several reasons: the risk of skin ulceration in VLBW infants, the high incidence of shunt obstruction, malfunction, and frequent need of revision. As mentioned, VSG shunt is preferred in those hydrocephalus cases because it is a simple and rapid method, precludes the need for repetitive aspiration for evacuation of CSF, establishes a permanent decompression without causing electrolyte and nutritional losses, and aims to protect the cerebral development of newborns with GMH.[10] Reservoirs are another alternative and

concern of reservoir infection from repeated tapping should not be a limiting factor against placement of reservoirs.[11]

Nonsurgical temporizing agents (thrombolytic agents including tPA and diuretics) are not recommended as methods to reduce the need for shunt placement in premature infants with PHH.[9]

The risk factors for shunt dependence and impaired neurodevelopment were IVH grade and increased head circumference. Among surviving patients, close attention must be given to neurodevelopment because of the risk of long-term consequences associated with this pathology.[12]

CSF DRAINAGE FROM VENTRICULAR TAP OR VENTRICULAR RESEVOIR

- ***Intermittent withdrawal of CSF from ventricular taps or ventricular reservoirs should be performed by Pediatric Neurosurgery or by direction of Pediatric Neurosurgery.***
- Recommended drainage volume is 10-15 mL/kg.
    - Guided by discretion of the neurosurgeon and clinical status of the infant.
    - If > 10 mLs/kg is removed, consider IV replacement fluid (typically normal saline 1:1, determined by primary team) and monitoring serum sodium concentrations.[13]
    - Monitor post-withdrawal of CSF for hypotension, hypovolemia, and tolerance of procedure.
- Notify Neurosurgery if symptoms of increased ICP do not improve after CSF withdrawal
- Use symptoms of increased ICP, opening pressure, closing pressure, changes in head ultrasounds and Pediatric Neurosurgery consult to determine frequency of CSF withdrawal until PHH stabilizes and/or the need for a permanent shunt is determined

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