POST HAEMORRHAGIC VENTRICULAR DILATATION

INTRODUCTION

- Incidence of intraventricular haemorrhage (IVH) has overall declined to 15–20% of preterm babies with birth weight <1500 g
- Post haemorrhagic ventricular dilation (PHVD) is a major complication of severe IVH
- nearly 10% of all babies with IVH, and 20% of babies with severe IVH, will develop progressive PHVD requiring surgical intervention to prevent parenchymal damage in the developing brain
- PHVD presents as:
- acute: evident within days as ballooning of the ventricles
- subacute/chronic: evident within weeks
- Discuss management of PHVD with neurosurgical team
- Management should be guided by Birmingham Children's Hospital neurosurgical team.
- Treatment may include lumbar punctures (LPs) or CSF tapping from temporising ventricular access device (VAD), with aim of reducing the pressure effect caused by progressive ventricular enlargement, and removing red cells and protein from CSF once standard threshold for treatment reached

RECOGNITION AND ASSESSMENT

Risk factors

- Prematurity
- Severe GMH-IVH with ventricular dilatation (>50% ventricular dilatation with ballooning of ventricle)
- Acute process due to impairment of CSF absorption and circulation associated with blood clots
- Subacute-chronic form with obliterative arachnoiditis in the posterior fossa

SIGNS

- Increase in lateral ventricular dimensions on serial cranial ultrasounds – measured as ventricular index (VI), and/or increase in anterior horn width (AHW) of the ventricle at the level of the 3rd ventricle in coronal views
- Rapid increase in occipitofrontal circumference (OFC) (see below)
- Symptoms of increased intracranial pressure (ICP) lag by 1–3 weeks and consist of:
- full fontanelle
- separated sutures
- apnoea
- poor feeding
- irritability
- increased/altered neurological tone
- seizures

MONITORING AND INVESTIGATIONS

Cranial ultrasound

- Perform twice weekly following large GMH-IVH to monitor evolution of PHVD
- Assess lateral ventricular size with 2 standard measurements taken at the level of the 3rd ventricle in the coronal view
- VI: distance between falx and lateral wall of anterior horn of lateral ventricle (plot on Levene's chart)
- AHW (to measure ballooning of ventricle)
  - AHW >4 mm indicative of enlarged ventricles in keeping with VI >97th centile + 4 mm
- Measure resistive index (RI) of anterior cerebral artery to assess raised ICP
- end diastolic velocity decreases as ICP increases, causing RI to increase >0.85
- RI >1.0 indicates impaired perfusion in absence of PDA

- Repeat cranial ultrasound scan after therapeutic LP to assess VI, with aim to reduce VI below threshold limit of treatment (<97th centile + 4 mm on Levene's chart)

Head circumference/OFC

- Measure OFC twice weekly **and** before and after intervention with LP
- Normal OFC growth:
- 26–32 weeks: 1 mm/day
- ≥33 weeks–term: 0.7 mm/day
- Head circumference growth accelerates with elevated CSF (OFC growth lags behind ventricular enlargement by 1–3 weeks)
- increase of >2 mm/day over 2 days, or 14 mm over 7 days, is excessive

Cerebral function monitoring (CFM) and EEG

- Use CFM to monitor for suspected seizures
- If there are seizures, confirm with full EEG
- Lack of normal background activity associated with poor outcome

MRI

- Before insertion of VP shunt
- Neurosurgeons may use MRI before insertion of VAD in selective cases

TREATMENT

- Threshold for intervention:
- VI >97th centile + 4 mm on Levene's chart for appropriate gestational age **and/or**
- OFC increase >4 mm over 2 days/>14 mm in 7 days **and/or**
- increase in AHW >4 mm
- Therapeutic LP to reduce CSF pressure through drainage of CSF
- before LP maintain:
  - platelet count >50
  - clotting profile in normal range
- Aseptic LP to remove ≥10 mL/kg CSF at rate of 1 mL/kg/min
- If rapid increase in OFC despite initial LP, repeat
- Do not exceed >15 mL/kg of CSF volume at one time
- removal of larger volumes of CSF faster than 1 mL/kg/min can result in apnoea, bradycardia and desaturation
- Send CSF for biochemical, microscopy and culture analysis each time LP performed
- Following therapeutic LP, repeat cranial ultrasound scan to assess VI; aim to reduce to below threshold limit
- Discuss with neurosurgical team before any intervention
- Refer to neurosurgical team for consideration of insertion of CSF reservoir/VAD if:
- LPs unsuccessful in draining CSF in 2 consecutive attempts
- non-communication between ventricles and spinal canal VIs remain above threshold for intervention **and/or**
- OFC continues to increase
- If available locally, consider ventricular tap under ultrasound guidance as a bridge to surgery for insertion of VAD
- avoid many ventricular taps – high risk of causing needle tract intra-parenchymal injury and infection
- If repeated prolonged tapping via VAD required to maintain normal head growth/ persistent rapid rise in OFC/baby remains symptomatic – discuss with neurosurgeon for consideration of VP shunts
- CSF protein to be <1.5 g m/L and weight to be >2 kg (in most cases)

SUBSEQUENT MANAGEMENT

- Discuss all treatment with Birmingham Children's Hospital Neurosurgical team
- Monitor serum sodium levels – increased risk of hyponatraemia with repeated CSF drainage
- Maintain sodium >140 mmol/L; supplement intake as necessary

- If therapeutic tap from VAD >12–15 mL/kg/tap, replace CSF volumes with sodium chloride 0.9% IV fluid bolus to avoid hypovolaemia and decreased cerebral perfusion
- if CSF volumes <12 mL/kg/tap, and done at 1 mL/kg/min, fluid bolus not required unless baby haemodynamically unstable
- Treat seizures (see **Seizures** guideline)
- Refer to physiotherapy service

INFORMATION FOR PARENTS

- On diagnosis of PHVD, most senior clinician to counsel parents about diagnosis, management and prognosis

PROGNOSIS

- Marked cognitive impairment (mental developmental quotient <70) seen in approximately 45–60% of babies with PHVD, along with impaired motor outcomes
- Need for VP shunt worsens long-term neurodevelopmental outcomes