Abstract:
Post hemorrhagic ventricular dilatation is a known complication of preterm neonates with intraventricular hemorrhage. For temporary management of rapidly progressing post hemorrhagic ventricular dilatation many interventions are available. All these need skill for instituting, moreover they are costly and the rate of fluid to be drained cannot be controlled. We present a simple cost effective method of controlled drainage of CSF in a preterm with rapidly progressing ventricular dilatation following hemorrhage, who was later treated with ventriculoperitoneal shunt.

Keyword: Intravenous cannula, Intravenous set, infusion pump, post hemorrhagic ventricular dilatation

Case summary:
A preterm girl baby thirty two weeks gestation with birth weight of 2090 grams delivered by emergency LSCS to a primipara mother, who required prolonged ventilation (16 days) for Respiratory distress syndrome and Ventilator associated pneumonia, developed intra ventricular hemorrhage and post hemorrhagic ventricular dilatation. Baby’s head circumference was rapidly increasing (>2cm/week) with wide open anterior fontenale and separated sutures. Serial Ultrasound of the cranium revealed intraventricular hemorrhage with tetraventricular hydrocephalus and Levene index (6) was 27.

Introduction:
External ventricular drainage is a temporary measure for babies with rapidly progressing hydrocephalus who cannot undergo ventriculoperitoneal shunt (VP) immediately. It gives time for the CSF clearance and enables placement of ventriculoperitoneal shunt under more favourable conditions.
Ultrasound guided placement of intravenous cannula into ventricle

Therapeutic lumbar puncture was done but we were able to drain only very minimal amount of dark brown coloured cerebrospinal fluid. The protein content of CSF was 520mg % and culture showed no growth. High protein content, bloody CSF and low weight of the baby were factors which made us opt for Direct External ventricular drainage rather than ventriculoperitoneal shunt. Direct external ventricular drainage was instituted using our new technique. This involves placing a 20G intravenous cannula directly into the ventricle under ultrasound guidance and connecting this cannula through an intravenous set to a volumetric pump and drainage of CSF at a preset rate by adjusting the flow rate. Over a period of 5 days of external ventricular drainage (from 22 to 27th of post natal day) 400ml of CSF drained at a rate of 44ml/kg/day. External ventricular drainage decreased the Levene index (from 27 to 18), protein content of CSF (from 520mg% to 80mg %) and cleared the bloody CSF. Baby was discharged when ventricular size did not show any further increase in size. On subsequent followup ventriculoperitoneal was placed under favourable conditions.

Discussion:
Post Haemorrhagic Ventricular Dilatation (PHVD) is a challenging condition to manage due to the lack of evidence regarding optimal management and the threshold and timing of intervention. A recent review by Brower et al, highlights wide variations in the approaches to diagnosis, treatment threshold and mode of intervention between neonatal centres (1).

Intraventricular haemorrhage (IVH) is a well recognised complication of prematurity. Only 25% of all neonates with any IVH will ultimately have progressive ventricular dilatation requiring treatment. Moreover, in 2/3rds of these cases the ventricular dilatation will spontaneously arrest following treatment.

Hence only 10% of all cases of IVH will ultimately
require CSF shunt insertion (2). PHVD leads to ballooning of the ventricles and distortion of the underlying developing brain with eventually rising pressures resulting in progressive periventricular white matter injury (3). Therapeutic interventions aim to reduce the number of VP (ventriculo peritoneal) shunts required and to improve neurodevelopmental outcome. Interventions include repeated lumbar punctures, ventricular access devices, drug treatment to reduce CSF production, intraventricular fibrinolytic therapy, External ventricular drain, ventriculo subgaleal shunt, and third ventriculostomy. However, there is currently no evidence to support one treatment option versus another (4,5).

Once the intervention threshold is reached, the mainstay of treatment of post hemorrhagic ventricular dilatation is reducing the CSF pressure through drainage of CSF via lumbar puncture. If Lumbar punctures are unsuccessful in draining CSF, usually due to non-communication between the spinal canal and the ventricles neonates should be referred to the neurosurgical team for consideration of ventricular drainage, usually as a bridge to surgery. Ventricular taps should NOT be used as a routine method for CSF drainage as repeated ventricular taps cause intraparenchymal needle track injury. Currently existing direct ventricular drainage devices need frequent height adjustment to achieve certain degree of rate control, moreover they are costly and need expertise.

**Our new design details:**

Under strict aseptic precautions, a 20G intravenous cannula is inserted into the dilated ventricular cavity under the ultrasound guidance, and then cannula is connected to intravenous fluid set which is passed through the infusion pump. Distal end of the intravenous fluid drip set is connected to an empty Difficulty in fixing the intravenous cannula in the scalp and frequent adjustments of cannula for continuous drainage of cerebrospinal fluid are the problems that we encountered with our design. There were no undue complications like bleeding, cannula displacement noted during the procedure which ensure the safety of our technique.

**Conclusion:**

Our indigenous direct external ventricular drainage system is a safe, simple, cost effective way of controlled drainage of cerebrospinal fluid in post hemorrhagic hydrocephalus in any level 3 NICU.

**References:**

1 AJ Brower et.al., European perspective on the diagnosis and treatment of posthaemorrhagic ventricular dilatation, Arch Dis Child Fetal Neonatal Ed. 2012:97 (1) 50-6

2 A Brouwer et al, Neurodevelopmental outcome of preterm infants with severe IVH and therapy for PHVD. L Pediatr 2008 May;152 (5):648-54

3 A Whitelaw, Kristian Aquilina, Management of posthaemorrhagic ventricular dilatation, Arch Dis Child Fetal Neonatal Ed. 2011 Feb 2 (Epub)
4 A Whitelaw et al., Intraventricular streptokinase after intraventricular hemorrhage in newborn infants. Cochrane Database of systematic reviews 2007, Issue 4

5. A Whitelaw, Repeated lumbar or ventricular punctures in newborn with intracranial hemorrhage. Cochrane Database of systematic reviews 2001, Issue 1