A Case Report of Neonatal posthemorrhagic hydrocephalus in a premature infant

**Case Report**

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**ABSTRACT**

**Background:** Neurosurgical services in the Maldives began around five years ago, but the first neurosurgical center is responsible for various emergency and clinical neurosurgical services. Published literature on neurosurgery from the Maldives Islands is limited. It is imperative to report unique cases from isolated countries to promote diversity for readers across the globe. **Case Presentation:** We present a case of a ventriculo-subgaleal shunt placement in an extremely premature male baby with intra-ventricular hemorrhage, causing communicating hydrocephalus born at 22 weeks of gestation weighing 600 grams to a young primigravida. The shunt was performed in the first month of life (780 grams) for communicating hydrocephalus secondary to the germinal matrix bleed into the ventricles. **Conclusion:** Ventriculo-subgaleal shunt under local anesthesia is a promising measure to treat hydrocephalus in pre-term very low birth weight infants secondary to germinal matrix hemorrhage.

**Keywords:** Communicating Hydrocephalus, Extreme prematurity, Intraventricular Hemorrhage, Ventriculo-subgaleal shunt.

**BACKGROUND**

The Maldives started Neurosurgical services less than five years ago when the first neurosurgeon completed formal training from Nepal. Various Neurosurgery services are currently in the developing phase. The first Neurosurgical center is responsible for many emergencies and elective Neurosurgery services to 400,000 Maldivian nationals, 200,000 migrant workers, and nearly 1.4 million tourists annually when necessary. Run by one local and one foreign neurosurgeon, and without residents, the work is challenging and tedious. Published literature in the area of neurosurgery from the Maldives Islands is scarce. It is imperative to report cases from this isolated and resource-limited country for readers across the globe.

**CASE REPORT**

The Primigravida, aged 21 years with ‘O’ positive blood group, was glucose -6-phosphate dehydrogenase (G6PD) non-deficient and was neither hemophilic nor a carrier. She was not allergic to any drug, was not under any medications, and had no history of systemic illnesses. However, a history of oral amoxicillin administration during the second trimester was present for upper respiratory illness when she delivered a child in the 22nd week of gestation. She delivered at Atoll (regional) hospital. She was later referred to the central government hospital of Maldives located at Male’ for management at the neonatal intensive care unit (NICU) for prematurity, respiratory distress syndrome (RDS), very low birth weight, sepsis, neonatal conjunctivitis, neonatal jaundice, apnea of prematurity, and anemia of prematurity. The child was conservatively managed with ventilator support, feed, and infection control at the center. On cranial ultrasonography, acute communicating hydrocephalus was detected, which was confirmed by computed tomography (CT) of the head on the 23rd day of life.

Pediatricians from the government hospital and neurosurgery team from ADK hospital discussed the case, and the baby was transferred to ADK for assessment and management of hydrocephalus. The baby had recently been relieved from sepsis and was recovering from respiratory distress syndrome (RDS). He was drowsy, seldom opened an eye, had a poor cry, and decreased spontaneous movement of limbs. Blood Pressure was 53/37 mmHg; Pulse was 141 bpm, RR 36 afebrile, and 98% saturation. At this point, the ...
baby was at the 26th week of gestation (1 month, six days old), weighed 780 grams, and was on bubble nasal continuous positive airway pressure (CPAP). On receiving, the baby was being given acetazolamide, aminophylline, phenobarbitone, and was on orogastric tube feeding at 150ml/kg/day. On examination, the head circumference measured 26.5 cm, the skin was shiny, there were prominent, abundant scalp veins, trans-illumination was positive, splaying of sutures, and upward gaze palsy was present. Fontanels were full but not tense. Blood investigations such as CBC, LFTs, and CRP were within normal limits. The blood group of the child was B positive.

The surgical team consisted of two neurosurgeons, two anesthetists, and one pediatrician. Blood grouping and cross-matching were completed before surgery. The baby was kept nil per oral (NPO) for 4 hours, and during that period, the baby received 0.2% normal saline in 10% dextrose at 150ml/kg/day. The baby was shifted from the NICU with a baby cot and a warmer (later modified as OT table). Standard American Society of Anesthesiologists (ASA) I and II monitoring was continued throughout the procedure. Blood sugar was checked before the procedure (95mg/dL), and at the end of the surgery, it was 115mg/dL.

After discussion with anesthetists and pediatricians, intubation required for surgery under general anesthesia seemed to be more delirious, considering the child's condition. However, a cerebrospinal fluid (CSF) diversion procedure was necessary for the child's survival and rationalizing further and ongoing treatment. Ventricular-subgaleal (VSG) shunt was planned, and its pros and cons were discussed with the family. Parents were informed that the ventriculo-subgaleal shunt might need to be changed to a permanent ventriculo-peritoneal (VP) shunt once the baby gains reasonable weight. The theatre was ready with necessary emergency drugs, intubating drugs, intubating kits, specialists, paramedics, gadgets, and shunts. CPAP was continued throughout the procedure; emergency drugs and intubation kits were kept ready in emergency intubation and management. The right side of the child's head was shaved, the child was laid over warm sterile drapes, a small portion of the right frontal and the right temporoparietal region was exposed, which was painted and draped. Prophylactic IV antibiotic injection Cefotaxime was given 15 minutes before the incision. Local infiltration anesthesia with 0.25% Bupivacaine at 2mg/kg and lignocaine 2% at 5mg/kg diluted in 2ml NS were used before incision. Two and a half ml normal saline (NS) was injected into the right temporoparietal region to open up the subgaleal space. The upper end of a normal ventricular catheter was used (Medtronic R). A 'C' shaped incision was given at the posterior-lateral margin of the anterior fontanel at the right frontal region. Four centimeters (cm) of the ventricular catheter was inserted into the ventricles; a free-high flow of clear CSF was noted. Then, 3 cm of the other end was placed into the subgaleal space of the right temporoparietal region through the same incision. Nearly 10 5 ml of CSF was drained during the whole procedure. The tubing was anchored with vicryl 3/0 with the pericranium. The skin was closed with 4/0 vicryl and 5/0 ethilon.

The postoperative period was uneventful. The total operative duration was 15 minutes, and blood loss was minimal. Postoperative pain was managed with paracetamol drops (equivalent to 10 mg) six hourly on the first day. On the 1st postoperative day, head circumference was reduced to 25 cm, fontanel was lax, and the baby had an active movement of limbs with a

Figure 1: Pre-op CT Scan brain showing hydrocephalus

Figure 2: Cranial USG, (A) Preop , (B) Postop
good cry. Orogastric tube (OGT) feeding was commenced 1 hour after the procedure; 10ml of packed red cell transfusion was done as a measure to control anemia (Hb 10gm/dl). IV cefotaxime was started. There were no new issues during the next 24 hours; the baby was transferred back to NICU and pediatric care at the government hospital due to financial constraints. On the 7th postoperative day; cranial USG was done, which showed a reduction in hydrocephalus with a static head circumference of 24 cm. There was a single episode of CSF leakage from the wound, which was managed with acetazolamide. There was no scalp swelling, which is usually expected and accepted with subgaleal shunts. Scalp stitches were removed on the 9th-day post-operation. For medical and nutritional issues, the baby was managed under the department of pediatrics at NICU. On the 93rd day of life, with a bodyweight of 2300 grams, the patient was discharged from the hospital without any complications of the procedure or hydrocephalus.

**DISCUSSION**

It has been well established that germinal matrix hemorrhage (GMH) is a common complication in preterm infants (<32weeks), with the highest incidence in neonates with very low birth weight (<1,500g). [1,2,10] Also, the risk of GMH is elevated further with the need for mechanical ventilation and other systemic complications.[6] In this case, the neonate is considered extremely preterm at 22 weeks of gestation and had suffered from respiratory distress syndrome and sepsis.

Proceeding after severe GMH, posthemorrhagic hydrocephalus is a widespread complication. Most cases of acquired hydrocephalus arise in neonates after the occurrence of GMH. 2, 10 The presence of a fragile germinal matrix and fluctuations in cerebral blood flow accompanied by poor autoregulation of the flow are the essential reasons for hemorrhage with the reason being the prematurity of the patient.[3]

Post hemorrhagic hydrocephalus can be communicating or non-communicating with obstruction as a cause generally arising acutely due to various reasons and communicating hydrocephalus present chronically, usually in adolescence and adulthood.[4] In this case, the newborn is presented with communicating hydrocephalus, which is not the usual example. The clinical presentation is typical of...
hydrocephalus with increased head circumference and signs of increased intracranial pressure, such as poor cry and drowsiness.[11] Depending on the case, there are slight variations in the clinical course. Here, as with most cases (60%), the hydrocephalus required a need for intervention. Nevertheless, it has been observed that 40% of infants can have spontaneous resolution without any treatment.[5]

Ventriculo-subgaleal (VSG) shunting is a rapid and simple surgical method for resolving hydrocephalus and is ideal for cases in newborns. It allows the premature newborn to develop normally without other cerebral complications associated with compression, where the more definitive treatment is contraindicated.[7] Other available surgical options include repeated early lumbar puncture (LP) or ventricular taps and external ventricular drainage (EVD). Due to prematurity, extremely low birth weight, and recent sepsis-invasive shunts like ventriculo-caval, ventriculoatrial shunt that may cause direct infection to endocardium was not preferred. Studies found that repeated early LP or ventricular taps do not reduce the need for further shunt placement and no significant impact concerning mortality rates or evidence in reducing the risk of the poor neurodevelopmental outcome.[8] Management via external ventricular taps produces an increased risk of infection and implications of over drainage.[8,9] These are also problems associated with VSG shunt, but the absence of electrolyte and nutritional loss places it at an advantage.[13] These methods have their respective advantages, such as the utilization of early tapping in cases with associated symptoms with increased intracranial pressure.[8]

VSG shunting, while being an effective temporary measure, has an infection as the most common complication.[11] Shunt blockages seemed to be another recurring problem. Other cases of complications were CSF leakage, tube kinking, wound breakdown, and migration of catheters.[12,13] In this case, no CSF leakage has occurred, but following up with cranial USG would be effective in detecting further complications. An unusual occurrence, in this case, there is no scalp swelling.

There can be varying quantities of fluid occupying the subgaleal space and commonly significant scalp swelling is reported in the literature as a result of the procedure.[11,12,13] There are often accumulations of CSF in the subgaleal space due to its slow absorption by the scalp's subcutaneous tissues.[14] There were no cases highlighted where there was no occurrence or resolution of scalp swelling. Scalp swelling can be distressing for the parents if not previously informed, and regular care and observation are required with the turning of the newborn's head every two hours, alongside immobilization with dressing, to avoid any skull deformations.[7,12,13] The conversion to ventriculo-peritoneal shunt (VP) is the typical course of action following temporary measures for hydrocephalus management. Resolutions without permanent shunt placement have also been demonstrated.[11] VP shunting has been described currently as the effective definitive management for post-hemorrhagic hydrocephalus.[6,7] VP shunt is usually delayed in preterm neonates due to various reasons. A weight exceeding 1500–2000g is generally agreed upon as a requirement before a VP shunt placement.[12,8] alongside this, a CSF protein level of <200mg/dL is also recommended. The weaker immune systems and their low level of subcutaneous tissue thickness and absorptive capacity of the abdominal cavity contribute to making this an unsatisfactory option to preterm neonates.[7]

This case has demonstrated the effectiveness of VSG shunt with a reduction in head circumference from 26.5 cm to 25 cm on the second day after the operation was performed and improvements in the symptoms arising from the hydrocephalus. There were no complications, but on the 7th postoperative day ultrasound, we can observe that there was no complete resolution of the hydrocephalus. The primary VSG shunt is adequate for approximately 37 days before replacement with a definitive intervention.[12]

CONCLUSION

A very low birth weight infant with extreme prematurity in the recovery phase of sepsis may be unable to undergo a ventriculo-peritoneal shunt due to high chances of shunt blockage, infection, shunt tract skin excoriation, and shunt failure. Ventriculo-subgaleal shunt has the advantage of draining the CSF into subgaleal space, which is a closed system avoiding infections contrary to the external ventricular drain (EVD) system. It leads to improvements and changes into ventriculoperitoneal shunt once the child gains reasonable weight and is completely treated for sepsis.

REFERENCES


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