

Perioperative management of an infant with huge hydrocephalus: a case report

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Key points

Pediatric patients presenting with congenital hydrocephalus, late in course of disease, may be a unique challenge for anaesthesiologist due to increased head circumference, altered neuro-physiology and pediatric age group. In this case report we discuss the perioperative management of an infant who presented with huge hydrocephalus.

Abstract

Hydrocephalus is a progressive disease, so if a patient presents late in the course of disease it is likely that the hydrocephalus may have become massive. A huge hydrocephalus is typically defined as circumference of the head larger than length of the infant. Such patients present unique challenge for anaesthesiologist due to problems related to pediatric age group and altered neuro-physiology. Appropriate and well-coordinated management of such patients by anaesthesiologist results in better outcome and goes a long way in reducing perioperative morbidity and mortality.

Keywords: Hydrocephalus, neuro-physiology, pediatric patients.

Introduction

Recent advances in both neuro-surgery and neuroanaesthesia have made early detection and management of hydrocephalus possible. But still, lack of adequate knowledge and proper access to medical care, may result in patients presenting very late in the course of disease. This is especially true in case of small children

or infants presenting with congenital hydrocephalus from remote areas in developing countries where health care facilities and means of transportation are limited. As we all know that hydrocephalus is a progressive disease, so if a patient presents late in the course of disease it is likely that the hydrocephalus may have become massive. Such cases can be a challenge for both surgeon and anaesthesiologist. A huge hydrocephalus is typically defined as circumference of the head larger than length of the infant. Though advances in neuroanaesthesia and critical care have improved the outcome of such patients but still proper knowledge is required on the part of neuro-anaesthesiologist regarding central nervous system physiology and effect of various drugs and other factors on it, for optimal care of such patients. This case report discusses perioperative management of one such infant presenting with huge hydrocephalus.

Case report

A 5 month old female child presented to pediatric surgery department of BPS Medical college, with history of progressive enlargement of head and off & on vomiti-

tings. There was no previous history of head injury, fever, seizures or altered sensorium. Her birth history was uneventful. She was conscious, alert, pulse rate was 124/minute and respiratory rate was about 32/minute with a head circumference of 54 cm. She also had bulging anterior fontanelle and positive sunset sign (Figure 1).



Figure 1. Infant with huge hydrocephalus and 'sunset' sign in both eyes

Routine laboratory investigations like haemoglobin, total and differential leucocyte count, urine routine and microscopy, x-ray chest were within normal limits.

A thorough preanaesthetic examination was performed and child was posted for ventriculo-peritoneal shunt after consultation with paediatric surgeons. Difficult airway was anticipated owing to large head circumference. Child was kept nil per oral for 6 hours, with clear liquids allowed up to 4 hours before surgery. After consultation with parents and obtaining a written informed consent infant was taken inside operation theatre.

Inside the OT, monitors (pulse oximeter, electrocardiogram) were attached and inj. Fentanyl 1 µg/kg & inj.

Glycopyrolate 0.004 mg/kg was given. Preoxygenation was done with 100% oxygen for 5 minutes with the help of facemask and Jackson-Ree's circuit. Operation table was made 10-15 degree head-up with head end tilted slightly downward, to extend the neck of the infant (Figure 2).



Figure 2. Infant placed on OT table with rolled table cloth placed below shoulders. Also head end was tilted slightly head low to facilitate intubation

Additionally a small table cloth was rolled and placed below upper chest and shoulders of the infant. A head ring was placed below the head of the infant to prevent it from falling sideways. Induction was done with inj. Theopentone sodium 5 mg/kg intravenously. After confirming adequacy of mask ventilation and trachea was intubated with 4.0 mm uncuffed endotracheal tube with inj. Succinylcholine 1 mg/kg. Bilateral air entry was checked endotracheal tube was fixed (Figure 3). Circuit was attached and patient was put on ventilator. She received a tidal volume of 8-10 ml/kg, respiratory rate of 25-30/min and inspiratory pressure of 12-15 cm of H₂O. Anaesthesia was maintained with sevoflurane, nitrous oxide and oxygen. Inj. Atracurium 0.5 mg/kg given for muscle relaxation, repeated at regular intervals for maintenance. Rest of the intraoperative period was uneventful. After the surgery, volatile anaesthetic agent was stopped and muscle relaxation was reversed using inj. Neostigmine 0.05 mg/kg along with inj. Glycopyrolate 0.008 mg/kg intravenously. Patient was extubated

after thorough suction, when protective airway reflexes were present. She was then shifted to post operative room for observation and afterwards shifted to ward.



Figure 3. Intubated infant

Discussion

Cerebrospinal fluid (CSF) is produced by choroid plexus continuously at the rate of about 0.2 to 4 ml/min with about 250 ml produced each day. Rate of production of CSF is determined by cerebral blood flow which is higher in infants and older children as compared to adults (90-100 ml/100g/min vs. 50 ml/100g/min) [1, 2]. This CSF circulates through the ventricles and is finally absorbed by arachnoid villi. Increased production of CSF, decreased absorption or obstruction to flow, results in enlargement of ventricles known as hydrocephalus. As the volume of CSF increases, intracranial pressure gradually rises.

Normal intracranial pressure (ICP) in term infants is about 1.5 to 6 mm of Hg while in adults it is 10 -15 mm of Hg [3] in supine position. Cerebral autoregulation is also limited in infants with a lower mean arterial blood pressure of 20 – 60 mm of Hg. Though cranial compartment in infants can expand owing to open cranial sutures and fontanel, this enlargement has an upper limit beyond which intracranial pressure begins to increase. Increase in ICP in infants lead to symptoms like vomiting, poor feeding, lethargy, drowsiness, increasing head circumference, and downward gazing eyes [4]. Focal is-

chemia may occur at ICP > 20 mm of Hg. Prolonged increase in ICP leads to neurological deficits [5].

The need for surgery depends upon the extent of rise in ICP. Hydrocephalus usually allows time for pre operative evaluation and optimisation. However in case of acute rise in ICP emergency surgery may be required. Minimum basic laboratory investigation include a haemoglobin level, which may be sufficient for most cases. Serum sodium level is required if there are repeated episodes of vomiting, and/or evidence of intravascular volume contraction. If the infant is drowsy or having altered mental status, an arterial blood gas analysis may also be required before surgery. Pre operative sedation should be best avoided as it may lead to increased PaCO₂ which further causes rise in ICP.

Positioning is another important aspect of perioperative management of such infants. Head may roll to either side due to big size, especially after induction of anaesthesia. So, it should be properly rested on a head rest. Similarly a folded sheet or small pillow can be placed below shoulders of such infants to prevent excessive flexion of the neck. Choice of induction agent should be guided by infant's general condition and anaesthetic agent's effect on paediatric neuro-physiology. If intravenous cannula is in place intravenous thiopentone should be preferred as it reduces cerebral blood flow and ICP. Inhalational induction can be performed with volatile anaesthetics like sevoflurane in children with no intravenous access. Airway should be secured by appropriate sized endotracheal tube after proper muscle relaxation. Anaesthesia can be maintained by a combination of volatile anaesthetics, opioids and muscle relaxants.

Most commonly performed surgical procedure is the ventriculo peritoneal shunt which diverts the CSF intraperitoneally reducing intracranial pressure. This procedure requires exposure of infant from head to abdomen [6]. So, appropriate care must be taken to prevent hypothermia. This may include properly covering the rest of the body of infant with cotton rolls, using warm intravenous fluids, maintaining operation theatre temperature

re within favourable range. Children with increased intracranial tension may also be dehydrated because of frequent episodes of vomiting and reduced intake due to altered mental status. So, appropriate rehydration preferably with 0.9% sodium chloride should be done. 0.9% NaCl is slightly hyperosmolar (308 mOsm) and thus may help to reduce cerebral edema. During tunnelling of VP shunt haemodynamic changes can be managed by either using a narcotic [7] or by increasing the depth of anaesthesia [8]. Also, rapid drainage of cerebrospinal fluid from ventricles may lead to arrhythmias and haemodynamic disturbances even cardiac arrest [9]. This should be avoided. Management during post operative period should depend upon the pre operative neurological status of the patients. After surgery, these infants should be kept under close observation immediate post operative period to prevent complications like excessive sedation, vomiting aspiration. Patients of hydrocephalus presenting late in the course of disease present unique challenge for anaesthesiologist due to problems related to pediatric age group and altered neuro-physiology. Appropriate and well-coordinated management of such patients by anaesthesiologist results in better outcome and goes a long way in reducing peri-operative morbidity and mortality.

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